

Worldwide Bioclimatology Manual and Guide

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ABSTRACT:

A summary exposition of Rivas-Martínez & al. (2011) "Worldwide Bioclimatic Classification System, Global Bioclimatics", is given. We comment, usually in their own words, on the originality of its **premises**, its basic **elements**, its hierarchical **levels**, its **Isobioclimates**, the **Ombroclimographes** (or Ombrolimogrames), and the **Synoptic Table** of the Bioclimatic Classification of the Earth. With the help of the information contained in the web: "<http://www.globalbioclimatics.org>", Rivas-Mart. & Rivas-Sáenz (1996-2017), an approach to World Bioclimatic Diversity is given. Also, as a complement to the theoretical exposition, a practical example of how to perform the Bioclimatic Classification of a weather station is provided. Finally, the possibility of performing bioclimatic thematic maps, is commented, with bibliographical mention of the most recent maps. As for us, we have expanded the Bioclimatic Variants of Rivas-Mart. et al. (2011), with the concept of Normal Variant. We have also added some precisions to their concept of Steppic Variant. We give a glossary of concepts, which, in the offered pdf file, indicates the pages in which each of the terms is used.

Key words:

Macrobioclimates, Bioclimates, Bioclimatic Variants, Bioclimatic Belts, Thermotypes, Ombrotypes, Isobioclimates, Ombroclimograms, Continentality, Steppicity, Submediterraneity, Global Bioclimatic Diversity, Bioclimatic Maps.

RESUMEN

Se realiza una exposición resumida de la Clasificación Bioclimática Mundial, "Global Bioclimatics", de Rivas-Martínez & al. (2011), comentando, muchas veces con sus mismas palabras, la originalidad de sus **premisas**, sus **elementos** básicos, sus **niveles** jerárquicos, los **Isobioclimas**, los **Ombroclimografos** (u Ombroclimogramas), y la **Tabla Sinóptica** de la Clasificación Bioclimática de la Tierra. Con ayuda de la información contenida en "<http://www.globalbioclimatics.org>", Rivas-Mart. & Rivas-Sáenz (1996-2017), se hace una aproximación a la Diversidad Bioclimática Mundial. Así

mismo se ofrece un ejemplo práctico de cómo realizar la clasificación bioclimática de una estación meteorológica, que complementa la exposición teórica. Para terminar, se comenta la posibilidad de realizar mapas temáticos bioclimáticos, con mención bibliográfica de los más recientes. Por nuestra parte, hemos ampliado las Variantes Bioclimáticas de Rivas-Mart. et al. (2011), con el concepto de Variante Normal, así como también hemos añadido algunas precisiones a su concepto de Variante Esteparia. El trabajo se acompaña de un glosario de conceptos, que, en la versión PDF que se ofrece, indica la página en que se utiliza cada uno de ellos.

Palabras clave:

Macrobioclimas, Bioclimas, Variantes Bioclimáticas, Pisos Bioclimáticos, Termotipos, Ombrotipos, Isobioclimas, Ombroclimograma, Continentalidad, Estepicidad, Submediterraneidad, Diversidad Bioclimática Mundial, Mapas Bioclimáticos.

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1.- INTRODUCTION

Bioclimatology is the science that studies the relationship between climate and the distribution of living beings and their communities on Earth.

Since approximately 1987, Rivas-Martínez has developed a new "Bioclimatic Classification of the Earth", the "GLOBAL BIOCLIMATICS" of Rivas-Martínez (1987, 2004, 2008). Precisely, also in 2008, López Fernández & López Fernández published a "Guide to Recognizing and Classifying Bioclimatic Units", with the aim of facilitating the understanding and use of Rivas-Martínez's "Global Bioclimatics".

Recently, Rivas-Martínez & al., 2011, have remodeled and completed the "Global Bioclimatics", also called "Worldwide Bioclimatic Classification System", which exclusively uses climatic data. The Worldwide Bioclimatic Classification, by Rivas Martínez & al., is hierarchical and recognizes three levels: Macrobioclimate, Bioclimate / Variant, and Bioclimatic Belt - consisting of a Thermotype and a Ombrotype. This new Bioclimatic Classification recognizes in the Earth 5 Macrobioclimates, to which are subordinated 28 Bioclimates - in each one of which operate one or more of the nine recognized Bioclimatic Variants, and, in addition, 31 Thermotypes and 9 Ombrotypes: Altogether, over 400 elemental bioclimatic combinations, known as Isobioclimates, each of one consisting of a Macrobioclimate, a Bioclimate / Variant and a Bioclimatic Belt (a Thermotype plus an Ombrotype), which have territorial representation in the Geobiosphere.

With this "Manual and Guide to World Bioclimatology", we aim to facilitate the understanding and use of this bioclimatic classification tool, so useful to explain and understand Biogeography.

2.- PREMISES OF THE BIOCLIMATIC CLASSIFICATION OF THE EARTH, RIVAS-MARTÍNEZ & al. (2011)

The following eight premises bring together the main lines of force that condition the distribution of life, as interpreted by Rivas-Martínez (2008) and Rivas-Martínez & al. (2011), so they are at the basis of their Earth's Bioclimatic Classification.

2.1. Reciprocity: In Bioclimatology, it has been shown that there is an adjusted and reciprocal relationship between climate, vegetation and geographical territories, ie, between Isobioclimates, biocenosis and biogeographical units. This is because the distribution of vegetation, as well as the evolution of the biocenosis, have accompanied and accompany the climatic oscillations and the geological variations of the earth, which have taken place in the past. (Exceptionally, some high alpine ridges have prevented vegetation migrations and that reciprocity: see premise 8: Orogenies, below)

2.2. Photoperiod / Latitude: In the distribution of life have great influence, both the photoperiod and its variation throughout the year, as well as the angle with which the sun's rays affect the surface of the Earth, both phenomena controlled by latitude. Therefore, latitude is the first factor used to characterize and differentiate Macrobioclimates.

2.3. Continentality / Oceanicity - Annual thermal amplitude: The annual thermal amplitude has an influence of first magnitude in the distribution of the biocenosis and, consequently, in the borders of many Bioclimates. In the Synoptic Table of the Earth's Bioclimatic Classification (see Figure 7, below), it can be seen how the Continentality is used to differentiate the Temperate Macrobioclimate from the Boreal Macrobioclimate, as well as all the Bioclimates from each other except the Tropical.

2.4. Seasonality of Precipitation: The annual rhythm of precipitation has as much or more importance, in the composition and distribution of the biocenosis, than the amount of rain itself. The annual rhythm is the distribution of precipitation throughout the year. Seasonality differentiates bioclimatic units of several ranges: Macrobioclimates, Bioclimates and Bioclimatic Variants.

2.5. Mediterraneity: There is a large Mediterranean Macrobioclimate, latitudinally extratropical, ombrially antithetical to the Tropical, Temperate and Boreal Macrobioclimates, showing a summer aridity (or summer drought) of at least two consecutive months: That is to say, in which the sum of the precipitations of the two consecutive driest months of the summer quarter is less than or equal to twice the sum of the average monthly temperatures of those same months: $(P_{si} + P_{sii}) \leq 2 (T_{si} + T_{sii})$, being *si* and *sii* the two consecutive months drier of the summer. Such a shortage of rain during the summer, which can last up to the twelve months of the year, is a brake for life, just during the months thermally more favorable to growth. This circumstance is reflected in deep physiognomic changes of the biocenosis, with respect to other Bioclimates with precipitations of similar quantity, but without summer drought.

2.6. Deserts: The deserts are the response of life to extremely unfavorable climatic conditions, either by cold, or by aridity, or by both. That is why there is no single type of desert bioclimate for all the deserts of the world, but there are cold deserts, in all Macrobioclimates, and warm deserts, in the Tropical and Mediterranean Macrobioclimates. In warm deserts, the rate of precipitation is decisive, with maximums in summer - tropical deserts - or in autumn and spring – Mediterranean deserts. The flora and vegetation of both types of deserts are clearly different and are phenologically adapted to the precipitation rhythms.

2.7. Oroclimates (Mountain climates): In the mountains, the Bioclimate, except for temperature and precipitation values, shows a close relationship, in the photoperiod values, with that of its piedmont. Therefore, in the mountains, just as there is a certain vertical zonation of the biocenosis, there is also, for each Macrobioclimate, a particular sequence of thermotypic and ombrotypic combinations, that is to say, a particular sequence of Bioclimatic Belts. So that the altitudinal succession of vegetation floors is

explained by thermal and ombic changes due to altitudinal and / or exposure-orientation changes.

2.8. Orogenies: In some regions of the Earth, paleogeological, orographic and paleoclimatic circumstances have prevented the free migration of the biocenosis, in correspondence with the climatic variations that were occurring. Therefore, in those regions, the reciprocal relationship between climate and distribution of the biocenosis, announced in the first Premise, can not be met. One such circumstance has been the Alpine orogeny, which gave rise to an almost continuous set of high mountain systems oriented East-West (Hindu Kush, Himalayan, Tibet and Karakorum, etc.) on the Asian continent. These reliefs, of considerable altitude, have acted as a barrier, greatly limiting the migratory movements of life forms, during the great climatic changes that followed. Thus, in addition to the severe extinctions during arid or glacial periods, these large Central Asian transverse ridges have prevented the biocenotic recolonizations from the adjacent subtropical belt during the interglacial and, ultimately, during the Holocene periods. As a consequence, between the meridians 70° and 110° E, and between the 25° and 35° N parallels, it was necessary to establish the altitudinal limit of 2,000 meters, as an approximate border between the Tropical Macrobioclimate on the one hand, and the Mediterranean and Temperate Macrobioclimates, on the other.

3.- BASIC COMPONENTS FOR THE WORLDWIDE BIOCLIMATIC CLASSIFICATION

After having seen the Premises that underpin this Worldwide Bioclimatology, we will now comment on its basic elements, namely: Latitude, Annual distribution of rainfall, Bioclimatic Parameters, and Bioclimatic Indices.

All the necessary data for the Bioclimatic Classification of the Earth are offered even by the simplest thermopluviometric stations. These are the following data: Name and Country; Latitude, Longitude and Altitude; period of temperature and precipitation observations; monthly averages of maximum and minimum temperatures; and monthly rainfall. In total, 43 data are needed from each meteorological station.

However, let us note that the great work of Rivas-Martínez and his team has been the double selection they have achieved: First, they have selected the parameters and indices that are significant for the distribution of life and which are easily obtained from the 43 basic data provided by the meteorological stations; And secondly, they have once again made a successful selection by assigning, at each step of the bioclimatic hierarchical classification, those parameters and indices that make it possible to differentiate these levels. All these selections are not subjective, but have been made by relating the different types of ecosystems to the climatological data offered by the stations (more than 20,000, worldwide, collected by Rivas Martínez, in the database of his Phytosociological Research Center, Spain, <http://globalbioclimatics.org/>).

In doing so, the predictive value of the result, that is, of the World Bioclimatic Classification, is truly astounding. But in reality, what should astound us is the knowledge of the different forms of life and their distribution-geographic positioning at world-wide level, and the work of relating that knowledge with the climatic data.

Next, we will discuss the following five topics:

- 3.1.- Latitude: Latitudinal Zones and Belts.
- 3.2.- Seasonality of temperatures and rainfall. Period of plant activity. Types of frost.
- 3.3.- Parameters
 - 3.3.1.- Seasonal Parameters
 - 3.3.2.- Temperature Parameters
 - 3.3.3.- Precipitation Parameters
- 3.4.- Bioclimatic Indexes
 - 3.4.1.- Continentality / Oceanicity Index: Annual thermal amplitude - **Ic** -
 - 3.4.2.- Index of Thermicity **It** and Index of Compensated Thermicity **Itc**
 - 3.4.3.- Ombrothermal Indexes - **Io** -
- 3.5.- Alphabetical list of the abbreviations that designate the Parameters and the Bioclimatic Indexes.

3.1.- Latitude: Latitudinal Zones and Belts.

The three factors that most influence the distribution of life - the photoperiod and its annual variation, the temperature and its seasonal variation, and the amount of precipitation along with its annual rhythm - have a close correlation with the values of latitude. It is therefore not surprising that the limits of the superior bioclimatic units in World Bioclimatology show a close correspondence with the latitudinal zones and belts traditionally proposed by geographers. In figure 1 we show the latitudinal Zones and Belts, for later, in figure 3, to point out and comment their correlations with the Macrobioclimates.

Latitudinal Zones. -In terms of latitude, at any altitude above sea level, large latitudinal zones are distinguished on Earth (see Rivas-Mart et al., 2011): one Warm – between the 35° North and South; two Temperate - between the 35°-66° N and S; and two Cold- between 66°-90° N and S.

Figure 1. Amplitude of **latitudinal Zones and Belts** recognized on Earth (according to Rivas-Mart et al., 2011):

	Latitudinal Zones	Latitudinal Belts
N	3. Cold 66°-90°	3a. Arctic 66°-90°
	2. Temperate 35°-66°	2b. Subtemperate 51°-66°
		2a. Eutemperate 35°-51°
	1. Warm 0°-35°	1c. Subtropical 23°-35°
		1b. Eutropical 7°-23°
1a. Equatorial 7°N-7°S		
S	1. Warm 0°-35°	1b. Eutropical 7°-23°
		1c. Subtropical 23°-35°
		2a. Eutemperate 35°-51°
	2. Temperate 35°-66	2b. Subtemperate 51°-66°
	3. Cold 66°-90°	3a. Antartic 66°-90°

Latitudinal Belts. - Depending on the latitude, at any altitude above sea level, 11 wide latitudinal belts are distinguished on Earth:

In the **Warm Zone**, the following 5 latitudinal Belts are recognized: one Equatorial Belt, 7° North - 7° South; two Eutropical Belts, 7°-23° North and 7°-23° South; and two Subtropical Belts, 23°-35° North and 23°-35° South.

In the **Temperate Zones**, which contact north and south with the warm zone, 4 latitudinal Belts are recognized: two Eutemperate Belts, 35°-51° North and 35°-51° South; and two Subtemperate Belts, 51°-66° North and 51°-66° South.

In the **Cold Zones**, which contact both in the North and the South with the Temperate zones, only two latitudinal belts are recognized, one Arctic belt, 66°-90° North and another Antarctic belt, 66°-90° South.

3.2.- Seasonality of temperatures and rainfall. Period of plant activity. Types of frost.

Seasonality refers to variations in temperature and precipitation occurring throughout the year. In tropical climates, seasonality is marked by precipitation, while, in the extratropical climates, seasonality is marked by temperatures.

The seasonality of temperatures and of precipitations is involved in the definition and formulation of most of the Parameters and Indexes used in this Worldwide Bioclimatic Classification, as we will see below. In fact, the seasonality of temperatures and the amount of monthly precipitation, as well as its annual rhythm, are data of great diagnostic value in the recognition and delimitation of Macrobioclimates, Bioclimates

One aspect of the seasonality of temperatures is the concept of "Plant activity period". "Plant activity period" is the number of months whose average monthly temperature exceeds a certain threshold to allow the biochemical activity of plants. The most accepted threshold is $T_i > 3^\circ\text{C}$. Another aspect of the seasonality of temperatures is the concept of "Types of frost", which may be: absent, probable or sure, depending on the magnitude of the parameters m_i and $m'i$. It is said that a month has frost absent, when its $m'i > 0$; it is said that a month has probable frost, when it simultaneously fulfills $m_i > 0$, and $m'i \leq 0$; and finally, it is said that one month has sure frost, if $m_i \leq 0$.

3.3.- Parameters

We understand by Parameters the data or significant values of those climatic variables that are considered necessary to analyze a bioclimatic situation.

In order to establish this Worldwide Bioclimatic Classification, climatic data that are easily accessible have been used - average monthly temperatures of the maximum and minimum, and average monthly temperatures, expressed in degrees centigrade ($^\circ\text{C}$), and monthly precipitations expressed in millimeters (mm). All these data, which we consider as Parameters in this classification, are offered even by the simplest weather stations, which, altogether, form a wide network around the world.

The main Parameters of seasonality, temperature and precipitation used in this "Bioclimatic Classification of the Earth" are listed below by their acronyms and notations. (For more information, see Rivas-Mart et al., 2011):

3.3.- Parameters

3.3.1. – Seasonal Parameters

3.3.2.- Temperature Parameters

3.3.3.- Precipitation Parameters

3.3.1.- Seasonal Parameters

The sequence of atmospheric changes, and their duration, are of paramount importance to life. Therefore, in Bioclimatology, it is interesting to take into account the following periods of time - Seasonal parameters - during which vegetation and flora are especially sensitive to certain climatic values of temperature and precipitation.

We list the main Seasonal Parameters used in this Classification. From each one its acronym and its contents are indicated:

- Tr1 Winter solstice trimester. Season: Winter (W, Winter). Dec-Jan-Feb, latitude N; Jun-Jul-Aug, latitude S.
- Tr2 Spring equinox trimester. Season: Spring (P, Spring). Mar-Apr-May, latitude N; Sep-Oct-Nov, latitude S.
- Tr3 Summer solstice trimester. Season: Summer (S, Summer). Jun-Jul-Aug, latitude N; Dec-Jan-Feb, latitude S.
- Tr4 Autumn equinox trimester. Season: Autumn (F, Fall, Autumn). Sep-Oct-Nov, latitude N; Mar-Apr-May, latitude S.
- Cm1 The warmest four-month period of the year.
- Cm2 Four-month period following the Cm1.
- Cm3 Four-month period prior to the Cm1.
- Pav Period of plant physiological activity: number of months whose average monthly temperature equals or exceeds 3.5°C: $T_i \geq 3,5^\circ\text{C}$.
- Pf Periods of frost: number of months with frost absent, probable or safe.
- Ss Warmer semester of the year
- Sw Warmer semester of the year

3.3.2.- Temperature Parameters

Are data, annual or monthly, of temperatura. We list them by their initials, indicating their content. Average temperatures are expressed in degrees centigrade and positive temperatures, in tenths of a degree centigrade.

- T Average annual temperature
- Ti Average monthly temperature, standing: 1 = January, ..., 12 = December

- Tmax Average monthly temperature of the warmest month of the year
- Tmin Average monthly temperature of the coldest month of the year.
- Tp Positive Annual Temperature: Quantifies, for each place, the thermal energy available for life. It is the sum, expressed in tenths of degree centigrade, of the average monthly temperatures of those months that exceed 0°C: $Tp = \sum Ti (Ti > 0) \times 10$
- Tps Positive Temperature of the warmest trimester of the year (Tropical Macrobioclimate), or summer trimester (Macrobioclimates extratropical), expressed in tenths of degree centigrade.
- Tpw Positive Temperature of the coldest trimester of the year, expressed in tenths of degree centigrade.
- Tsi Monthly Medium Temperature of any Summer month
- M Average temperature of the maximum temperatures of the coldest month in the year, ie, the month with the lowest Ti.
- m Average temperature of the minimum temperatures of the coldest month in the year, that is, the month with the lowest Ti.
- mi Average monthly temperature of the minimum temperatures, where i: 1 = January, ..., 12 = December.
- m'i Average monthly temperature of absolute minimum temperatures, where i: 1 = January, ..., 12 = December.

3.3.3.- Precipitation Parameters.

They are expressed in mm (or liters per square meter):

- P Annual precipitation.
- Pi Monthly precipitation, where i: 1 = January, ..., 12 = December.
- Pss Precipitation of the six warmest months of the year
- Psw Precipitation of the coldest six months of the year
- Pcm1 Precipitation of the warmest four-month period of the year.
- Pcm2 Precipitation of the four months period following the warmest four-month period of the year.
- Pcm3 Precipitation of the four months period previous to the warmest four months period of the year.
- P Tr1 Precipitation of the winter solstice trimester. Season: Winter (W, Winter). Dec-Jan-Feb, latitude N; Jun-Jul-Ago, latitude S.
- P Tr2 Precipitation of the spring equinox trimester. Season: Spring (P, Spring). Mar-Abr-May, latitude N; Sep-Oct-Nov, latitude S.

- P Tr3 Precipitation of the summer solstice trimester. Season: Summer (S, Summer). Jun-Jul-Aug, latitude N; Dec-Jan-Feb, latitude S.
- P Tr4 Precipitation of the autumn equinox trimester. Season: Autumn (F, Fall, Autumn). Sep-Oct-Nov, latitude N; Mar-Apr-May, latitude S.
- Ps Precipitation of the summer trimester -S, Summer. Jun-Jul-Aug, latitude N; Dec-Jan-Feb, latitude S.
- Psi Monthly precipitation of any Summer month
- Pw Winter trimester precipitation -W, Winter. Dec-Jan-Feb, latitude N; Jun-Jul-Ago, latitude S.
- Psb1 Precipitation of the first two months after the summer solstice (July-August in latitude N, January-February in latitude S)
- Psb2 Precipitation of the two subsequent months to Psb1 (September-October in latitude N, March-April in latitude S)
- Pp Annual Positive Precipitation: $Pp = \sum P_i (T_i > 0^\circ C)$. Pp is the sum of P_i of all months of the year, whose T_i is greater than $0^\circ C$. $Pp = \sum P_i (T_i > 0)$, being i: 1 = January, ..., 12 = December.
- Pps Positive Precipitation of the three warmest months period of the year (tropical zones), or of the summer trimester (extratropical zones).
- Ppw Positive Precipitation of the three coldest months period of the year (tropical zones), or of the winter trimester (extratropical zones).
- > W> Winter precipitation.
- > P> Spring precipitation.
- > S> Summer precipitation.
- > F> Fall precipitation.

3.4.- Bioclimatic Indexes

3.4.1.- **Continentality / Oceanicity Index: Annual thermal amplitude -Ic-**

3.4.2.- **Thermicity Index -It- and Compensated Thermicity Index -Itc-**

3.4.3.- **Ombrothermic Indexes -Io-**

The indexes are the result of applying simple arithmetic formulas to various parameters of rainfall and / or temperature, selected by seasonal criteria or by criteria of specific biological requirements.

For this classification, Rivas-Martínez (2008) and Rivas-Martínez et al. (2011) have selected some Indexes, such as Continentality Index, already proposed by other authors, but, above all, they have created other new Indexes -the Thermicity Index as well as the

Ombrothermic Indexes- which have great prediction capacity with respect to the distribution of the life.

It is precisely in the discovery of new Bioclimatic Indexes that the most brilliant part of the bioclimatic system of Rivas-Martínez (2008) and Rivas-Martínez et al. (2011), as we have already said. To discover and establish them, interpreting and following the dictation of the distribution of life and its dynamism, they have used all the ideas and demands contained in the Premises and the Basic Elements, already commented. They have also handled climate data from 20,000 stations around the world, which obviously reduces the subjectivism of choice.

3.4.1.- Continentality / Oceanicity Index: Annual thermal amplitude -Ic-

The Continentality / Oceanicity Index quantifies the amplitude of the annual thermal oscillation by calculating the thermal interval between the highest and lowest monthly average temperatures of the year. Although the index is called "Continentality Index", if its values are between 0 and 21, traditionally we talk about Oceanicity, while, if they are high, over 21, we talk about Continentality. This Continentality Index, despite its simplicity, shows an excellent correlation with life. In addition, the data required for its calculation are provided by all weather stations, even the simplest ones.

The Continentality / Oceanicity index expresses the difference, in degrees centigrade, between the highest and lowest monthly average temperatures of the year:

$$Ic = Tmax - Tmin$$

The Continentality Types and Subtypes recognized in the "Bioclimatic Classification of the Earth, together with their Ic intervals, are shown in Figure 1A.

Figura 1A. Types and Subtypes of Continentality, and their intervals of Ic.

TYPES	Ic VALUES	SUBTYPES	Ic VALUES
Hyperoceanic	$0 \leq Ic \leq 11$	1.1 Ultrahyperoceanic	$0 \leq Ic \leq 4$
		1.2 Euhyperoceanic	$4 < Ic \leq 8$
		1.3 Subhyperoceanic	$8 < Ic \leq 11$
Oceanic	$11 < Ic \leq 21$	2.1 Semihyperoceanic	$11 < Ic \leq 14$
		2.2 Euoceanic	$14 < Ic \leq 17$
		2.3 Semicontinental	$17 < Ic \leq 21$
Continental	$21 < Ic \leq 66$	3.1 Subcontinental	$21 < Ic \leq 28$
		3.2 Eucontinental	$28 < Ic \leq 46$
		3.3 Hypercontinental	$46 < Ic \leq 66$

3.4.2.- Index of Thermicity -It- and Index of Thermicity Compensated -Itc-

The **Thermicity Index** weighs and quantifies the intensity of the winter cold, a limiting factor for many types of life. It is calculated by summing T (mean annual temperature), M (mean temperature of the maximum of the coldest month), and m (mean temperature of the minimum of the coldest month), and expressed in tenths of a degree centigrade:

$$It = (T + M + m) 10$$

It is, therefore, an Index that considers together the intensity of the winter cold and the average annual temperature.

But since $(M + m)$ is approximately, $\approx 2T_{\min}$ (T_{\min} = average temperature of the coldest month of the year), it is not necessary to know neither M nor m , to calculate It :

$$It \approx (T + 2 T_{\min}) 10$$

The correlation of this Thermicity Index with vegetation is very satisfactory in countries with warm and temperate climates. However, in cold countries, or in countries with a continental tendency, the relationship with vegetation is more precise if the Annual Positive Temperature (T_p) is used. For this reason, it is a very useful Index to distinguish the Tropical Macrobioclimate from the Mediterranean and Temperate Macrobioclimates, in those latitudes in which the three Macrobioclimates coincide (latitudes above 23 N and S). In the Mediterranean and Temperate Macrobioclimates, unlike in the Tropical, there is the winter: therefore, their It is necessarily lower than in the Tropical.

Compensated Thermicity Index.

As the Thermicity Index is greatly affected by the annual thermal amplitude - Continental Index, I_c -, it needs a certain compensation, to make possible the comparisons between localities, regardless of the excesses of temperance or cold, that occur in hyperoceanic climates, or in the hypercontinental ones. It has been thus arrived at the Compensated Thermicity Index - I_{tc} - which is no more than the value of It plus a compensation value, C_i :

$$I_{tc} = It + C_i$$

Value of C_i . C_i is the compensation value to correct for the excess "temperance" or "cold" occurring in extratropical areas (more than 23 ° N and S), when the Continental Index is extremely low ($I_c \leq 8$), or high ($I_c > 17$), compared to cases where I_c has mean values: In this way, the effect of an "excess" Ocean / Continental, on the measure of the climate thermal comfort, is neutralized. The value of C_i is calculated according to latitude and Continentality. Chapter 10 details the procedure for calculating I_{tc} and C_i , with the help of several examples of stations with different Continental Indexes. (See Chapter 10).

As the truly meaningful Index is the **Compensated Thermicity Index**, I_{tc} , we will always speak, in this work, of I_{tc} . (In their study of the world's weather stations, see www.globalbioclimatics.org (Rivas-Mart. & Rivas-Sáenz, 1996-2017), authors indicate both It and I_{tc}).

3.4.3.- Ombrothermic Indexes - I_o -

They serve to measure the moisture comfort that life enjoys in the different terrestrial zones. The Ombrothermic Index relates the precipitation to the temperature, but using the Parameters of Positive Precipitation and Positive Temperature, already discussed.

The value of an Ombrothermic Index is the quotient between Positive Precipitation and Positive Temperature of the considered period, multiplied by ten:

$$I_o = (P_p/T_p) 10.$$

Certain intervals of I_o reflect faithfully changes in biocenosis. The Ombrothermic Indexes are so determinant and significant that their intervals are used in all hierarchical levels of the Bioclimatic Classification of the Earth of Rivas-Martínez (2008) and Rivas-Martínez et al. (2011).

In addition to the **I_o , Annual Ombrothermic Index**, many other Ombrothermic Indices can be calculated, for various periods that are considered significant, of 1, 2, 3, or more months.

In tropical territories, it is sometimes necessary to know the index:

I_{od2} Ombrothermic Index of the driest bimester within the driest four-month period of the year.

Among the various Ombrothermic Indexes used in extratropical territories, the following are very significant:

- I_{os} , I_{osi}** Ombrothermic Index of any month of the summer trimester ($Tr3$)
- I_{os1}** Ombrothermic Index of the hottest month of the summer trimester ($Tr3$)
- I_{os2}** Ombrothermic Index of the hottest bimester of the summer trimester ($Tr3$)
- I_{osc}** Summer compensable Ombrothermic Indexes. Two of them are considered:
 - I_{osc3} (= I_{os3}):** Compensable Ombrothermic Index of the summer trimester ($Tr3$), necessary to evaluate the summer aridity
 - I_{osc4} (= I_{os4}):** Compensable Summer Ombrothermic Index for the four-month period resulting from adding, to the summer trimester ($Tr3$), the month immediately preceding. This index is also used to assess summer aridity.

All these Summer Ombrothermic Indexes are very important, since they measure the summer aridity and its possible compensation: They are essential to differentiate the Mediterranean Macrobioclimate, from the Temperate and Boreal Macrobioclimates (see these, sections 4.1.2, 4.1.3, and 4.1.4). For the correct use of all these Indexes, see chapter 9.

3.5.- Alphabetical list of the abbreviations that designate the Parameters and the Bioclimatic Indexes.

We have found it necessary to list, in alphabetical order, all the Parameters and Indices mentioned in the previous headings (See Figure 2).

Figure 2. Alphabetical list of Parameters and Bioclimatic Indexes acronyms.

Parameter /Index	Descripción	Page
Ci	Continentalidad compensation value	13
Cm1	The warmest four-month period of the year.	9
Cm2	Four-month period following the Cm1	9
Cm3	Four-month period prior to the Cm1	9
Ic	Continentalidad / Oceanicity Index: Annual thermal amplitude.	12
Io	Annual Ombrothermal Index: $(Pp/Tp) \times 10$.	13
Iod2	Ombrothermal Index of the driest bimester within the driest four-month period of the year.	14
Ios, Iosi	Ombrothermal Index of any month of the summer trimester	14
Ios1	Ombrothermal Index of the hottest month of the summer trimester (Tr3)	14
Ios2	Ombrothermal Index of the hottest bimester of the summer trimester (Tr3)	14
Iosc	Summer compensable Ombrothermal Indexes	14
Iosc3(= Ios3)	Compensable Ombrothermic Index of the summer trimester, necessary to evaluate the summer aridity	14
Iosc4(= Ios4)	Compensable Summer Ombrothermal Index for the four-month period resulting from adding, to the summer trimester, the month immediately preceding. This index is also used to assess summer aridity.	14
It	Thermicity Index	12
Itc	Compensated Thermicity Index	13
M	Average temperature of the maximum temperatures of the coldest month in the year, ie, the month with the lowest T_i . (Seasonal Temperature Index)	10
m	Average temperature of the minimum temperatures of the coldest month in the year, that is, the month with the lowest T_i . (Seasonal Temperature Index)	10
mi	Average monthly temperature of the minimum temperatures, where i: 1 = January, ..., 12 = December.	10
m'i	Average monthly temperature of absolute minimum temperatures, where i: 1 = January, ..., 12 = December	10
P	Annual precipitation	10
Pav	Period of plant physiological activity	9
Pcm1	Precipitation of the warmest four-month period of the year.	10
Pcm2	Precipitation of the four months period following the warmest four-month period of the year	10
Pcm3	Precipitation of the four months period previous to the warmest four months period of the year	10
Pf	Periods of frost	9
Pi	Monthly precipitation, where i: 1 = January, ..., 12 = December. (Weather parameter)	10

Pp	Annual Positive Precipitation	11
Pps	Positive Precipitation of the three warmest months period of the year (tropical zones), or of the summer trimester (extratropical zones).	11
Ppw	Positive Precipitation of the three coldest months period of the year (tropical zones), or of the winter trimester (extratropical zones).	11
Ps	Precipitation of the summer trimester	11
Psb1	Precipitation of the first two months after the summer solstice (July-August in latitude N, January-February in latitude S)	11
Psb2	Precipitation of the two subsequent months to Psb1 (September-October in latitude N, March-April in latitude S)	11
Psi	Monthly precipitation of any Summer month	11
Pss	Precipitation of the six warmest months of the year	10
Psw	Precipitation of the coldest six months of the year	10
PTr1	Precipitation of the winter solstice trimester	10
PTr2	Precipitation of the spring equinox trimester	10
PTr3	Precipitation of the summer solstice trimester	11
PTr4	Precipitation of the autumn equinox trimester	11
Pw	Winter trimester precipitation	11
Ss	Warmer semester of the year	9
Sw	Warmer semester of the year	9
T	Average annual temperature. (Weather parameter)	9
Ti	Average monthly temperature, standing: 1 = January, ..., 12 = December. (Weather parameter)	9
Tmax	Average monthly temperature of the warmest month of the year.	10
Tmin	Average monthly temperature of the coldest month of the year.	10
Tp	Positive Annual Temperature	10
Tps	Positive Temperature of the warmest trimester of the year (Tropical Macrobioclimate), or summer trimester (Macrobioclimates extratropical)	10
Tpw	Positive Temperature of the coldest trimester of the year	10
Tr1	Winter solstice trimester	9
Tr2	Spring equinox trimester	9
Tr3	Summer solstice trimester	9
Tr4	Autumn equinox trimester	9
Tsi	Monthly Medium Temperature of any Summer month	10
>W>	Winter precipitation.	11
>P>	Spring precipitation.	11
>S>	Summer precipitation.	11
>F>	Fall precipitation.	11

4.- WORLDWIDE BIOCLIMATIC CLASSIFICATION

The Worldwide Bioclimatic Classification (Rivas-Mart, 2008, Rivas-Mart et al., 2011) is necessarily hierarchical, because it has to reflect the different range of influence of climatic factors on the distribution of life. The hierarchical bioclimatic units of the Classification are: 1-Macrobioclimates, 2-Bioclimate / Variants, and 3-Bioclimatic Belts.

Latitude has a decisive influence on the distribution of living beings and, for that reason, it is used in the first hierarchical step of classification, that of the Macrobioclimates. Indeed, latitude determines the photoperiod, the inclination of the sun's rays, the distribution of high and low atmospheric pressures, the general circulation of the atmosphere and its effect on the amount and distribution of rainfall, etc.,

Likewise, in each Macrobioclimate, the distribution patterns of the plant communities are governed by combinations of Continentality levels, together with humidity comfort levels: **Ic** and **Io**. Bioclimate and their variants are thus defined.

And in each Bioclimatic / Variant unit, the combination of one level of **ltc**, -or of **Tp** - (Thermotype) with another of **Io** (Ombrotipo), reflects the actual distribution of vegetation types and, thus, define the third hierarchical level of the classification, the Bioclimatic Belts.

- 4.1.- First hierarchical level of the Classification: Macrobioclimates
- 4.2.- Second hierarchical level of the Classification: Bioclimate / Variants
- 4.3.- Third hierarchical level of the Classification: Bioclimatic Belts - Thermotypes and Ombrotypes-

4.1. First hierarchical level of the Classification: Macrobioclimates

The Macrobioclimates are the greater rank typological units of this Bioclimatic Classification. These are synthetic biophysical models, delimited by certain latitudinal and climatic values, that have a wide territorial jurisdiction and that are related to the great types of climates, biomes, and biogeographic regions, of the Earth. The five Macrobioclimates that are accepted in this classification are: Tropical, Mediterranean, Temperate, Boreal and Polar.

To distinguish the Macrobioclimates, the latitudinal values are the first to be taken into account, and their limits are shown in figure 3: Tropical Macrobioclimate fits the latitudinal warm zone (35° N & S); Mediterranean Macrobioclimate participates in the warm and temperate zones (23°-52° N & S); Temperate Macrobioclimate also participates in the warm zone and extends through almost all the temperate zone (23°-66°N and 23°-55° S); Boreal Macrobioclimate is distributed throughout almost all the temperate zone and the cold zone, but has an asymmetric latitudinal distribution (42°-72° N and 49°-56° S); finally, the Polar Macrobioclimate is almost symmetrically distributed in the temperate zone and throughout the cold zone (51°-90°N and 53°-90°S).

Figure 3. Width of latitudinal zones and belts recognized on Earth, and their relationship to the distribution of Macrobioclimates. As can be seen, the limits of the Macrobioclimates do not coincide exactly with the corresponding belts, although they show close correspondences.

	Latitudinal Zones	Latitudinal Belts	Macrobioclimates				
N	3. Cold 66°-90°	3a. Arctic 66°-90°					Polar 51°-90°
	2. Temperate 35°-66°	2b. Subtemperate 51°-66°				Boreal 42°-72°	
		2a. Eutemperate 35°-51°		Mediterranean 23°-52°	Temperate 23°-66°		
	1. Warm 0°-35°	1c. Subtropical 23°-35°	Tropical 0°-35°				
		1b. Eutropical 7°-23°					
		1a. Equatorial 7°N-7°S					
S	1. Warm 0°-35°	1b. Eutropical 7°-23°	Tropical 0-35°				
		1c. Subtropical 23°-35°		Mediterranean 23°-52°	Temperate 23°-55°		
		2a. Eutemperate 35°-51°				Boreal 49°-56°	
	2b. Subtemperate 51°-66°						
	3. Cold 66°-90°	3a. Antarctic 66°-90°					Polar 53°-90°

As shown in Figure 3, and despite their denominations, the boundaries of the Macrobioclimates do not correspond exactly to the Latitudinal Zones and Belts, but the comparison with them helps to locate the areas of each Macrobioclimate on the continents.

- 1.-In the latitudinal belts equatorial - 7°N - 7°S - and eutropical - 7° - 23°N and S-, as the solar radiation is practically zenith and the duration of the day and of the night vary little along the year, the Macrobioclimate, at any altitude, regardless of temperature, is considered tropical.
- 2.- In the subtropical latitudinal belts - 23° - 35° N and S -, depending on the temperature and the rhythm of the precipitations throughout the year, the territory is divided between the Tropical, Mediterranean and Temperate Macrobioclimates.
- 3.-In the eu-temperate latitudinal belts - 35° - 52°N and S-, the seasonal photoperiods and the less energy received represent a severe border for plant and animal life, which have to adapt to drought and cold of the Mediterranean, Temperate or Boreal Macrobioclimates, depending on the rainfall rhythms and thermal levels.
- 4.-In the latitudinal subtemperate belts - 52° - 66°N and 52° - 60°S -, the photoperiod and the thermicity establish new limits to the life, by the necessary adaptations to the intense photoperiod and the intense cold, typical of the Macrobioclimates Temperate, Boreal and Polar .
- 5.-In the latitudinal Arctic - 66° - 90°N -and Antarctic - 60° - 90°S - belts, due to the great difference in the duration of day and night, and the little thermal energy that is received during the solstices, life finds very severe limitations. Therefore, at any latitude and altitude, the Macrobioclimate is considered Polar.

In addition to the latitude, in the differentiation of the Macrobioclimas several thermal indices are used, in some cases related to the Continental Index, as well as certain rainfall rhythms. Thus, the Compensated Thermicity Index, ITC, which accurately measures the winter cold intensity - a true barrier for many living beings - is very discriminant to differentiate tropical, Mediterranean and temperate Macrobioclimates.

In the Earth's Bioclimatic Synopsis, Figure 7, in the Macrobioclimates column, we find all the necessary values to distinguish the Macrobioclimates from each other. Figure 4 is a copy of that first column of the Earth's Bioclimatic Synopsis, which facilitates its consultation.

Note: According to the Orobioclimates premise, to analyze the Macrobioclimate of a meteostation located at a certain height above sea level, it is necessary to theoretically calculate the thermal values that would have in its base, that is, between 0 and 200 meters above sea level. For that, it is necessary to increase T, M, ITC and Tp in certain values, for every 100 m that the weather station exceeds 200m. The amount of the increments vary somewhat with the latitude, so they are given, as a note, at the bottom of the summary table "Bioclimatic Synopsis of the Earth". (See Figure 7)

Figure 4.- Column of Macrobioclimates, extracted from the Bioclimatic Synopsis of the Earth

Macrobioclimates ⁽¹⁾
Name, Acronym and Differential Characters
Tropical Tr
Warm Zone: Equatorial, Eutropical and Subtropical Belts (0° - 35° N & S). In Subtropical (23° - 35° N & S) at < 200 m, at least two values: $T \geq 25^\circ$, $m \geq 10^\circ$, $l_{tc} \geq 580$; or, if $P_{ss} > P_{sw}$, or $P_{cm_2} < P_{cm_1} > P_{cm_3}$, at least two values: $T \geq 21^\circ$, $M \geq 18^\circ$, $l_{tc} \geq 470$. In Eurasia, from 25° to 35° N, height $\geq 2000m$: it is not tropical.
Mediterranean Me
Subtropical Warm Zone (23° to 35° N & S) and Eutemperate Temperate Zone (35° to 52° N & S), with summer aridity at least bimonthly after the summer solstice: $l_{os_2} \leq 2$, $l_{osc_4} \leq 2$. In the Subtropical, at least two of the three thermal values: $T < 25^\circ$, $m < 10^\circ$, $l_{tc} < 580$.
Temperate Te
Subtropical Warm Zone (23° to 35° N & S) and Temperate Zone (35° to 66° N & 35° a 54° S). Without summer aridity: $l_{os_2} > 2$, $l_{osc_4} > 2$. At <200 m, $T_p \geq 380$. Besides: a), from 23° to 35° N & S, at <200 m, at least two values: $T < 21^\circ$, $M < 18^\circ$, $l_{tc} < 470$; or b), against Boreal, at <200 m: if $l_c \leq 11$: $T > 6^\circ$, $T_{max} > 10^\circ$ and $T_{ps} > 320$; if $11 < l_c \leq 21$: $T_p > 720$ and $T > 5.3^\circ$; if $21 < l_c \leq 28$: $T_p > 740$ and $T > 4.8^\circ$; if $28 < l_c \leq 46$: $T_p > 800$ and $T > 3.8^\circ$; and if $46 < l_c$: $T_p > 800$ and $T > 0^\circ$.
Boreal Bo
Temperate and Cold Zones (42° to 72° N, 49° to 56° S). Without summer aridity: $l_{os_2} > 2$, $l_{osc_4} > 2$. At <200 m, $T_p \geq 380$. If $l_c \leq 11$: $T \leq 6^\circ$, $T_{max} \leq 10^\circ$, $380 \leq T_p \leq 720$ and $T_{ps} \leq 320$; if $11 < l_c \leq 21$: $380 \leq T_p \leq 720$ and $T \leq 5.3^\circ$; if $21 < l_c \leq 28$: $380 \leq T_p \leq 740$ and $T \leq 4.8^\circ$; if $28 < l_c \leq 46$: $380 \leq T_p \leq 800$ and $T \leq 3,8$; and if $46 < l_c$: $380 \leq T_p \leq 800$ and $T \leq 0^\circ$.
Polar Po
Temperate and Cold Zones (51° a 90° N & S). Altitude < 100m: $T_p < 380$.
(Rivas-Mart. et al., 2011) (Modified M.L. López y M.S. López, 26 Dec. 2016)
(1) Between 23° - 48° N and 23° - 51° S, if the locality is 200 m, or more, of altitude, it is necessary to theoretically calculate the thermal values at such a height by increasing T by 0.6 °; M and m, by 0.5°; and l_{tc} by 13 units, for every 100 m that exceeds said altitude. More than 48° N ó 51° S, it is necessary to calculate the theoretical values of the average annual temperature, of the average of the maximums temperature of the coldest month, and of the annual positive temperature, increasing T by 0.4°, M by 0.5° and T_p by 12 units, for every 100 m that exceeds said altitude.

4.1.1.- Tropical Macrobioclimate

The Tropical Macrobioclimate is distributed between latitudes 35° N & S, corresponding to the latitudinal belts equatorial, eutropical and subtropical, this last latitudinal belt, 23°-35° N and S, also occupied by the Mediterranean and Temperate Macrobioclimates. It should be remembered here the reciprocity premise, that in Eurasia, between 25° and 35° N and 70°-120° E, territories at 2,000m, or higher, are not tropical.

The territories with Tropical Macrobioclimate have very low Continentality, since the temperatures remain almost constant throughout the year. However, the ombic rhythms of the 6-months periods, or 4-months periods, are very important here, as well as a high level of certain thermal parameters and indices. (See Figure 4, or also, the Synopsis of the World Bioclimatic Classification, figure 7).

The optimum of vegetation in the Tropical Macrobioclimate is the rainforest, or equatorial forest, which is the terrestrial vegetation with the greatest biodiversity, structural complexity, biomass and productivity, with three or more layers of trees, with abundant woody lianas and numerous epiphytes. However, depending on the amount of precipitation, the structure of tropical potential vegetation corresponds to other types: semi-deciduous forests, open forests, shrub vegetation, semi-deserts, deserts, or hyper-deserts. In addition, the phytochenosis ruled by the Tropical Macrobioclimate have a very original flora and vegetation, rich and diverse, and, therefore, radically different from those of the territories with Mediterranean or Temperate Macrobioclimates, with precipitations of similar quantity.

The Tropical Macrobioclimate is present in all the continents, except in Antarctica.

4.1.2.- Mediterranean Macrobioclimate

The Mediterranean Macrobioclimate is distributed between the 23°-52° N & S, latitudes in which it coincides with the Tropical (23°-35° N & S), Temperate (23°-52° N & S) and Boreal (42°-52° N and 49° -52 S) Macrobioclimates. It should be remembered here the reciprocity premise, that in Eurasia, between 25° and 35° N and 70°-120° E, territories at 2,000m, or higher, are either Mediterranean or Temperate (not tropical).

Territories with a Mediterranean Macrobioclimate have a non-compensable summer aridity (see Chapter 9), ie, $Ios2 \leq 2$, with $Iosc3 \leq 2$, or $Iosc4 \leq 2$, in addition to a lower level than the Tropical in certain thermal Parameters and Indices. (See Figure 4, or also, the Synopsis of the World Bioclimatic Classification, figure 7).

The optimum of vegetation in the Mediterranean Macrobioclimate are the durisilva, sclerophyll forests of modest size, low biodiversity and productivity, with few lianas and almost no epiphytes. However, depending on the amount of rainfall, the structure of Mediterranean potential vegetation corresponds to very different types: further to durisilva, there are closed deciduous forests, conifer forests, shrub vegetation, semi-deserts, deserts or hyper-deserts. In addition, phytochenosis of the Macrobioclimate

Mediterranean, have a very original flora and vegetation, rich and diverse, and, therefore, radically different from those of the territories with Tropical, Temperate, or Boreal Macrobioclimates, with precipitations of similar amount.

The Mediterranean Macrobioclimate has its greatest territorial representation in the center and in the western part of all continents, and does not exist in Antarctica.

4.1.3. Temperate Macrobioclimate

Temperate Macrobioclimate is distributed between latitudes 23° to 66° N and 23° to 54° S, latitudes in which it coincides, in whole or in part, with the Tropical, Mediterranean and Boreal Macrobioclimates. The lack of summer aridity, by itself, distinguishes the Temperate Macrobioclimate of the Mediterranean Macrobioclimate, but, to distinguish it from the Tropical and the Boreal, it is necessary to specify well its thermal thresholds:

- a) **Summer aridity:** The Temperate Macrobioclimate, at any altitude and value of Continentality, lacks summer aridity: that is, the two consecutive warmer months of the summer trimester (or warmer period of the year) have $Ios2 > 2$; or, if there were two arid months, with: $Ios2 \leq 2$, this aridity is compensated by the rains of the previous month, or of the previous two months: $Iosc3 > 2$, or $Iosc4 > 2$. (See Figure 4, or also the Synopsis of the World Bioclimatic Classification, figure 7).
- b) **Thermal thresholds of Temperate Macrobioclimate in front of Tropical Macrobioclimate.** Between 23° to 35° N & S, theoretically calculated at 200 m altitude, two of the three thermal values mentioned must meet the following conditions: $T < 21^\circ$, $M < 18^\circ$, $I_{tc} < 470$.
- c) **Thermal thresholds of Temperate Macrobioclimate versus Boreal Macrobioclimate.** Between 43° to 66° N and 49° to 54° S, values theoretically calculated at an altitude of 200 m, or those at lower altitudes, must be greater than the threshold values that limit Temperate and Boreal Macrobioclimates. Those thresholds, which depend on the Continentality Index values, can be seen in figure 4, or also in the Synopsis of the World Bioclimatic Classification, figure 7.

The optimum of vegetation in the Temperate Macrobioclimate are the evergreen laurisilva rich in arborescent ferns, as well as the deciduous aestisilva; in the cold extremes of the Temperate Macrobioclimate are characteristic the aciculisilvas; and, finally, in the xeric extremes of the Temperate Macrobioclimate, the deciduous woodland becomes discontinuous and easily transformed into extensive pastures, or steppes, under the pressure of grazing and of fires.

The Temperate Macrobioclimate is represented on all continents, except in Antarctica.

4.1.4.- Boreal Macrobioclimate

The Boreal Macrobioclimate extends from latitudes 42° to 72° N and from 49° to 56° S, latitudes in which it coincides, to a greater or lesser extent, with the Mediterranean,

Temperate and Polar Macrobioclimates. The following characteristics allow to define the Boreal Macrobioclimate and to differentiate it from the other three: the lack of summer aridity, by itself, distinguishes between Macrobioclimates Boreal and Mediterranean; the lower thermal threshold separates it from the Polar Macrobioclimate; but in order to distinguish it from the Temperate Macrobioclimate, its thermal thresholds must be well defined in dependence with Continentality.

1. **a). - Lack of summer aridity.** In the Boreal Macrobioclimate, at any altitude and value of Continentality, there are no two consecutive arid months during the summer or warmer period of the year; that is, $Ios2 > 2$; or, if there were two arid months, $Ios2 \leq 2$, these are compensated with $Iosc3 > 2$, or $Iosc4 > 2$. (See Chapter 9).
2. **b). - Thermal thresholds of Boreal Macrobioclimate versus Temperate Macrobioclimate.** Between latitudes 42° to 72° N and 49° to 56° S, thermoclimatic values theoretically calculated at an altitude of 200 m, or those at lower altitudes, must be lower than the threshold values between the Boreal and Temperate Macrobioclimates. Those thresholds, which depend on the Continentality Index values, can be seen in figure 4, or also in the Synopsis of the World Bioclimatic Classification, figure 7.
3. **c). - Lower thermal threshold compared to Polar Macrobioclimate.** The Boreal Macrobioclimate has a lower thermal threshold, calculated to less than 200 m, of $Tp \geq 380$. This threshold distinguishes it from the Polar Macrobioclimate.

The optimum of vegetation in the Macrobioclimate Boreal are acciculisilvas, conifer or taiga forests, with low understory but, at the thermal limits of the Macrobioclimate, the Tundra of nanofanerófitos, nanocaméfitos and hemicryptophytes appear.

The Boreal Macrobioclimate is represented in the continents of Eurasia, North America and South America, but is lacking in Africa, Australia and Antarctica.

4.1.5.- Polar Macrobioclimate

It is considered that all territories between the parallels 51° to 90° N & S, with a Positive Annual Temperature, theoretically calculated at 200 m altitude, lower than 380 ($Tp < 380$), have a Polar Macrobioclimate. (See Figure 4, or also, the Synopsis of the World Bioclimatic Classification, figure 7).

The optimum of vegetation in the Macrobioclimate Polar are the nanofanerophytes and nanocamephytes tundras, and the graminoids lawns with more or less mosses and lichens, all of them communities of little productivity and slow growth.

The Polar Macrobioclimate is the only Macrobioclimate present in Antarctica and is also represented in the continents of Eurasia and North America, but it does not exist in Africa, South America or Australia.

4.1.6.- Macrobioclimates Continental Distribution

We show, in Figure 5, the continental distribution of Macrobioclimates.

Figure 5. Continental distribution of the Macrobioclimates

Continents / Macrobioclimates	North America	South America	Eurasia	Africa	Australia- Polynesi	Antarctica	Total, by Continents
Tropical	+	+	+	+	+	---	5
Mediterranean	+	+	+	+	+	---	5
Temperate	+	+	+	+	+	---	5
Boreal	+	+	+	---	+	---	4
Polar	+	+ (Insular)	+	---	---	+	4
Total Macrobioclimates	5	5	5	3	4	1	

4.2.- Second hierarchical level of the Classification: Bioclimates / Variants

Bioclimates constitute the second rank of the Rivas-Mart. (2008) and Rivas-Mart. & al. (2011) hierarchical Bioclimatic Classification. In the wide territories of each Macrobioclimate, life detects climate scenarios related to certain thresholds **lo** and **lc**, mainly, but also, in certain cases, with the precipitation rhythms (in the Tropical Macrobioclimate), or with the **Tp** (in Polar Macrobioclimate): those sets of climatic-environmental scenarios, indicated by changes vegetation, and subordinated to the Macrobioclimas, are the **Bioclimates**. 28 Bioclimates are recognized, distributed in the five Macrobioclimates. (See Synoptic Table, second column, figure 7). Each Bioclimate possesses vegetal formations, biomas, biocenosis and vegetal communities, of its own.

Regarding the **Variants**, in all the Bioclimates, certain peculiarities and variations of the seasonal rhythms of precipitation and / or temperature, tolerable within their defining intervals, allow to recognize the **Bioclimatic Variants**. Globally, nine Bioclimatic Variants are recognized.

Coming up next we will comment in detail: in 4.2.1, the distinguishable Bioclimates within each Macrobioclimate; and in 4.2.2, the recognized Bioclimatic Variants, their peculiarities, and the Bioclimates to which they affect:

4.2.- Second hierarchical level of the Classification: Bioclimates / Variants

4.2.1. Bioclimates

4.2.1.a) Tropical Bioclimates

- 4.2.1.b) Mediterranean Bioclimates
- 4.2.1.c) Temperate Bioclimates
- 4.2.1.d) Boreal Bioclimates
- 4.2.1.e) Polar Bioclimates
- 4.2.2.- Bioclimatic Variants
 - 4.2.2.a) Pluviserotin Variant (Pse).
 - 4.2.2.b) Antitropical Variant (Ant).
 - 4.2.2.c) Bixeric Variant (Bix).
 - 4.2.2.d) Tropical Drought Variants (Str).
 - 4.2.2.e) Semitropical Hyperdesertic Variant (Strhd).
 - 4.2.2.f) Steppic Variant (Stp).
 - 4.2.2.g) Submediterranean Variant (Sbm).
 - 4.2.2.h) Polar Semiboreal Variant (Pose).
 - 4.2.2.i) Normal Variant (Nor).

4.2.1. **Bioclimates**

In the Tropical Macrobioclimate, which maintains a very constant temperature throughout the year, the amount and the seasonal rhythm of the precipitations are the criteria that delimit its Bioclimates. In the rest of the Macrobioclimates there are already seasonal variations, both rainfall and temperature, throughout the year, so that, in addition to the humidity comfort - Ombrothermal Index, **Io**-, also the annual thermal amplitude - Continentality Index, **Ic** -, differentiate bioclimatic ambits. However, in the Mediterranean Macrobioclimate, with summer aridity, in which by definition water acts as a limiting factor of life, especially during summer, the vegetation perceives up to four levels of **Io** and two levels of **Ic**. As for Temperate, Boreal and Polar Macrobioclimates, without summer aridity, the most discriminating factor for life is the annual thermal amplitude -**Ic**-, followed in importance by the humidity comfort -**Io**-: the vegetation itself marks three levels of **Ic** in the Temperate and Polar Macrobioclimates, and five levels in the Boreal Macrobioclimate; while, with respect to **Io**, the vegetation only distinguishes two levels in all the three Macrobioclimates.

4.2.1.a) **Tropical Bioclimates**

Within the vast territories occupied by the Tropical Macrobioclimate, five Bioclimas are recognized, which correspond with the five large caesuras, related to both the annual Ombrothermal Index, **Io**, and the rainfall regime, **Iod2**. (See figure 7, Synopsis of the Worldwide Bioclimatic Classification).

Thus, the tropical bioclimatic space distinguishes three thresholds of **Io**, delimiting four intervals, in the wettest of which, the rainfall regime, **Iod2**, separates, in turn, two other intervals: in total, five Bioclimates. The three threshold values of **Io** are: 3.6, 1.0 and 0.2, and the threshold value of **Iod2** is 2.5. The five Tropical Bioclimates are thus defined: **Tropical Pluvial**, with $Io \geq 3,6$ and $Iod2 > 2,5$; **Tropical Pluviseasonal**, with $Io \geq 3,6$ and $Iod2 \leq 2,5$; **Tropical Xeric**, with $1,0 \leq Io < 3,6$; **Tropical Desertic**, with $0,2 \leq Io < 1,0$; and **Tropical Hyperdesertic**, with $Io < 0,2$.

The optimum of vegetation in each of the Tropical Bioclimates are the following formations: in the Tropical Pluvial, the rainforests; In the Tropical Pluviseasonal, the hiemisilva; in the Tropical Xeric, the open hiemifruticeta in mixture with the terriherbosa; in the Tropical Desertic, the sicidesertas; and in the Tropical Hyperdesertic, the absence of rooted vascular plants, since they are regions without vascular plants.

4.2.1.b) Mediterranean Bioclimates

In the territories of Mediterranean Macrobioclimate, located in the center and in the western façades of the continents, eight Mediterranean Bioclimates are recognized, which correspond to as many changes in vegetation, and which are related to the combination of four levels of humidity comfort -**Io**-, with two levels of Continentality -**Ic**-. (See figure 7, Synopsis of the Worldwide Bioclimatic Classification).

And so, in the Mediterranean Macrobioclimate, life distinguishes three thresholds of **Io**, delimiting the following four intervals of humidity comfort: with $2,0 \leq Io$, two Mediterranean Pluviseasonal Bioclimates; with $1,0 \leq Io < 2$, two Mediterranean Xeric Bioclimates; with $0,2 \leq Io < 1,0$, two Mediterranean Desertic Bioclimates; and with $Io < 0,2$, two Mediterranean Hyperdesertic Bioclimates. At each of those four intervals, two levels of Continentality can be recognized: with $Ic \leq 21$, four Mediterranean Oceanic Bioclimates; with $Ic > 21$, four Mediterranean Continental Bioclimates. The eight Mediterranean Bioclimates are thus characterized: **Mediterranean Pluviestacional Oceanic**, **Me. Pluviestacional Continental**, **Me. Xeric Oceanic**, **Me. Xeric Continental**, **Me. Desert Oceanic**, **Me. Desert Continental**, **Me. Hyperdesertic Oceanic** and **Me. Hyperdesertic Continental**.

The optimum of vegetation in each of the Mediterranean Bioclimates are the following formations: in the Pluviestacional Mediterranean Bioclimates, the optimum of vegetation are sclerophyllous forests and, to a lesser extent, laurifolia semipervirent forests, deciduous forests and needle-leaves forests; in the Xeric Mediterranean Bioclimates, the optimum of vegetation are closed microforests and shrubs; in the Mediterranean Desertic Bioclimates, the optimum of vegetation are semi-deserts, open shrubs and scatered thickets; and in the Hyperdesertic Mediterranean Bioclimates, the characteristic feature is the absence of climatophile woody vegetation.

4.2.1.c) Temperate Bioclimates

In Temperate Macrobioclimate life distinguishes two intervals of humidity comfort: thus, with $Io \leq 3.6$, **Xeric Temperate Bioclimate**, and with $Io > 3.6$, three Bioclimates, distinguishable by two Continentality thresholds, 11 and 21: with $Ic \leq 11$, **Hyperoceanic Temperate Bioclimate**; with $11 < Ic \leq 21$, **Oceanic Temperate Bioclimate**; and with $Ic > 21$, **Continental Temperate Bioclimate**. In this way, four Bioclimas have been recognized within the Temperate Macrobioclimate. (See figure 7, Synopsis of the Worldwide Bioclimatic Classification).

The optimum of vegetation in each of the Temperate Bioclimates are: in the Hyperoceanic Temperate Bioclimate, the optimum of vegetation are the lauroid forests; in the Oceanic Temperate and Continental Temperate Bioclimates, the optimum of vegetation are the winter deciduous forests, as well as, in the mountains, conifer forests; and in the Xeric Temperate Bioclimate the optimum of vegetation are the laurifruticeta and the aestifruticeta.

4.2.1.d) Boreal Bioclimates

In the Boreal Macrobioclimate territories, six Bioclimates are recognized, characterized by their levels of Continentality, in combination with the Ombrothermal Index. In this Macrobioclimate, life has great sensitivity to Continentality, recognizing four thresholds that delimit five intervals: $Ic \leq 11$, $11 < Ic \leq 21$, $21 < Ic \leq 28$, $28 < Ic \leq 46$, $46 < Ic$. With respect to Io , only two intervals, separated by a threshold, are recognized: $Io > 3.6$, or $Io \leq 3.6$ (See figure 7, Synopsis of the Worldwide Bioclimatic Classification).

So, when Continentality is extremely high, $Ic > 46$, the **Bioclimate** is **Boreal Hypercontinental**, regardless of the Ombrothermal Index of the place. However, with Continentality Index below 46, $Ic \leq 46$, if the Ombrothermic Index is less than, or equal to, $3.6 - Io \leq 3.6$ -, the **Bioclimate** is **Boreal Xeric**; But if the Ombrothermic Index is greater than $3.6 - Io > 3.6$ -, the Bioclimate goes in function of the Ic , as follows: with $Ic \leq 11$, **Boreal Hyperoceanic Bioclimate**; with Ic between 11 y 21 - $11 < Ic \leq 21$ -, **Boreal Oceánico Bioclimate**; with Ic between 21 y 28 - $21 < Ic \leq 28$ -, **Boreal Subcontinental Bioclimate**; and if Ic between 28 y 46 - $28 < Ic \leq 46$ -, **Boreal Continental Bioclimate**.

The optimum vegetation in the Boreal Bioclimates are coniferous forests, and shrub and Ericaceae tundra.

4.2.1.e) Polar Bioclimates

In the territories with Polar Macrobioclimate, due to the intrinsic difficulties that represent the low temperatures, life distinguishes: in addition to a threshold and two ranges of Positive Temperature - $Tp = 0$, or $Tp > 0$ -, two thresholds and three intervals of Continentality, $-Ic : 11$ y 21 -, as well as one threshold and two intervals of Io , $-3,6$ -, thus defining, in total, five Bioclimates: **Polar Hyperoceanic**, **Polar Oceanic**, **Polar Continental**, **Polar Xeric** and **Polar Pergelid** (See figure 7, Synopsis of the Worldwide Bioclimatic Classification).

The optimum vegetation in the Polar Bioclimates are the dwarf shrubs tundra, the graminoid tundra and the moss and lichen tundra.

4.2.2.- Bioclimatic Variants

The amplitude of the intervals defining each Bioclimate, allows certain variations in the rhythms of humidity and/or temperature (such as advance / delay of rains, or of high / low temperatures). The vegetation reflects these variations, which are bioclimatically expressed by the Variants.

In the set of five Macrobioclimates, nine Bioclimatic Variants have been recognized (See Figure 6). (It should be noted that the Variant of Tropical Drought includes, in fact, seven Variants):

Pluviserotin (late-summer rains), Antitropical, Bixeric (two droughts), Tropical Drought, Semitropical Hyperdesertic, Steppic, Submediterranean, Polar Semiboreal, and Normal.

4.2.2.a) Pluviserotin Variant (Pse). Tropical Bioclimatic Variant in which the precipitation of the first two months of the summer solstice (June-July, in latitudes N, and December-January, in latitudes S) is less than 1.3 times that corresponding to the two months that follow (August-September in latitudes N, and February-March, in latitudes S): $Psb1 < 1.3Psb2$. This Variante does not take place in either the Tropical Pluvial Bioclimate or the Tropical Hyperdesertic Bioclimate.

This Bioclimatic Variant is due to the monsoon activity that, in Africa, Indostan and North America, delays the summer rains until the autumn. Its plant communities have the same structure as the normal tropical ones with equivalent Ombrotype, although their floristic element differs, due to the phenological isolation.

4.2.2.b) Antitropical Variant (Ant). Tropical Bioclimatic Variant, practically restricted to the equatorial waist and adjacent territories, where rainfall corresponding to the winter solstice trimester (December, January and February, in latitude N, and June, July and August, in latitude S) are higher than those of the summer trimester (June, July and August, in latitude N, and December, January and February, in latitude S): $PTr1 > PTr3$. This Variant does not take place in either the Tropical Pluvial Bioclimate or the Tropical Hyperdesertic Bioclimate.

The Antitropical plant formations are very similar, in their structure, to those of the Tropical Pluviserotin Variant and of the Normal Variant, with equivalent Ombrotype, although their floristic element has a high number of endemisms, obviously caused by a phenological period practically antithetical, which has favored their isolation and, therefore, their speciation

4.2.2.c) Bixeric Variant (Bix). Tropical Bioclimatic Variant, in which there are two annual periods of aridity, with at least one month of $P \leq 2T$, in both solstices, separated by two more rainy periods in both equinoxes, in which at least one month is $P > 2T$. This Variant does not take place in either the Tropical Pluvial Bioclimate or the Tropical Hyperdesertic Bioclimate.

The Bixeric Tropical plant formations have structural, and sometimes phylogenetic, relationships with those Mediterranean pluviestational, xeric and desertic.

Figure 6. Distribution of the Bioclimatic Variants in the Macrobioclimates of the Earth. Tr = Tropical, Me = Mediterranean; Te = Temperate; Bo = Boreal; And Po = Polar. (According to Rivas-Mart et al., 2011, modified by the authors).

Bioclimatic Variants	("drought" levels)	Tr	Me	Te	Bo	Po
Pluviserotin (Pse)		•				
Antitropical (Ant)		•				
Bixeric (Bix)		•				
Tropical Drought (Str), (7 Humidity-Variants of)	Pluvial Hygrophytic	•				
	Pluvial Subhygrophytic	•				
	Pluvial Submesophytic	•				
	Pluviseasonal Mesophytic	•				
	Pluviseasonal Submesophytic	•				
	Pluviseasonal Subxerophytic	•				
	Pluviseasonal Xerophytic	•				
Semitropical Hyperdesertic (Strhd)			•			
Steppic (Stp)			•	•	•	•
Submediterranean (Sbm)				•	•	•
Polar Semiboreal (Pose)					•	
Normal (Nor)		•	•	•	•	•

4.2.2.d) **Tropical Drought Variants (Str)**. Bioclimatic Variants that operate in the Tropical Pluvial and Tropical Pluviestational Bioclimates, when the monthly I_o , in one or several months, is **lower than 2.5**, circumstance that gives rise to a period, more or less prolonged and / or more or less intense, of relative drought. Three Variants ("drought" levels) are recognized in the Tropical Pluvial Bioclimate, and four other Variants in the Pluviseasonal Tropical Bioclimate. (Figure 6). (For more information, see Rivas-Mart et al., 2011, pp. 15).

4.2.2.e) **Semitropical Hyperdesertic Variant (Strhd)**. In the subtropical latitudinal zone (23°-35° N & S), a territory of Mediterranean Macrobioclimate and Ombrotype from Hyperarid to Ultrahyperarid ($I_o = 0.0 - 0.4$) should be considered as a Hyperdesertic Semitropical Variant, when the trimester precipitation corresponding to the solstice of Summer (Tr3) is only 0.7 times lower than the winter solstice trimester (Tr1) precipitation: $PTr3 < 0.7 PTr1$. This occurs in the hottest deserts of California, in North America, in the deserts of Antofagasta or Atacama in South America, and in the deserts of the oceanic Sahara and Namibia in Africa. (For more information, see Rivas-Mart et al., 2011, pp. 15).

4.2.2.f) **Steppic Variant (Stp)**. Steppicity is a bioclimatic characteristic that, in the extratropical Macrobioclimates (Mediterranean, Temperate, Boreal and Polar), indicates the existence of two breakes off (or pauses) in the vital activity during both solstices, in summer (June, July and August, in latitudes N, And December, January and February, in latitudes S) and in winter (December, January and February, in latitudes N, and June, July and August, in latitudes S), due to drought and/or cold. The steppic character only appears in Bioclimates with tendencies to drought and to Continentality, and is emphasized by the appearance of xerophytic types of vegetation, due to the water limitation and / or the low temperatures, existing in both solstices.

For the Steppic Variant to appear, the Bioclimate must have a I_c at least of Semicontinental, $I_c > 17$, and a I_o low, between the Lower Hyperarid and the Upper Sub-humid, $6.0 \geq I_o > 0.2$. The brakes on vegetative activity, characteristic of the Steppic Variant, imply the following: a), The braking of the steppic summer requires at least one month of summer with the precipitation, in mm, less than three times its temperature, in degrees centigrade: $Psi < 3Tsi$; b), The braking of the steppic winter is recognized because the positive precipitation of the summer trimester is higher to the positive precipitation of the winter trimester: $Pps > Ppw$.

The steppic character is highlighted in very diverse continental or semicontinental plant formations, due to the appearance of types of xerophytic vegetation, as well as for the fragility of the forests, due to the water limitation existing in both solstices. The most characteristic steppic plant formations of the Earth, corresponding to this Bioclimatic Variant, are: the micro-forests, shrubland and Mediterranean xeric steppe grasslands of the Northern Hemisphere; the steppes and temperate steppic forests of Eurasia; the broad grasslands, wooded or not, of North America; and also the taiga and tundra steppic formations, boreal and polar, restricted to areas of low summer precipitation, in Asia and North America.

4.2.2.g) **Submediterranean Variant (Sbm)**. Bioclimatic variant frequent in temperate Macrobioclimate, and scarce in Boreal and Polar Macrobioclimates, in which, at least during one summer month (June, July or August, in latitudes N, and December, January or February, in latitudes S), the precipitation in millimeters is less than

two and eight tenths the average temperature in degrees centigrade of that same period:
Iosi <2.8, or Psi<2.8Tsi

The most characteristic submediterranean temperate plant formations are those of transition or ecotone between Temperate Bioclimates, lacking summer aridity, and the genuinely Mediterranean, where the summer drought lasts for at least two months. In the Holarctic Kingdom, the most representative plant formations are usually those formed, in the mature stage, by sclerophyllous or deciduous forests, as well as certain types of xerophytic coniferous forests and xerophytic tundra.

4.2.2.h) **Polar Semiboreal Variant (Pose).**

A Boreal Macrobioclimate territory, with **Ic≤28** -Bioclimates Boreal Hyper-oceanic, Boreal Oceanic and Boreal Subcontinental-, and Thermotype Oroboreal, **Tp** between 380-480, should be considered as a Polar Semiboreal variant, if it is a mountain completely surrounded by forest at its base and, in addition, the **Tmax ≤11°** (average monthly temperature of the warmest month of the year) and **Tps≤320** (positive temperature of the summer trimester, in tenths of degree), since the natural potential vegetation in these bioclimatic conditions are deforested tundras, instead of micro-forests: that is the case in North America - on the western shores and reliefs of the Alaska Peninsula towards the Bering Strait, or on the Aleutian Peninsula and Islands -, and in other artoboreal and antiboreal territories of the Earth. (For more information, see Rivas-Mart et al., 2011, pp. 15).

4.2.2.i) **Normal Variant (Nor).**

In this hierarchical level "Bioclimate / Variant", the portion of a Bioclimate that does not present any of the thermal or ombric peculiarities of any of the other eight variants described above, is considered to have Normal Variant. It is essential to name as Normal Variant the rest of the Bioclimate not included in any of the other eight Variants, because using the name of the Bioclimate for both the Bioclimate and for what remains after assigning Variant to some parts of it, would be a cause of confusion, especially when making Bioclimatic Maps (because we would be giving the same name to two different hierarchical levels). So the Normal Variant occurs in all of the Bioclimates, alone or accompanied by one or more of the other Variants, except in the Tropical Pluvial and Tropical Pluviseasonal. (See Figure 6).

4.3.- **Third hierarchical level of the Classification: Bioclimatic Belts -Thermotypes and Ombrotypes-**

Bioclimatic Belts are each one of the environments that follow each other in a latitudinal, longitudinal or altitudinal cliserie. Each Bioclimatic Belt is defined by a thermal interval together with a humidity comfort interval: that is, by a Thermotype and a Ombrotype. Each Bioclimatic Belt corresponds to certain formations and plant communities: a vegetation belt. The phenomenon of plant zoning has universal jurisdiction. The Thermotypic threshold values (**I_{tc}**, **T_p**) differ somewhat from one

Macrobioclimate to another (see figure 7, Bioclimatic Belts, column 3), but Ombroclimatic threshold values (**Io**) are the same in all Macrobioclimates (see figure 7: Bioclimatic Belts, column 4).

Sometimes it is convenient to distinguish, within the Bioclimatic Belts, the lower and upper halves of their thermal and ombric intervals: thus appear the subordinate units of Bioclimatic belts, the so-called Bioclimatic Horizons, Termotypic and Ombrotypic. Bioclimatic Horizons are named by adding the word "lower" or "upper" to the corresponding name of the Thermotype or the Ombrotype: Upper Termomediterranean Horizon; Lower Subhumid Horizon.

Expressing the Thermotypes and the Ombrotypes as Belts, or as Horizons, depends on the territorial scale to which we work.

Explanatory note:

It is important to remark a peculiarity in the names of the Termotypic Horizons: the upper / lower adjectives refer to the actual values of thermal comfort (Thermotypes), precisely to the hotter half, or cooler half, of the thermal belt. But it is necessary to take into account that, in Nature, the upper thermal Horizon, hotter, is found, paradoxically, at the lower height. So, in nature, and contrary to what their names indicate, the higher, hotter Horizon is situated at a lower altitude than the lower, colder Horizon, which stands higher.

4.3.1.- **Thermotypes.** These are thermal categories of the climate, which take into account certain intervals of **I_{tc}** and / or **T_p**, and that occurring in latitudinal, longitudinal or altitudinal sequence -thermobelts - in each of the Macrobioclimates of the Earth. Generally speaking, seven thermobelts are recognized: Infra-, Thermo-, Meso-, Supra-, Oro-, Crioro- and Gelid-, although not all seven are recognized in each Macrobioclimate. Besides, as thermo-threshold values vary slightly from one Macrobioclimate to another, the Thermotypes of each Macrobioclimate need to be named by adding, to the general word that indicates the belt, the name of the Macrobioclimate itself: Termotropical, Suprapolar, etc. Thus, the Thermotypes recognized in the Bioclimatic Classification of the Earth amount to 31. In the fourth and fifth column -Thermotypes- of the table "Bioclimatic Synopsis of the Earth" (Figure 7), the names of all the Thermotypes in each Macrobioclimate, and the intervals of **I_{tc}** and **T_p** that delimit them in each Macrobioclimate, are indicated, as well as the acronyms that designate them. At any altitude, or latitude, when the Thermicity Compensated Index (**I_{tc}**) is lower than 120, or when the Continentality Index (**I_c**) is equal to or higher than 21, to recognize the Thermotype, the value of the Annual Positive Temperature (**T_p**) is used.

To express the Upper and Lower Horizons of each Thermotype, the upper / lower words are added to the Thermotype name, or the letters "s" or "i", to the corresponding acronym. Thus, for example: Upper Mesomediterranean Horizon - **Mmes**; Lower Mesomediterranean Horizon - **Mmei**. (Thermo-Horizons are not recognized in the Gelid Thermotypes or the Infratemperate Thermotype).

4.3.2.- **Ombrotypes**. They are climate categories, which express the level of humidity comfort, or discomfort, through intervals of the Annual Ombrothermal Index, **Io**. The Ombrotyps follow each other in the latitudinal, longitudinal or altitudinal sequence - ombro-belts - in each of the Macrobioclimates of the Earth. Given the high predictive value and the high correlation that the annual ombrothermal values show with the climatophilic potential vegetation structures in the whole Earth, Rivas-Martínez & al. (2011) have used humidity confort intervals to establish their Omóptotypes.

The Ombrotypes recognized in the Bioclimatic Classification of the Earth are the following nine: Ultrahyperarid, Hyperarid, Arid, Semi-arid, Dry, Sub-humid, Humid, Hyper-humid and Ultrahyper-humid. The threshold values that diagnose the Ombrotypes are always the same in all Macrobioclimates and their intervals, as well as the abbreviations that designate them, are shown in the fourth column - Ombrotypes- of the table "Bioclimatic Synopsis of the Earth" (see figure 7).

To express the Upper and Lower Horizons of each Ombrotype, the upper / lower / lower word is added to the Ombrotype name, or the letters "s" or "i", to the corresponding acronym. Thus, for example: Upper Dry Horizon – **Drys/Secs**; Lower Dry Horizon - **Dryi/Seci**.

5.- BIOCLIMATIC SYNOPSIS OF THE EARTH

It is a table, compacted into one page, that summarizes the whole of the Bioclimatic

Figure 7: Bioclimatic Synopsis of the Earth. [\(Link to its quality file\)](#).

BIOCLIMATIC SYNOPSIS OF THE EARTH
(summary table)

Macrobioclimates ⁽¹⁾	Bioclimates and Bioclimatic Variants ⁽²⁾				Bioclimatic Belts						
Name, Acronym and Differential Characters	Bioclimates	Variants	Bioclimatic intervals	Acronym	Bioclimatic Belts: Thermotypes ⁽³⁾		Acronym	Bioclimatic Belts: Ombrotypes	Acronym		
			Io	Ic	Iod2	Ite	Tp ⁽²⁾		Io		
Tropical Tr Warm Zone: Equatorial, Eutropical and Subtropical Belts (0° - 35° N & S). In Subtropical (23° - 35° N & S) at < 200 m, at least two values: T ≥ 25°, m ≥ 10°, Ite ≥ 580; or, if Pass > Psw, or Pem2 < Pem1 > Pem3, at least two values: T ≥ 21°, M ≥ 18°, Ite ≥ 470. In Eurasia, from 25° to 35° N, height ≥ 2000m: it is not tropical.	Tr. Pluvial	<i>Pse, Ant, Bix, Str</i>	3.6≤Io	—	> 2.5	Trpl	710<Ite<890	2900<Tp	1. Ultrahyperarid	Io<0.2	Uha
	Tr. Pluviseasonal	<i>Pse, Ant, Bix, Str</i>	3.6≤Io	—	≤ 2.5	Tpls	490<Ite<710	2300<Tp<2900	2. Hyperarid	0.2≤Io<0.4	Har
	Tr. Xeric	<i>Pse, Ant, Bix, Str</i>	0.0≤Io<3.6	—	—	Ttxe	320<Ite<490	1700<Tp<2300	3. Arid	0.4≤Io<1.0	Ari
	Tr. Desertic	<i>Pse, Ant, Bix, Str</i>	0.2≤Io<1.0	—	—	Trde	160<Ite<320	950<Tp<1700	4. Semi-arid	1.0≤Io<2.0	Sar
	Tr. Hyperdesertic	<i>Pse, Ant, Bix, Str</i>	Io<0.2	—	—	Trhd	120<Ite<160	450<Tp<950	5. Dry	2.0≤Io<3.6	Sec
									6. Subhumid	3.6≤Io<6.0	Shu
									7. Humid	6.0≤Io<12.0	Hum
									8. Hyperhumid	12.0≤Io<24.0	Ihu
									9. Ultrahyperhumid	24.0≤Io	Uhh
Mediterranean Me Subtropical Warm Zone (23° to 35° N & S) and Eutemperate Temperate Zone (35° to 52° N & S), with summer aridity at least bimonthly after the summer solstice: Ios2 ≤ 2, Ios4 ≤ 2. In the Subtropical, at least two of the three thermal values: T < 25°, m < 10°, Ite < 580.	Me. Pluviseasonal Oceanic	<i>Stp, Nor</i>	2.0≤Io	≤ 21	—	Mepo	450<Ite<580	2400<Tp	1. Ultrahyperarid	Io	Uha
	Me. Pluviseasonal Continental	<i>Stp, Nor</i>	2.0≤Io	> 21	—	Mepe	350<Ite<450	2100<Tp<2400	2. Hyperarid	0.2≤Io<0.4	Har
	Me. Xeric Oceanic	<i>Stp, Nor</i>	1.0≤Io<2.0	≤ 21	—	Mexo	220<Ite<350	1500<Tp<2100	3. Arid	0.4≤Io<1.0	Ari
	Me. Xeric Continental	<i>Stp, Nor</i>	1.0≤Io<2.0	> 21	—	Mexc	120<Ite<220	900<Tp<1500	4. Semi-arid	1.0≤Io<2.0	Sar
	Me. Desertic Oceanic	<i>Stp, Nor</i>	0.2≤Io<1.0	≤ 21	—	Medo	—	450<Tp<900	5. Dry	2.0≤Io<3.6	Sec
	Me. Desertic Continental	<i>Stp, Nor</i>	0.2≤Io<1.0	> 21	—	Medc	—	0<Tp<450	6. Subhumid	3.6≤Io<6.0	Shu
	Me. Hyperdesertic Oceanic	<i>Stp, Nor</i>	Io<0.2	≤ 21	—	Meho	—	0<Tp<450	7. Humid	6.0≤Io<12.0	Hum
	Me. Hyperdesertic Continental	<i>Stp, Nor</i>	Io<0.2	> 21	—	Mehc	—	0<Tp<450	8. Hyperhumid	12.0≤Io<24.0	Ihu
									9. Ultrahyperhumid	24.0≤Io	Uhh
Temperate Te Subtropical Warm Zone (23° to 35° N & S) and Temperate Zone (35° to 66° N & 35° to 54° S). Without summer aridity: Ios2>2, Ios4>2. At <200 m, Tp>380. Besides: a), from 23° to 35° N & S, at <200 m, at least two values: T<21°, M<18°, Ite<470; or b), against Boreal, at <200 m: if Ie<11; T>6°, Tmax<10° and Tps>320; if 11<Ie<21; Tp>720 and T>53°; if 21<Ie<28; Tp>740 and T>54.8°; if 28<Ie<46; 380≤Tp<800 and T>3.8°; and if 46<Ie; Tp>800 and T>0°.	Te. Hyperoceanic	<i>Stm, Nor</i>	> 3.6	Ie<11	—	Teho	410<Ite	2350<Tp	4. Semi-arid	Io<2.0	Sar
	Te. Oceanic	<i>Stp, Sbm, Nor</i>	> 3.6	11<Ie<21	—	Teoc	290<Ite<410	2000<Tp<2350	5. Dry	2.0≤Io<3.6	Sec
	Te. Continental	<i>Stp, Sbm, Nor</i>	> 3.6	21<Ic	—	Tecc	190<Ite<290	1400<Tp<2000	6. Subhumid	3.6≤Io<6.0	Shu
	Te. Xeric	<i>Stp, Sbm, Nor</i>	≤ 3.6	4≤Ic	—	Texe	120<Ite<190	800<Tp<1400	7. Humid	6.0≤Io<12.0	Hum
									8. Hyperhumid	12.0≤Io<24.0	Ihu
									9. Ultrahyperhumid	24.0≤Io	Uhh
Boreal Bo Temperate and Cold Zones (42° to 72° N, 49° to 56° S). Without summer aridity: Ios2>2, Ios4>2. At <200 m, Tp ≥ 380. If Ie<11; T>6°, Tmax<10°, 380<Tp<720 and Tps<320; if 11<Ie<21; 380≤Tp<720 and T>5.3°; if 21<Ie<28; 380≤Tp<740 and T>54.8°; if 28<Ie<46; 380≤Tp<800 and T>3.8°; and if 46<Ie; 380≤Tp<800 and T>0°.	Bo. Hyperoceanic	<i>Stm, Nor</i>	> 3.6	Ie<11	—	Boho	—	680<Tp	4. Semi-arid	Io<2.0	Sar
	Bo. Oceanic	<i>Stp, Sbm, Nor</i>	> 3.6	11<Ie<21	—	Booc	—	580<Tp<680	5. Dry	2.0≤Io<3.6	Sec
	Bo. Subcontinental	<i>Stp, Sbm, Nor</i>	> 3.6	21<Ie<28	—	Booc	—	480<Tp<580	6. Subhumid	3.6≤Io<6.0	Shu
	Bo. Continental	<i>Stp, Sbm, Nor</i>	> 3.6	28<Ie<46	—	Bohc	—	380<Tp<480	7. Humid	6.0≤Io<12.0	Hum
	Bo. Hypercontinental	<i>Stp, Sbm, Nor</i>	≤ 3.6	46<Ic	—	Boxe	—	0<Tp<380	8. Hyperhumid	12.0≤Io<24.0	Ihu
	Bo. Xeric	<i>Stp, Sbm, Nor</i>	≤ 3.6	Ie<46	—	Pogg	—	0<Tp<380	9. Ultrahyperhumid	24.0≤Io	Uhh
Polar Po Temperate and Cold Zones (51° a 90° N & S). Altitude < 100m: Tp < 380. (Rivas-Mart. et al., 2011) (Modified M.L. López y M.S. López, 26 Dec. 2016)	Po. Hyperoceanic	<i>Stm, Nor</i>	> 3.6	Ie<11	<380	Poho	—	280<Tp<380	4. Semi-arid	Io<2.0	Sar
	Po. Oceanic	<i>Stp, Sbm, Nor</i>	> 3.6	11<Ie<21	<380	Pooc	—	100<Tp<280	5. Dry	2.0≤Io<3.6	Sec
	Po. Continental	<i>Stp, Sbm, Nor</i>	> 3.6	21<Ic	<380	Pooc	—	100<Tp<280	6. Subhumid	3.6≤Io<6.0	Shu
	Po. Xeric	<i>Stp, Sbm, Nor</i>	≤ 3.6	4≤Ic	<380	Poxe	—	0<Tp<100	7. Humid	6.0≤Io<12.0	Hum
	Po. Pergelid	<i>Stp, Sbm, Nor</i>	—	—	= 0	Pogg	—	0<Tp<100	8. Hyperhumid	12.0≤Io<24.0	Ihu
									9. Ultrahyperhumid	24.0≤Io	Uhh

(1) Between 23° - 48° N and 23° - 51° S, if the locality is to 200 m, or more, of altitude, the thermal values must theoretically be calculated at such a height increasing T by 0.6°, M and m, by 0.5 °; and Ite by 13 units, per every 100 m that exceeds that altitude. At more than 48° N or 51° S, it is necessary to calculate the theoretical values of the average annual temperature, the average of the maximums of the coldest month, and the annual positive temperature, increasing T by 0.4 °, M by 0.5 ° and Tp by 12 units, for every 100 m exceeding said altitude. (2) When Ie ≥ 21 (continental) or when the values of Ite < 120, the Thermotype is calculated as a function of Tp, and the theoretical values of Tp at 200 are calculated by increasing 55 units per each 100m that exceeds said altitude. (3) In the Geild Thermotypes, depending on the amount of annual precipitation, the following Ombrotypes (Chionotypes) are recognized: no-snowy (< 20 mm), little-snowy (20-200 mm), semi-snowy (200-500 mm), super-snowy (500-1000 mm), and ultra-super-snowy (> 1000 mm). (4) The Hemioboreal Thermotype (Hbo) is used in Temperate Macrobioclimate territories, north of 45°N, or south of 49°S, that have the following values: if Ie<21 and altitude<400 m: 720<Tp<900; if 21<Ie<28 and altitude<600 m: 740<Tp<900; and if 28<Ie and altitude<1000 m: 800<Tp<900. (5) Bioclimatic Variants: a) Pse, Pluviseasonal; b) Ant, Antitropical; c) Bix, Bixerian; d) Str, Tropical Drought; e) Strh, Semitropical Hyperdesertic (unmarked); f) Stp, Steppic; g) Sbm, Submediterranean; h) Pose, Polar Semiboreal

world hierarchical Classification, with an indication of the characters and thresholds that distinguish each one of its three levels: Macrobioclimates, Bioclimates / Variants (these only mentioned), and Bioclimatic Belts. (See Figure 7).

6.- ISOBIOCLIMATE

An Isobioclimate is a unique bioclimatic space, defined by a Bioclimate / Variant, together with a Bioclimatic Belt - Thermotype + Ombrotype-. Each Isobioclimate is an elemental bioclimatic unit, as perceived and distinguished by living beings. We can consider each Isobioclimate as a natural culture chamber, a Phytotron, whose "walls" are the lower and upper thresholds that define each one of its components: Macrobioclimate, Bioclimate / Variant and Bioclimatic Belt-Thermotype and Ombrotype-. Considering fixed other environmental variables - such as mother rock, soil, geological history, evolutionary history of living beings, etc. - each Isobioclimate harbors, in a climax position, a single vegetation series.

Isobioclimates are useful for identifying bioclimatically analogous territories on any of the five Continents, as well as for recognizing equivalent types of vegetation. The representation on the map of the areas occupied by each Isobioclima allows very precise bioclimatic maps to be obtained. (See figure 116, Isobioclimatic Map of Peninsular Spain).

To name each Isobioclimate is used a phrase that includes: Bioclimate / Bioclimatic Variant, together with a Bioclimatic Belt - Thermotype + Ombrotype-. Thus, for example: **Mepo Nor Tme Dry** is the Isobioclimate "Mediterranean Pluviseasonal Oceanic, Normal Variant, Thermomediterranean, Dry", which is found, for example, in much of Andalusia, Spain; or **Boxe Stp Tbo Dry** is the Isobioclimate "Boreal Xeric Steppic, Termoboreal, Dry", which operates, for example, in Petropavlovsk, Kazakhstan.

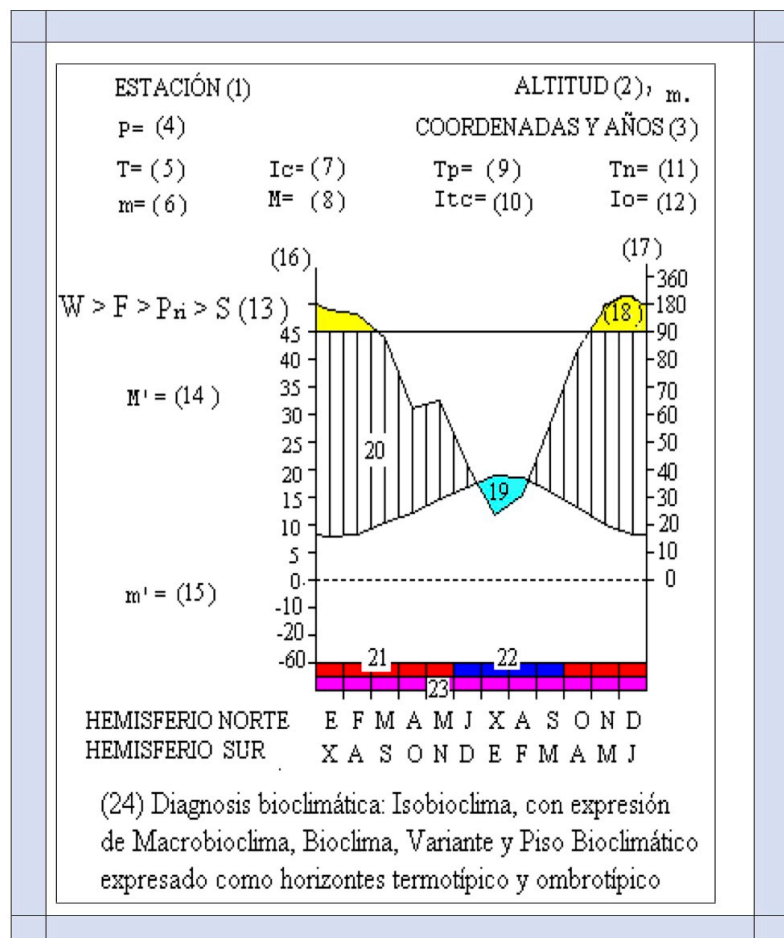
7.- BIOCLIMOGRAMS

Bioclimograms, also called Bioclimographs, or Ombro-Termoclimograms, are the graphical representation of Isobioclimates. Bioclimograms used by Rivas-Martínez (2008) and Rivas-Martínez & al. (2011), are based on those of Gaussen & Bagnouls (1952) and also on those of Walter & Lieth (1967). These graphs, very expressive, represent, in a Cartesian coordinate system with two ordinates and one abscissa, the temperature and rainfall data of a meteorological station, throughout the year. In the left ordinate, the temperature is represented, and in the right ordinate, the rainfall: their scales are adjusted to the ratio $2T (^{\circ}\text{C}) = P (\text{mm})$. On the abscissa, the months of the year are represented: in the first place appears the month following the winter solstice: January in the Northern Hemisphere, and July in the Southern Hemisphere.

The graph of Figure 8 is accompanied by a data panel, which includes:

name of the station (1); its altitude in meters (2); its latitude, longitude, and the number of years of meteorological observations (3); P (4), T (5), m (6), Ic (7), M (8), Tp (9), Itc (10), Tn (11), Io (12); trimesterly precipitation in decreasing order (13): Pn=spring, S=summer, F=autumn, and W=winter; M' (14); m' (15); temperature scale (16); precipitation scale (17).

Figure 8.- Structure of the Bioclimogram (Rivas-Mart, 2008, Rivas-Mart et al., 2011, somewhat modified by the authors). (Explanation of numbers, in the text).



In order to accommodate, in a single type of Bioclimograma, all the variations of T_i and P_i occurring in the world, the temperature scale (16) starts at zero on the dotted line and advances five degrees by five degrees above zero; with respect to negative temperatures, the scale is modified and each interval represents the following temperatures: -10, -20 y -60°C. As for the precipitations (17), each segment represents 10mm of rainfall until reaching 90mm, because, from this rainfall, the values are doubled for each interval:

180, 360 y 720mm of Pi (18). The surface of the rainfall curve, that exceeds the 90 mm line, is colored in blue (18) (in this diagram we have put it in yellow), to indicate the change of scale. When the temperature curve exceeds that of the precipitation, the area enclosed between the two curves, drought expression (19), is colored red (in this scheme we have put it in blue); But, if the rainfall curve exceeds that of the temperature, that surface is striped, to indicate period with available humidity (20). Monthly frost periods: sure or probable (21); and absent (22). The period of plant activity, Pav, (23): months with $T_i \geq 3,5^\circ$; NORTH HEMISPHERE: months in the Northern Hemisphere, and HEMISPHERE SUR: months in the Southern Hemisphere: E, January; ...; X, July; ...; (24): at the bottom of the graph, the complete bioclimatic diagnosis, the Isobioclimate, -including Macrobioclimate (named in the Bioclimate), Bioclimate, Bioclimatic Variant and Bioclimatic Belt, expressed as Thermotype and Ombrotype horizons-, is given.

8.- APPROACH to the GLOBAL BIOCLIMATIC DIVERSITY

Global Bioclimatic Diversity can be considered at each of the three hierarchical levels of the World Bioclimatic Classification:

8.1.- At the **first hierarchical level**, that of the **Macrobioclimates**, total World Diversity is 5 Macrobioclimates.

8.2.- For the **second hierarchical level**, that of the **Bioclimates/Variants**, we have collected, in figure 9, almost the whole totality of the World Diversity at this level, 74 Bioclimate / Variant units, distributed by Bioclimates and by Variants.

As for Macrobioclimates, at this Bioclimate / Variant level, the most diversified is the Tropical Macrobioclimate, with 18 Bioclimate/Variant units, followed by the Boreal Macrobioclimate, with 17. By variants, the best represented are: the Normal Variant, which is present in each Bioclimate, except in Tropical Pluvial and Tropical Pluviseasonal; the Steppic Variant, present in 18 of the Bioclimates; and the Submediterranean Variant, present in 15 Bioclimates.

8.3.- And, in the **third hierarchical level**, that of the **Bioclimatic Belts -Thermotypes and Ombrotypes-**, the World Bioclimatic Diversity, at this level of **Isobioclimates**, is almost 400 Isobioclimates, although only about 300 Isobioclimates have a significant territorial entity worldwide. (Rivas-Mart. & Rivas-Sáenz, 1996-2017; Rivas-Mart. et al., 2011).

Figure 10 lists, for each Macrobioclimate, the number of its Bioclimates, its Variants, its combined units Bioclimate + Variant, and of the Thermotypes and Ombrotypes that operate in it. And, in its last column, appears the approximate number of its Isobioclimates

The world's largest bioclimatic diversity, at Isobioclimates level, is offered by Temperate Macrobioclimate, with more than 97 Isobioclimates, followed by Tropical Macrobioclimate, with more than 91.

Boho						•	•	2	
Booc					•	•	•	3	
Bosc					•	•	•	3	
Boco					•	•	•	3	
Bohc					•	•	•	3	
Boxe					•	•	•	3	
Total Boreal									17
Poho						•	•	2	
Pooc					•	•	•	3	
Poco					•	•	•	3	
Poxe					•	•	•	3	
Popg					•	•	•	3	
Total Polar									14
TOTAL	3	3	2	7	18	15	26	74	74

Figure 10.- The almost totality of World Bioclimatic Diversity at Isobioclimates level.

Macro-bioclimate	Bio-climates	Operating Variants	Bioclimates + Variants	Operating Thermo-types	Operating Ombro-types	Isobioclimates
Tropical	5	11	18	7	9	Más de 91
Mediterranean	8	2	14	7	9	Más de 68
Temperate	4	3	11	7	6	Más de 97
Boreal	6	3	17	6	6	Más de 66
Polar	5	3	14	4	6	Más de 29
Total	28	13 in the world	74	31	9 in the world	Almost 400

8.4.- As illustrative **examples of World Bioclimatic Diversity**, next we give 59 climatic-bioclimatic examples, from as many meteorological stations, which represent the majority of the existing combinations of **Macrobioclimate**, **Bioclimate** and **Bioclimatic Variant**. Moreover, this information is available in: Worldwide Bioclimatic Classification System, 1996-2017, S. Rivas-Martínez & S. Rivas-Sáenz, Phytosociological Research Center, Spain, <http://www.globalbioclimatics.org>. In order to facilitate access to those examples, in Figure 11 we give the list of the 59 selected stations, ordered according to the Bioclimatic Synopsis of the Earth (see Figure 7, Chapter 5); and in figure 12, the list of those same selected stations, sorted alphabetically by country. After the figures 11 and 12, appear each of the climatic-bioclimatic examples, ordered by Bioclimate / Variant, figures 13-71.

Figure 11.- List of climate-bioclimatic representative examples of almost every combination of Macrobioclimate and Bioclimate / Bioclimatic Variant, with territorial representation on Earth, in bioclimatic order.

	Bioclimate / Variant	Country	Weather Station
1	Trpl Hygrophytic	Japan	Ishigaki
2	Trpl Subhygrophytic	Suriname	Zanderij
3	Trpl Submesophytic	China	Wucho/Tsang-Wu
4	Trps Mesophytic	Indonesia	Achmad Yani
5	Trps Submesophytic	Bahamas Islands	Nassau Intl
6	Trps Subxerophytic	Madagascar	Tananarive
7	Trps Xerophytic	Mexico	Zapopán
8	Trps Pse	Vietnam	Donghoi
9	Trps Ant	Sri Lanka	Trincomalee
10	Trps Bix	Ivory Coast	Port Bouet
11	Trxe Pse	Chad	Ati
12	Trxe Ant	Saudi Arabia	Khamis Mushait
13	Trxe Bix	Ethiopia	Diredawa
14	Trxe Normal	Botswana	Ghanzi
15	Trde Pse	Peru	Arequipa
16	Trde Ant	Iran	Jask
17	Trde Normal	Pakistan	Karachi
18	Trhd Normal	Namibia	Mowebaai
19	Mepo Stp	Spain	Tudela
20	Mepo Normal	Chile	Hualpencillo
21	Mepc Stp	Ukraine	Bolgrad
22	Mepc Normal	Tajikistan	Dushanbe

23	Mexo Stp	Argentina	Coronel J.J.Gómez
24	Mexo Normal	Libya	Idris
25	Mexc Stp	Kazakhstan	Pavlodar
26	Mexc Normal	Armenia	Jerevan
27	Medo Stp	Australia	Farina
28	Medo Normal	Egypt	Salum
29	Medc Stp	Kazakhstan	Dzhezkazgan
30	Medc Normal	Uzbekistan	Ak-Baytal
31	Meho Normal	Libya	Gialo
32	Mehc Normal	Iran	Yazd
33	Teho Sbm	New Zealand	Wigram
34	Teho Normal	Ireland	Valentia
35	Teoc Stp	China	Matsu
36	Teoc Sbm	Croatia	Rab
37	Teoc Normal	Uruguay	Artigas
38	Teco Stp	Hungary	Pecs
39	Teco Sbm	India	Srinagar
40	Teco Normal	Byelarus	Brest
41	Texe Stp	Mongolia	Altai
42	Texe Sbm	Ukraine	Kharkov
43	Texe Normal	Argentina	Villa Mercedes
44	Boho Normal	Chile	Navarino
45	Booc Normal	Iceland	Husavik
46	Bosc Stp	Sweden	Bjuroklubb
47	Bosc Normal	Finland	Oulu
48	Boco Stp	Russia	Anavgay Kamchatk
49	Boco Normal	Mongolia	Bulgan
50	Bohc Stp	Russia Yakutskaya	Verkhoyansk
51	Bohc Normal	Russia Yakutskaya	Komara
52	Boxe Stp	USA Alaska	Fort Yukon
53	Poho Normal	Norway	Jan Mayen
54	Pooc Normal	Greenland -DNK-	Iviglut
55	Poco Stp	Canada	Cambridge Bay
56	Poco Normal	Russia	Yamsk
57	Poxe Stp	Russia Yakutia	Sredne-Kolymsk
58	Poxe Normal	Greenland-Dnk	Umanak
59	Popg Normal	Antarctica	Mcmurdo Station

Figure 12.- List of climate-bioclimate representative examples of almost every combination of Macrobioclimate and Bioclimate / Bioclimatic Variant, with territorial representation on Earth, in alphabetical order of countries.

	Country	Weather Station	Bioclimate/ Variant
59	Antarctica	Mcmurdo Station	Popg Normal
23	Argentina	Coronel J.J. Gómez	Mexo Stp
43	Argentina	Villa Mercedes	Texe Normal
26	Armenia	Jerevan	Mexc Normal
27	Australia	Farina	Medo Stp
5	Bahamas Islands	Nassau Intl	Trps Submesophytic
14	Botswana	Ghanzi	Trxe Normal
40	Byelarus	Brest	Teco Normal
55	Canada	Cambridge Bay	Poco Stp
11	Chad	Ati	Trxe Pse
20	Chile	Hualpencillo	Mepo Normal
44	Chile	Navarino	Boho Normal
3	China	Wucho/Tsang-Wu	Trpl Submesophytic
35	China	Matsu	Teoc Stp
36	Croatia	Rab	Teoc Sbm
28	Egypt	Salum	Medo Normal
13	Ethiopia	Diredawa	Trxe Bix
47	Finland	Oulu	Bosc Normal
54	Greenland -DNK-	Iviglut	Pooc Normal
58	Greenland-Dnk	Umanak	Poxe Normal
38	Hungary	Pecs	Teco Stp
45	Iceland	Husavik	Booc Normal
39	India	Srinagar	Teco Sbm
4	Indonesia	Achmad Yani	Trps Mesophytic
16	Iran	Jask	Trde Ant
32	Iran	Yazd	Mehc Normal
34	Ireland	Valentia	Teho Normal
10	Ivory Coast	Port Bouet	Trps Bix
1	Japan	Ishigaki	Trpl Hygrophytic
25	Kazakhstan	Pavlodar	Mexc Stp
29	Kazakhstan	Dzhezkazgan	Medc Stp
24	Libya	Idris	Mexo Normal
31	Libya	Gialo	Meho Normal
6	Madagascar	Tananarive	Trps Subxerophytic
7	Mexico	Zapopán	Trps Xerophytic
41	Mongolia	Altai	Texe Stp
49	Mongolia	Bulgan	Boco Normal
18	Namibia	Mowebaai	Trhd Normal

33	New Zealand	Wigram	Teho Sbm
53	Norway	Jan Mayen	Poho Normal
17	Pakistan	Karachi	Trde Normal
15	Peru	Arequipa	Trde Pse
48	Russia	Anavgay Kamchatk	Boco Stp
56	Russia	Yamsk	Poco Normal
57	Russia Yakutia	Sredne-Kolymsk	Poxe Stp
50	Russia Yakutskaya	Verkhoyansk	Bohc Stp
51	Russia Yakutskaya	Komara	Bohc Normal
12	Saudi Arabia	Khamis Mushait	Trxe Ant
19	Spain	Tudela	Mepo Stp
9	Sri Lanka	Trincomalee	Trps Ant
2	Suriname	Zanderij	Trpl Subhigrophytic
46	Sweden	Bjuroklubb	Bosc Stp
22	Tajikistan	Dushanbe	Mepc Normal
21	Ukraine	Bolgrad	Mepc Stp
42	Ukraine	Kharkov	Texe Sbm
37	Uruguay	Artigas	Teoc Normal
52	USA Alaska	Fort Yukon	Boxe Stp
30	Uzbekistan	Ak-Baytal	Medc Normal
8	Vietnam	Donghoi	Trps Pse

Next, the 59 stations, as examples of the bioclimatic diversity at the level of Macrobioclima - Bioclima / Variant, ordered by that concept, following figure 11.

Note: At the computer exits, from the web <http://www.globalbioclimatics.org>, the stations in which no variant is specified, must be considered as Normal Variant (Nor) (See Normal Variant, above). We add this indication in each of the stations with Variante Nor.

Figure 13

01

ISHIGAKI (JAPAN) Altitude: 24 m.
 Latitude: 24° 20'N Longitude: 124° 11'E
 Temperature observation period.: 1962-1994 (33)
 Rainfall observation period....: 1964-1994 (31)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	18.06	21.11	15.00	27.78	6.11	148.3	42.83
Feb.	17.77	21.11	14.44	28.89	6.11	127.8	39.16
Mar.	19.73	22.78	16.67	29.44	7.22	122.4	60.87
Apr.	22.50	25.56	19.44	32.78	10.00	129.0	90.74
May.	24.73	27.78	21.67	33.89	11.11	204.0	128.50
Jun.	27.22	30.00	24.44	33.89	16.67	200.2	161.04
Jul.	28.06	31.11	25.00	34.44	20.00	202.7	171.67
Aug.	28.06	31.11	25.00	35.00	17.22	235.5	165.75
Sep.	26.95	30.56	23.33	35.56	17.22	258.3	141.89
Oct.	24.73	27.78	21.67	33.33	13.89	231.4	110.63
Nov.	21.95	25.00	18.89	31.11	7.22	171.5	72.64
Dec.	19.17	22.22	16.11	27.78	6.67	170.7	50.13
Year	23.24	26.34	20.14	31.99	11.62	2202	1235.8

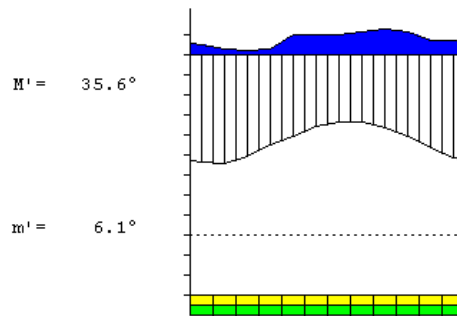
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 588
 Compensated thermicity index.....(Itc): 588
 Simple continentality index.....(Ic): 10.3
 Diurnality index.....(Id): 7.2
 Annual ombrothermic index.....(Io): 7.89
 Monthly dry ombrothermic index.....(Iod1): 6.20
 Bimonthly dry ombrothermic index.....(Iod2): 6.67
 Threemonthly dry ombrothermic index.....(Iod3): 6.32
 Fourmonthly dry ombrothermic index.....(Iod4): 6.76
 Annual ombro-evaporation index.....(Ioe): 1.78
 Annual positive temperature.....(Tp): 2789
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 600
 Positive precipitation.....(Pp): 2202

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	12	0	0	0	0

Latitudinal Belt...: Subtropical
 Continentality....: Hyperoceanic - Low Subhyperoceanic
 Bioclimate(Variant): TROPICAL PLUVIAL (HYGROPHYTIC)
 Bioclimatic belt...: UPPER THERMOTROPICAL LOW HUMID

ISHIGAKI (JAPAN) 24 m
 P= 2202 24° 20'N 124° 11'E 33/31 y.
 T= 23.2 ° Ic= 10.3 Tp= 2789 Tn= 0
 m= 14.4 ° M= 21.1 ° Itc= 588 Io= 7.9



TROPICAL PLUVIAL (HYGROPHYTIC)
UPPER THERMOTROPICAL LOW HUMID

**Tropical Pluvial Bioclimate,
 Hygrophytic Variant**

Figure 14

02

ZANDERIJ (SURINAME) Altitude: 16 m.

Latitude: 5° 27'N Longitude: 55° 12'W
 Temperature observation period.: 1988-1994 (7)
 Rainfall observation period....: 1988-1994 (7)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	26.12	30.56	21.67	32.78	16.11	282.2	128.23
Feb.	25.56	30.00	21.11	33.89	17.22	223.8	107.70
Mar.	25.84	30.00	21.67	33.89	17.78	234.2	124.30
Apr.	26.39	31.11	21.67	33.89	18.89	302.0	133.32
May.	26.39	30.56	22.22	36.11	17.78	332.5	138.55
Jun.	26.67	31.11	22.22	33.89	18.89	393.2	140.97
Jul.	26.67	31.67	21.67	33.89	15.00	253.5	145.07
Aug.	27.23	32.78	21.67	36.11	18.89	196.3	148.41
Sep.	27.50	33.33	21.67	35.00	18.89	100.6	144.94
Oct.	27.78	33.33	22.22	37.78	20.00	66.0	150.12
Nov.	27.50	32.78	22.22	36.11	20.00	118.9	142.07
Dec.	26.67	31.67	21.67	35.00	17.78	158.2	139.60
Year	26.69	31.58	21.81	34.86	18.10	2661	1643.3

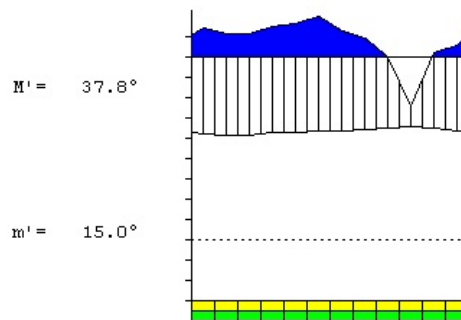
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 778
 Compensated thermicity index.....(Itc): 778
 Simple continentality index.....(Ic): 2.2
 Diurnality index.....(Id): 11.7
 Annual ombrothermic index.....(Io): 8.31
 Monthly dry ombrothermic index.....(Iod1): 2.38
 Bimonthly dry ombrothermic index.....(Iod2): 3.01
 Threemonthly dry ombrothermic index.....(Iod3): 3.45
 Fourmonthly dry ombrothermic index.....(Iod4): 4.38
 Annual ombro-evaporation index.....(Ioe): 1.62
 Annual positive temperature.....(Tp): 3203
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 828
 Positive precipitation.....(Pp): 2661

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	10	2	0	0	0

Latitudinal Belt....: Equatorial
 Continentality.....: Hyperoceanic - Low Ultrahyperoceanic
 Bioclimate(Variant): TROPICAL PLUVIAL (SUBHYGROPHYTIC)
 Bioclimatic belt....: UPPER INFRATROPICAL LOW HUMID

ZANDERIJ (SURINAME) 16 m
 P= 2661 5° 27'N 55° 12'W 7/7 y.
 T= 26.7 ° Ic= 2.2 Tp= 3203 Tn= 0
 m= 21.1 ° M= 30.0 ° Itc= 778 Io= 8.3



TROPICAL PLUVIAL (SUBHYGROPHYTIC)
UPPER INFRATROPICAL LOW HUMID

**Tropical Pluvial Bioclimate,
 Subhigrophytic Variant**

Figure 15

03

WUCHOW/TSANG-WU (CHINA) Altitude: 119 m.

Latitude: 23° 30'N Longitude: 111° 25'E
 Temperature observation period.: 1986-1994 (9)
 Rainfall observation period....: 1955-1994 (40)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	Epi
Jan.	12.50	17.22	7.78	27.78	-1.11	32.5	17.61
Feb.	13.61	17.78	9.44	32.22	-2.78	54.6	21.06
Mar.	18.33	22.22	14.44	33.89	5.00	90.4	53.19
Apr.	22.50	26.67	18.33	36.11	7.78	155.2	93.67
May.	26.12	30.56	21.67	37.22	13.89	203.5	150.24
Jun.	28.06	32.22	23.89	37.78	12.78	196.3	168.71
Jul.	29.17	33.89	24.44	37.78	11.11	155.7	181.97
Aug.	29.17	33.89	24.44	38.89	21.11	174.0	175.70
Sep.	27.78	32.78	22.78	38.89	16.11	87.1	148.66
Oct.	23.89	29.44	18.33	35.00	2.22	42.4	102.36
Nov.	19.44	24.44	14.44	32.22	3.89	38.4	54.82
Dec.	14.72	20.00	9.44	28.89	2.22	39.6	26.74
Year	22.11	26.76	17.45	34.72	7.68	1270	1194.7

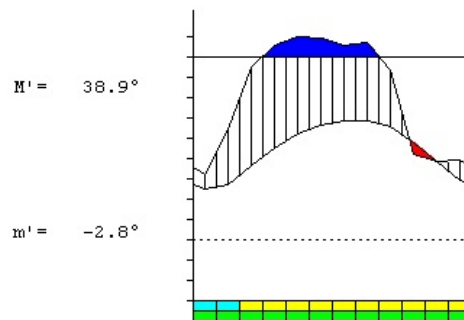
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 471
 Compensated thermicity index.....(Itc): 471
 Simple continentality index.....(Ic): 16.7
 Diurnality index.....(Id): 11.1
 Annual ombrothermic index.....(Io): 4.79
 Monthly dry ombrothermic index.....(Iod1): 2.60
 Bimonthly dry ombrothermic index.....(Iod2): 2.65
 Threemonthly dry ombrothermic index.....(Iod3): 2.37
 Fourmonthly dry ombrothermic index.....(Iod4): 2.17
 Annual ombro-evaporation index.....(Ioe): 1.06
 Annual positive temperature.....(Tp): 2653
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 467
 Positive precipitation.....(Pp): 1270

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	7	3	2	0	0

Latitudinal Belt....: Subtropical
 Continentality.....: Oceanic - Low Euoceanic
 Bioclimate(Variant): TROPICAL PLUVIAL (SUBMESOPHYTIC)
 Bioclimatic belt....: LOW MESOTROPICAL LOW SUBHUMID

WUCHOW/TSANG-WU (CHINA) 119 m
 P= 1270 23° 30'N 111° 25'E 9/40 y.
 T= 22.1 ° Ic= 16.7 Tp= 2653 Tn= 0
 m= 7.8 ° M= 17.2 ° Itc= 471 Io= 4.8



TROPICAL PLUVIAL (SUBMESOPHYTIC)
 LOW MESOTROPICAL LOW SUBHUMID

Tropical Pluvial Bioclimate,
 Submesophytic Variant

Figure 16

04

ACHMAD YANI (INDONESIA)

Altitude: 3 m.

Latitude: 6° 58'S Longitude: 110° 22'E
 Temperature observation period.: 1992-1994 (3)
 Rainfall observation period.....: 1931-1994 (64)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	28.06	31.67	24.44	33.89	22.78	372.1	158.35
Feb.	27.23	30.56	23.89	32.78	22.78	332.0	135.69
Mar.	27.78	31.11	24.44	32.78	22.78	246.1	151.58
Apr.	28.33	32.22	24.44	33.89	22.78	203.0	150.15
May.	28.61	32.22	25.00	33.89	22.78	144.0	155.44
Jun.	28.34	32.78	23.89	33.89	21.11	92.0	147.22
Jul.	28.33	32.22	24.44	33.89	22.78	65.0	151.65
Aug.	28.06	32.78	23.33	35.00	22.22	56.1	150.95
Sep.	28.34	33.89	22.78	37.22	20.00	88.1	150.23
Oct.	28.61	33.89	23.33	37.22	21.11	137.9	160.01
Nov.	28.34	32.78	23.89	35.00	22.22	199.1	156.24
Dec.	27.50	31.11	23.89	32.78	22.78	258.1	153.55
Year	28.13	32.27	23.98	34.35	22.18	2194	1821.0

BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It):	826
Compensated thermicity index.....(Itc):	826
Simple continentality index.....(Ic):	1.4
Diurnality index.....(Id):	11.1
Annual ombrothermic index.....(Io):	6.50
Monthly dry ombrothermic index.....(Iod1):	2.00
Bimonthly dry ombrothermic index.....(Iod2):	2.15
Threemonthly dry ombrothermic index.....(Iod3):	2.47
Fourmonthly dry ombrothermic index.....(Iod4):	2.66
Annual ombro-evaporation index.....(Ioe):	1.20
Annual positive temperature.....(Tp):	3375
Annual negative temperature.....(Tn):	0
Dry station temperature.....(Td):	847
Positive precipitation.....(Pp):	2194

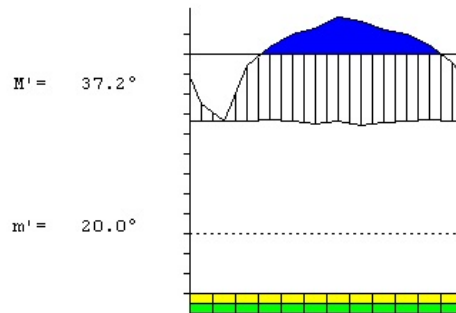
N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	8	3	1	0	0

Latitudinal Belt...: Equatorial
 Continentality.....: Hyperoceanic - High Ultrahyperoceanic
 Bioclimate(Variant): TROPICAL PLUVISEASONAL (MESOPHYTIC)
 Bioclimatic belt...: LOW INFRATROPICAL LOW HUMID

ACHMAD YANI (INDONESIA)

3 m

P= 2194 6° 58'S 110° 22'E 3/64 y.
 T= 28.1° Ic= 1.4 Tp= 3375 Tn= 0
 m= 23.9° M= 30.6° Itc= 826 Io= 6.5



TROPICAL PLUVISEASONAL (MESOPHYTIC)
LOW INFRATROPICAL LOW HUMID

**Tropical Pluviseasonal Bioclimate,
 Mesophytic Variant**

Figure 17

05

NASSAU INTL (BAHAMAS ISLANDS) Altitude: 2 m.
 Latitude: 25° 2'N Longitude: 77° 28'W
 Temperature observation period.: 1959-1994 (36)
 Rainfall observation period.....: 1937-1994 (58)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	21.67	25.00	18.33	29.44	5.00	35.6	66.04
Feb.	21.39	25.00	17.78	30.00	6.11	38.1	60.62
Mar.	22.50	26.11	18.89	31.11	7.78	35.6	82.51
Apr.	23.89	27.22	20.56	32.78	11.67	63.5	102.91
May.	25.28	28.89	21.67	33.33	11.67	116.8	133.85
Jun.	26.95	30.56	23.33	34.44	16.67	162.6	158.58
Jul.	27.50	31.11	23.89	34.44	19.44	147.3	167.90
Aug.	28.06	31.67	24.44	34.44	19.44	134.6	165.75
Sep.	27.50	31.11	23.89	33.33	18.33	175.3	146.38
Oct.	26.11	29.44	22.78	33.33	12.22	165.1	127.80
Nov.	24.17	27.22	21.11	31.67	9.44	71.1	91.71
Dec.	22.78	26.11	19.44	30.00	7.22	33.0	75.84
Year	24.82	28.29	21.34	32.36	12.08	1179	1379.9

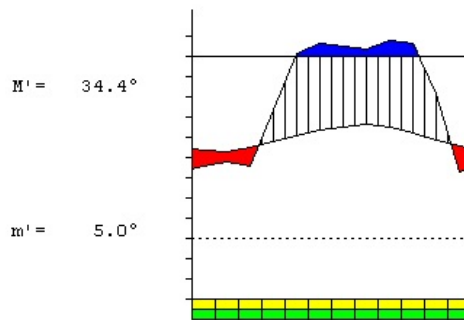
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 676
 Compensated thermicity index.....(Itc): 663
 Simple continentality index.....(Ic): 6.7
 Diurnality index.....(Id): 7.2
 Annual ombrothermic index.....(Io): 3.96
 Monthly dry ombrothermic index.....(Iod1): 1.45
 Bimonthly dry ombrothermic index.....(Iod2): 1.54
 Threemonthly dry ombrothermic index.....(Iod3): 1.62
 Fourmonthly dry ombrothermic index.....(Iod4): 1.98
 Annual ombro-evaporation index.....(Ioe): 0.85
 Annual positive temperature.....(Tp): 2978
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 658
 Positive precipitation.....(Pp): 1179

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	6	2	4	0	0

Latitudinal Belt...: Subtropical
 Continentality.....: Hyperoceanic - Low Euhyperoceanic
 Bioclimate(Variant): TROPICAL PLUVISEASONAL (SUBMESOPHYTTIC)
 Bioclimatic belt...: LOW THERMOTROPICAL LOW SUBHUMID

NASSAU INTL (BAHAMAS ISLANDS) 2 m
 P= 1179 25° 2'N 77° 28'W 36/58 y.
 T= 24.8 ° Ic= 6.7 Tp= 2978 Tn= 0
 m= 17.8 ° M= 25.0 ° Itc= 663 Io= 4.0



TROPICAL PLUVISEASONAL (SUBMESOPHYTTIC)
LOW THERMOTROPICAL LOW SUBHUMID

**Tropical Pluviseasonal Bioclimate,
 Submesophytic Variant**

Figure 18

06

TANANARIVE (MADAGASCAR) Altitude: 1310 m.

Latitude: 18° 54'S Longitude: 47° 32'E
 Temperature observation period.: 1947-1980 (34)
 Rainfall observation period.....: 1967-1980 (14)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	19.80	25.00	16.00	30.00	12.00	255.0	91.95
Feb.	19.90	26.00	16.00	30.00	11.00	187.0	80.56
Mar.	19.40	25.00	16.00	29.00	12.00	263.0	81.71
Apr.	18.20	24.00	15.00	29.00	9.00	42.0	67.47
May.	16.40	22.00	12.00	28.00	3.00	8.0	55.61
Jun.	14.00	21.00	10.00	26.00	3.00	9.0	40.36
Jul.	13.30	20.00	10.00	25.00	3.00	17.0	38.09
Aug.	13.80	20.00	10.00	29.00	2.00	13.0	42.78
Sep.	15.60	22.00	11.00	29.00	3.00	16.0	53.06
Oct.	17.80	25.00	12.00	32.00	6.00	47.0	72.92
Nov.	19.30	26.00	15.00	31.00	8.00	170.0	84.06
Dec.	19.50	25.00	16.00	30.00	10.00	366.0	89.52
Year	17.25	23.42	13.25	29.00	6.83	1393	798.09

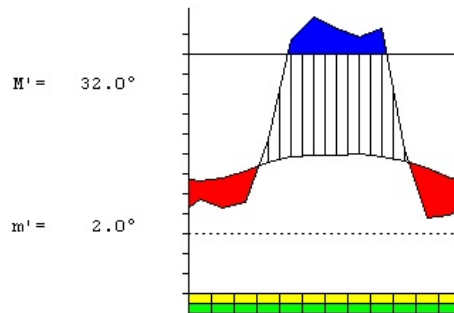
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 473
 Compensated thermicity index.....(Itc): 473
 Simple continentality index.....(Ic): 6.6
 Diurnality index.....(Id): 13.0
 Annual ombrothermic index.....(Io): 6.73
 Monthly dry ombrothermic index.....(Iod1): 0.49
 Bimonthly dry ombrothermic index.....(Iod2): 0.56
 Threemonthly dry ombrothermic index.....(Iod3): 0.78
 Fourmonthly dry ombrothermic index.....(Iod4): 1.23
 Annual ombro-evaporation index.....(Ioe): 1.75
 Annual positive temperature.....(Tp): 2070
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 437
 Positive precipitation.....(Pp): 1393

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	5	2	2	3	0

Latitudinal Belt...: Eutropical
 Continentality.....: Hyperoceanic - Low Euhyperoceanic
 Bioclimate(Variant): TROPICAL PLUVISEASONAL (SUBXEROPHYTIC)
 Bioclimatic belt...: LOW MESOTROPICAL LOW HUMID

TANANARIVE (MADAGASCAR) 1310 m
 P= 1393 18° 54'S 47° 32'E 34/14 y.
 T= 17.3 ° Ic= 6.6 Tp= 2070 Tn= 0
 m= 10.0 ° M= 20.0 ° Itc= 473 Io= 6.7



TROPICAL PLUVISEASONAL (SUBXEROPHYTIC)
LOW MESOTROPICAL LOW HUMID

**Tropical Pluviseasonal Bioclimate,
 Subxerophytic Variant**

Figure 19

07

ZAPOPAN (MEXICO) Altitude: 1626 m.
 Latitude: 20° 45'N Longitude: 102° 27'W
 Temperature observation period.: 1968-1994 (27)
 Rainfall observation period.....: 1961-1994 (34)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	15.00	22.78	7.22	29.44	-3.33	10.2	40.15
Feb.	16.39	25.00	7.78	31.67	-2.78	5.1	45.98
Mar.	18.61	27.22	10.00	34.44	-2.22	5.1	68.00
Apr.	20.56	29.44	11.67	36.11	0.00	5.1	84.76
May.	22.50	30.56	14.44	38.33	5.56	27.9	109.43
Jun.	22.50	28.89	16.11	36.11	7.78	223.5	107.50
Jul.	20.84	26.11	15.56	32.78	11.11	238.8	95.41
Aug.	20.56	25.56	15.56	33.89	10.56	215.9	89.61
Sep.	20.56	25.56	15.56	33.33	6.67	182.9	82.34
Oct.	19.45	25.56	13.33	33.89	1.67	55.9	72.17
Nov.	17.22	24.44	10.00	30.56	-2.78	20.3	51.93
Dec.	15.56	23.33	7.78	28.89	-2.22	17.8	43.24
Year	19.15	26.20	12.08	33.29	2.50	1009	890.50

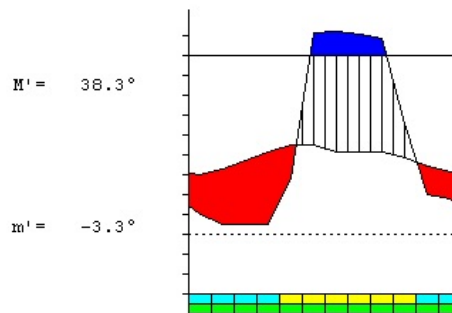
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 491
 Compensated thermicity index.....(Itc): 491
 Simple continentality index.....(Ic): 7.5
 Diurnality index.....(Id): 17.8
 Annual ombrothermic index.....(Io): 4.39
 Monthly dry ombrothermic index.....(Iod1): 0.31
 Bimonthly dry ombrothermic index.....(Iod2): 0.29
 Three monthly dry ombrothermic index.....(Iod3): 0.28
 Four monthly dry ombrothermic index.....(Iod4): 0.36
 Annual ombro-evaporation index.....(Ioe): 1.13
 Annual positive temperature.....(Tp): 2298
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 556
 Positive precipitation.....(Pp): 1009

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	4	1	3	4	0

Latitudinal Belt...: Eutropical
 Continentality.....: Hyperoceanic - Low Euhyperoceanic
 Bioclimate(Variant): TROPICAL PLUVISEASONAL (XEROPHYTIC)
 Bioclimatic belt...: UPPER THERMOTROPICAL LOW SUBHUMID

ZAPOPAN (MEXICO) 1626 m
 P= 1009 20° 45'N 102° 27'W 27/34 y.
 T= 19.1 ° Ic= 7.5 Tp= 2298 Tn= 0
 m= 7.2 ° M= 22.8 ° Itc= 491 Io= 4.4



TROPICAL PLUVISEASONAL (XEROPHYTIC)
UPPER THERMOTROPICAL LOW SUBHUMID

**Tropical Pluviseasonal Bioclimate,
 Xerophytic Variant**

Figure 20

08

DONGHOI (VIETNAM)

Altitude: 5 m.

Latitude: 17° 29'N Longitude: 106° 36'E
 Temperature observation period.: 1948-1994 (47)
 Rainfall observation period.....: 1947-1994 (48)

(C/mmo)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	19.72	22.22	17.22	34.44	7.78	66.0	47.53
Feb.	20.28	22.78	17.78	37.22	7.78	43.2	50.09
Mar.	22.22	25.00	19.44	39.44	10.56	45.7	76.43
Apr.	25.56	28.89	22.22	41.11	11.67	53.3	125.25
May.	28.89	32.78	25.00	42.22	15.00	109.2	173.19
Jun.	30.56	34.44	26.67	41.67	20.56	81.3	183.12
Jul.	30.56	34.44	26.67	41.11	20.56	91.4	189.84
Aug.	30.00	33.89	26.11	41.67	22.22	139.7	178.23
Sep.	27.78	31.11	24.44	41.11	18.33	421.7	148.66
Oct.	25.28	28.33	22.22	37.22	16.11	543.6	114.92
Nov.	22.78	25.56	20.00	35.00	12.22	360.7	75.89
Dec.	20.28	22.78	17.78	29.44	10.00	134.6	52.26
Year	25.33	28.52	22.13	38.47	14.40	2090	1415.4

BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 648
 Compensated thermicity index.....(Itc): 648
 Simple continentality index.....(Ic): 10.8
 Diurnality index.....(Id): 7.8
 Annual ombrothermic index.....(Io): 6.88
 Monthly dry ombrothermic index.....(Iod1): 2.13
 Bimonthly dry ombrothermic index.....(Iod2): 2.09
 Three-monthly dry ombrothermic index.....(Iod3): 2.09
 Four-monthly dry ombrothermic index.....(Iod4): 2.37
 Annual ombro-evaporation index.....(Ioe): 1.48
 Annual positive temperature.....(Tp): 3039
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 681
 Positive precipitation.....(Pp): 2090

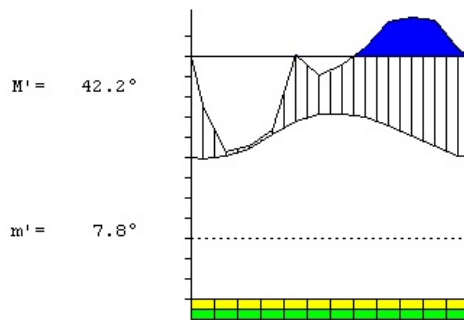
N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	5	7	0	0	0

Latitudinal Belt...: Eutropical
 Continentality.....: Hyperoceanic - Low Subhyperoceanic
 Bioclimate(Variant): TROPICAL PLUVISEASONAL (PLUVISEROTIN, MESOPHYTIC)
 Bioclimatic belt...: LOW THERMOTROPICAL LOW HUMID

DONGHOI (VIETNAM)

5 m

P= 2090 17° 29'N 106° 36'E 47/48 y.
 T= 25.3 ° Ic= 10.8 Tp= 3039 Tn= 0
 m= 17.2 ° M= 22.2 ° Itc= 648 Io= 6.9



TROPICAL PLUVISEASONAL (PLUVISEROTIN)
LOW THERMOTROPICAL LOW HUMID

Tropical Pluviseasonal Bioclimate,
Pluviserotin Variant

Figure 21

09

TRINCOMALEE (SRI LANKA)

Altitude: 7 m.

Latitude: 8° 35'N Longitude: 81° 15'E
 Temperature observation period.: 1953-1994 (42)
 Rainfall observation period.....: 1914-1994 (81)

(C/mmo)	Ti	Mi	mi	M'i	m'i	Pi	EPi
Jan.	25.28	26.67	23.89	33.33	18.33	172.7	105.90
Feb.	26.11	27.78	24.44	35.56	18.89	66.0	111.67
Mar.	26.94	29.44	24.44	38.33	19.44	48.3	143.19
Apr.	28.62	31.67	25.56	38.89	19.44	58.4	157.04
May.	29.72	33.33	26.11	40.00	19.44	68.6	174.17
Jun.	29.72	33.33	26.11	39.44	21.67	27.9	169.34
Jul.	29.45	33.33	25.56	38.33	21.11	50.8	171.84
Aug.	29.17	33.33	25.00	38.89	20.56	106.7	166.28
Sep.	29.17	33.33	25.00	38.89	21.11	106.7	160.01
Oct.	27.78	31.11	24.44	38.89	20.56	221.0	148.66
Nov.	26.39	28.89	23.89	36.11	19.44	358.2	124.43
Dec.	25.56	27.22	23.89	32.78	18.89	363.2	110.95
Year	27.83	30.79	24.86	37.45	19.91	1649	1743.5

BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 784
 Compensated thermicity index.....(Itc): 784
 Simple continentality index.....(Ic): 4.4
 Diurnality index.....(Id): 8.3
 Annual ombrothermic index.....(Io): 4.94
 Monthly dry ombrothermic index.....(Iod1): 0.94
 Bimonthly dry ombrothermic index.....(Iod2): 1.33
 Three-monthly dry ombrothermic index.....(Iod3): 1.66
 Four-monthly dry ombrothermic index.....(Iod4): 1.75
 Annual ombro-evaporation index.....(Ioe): 0.95
 Annual positive temperature.....(Tp): 3339
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 889
 Positive precipitation.....(Pp): 1649

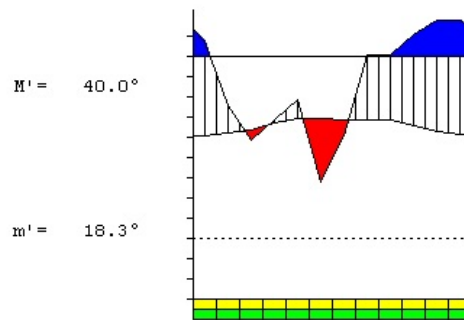
N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	4	5	2	1	0

Latitudinal Belt...: Eutropical
 Continentality.....: Hyperoceanic - High Euhyperoceanic
 Bioclimate(Variant): TROPICAL PLUVISEASONAL (ANPHITROPICAL, SUBMESOP)
 Bioclimatic belt...: UPPER INFRATROPICAL UPPER SUBHUMID

TRINCOMALEE (SRI LANKA)

7 m

P= 1649 8° 35'N 81° 15'E 42/81 y.
 T= 27.8 ° Ic= 4.4 Tp= 3339 Tn= 0
 m= 23.9 ° M= 26.7 ° Itc= 784 Io= 4.9



**TROPICAL PLUVISEASONAL (ANPHITROPICAL)
 UPPER INFRATROPICAL UPPER SUBHUMID**

**Tropical Pluviseasonal Bioclimate,
 Antitropical Variant**

Figure 22

10

PORT BOUET (IVORY COAST)

Altitude: 6 m.

Latitude: 5° 15'N Longitude: 3° 55'W
 Temperature observation period.: 1981-1994 (14)
 Rainfall observation period.....: 1968-1994 (27)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	26.95	31.11	22.78	34.44	15.00	31.0	141.89
Feb.	28.06	32.22	23.89	35.00	17.78	55.1	137.63
Mar.	28.06	32.22	23.89	35.56	19.44	117.1	152.43
Apr.	28.06	32.22	23.89	35.00	20.00	122.9	150.95
May.	27.50	31.11	23.89	34.44	20.00	358.9	152.12
Jun.	26.11	29.44	22.78	33.89	20.00	552.0	129.07
Jul.	25.56	28.33	22.78	32.78	17.78	213.1	122.47
Aug.	24.73	27.78	21.67	31.11	17.22	45.0	106.96
Sep.	25.56	28.33	22.78	32.22	18.33	71.1	116.69
Oct.	26.39	29.44	23.33	33.33	19.44	216.9	134.43
Nov.	26.95	30.56	23.33	34.44	19.44	198.1	137.71
Dec.	27.22	31.11	23.33	35.00	16.67	87.9	144.09
Year	26.76	30.32	23.19	33.93	18.43	2069	1626.4

BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It):	762
Compensated thermicity index.....(Itc):	762
Simple continentality index.....(Ic):	3.3
Diurnality index.....(Id):	8.3
Annual ombrothermic index.....(Io):	6.44
Monthly dry ombrothermic index.....(Iod1):	1.15
Bimonthly dry ombrothermic index.....(Iod2):	1.57
Three-monthly dry ombrothermic index.....(Iod3):	2.12
Four-monthly dry ombrothermic index.....(Iod4):	3.41
Annual ombro-evaporation index.....(Ioe):	1.27
Annual positive temperature.....(Tp):	3212
Annual negative temperature.....(Tn):	0
Dry station temperature.....(Td):	822
Positive precipitation.....(Pp):	2069

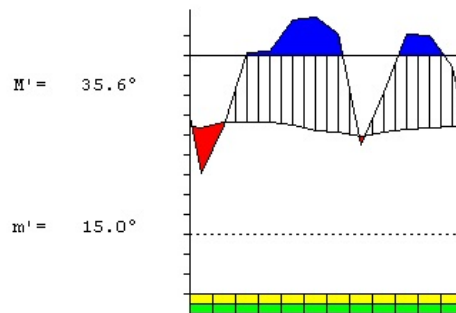
N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	7	2	3	0	0

Latitudinal Belt...: Equatorial
 Continentality.....: Hyperoceanic - Low Ultrahyperoceanic
 Bioclimate(Variant): TROPICAL PLUVISEASONAL (BIXERIC, MESOPHYTIC)
 Bioclimatic belt...: UPPER INFRATROPICAL LOW HUMID

PORT BOUET (IVORY COAST)

6 m

P= 2069 5° 15'N 3° 55'W 14/27 y.
 T= 26.8 ° Ic= 3.3 Tp= 3212 Tn= 0
 m= 21.7 ° M= 27.8 ° Itc= 762 Io= 6.4



**TROPICAL PLUVISEASONAL (BIXERIC)
 UPPER INFRATROPICAL LOW HUMID**

**Tropical Pluviseasonal Bioclimate,
 Bixerix Variant**

Figure 23

11

ATI (CHAD) Altitude: 333 m.

Latitude: 13° 13'N Longitude: 18° 19'E
 Temperature observation period.: 1951-1978 (28)
 Rainfall observation period.....: 1936-1978 (43)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPi
Jan.	24.12	30.23	17.88	0.00	0.00	0.0	78.18
Feb.	26.46	32.85	19.85	0.00	0.00	0.1	113.29
Mar.	30.38	36.21	24.84	0.00	0.00	0.2	171.55
Apr.	33.16	36.83	29.68	0.00	0.00	0.7	196.36
May.	33.47	37.17	30.03	0.00	0.00	15.1	210.41
Jun.	32.31	37.50	27.10	0.00	0.00	28.3	194.74
Jul.	29.22	33.38	24.93	0.00	0.00	113.5	173.00
Aug.	27.29	31.66	22.89	0.00	0.00	179.2	153.17
Sep.	28.53	32.45	24.65	0.00	0.00	59.5	154.78
Oct.	29.38	34.84	24.11	0.00	0.00	4.4	160.14
Nov.	27.36	33.29	21.26	0.00	0.00	0.1	136.69
Dec.	24.62	32.95	16.05	0.00	0.00	0.0	86.07
Year	28.86	34.11	23.61	0.00	0.00	401	1828.4

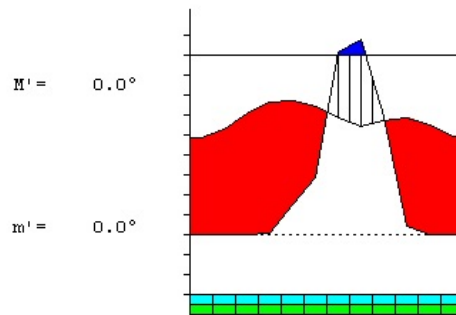
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 770
 Compensated thermicity index.....(Itc): 770
 Simple continentality index.....(Ic): 9.4
 Diurnality index.....(Id): 16.9
 Annual ombrothermic index.....(Io): 1.16
 Monthly dry ombrothermic index.....(Iod1): No
 Bimonthly dry ombrothermic index.....(Iod2): No
 Threemonthly dry ombrothermic index.....(Iod3): 0.00
 Fourmonthly dry ombrothermic index.....(Iod4): 0.00
 Annual ombro-evaporation index.....(Ioe): 0.22
 Annual positive temperature.....(Tp): 3463
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 752
 Positive precipitation.....(Pp): 401

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	1	2	0	9	0

Latitudinal Belt....: Eutropical
 Continentality.....: Hyperoceanic - High Subhyperoceanic
 Bioclimate(Variant): TROPICAL XERIC (PLUVISEROTIN, SEMIARID)
 Bioclimatic belt....: UPPER INFRATROPICAL LOW SEMIARID

ATI (CHAD) 333 m
 P= 401 13° 13'N 18° 19'E 28/43 y.
 T= 28.9 ° Ic= 9.4 Tp= 3463 Tn= 0
 m= 17.9 ° M= 30.2 ° Itc= 770 Io= 1.2



TROPICAL XERIC (PLUVISEROTIN)
 UPPER INFRATROPICAL LOW SEMIARID

Tropical Xeric Bioclimate,
 Pluviserotin Variant

Figure 24

12

KHAMIS MUSHAIT (SAUDI ARABIA)

Altitude: 2066 m.

Latitude: 18° 18'N Longitude: 42° 48'E
 Temperature observation period.: 1967-1993 (27)
 Rainfall observation period....: 1967-1993 (27)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	13.53	17.49	9.36	0.00	0.00	10.6	33.80
Feb.	14.78	18.70	10.90	0.00	0.00	11.8	37.80
Mar.	17.09	19.79	14.26	0.00	0.00	76.2	57.81
Apr.	18.18	24.60	11.60	0.00	0.00	57.0	66.67
May.	21.31	26.50	16.10	0.00	0.00	36.5	97.66
Jun.	23.62	29.06	17.69	0.00	0.00	7.1	117.78
Jul.	23.61	26.85	20.35	0.00	0.00	23.1	120.89
Aug.	23.11	27.00	19.20	0.00	0.00	34.9	112.76
Sep.	22.03	27.54	16.81	0.00	0.00	6.5	95.03
Oct.	18.81	23.68	13.93	0.00	0.00	3.3	67.97
Nov.	16.55	19.55	13.05	0.00	0.00	13.2	49.48
Dec.	14.21	18.38	9.93	0.00	0.00	49.3	36.89
Year	18.90	23.26	14.43	0.00	0.00	330	894.56

BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 458
 Compensated thermicity index.....(Itc): 458
 Simple continentality index.....(Ic): 10.1
 Diurnality index.....(Id): 13.0
 Annual ombrothermic index.....(Io): 1.45
 Monthly dry ombrothermic index.....(Iod1): 0.18
 Bimonthly dry ombrothermic index.....(Iod2): 0.24
 Three-monthly dry ombrothermic index.....(Iod3): 0.40
 Four-monthly dry ombrothermic index.....(Iod4): 0.72
 Annual ombro-evaporation index.....(Ioe): 0.37
 Annual positive temperature.....(Tp): 2268
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 574
 Positive precipitation.....(Pp): 330

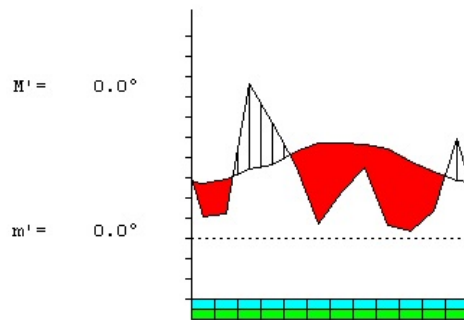
N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	1	2	2	7	0

Latitudinal Belt...: Eutropical
 Continentality.....: Hyperoceanic - Low Subhyperoceanic
 Bioclimate (Variant): TROPICAL XERIC (ANPHITROPICAL, SEMIARID)
 Bioclimatic belt...: LOW MESOTROPICAL LOW SEMIARID

KHAMIS MUSHAIT (SAUDI ARABIA)

2066 m

P= 330 18° 18'N 42° 48'E 27/27 y.
 T= 18.9° Ic= 10.1 Tp= 2268 Tn= 0
 m= 9.4° M= 17.5° Itc= 458 Io= 1.5



TROPICAL XERIC (ANPHITROPICAL)
LOW MESOTROPICAL LOW SEMIARID

**Tropical Xeric Bioclimate,
 Antitropical Variant**

Figure 25

13

DIREDAWA (ETHIOPIA) Altitude: 1162 m.
 Latitude: 9° 36'N Longitude: 41° 52'E
 Temperature observation period.: 1982-1994 (13)
 Rainfall observation period....: 1982-1994 (13)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	21.95	28.33	15.56	38.89	10.00	21.8	73.97
Feb.	22.50	29.44	15.56	42.22	10.00	47.0	73.68
Mar.	25.28	31.67	18.89	42.22	8.89	53.6	119.87
Apr.	25.83	32.22	19.44	37.22	8.89	81.8	128.44
May.	26.95	33.89	20.00	38.89	10.00	18.5	150.23
Jun.	28.34	35.56	21.11	38.33	12.78	33.5	159.24
Jul.	25.56	32.22	18.89	37.78	12.22	87.4	130.21
Aug.	24.45	31.11	17.78	37.22	5.00	168.2	111.88
Sep.	25.56	32.78	18.33	37.22	8.89	76.7	122.98
Oct.	25.56	33.33	17.78	37.22	7.78	10.7	122.98
Nov.	23.62	31.67	15.56	36.67	11.11	5.6	91.72
Dec.	22.50	28.89	16.11	37.78	9.44	9.9	79.28
Year	24.84	31.76	17.92	38.47	9.58	615	1364.5

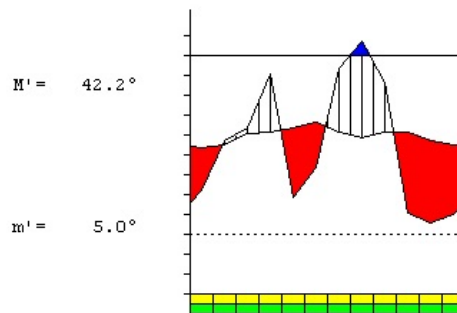
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 687
 Compensated thermicity index.....(Itc): 687
 Simple continentality index.....(Ic): 6.4
 Diurnality index.....(Id): 16.1
 Annual ombrothermic index.....(Io): 2.06
 Monthly dry ombrothermic index.....(Iod1): 0.24
 Bimonthly dry ombrothermic index.....(Iod2): 0.34
 Threemonthly dry ombrothermic index.....(Iod3): 0.37
 Fourmonthly dry ombrothermic index.....(Iod4): 1.06
 Annual ombro-evaporation index.....(Ioe): 0.45
 Annual positive temperature.....(Tp): 2981
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 717
 Positive precipitation.....(Pp): 615

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	1	5	1	5	0

Latitudinal Belt....: Eutropical
 Continentality.....: Hyperoceanic - Low Euhyperoceanic
 Bioclimate(Variant): TROPICAL XERIC (BIXERIC, DRY)
 Bioclimatic belt....: LOW THERMOTROPICAL LOW DRY

DIREDAWA (ETHIOPIA) 1162 m
 P= 615 9° 36'N 41° 52'E 13/13 y.
 T= 24.8° Ic= 6.4 Tp= 2981 Tn= 0
 m= 15.6° M= 28.3° Itc= 687 Io= 2.1



TROPICAL XERIC (BIXERIC)
LOW THERMOTROPICAL LOW DRY

**Tropical Xeric Bioclimate,
 Bixerix Variant**

Figure 26

14

GHANZI (BOTSWANA) Altitude: 1131 m.
 Latitude: 21° 42'S Longitude: 21° 39'E
 Temperature observation period.: 1952-1980 (29)
 Rainfall observation period....: 1950-1980 (31)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	25.00	32.00	18.00	42.00	7.00	98.0	135.92
Feb.	24.40	32.00	18.00	38.00	7.00	94.0	111.74
Mar.	22.80	30.00	16.00	39.00	8.00	74.0	100.32
Apr.	20.60	29.00	13.00	36.00	-1.00	39.0	72.56
May.	16.70	26.00	8.00	33.00	-6.00	8.0	44.22
Jun.	13.90	23.00	4.00	32.00	-7.00	1.0	27.42
Jul.	13.90	24.00	4.00	31.00	-6.00	0.0	28.64
Aug.	16.70	27.00	6.00	38.00	-3.00	0.0	46.08
Sep.	20.60	31.00	10.00	38.00	-1.00	2.0	75.58
Oct.	24.40	33.00	15.00	39.00	1.00	21.0	122.92
Nov.	25.00	33.00	17.00	42.00	6.00	43.0	130.01
Dec.	25.00	33.00	18.00	41.00	7.00	66.0	137.10
Year	20.75	29.42	12.25	37.42	1.00	446	1032.5

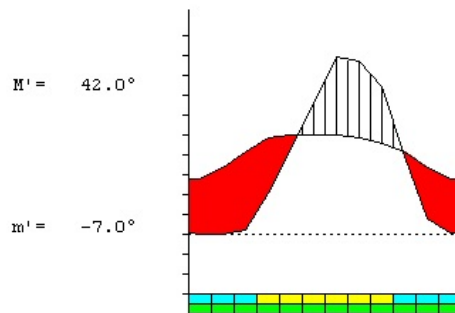
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 478
 Compensated thermicity index.....(Itc): 478
 Simple continentality index.....(Ic): 11.1
 Diurnality index.....(Id): 21.0
 Annual ombrothermic index.....(Io): 1.79
 Monthly dry ombrothermic index.....(Iod1): No
 Bimonthly dry ombrothermic index.....(Iod2): No
 Threemonthly dry ombrothermic index.....(Iod3): 0.02
 Fourmonthly dry ombrothermic index.....(Iod4): 0.15
 Annual ombro-evaporation index.....(Ioe): 0.43
 Annual positive temperature.....(Tp): 2490
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 445
 Positive precipitation.....(Pp): 446

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	0	4	2	6	0

Latitudinal Belt...: Eutropical
 Continentality....: Oceanic - High Semihyperoceanic
 Bioclimate(Variant): TROPICAL XERIC (SEMIARID)
 Bioclimatic belt...: LOW MESOTROPICAL UPPER SEMIARID

GHANZI (BOTSWANA) 1131 m
 P= 446 21° 42'S 21° 39'E 29/31 y.
 T= 20.8° Ic= 11.1 Tp= 2490 Tn= 0
 m= 4.0° M= 23.0° Itc= 478 Io= 1.8



TROPICAL XERIC (SEMIARID)
LOW MESOTROPICAL UPPER SEMIARID

Tropical Xeric Bioclimate,
 Normal Variant

Figure 27

15

AREQUIPA (PERU) Altitude: 2525 m.
 Latitude: 16° 19'S Longitude: 71° 33'W
 Temperature observation period.: 1958-1980 (23)
 Rainfall observation period....: 1951-1980 (30)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	13.90	0.00	0.00	27.00	2.00	31.0	62.63
Feb.	13.90	0.00	0.00	27.00	1.00	48.0	54.80
Mar.	13.50	0.00	0.00	28.00	1.00	19.0	56.42
Apr.	14.10	0.00	0.00	27.00	1.00	0.0	55.88
May.	13.80	0.00	0.00	26.00	0.00	0.0	54.26
Jun.	13.20	0.00	0.00	27.00	-3.00	0.0	48.46
Jul.	13.10	0.00	0.00	27.00	-4.00	0.0	50.02
Aug.	13.80	0.00	0.00	28.00	-3.00	0.0	56.48
Sep.	14.40	0.00	0.00	27.00	-2.00	1.0	58.69
Oct.	13.60	0.00	0.00	27.00	-1.00	0.0	58.07
Nov.	13.90	0.00	0.00	28.00	0.00	1.0	59.83
Dec.	14.10	0.00	0.00	29.00	0.00	4.0	64.43
Year	13.78	0.00	0.00	27.33	-0.67	104	679.96

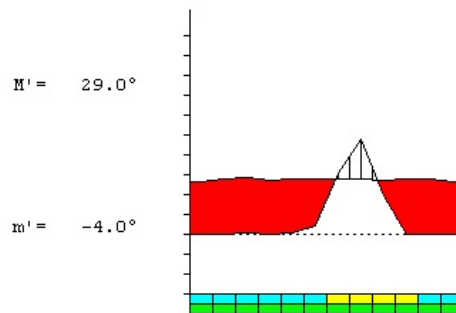
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 400
 Compensated thermicity index.....(Itc): 400
 Simple continentality index.....(Ic): 1.3
 Diurnality index.....(Id): 0.0
 Annual ombrothermic index.....(Io): 0.63
 Monthly dry ombrothermic index.....(Iod1): No
 Bimonthly dry ombrothermic index.....(Iod2): No
 Three-monthly dry ombrothermic index.....(Iod3): No
 Four-monthly dry ombrothermic index.....(Iod4): 0.35
 Annual ombro-evaporation index.....(Ioe): 0.15
 Annual positive temperature.....(Tp): 1653
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 411
 Positive precipitation.....(Pp): 104

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	0	2	1	9	0

Latitudinal Belt...: Eutropical
 Continentality....: Hyperoceanic - High Ultrahyperoceanic
 Bioclimate(Variant): TROPICAL DESERTIC (PLUVISEROTIN, ARID)
 Bioclimatic belt...: UPPER MESOTROPICAL LOW ARID

AREQUIPA (PERU) 2525 m
 P= 104 16° 19'S 71° 33'W 23/30 y.
 T= 13.8° Ic= 1.3 Tp= 1653 Tn= 0
 m= 13.1° M= 13.1° Itc= 400 Io= 0.6



TROPICAL DESERTIC (PLUVISEROTIN)
UPPER MESOTROPICAL LOW ARID

Tropical Desertic Bioclimate,
 Pluviserotin Variant

Figure 28

16

JASK (IRAN) Altitude: 4 m.
 Latitude: 25° 45'N Longitude: 57° 45'E
 Temperature observation period.: 1956-1994 (39)
 Rainfall observation period.....: 1956-1994 (39)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	Epi
Jan.	19.45	23.33	15.56	29.44	5.00	30.5	36.53
Feb.	20.28	23.89	16.67	31.11	8.33	22.9	41.10
Mar.	23.33	27.22	19.44	33.89	8.33	15.2	82.93
Apr.	26.67	30.56	22.78	42.22	15.56	5.1	146.44
May.	29.73	33.89	25.56	43.33	18.33	1.3	187.17
Jun.	32.22	36.11	28.33	45.00	22.78	1.3	208.47
Jul.	32.78	36.11	29.44	44.44	24.44	1.3	217.34
Aug.	31.95	35.00	28.89	43.33	17.22	1.3	200.62
Sep.	30.56	33.89	27.22	41.67	21.11	0.0	171.36
Oct.	28.34	32.78	23.89	39.44	17.78	5.1	148.73
Nov.	24.45	28.89	20.00	41.11	11.11	7.6	87.91
Dec.	21.39	25.56	17.22	31.11	7.78	30.5	52.28
Year	26.76	30.60	22.92	38.84	14.81	122	1580.9

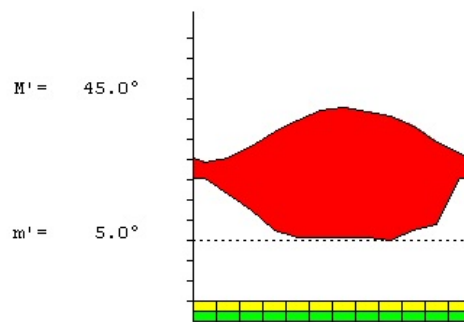
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 657
 Compensated thermicity index.....(Itc): 657
 Simple continentality index.....(Ic): 13.3
 Diurnality index.....(Id): 8.9
 Annual ombrothermic index.....(Io): 0.38
 Monthly dry ombrothermic index.....(Iod1): No
 Bimonthly dry ombrothermic index.....(Iod2): 0.02
 Threemonthly dry ombrothermic index.....(Iod3): 0.03
 Fourmonthly dry ombrothermic index.....(Iod4): 0.03
 Annual ombro-evaporation index.....(Ioe): 0.08
 Annual positive temperature.....(Tp): 3212
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 953
 Positive precipitation.....(Pp): 122

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	0	0	3	9	0

Latitudinal Belt...: Subtropical
 Continentality.....: Oceanic - Low Semihyperoceanic
 Bioclimate(Variant): TROPICAL DESERTIC (ANPHITROPICAL, HYPERARID)
 Bioclimatic belt...: LOW THERMOTROPICAL UPPER HYPERARID

JASK (IRAN) 4 m
 P= 122 25° 45'N 57° 45'E 39/39 y.
 T= 26.8 ° Ic= 13.3 Tp= 3212 Tn= 0
 m= 15.6 ° M= 23.3 ° Itc= 657 Io= 0.4



TROPICAL DESERTIC (ANPHITROPICAL)
LOW THERMOTROPICAL UPPER HYPERARID

**Tropical Desertic Bioclimate,
 Antitropical Variant**

Figure 29

17

KARACHI (PAKISTAN) Altitude: 4 m.
 Latitude: 24° 48'N Longitude: 66° 59'E
 Temperature observation period.: 1937-1980 (44)
 Rainfall observation period....: 1921-1980 (60)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	18.90	25.00	12.80	31.70	4.40	13.0	37.32
Feb.	20.30	26.10	14.40	33.90	6.10	10.0	46.09
Mar.	24.40	29.40	19.40	41.10	8.30	8.0	102.84
Apr.	27.50	32.20	22.80	43.90	13.90	3.0	152.12
May.	30.00	33.90	26.10	47.80	18.30	3.0	188.04
Jun.	30.90	33.90	27.80	45.60	20.00	18.0	194.62
Jul.	30.00	32.80	27.20	43.30	22.80	84.0	191.31
Aug.	28.60	31.10	26.10	37.20	22.80	41.0	170.59
Sep.	28.10	31.10	25.00	41.10	20.60	13.0	151.27
Oct.	27.50	32.80	22.20	42.20	13.90	2.0	142.07
Nov.	24.20	30.60	17.80	37.80	8.90	3.0	88.23
Dec.	20.30	26.70	13.90	32.80	3.90	5.0	47.12
Year	25.89	30.47	21.29	39.87	13.66	203	1511.6

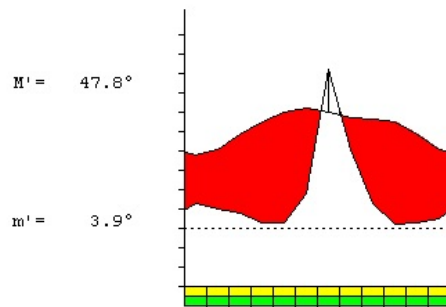
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 637
 Compensated thermicity index.....(Itc): 637
 Simple continentality index.....(Ic): 12.0
 Diurnality index.....(Id): 12.8
 Annual ombrothermic index.....(Io): 0.65
 Monthly dry ombrothermic index.....(Iod1): 0.07
 Bimonthly dry ombrothermic index.....(Iod2): 0.10
 Threemonthly dry ombrothermic index.....(Iod3): 0.14
 Fourmonthly dry ombrothermic index.....(Iod4): 0.23
 Annual ombro-evaporation index.....(Ioe): 0.13
 Annual positive temperature.....(Tp): 3107
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 720
 Positive precipitation.....(Pp): 203

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	0	1	1	10	0

Latitudinal Belt...: Subtropical
 Continentality.....: Oceanic - High Semihyperoceanic
 Bioclimate(Variant): TROPICAL DESERTIC (ARID)
 Bioclimatic belt...: LOW THERMOTROPICAL LOW ARID

KARACHI (PAKISTAN) 4 m
 P= 203 24° 48'N 66° 59'E 44/60 y.
 T= 25.9 ° Ic= 12.0 Tp= 3107 Tn= 0
 m= 12.8 ° M= 25.0 ° Itc= 637 Io= 0.7



TROPICAL DESERTIC (ARID)
LOW THERMOTROPICAL LOW ARID

Tropical Desertic Bioclimate,
 Normal Variant

Figure 30

18

MOWEBAAI (NAMIBIA) Altitude: 16 m.

Latitude: 19° 20'S Longitude: 12° 43'E
 Temperature observation period.: 1968-1984 (17)
 Rainfall observation period....: 1968-1984 (17)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	18.70	21.00	16.50	23.30	14.10	3.0	86.82
Feb.	19.20	21.40	16.90	24.40	15.10	3.0	78.72
Mar.	18.60	20.80	16.40	23.70	14.40	9.0	79.26
Apr.	17.20	19.40	14.90	26.30	12.10	1.0	64.43
May.	16.30	19.40	13.00	32.50	10.00	0.0	58.40
Jun.	15.20	18.70	12.10	28.70	9.40	0.0	49.92
Jul.	14.10	17.10	11.20	30.10	8.20	0.0	45.59
Aug.	13.40	15.70	11.00	21.60	8.50	0.0	44.15
Sep.	13.80	16.00	11.80	18.60	9.00	0.0	46.33
Oct.	14.90	17.10	12.80	19.80	10.30	0.0	57.25
Nov.	16.30	18.60	14.10	20.90	11.80	0.0	66.31
Dec.	17.60	20.00	15.30	22.00	13.10	0.0	78.62
Year	16.27	18.77	13.83	24.33	11.33	16	755.80

BIOCLIMATIC INDICES AND DIAGNOSIS

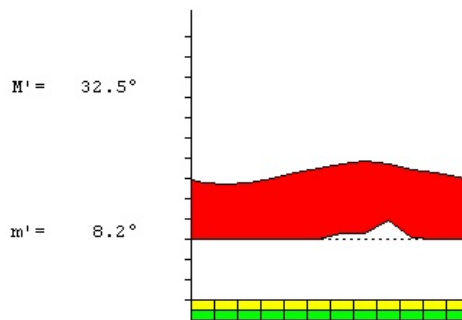
Thermicity index.....(It): 430
 Compensated thermicity index.....(Itc): 430
 Simple continentality index.....(Ic): 5.8
 Diurnality index.....(Id): 6.6
 Annual ombrothermic index.....(Io): 0.08
 Monthly dry ombrothermic index.....(Iod1): No
 Bimonthly dry ombrothermic index.....(Iod2): No
 Threemonthly dry ombrothermic index.....(Iod3): No
 Fourmonthly dry ombrothermic index.....(Iod4): 0.02
 Annual ombro-evaporation index.....(Ioe): 0.02
 Annual positive temperature.....(Tp): 1953
 Annual negative temperature.....(Tn): 0
 Dry station temperature.....(Td): 456
 Positive precipitation.....(Pp): 16

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	0	0	0	12	0

Latitudinal Belt...: Eutropical
 Continentality....: Hyperoceanic - High Euhyperoceanic
 Bioclimate(Variant): TROPICAL HYPERDESERTIC (EXTREME)
 Bioclimatic belt...: LOW MESOTROPICAL LOW ULTRAHYPERARID

MOWEBAAI (NAMIBIA) 16 m

P= 16 19° 20'S 12° 43'E 17/17 y.
 T= 16.3 ° Ic= 5.8 Tp= 1953 Tn= 0
 m= 11.0 ° M= 15.7 ° Itc= 430 Io= 0.1



TROPICAL HYPERDESERTIC (EXTREME)
LOW MESOTROPICAL LOW ULTRAHYPERARID

**Tropical Hyperdesertic Bioclimate,
 Normal Variant**

Figure 31

19

TUDELA (ESP NAVARRA) Altitude: 263 m.

Latitude: 42° 4'N Longitude: 1° 36'W
 Temperature observation period.: 1935-1969 (35)
 Rainfall observation period.....: 1935-1969 (35)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	5.00	8.80	1.10	15.80	-5.30	26.0	10.09
Feb.	6.80	11.50	2.10	17.50	-3.80	27.0	15.69
Mar.	10.20	15.40	5.00	22.00	-0.50	37.0	35.29
Apr.	12.90	18.10	7.60	25.60	2.10	47.0	53.77
May.	16.30	22.00	10.60	29.80	4.80	52.0	84.64
Jun.	20.10	26.20	14.00	34.10	8.80	43.0	115.28
Jul.	23.00	29.60	16.30	36.50	11.70	23.0	141.00
Aug.	22.20	28.60	15.80	35.50	11.30	26.0	124.59
Sep.	19.40	25.30	13.60	31.70	8.00	41.0	89.71
Oct.	14.40	19.60	9.20	25.40	2.70	53.0	53.41
Nov.	8.90	13.30	4.50	19.80	-1.60	48.0	23.10
Dec.	6.00	9.60	2.50	15.70	-3.50	39.0	12.63
Year	13.77	19.00	8.52	25.78	2.89	462	759.19

BIOCLIMATIC INDICES AND DIAGNOSIS

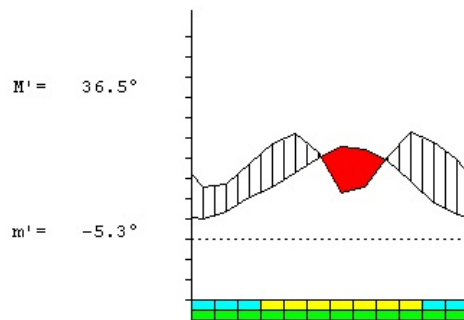
Thermicity index.....(It): 237
 Compensated thermicity index.....(Itc): 237
 Simple continentality index.....(Ic): 18.0
 Diurnality index.....(Id): 13.3
 Annual ombrothermic index.....(Io): 2.80
 Monthly estival ombrothermic index.....(Ios1): 1.00
 Bimonthly estival ombrothermic index.....(Ios2): 1.08
 Three-monthly estival ombrothermic index.....(Ios3): 1.41
 Four-monthly estival ombrothermic index.....(Ios4): 1.76
 Annual ombro-evaporation index.....(Ioe): 0.61
 Annual positive temperature.....(Tp): 1652
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 653
 Positive precipitation.....(Pp): 462

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	3	7	2	0	0

Latitudinal Belt...: Low eutemperate
 Continentality.....: Oceanic - Low Semicontinental
 Bioclimate (Variant): **MEDITERRANEAN PLUVISEASONAL-OCEANIC (STEPPIC)**
 Bioclimatic belt...: **UPPER MESOMEDITERRANEAN LOW DRY**

TUDELA (ESP NAVARRA) 263 m

P= 462 42° 4'N 1° 36'W 35/35 y.
 T= 13.8 ° Ic= 18.0 Tp= 1652 Tn= 0
 m= 1.1 ° M= 8.8 ° Itc= 237 Io= 2.8



MEDITERRANEAN PLUVISEASONAL-OCEANIC (STEPPIC)
UPPER MESOMEDITERRANEAN LOW DRY

**Mediterranean Pluviseasonal Oceanic Bioclimate,
 Steppic Variant**

Figure 32

20

HUALPENCILLO (CHILE)

Altitude: 23 m.

Latitude: 36° 47'S Longitude: 73° 5'W
 Temperature observation period.: 1987-1994 (8)
 Rainfall observation period.....: 1949-1994 (46)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	16.67	23.33	10.00	30.00	3.89	17.8	94.60
Feb.	16.67	24.44	8.89	33.89	5.00	20.3	80.22
Mar.	15.00	22.22	7.78	27.22	1.11	61.0	70.28
Apr.	12.50	18.33	6.67	25.00	-1.11	83.8	49.59
May.	10.84	15.56	6.11	25.00	-1.11	198.1	38.84
Jun.	9.17	13.89	4.44	17.78	-5.00	236.2	28.63
Jul.	8.06	13.33	2.78	17.78	-6.11	248.9	26.18
Aug.	8.61	13.89	3.33	20.00	-2.78	185.4	31.08
Sep.	9.72	15.00	4.44	21.11	-2.78	101.6	38.49
Oct.	11.11	17.22	5.00	23.89	-2.22	58.4	51.89
Nov.	13.89	21.11	6.67	28.89	2.22	45.7	71.05
Dec.	15.84	22.78	8.89	32.22	2.78	25.4	90.16
Year	12.34	18.42	6.25	25.23	-0.51	1283	671.01

BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 285
 Compensated thermicity index.....(Itc): 285
 Simple continentality index.....(Ic): 8.6
 Diurnality index.....(Id): 15.6
 Annual ombrothermic index.....(Io): 8.66
 Monthly estival ombrothermic index.....(Ios1): 1.07
 Bimonthly estival ombrothermic index.....(Ios2): 1.14
 Threemonthly estival ombrothermic index.....(Ios3): 1.29
 Fourmonthly estival ombrothermic index.....(Ios4): 1.73
 Annual ombro-evaporation index.....(Ioe): 1.91
 Annual positive temperature.....(Tp): 1481
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 492
 Positive precipitation.....(Pp): 1283

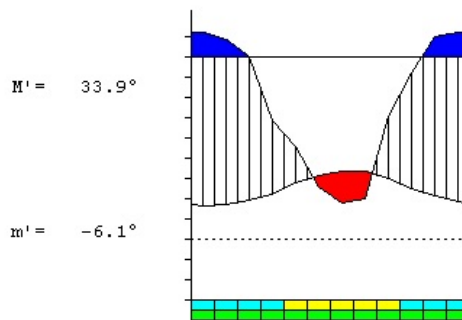
N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	8	1	3	0	0

Latitudinal Belt...: Low eutemperate
 Continentality.....: Hyperoceanic - High Subhyperoceanic
 Bioclimate.....: MEDITERRANEAN PLUVISEASONAL-OCEANIC
 Bioclimatic belt...: UPPER MESOMEDITERRANEAN LOW HUMID

HUALPENCILLO (CHILE)

23 m

P= 1283 36° 47'S 73° 5'W 8/46 y.
 T= 12.3 ° Ic= 8.6 Tp= 1481 Tn= 0
 m= 2.8 ° M= 13.3 ° Itc= 285 Io= 8.7



MEDITERRANEAN PLUVISEASONAL-OCEANIC
UPPER MESOMEDITERRANEAN LOW HUMID

Mediterranean Pluviseasonal Oceanic Bioclimate,
 Normal Variant

Figure 33

21

BOLGRAD (UKRAINE) Altitude: 81 m.
 Latitude: 45° 40'N Longitude: 28° 37'E
 Temperature observation period.: 1984-1994 (11)
 Rainfall observation period.....: 1984-1994 (11)

(C/mn)	Ti	Mi	mi	M'i	m'i	Pi	Epi
Jan.	-3.34	-0.56	-6.11	10.00	-23.89	37.8	0.00
Feb.	-0.28	2.22	-2.78	17.22	-21.11	34.3	0.00
Mar.	3.89	8.33	-0.56	21.11	-13.89	37.6	12.19
Apr.	10.56	16.11	5.00	26.11	-6.11	38.9	47.75
May.	16.12	21.67	10.56	30.00	1.11	52.3	93.07
Jun.	20.56	26.11	15.00	35.00	6.11	57.9	127.58
Jul.	22.22	28.33	16.11	36.11	10.00	47.8	142.91
Aug.	21.67	27.78	15.56	35.00	6.11	29.5	127.96
Sep.	17.22	23.33	11.11	32.22	2.78	39.4	81.56
Oct.	12.22	17.22	7.22	26.11	-3.89	29.0	47.77
Nov.	6.95	10.00	3.89	23.89	-8.89	31.5	19.66
Dec.	0.55	3.33	-2.22	16.11	-20.00	40.9	0.74
Year	10.69	15.32	6.07	25.74	-5.97	477	701.20

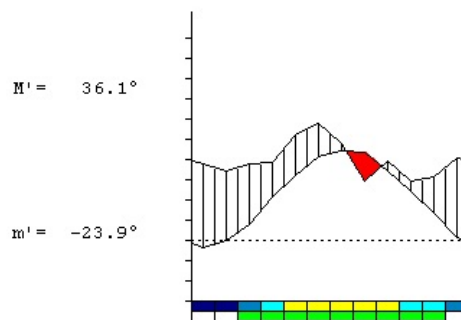
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 40
 Compensated thermicity index.....(Itc): 124
 Simple continentality index.....(Ic): 25.6
 Diurnality index.....(Id): 12.2
 Annual ombrothermic index.....(Io): 3.07
 Monthly estival ombrothermic index.....(Ios1): 1.36
 Bimonthly estival ombrothermic index.....(Ios2): 1.76
 Threemonthly estival ombrothermic index.....(Ios3): 2.10
 Fourmonthly estival ombrothermic index.....(Ios4): 2.33
 Annual ombro-evaporation index.....(Ioe): 0.68
 Annual positive temperature.....(Tp): 1320
 Annual negative temperature.....(Tn): 36
 Estival temperature.....(Ts): 645
 Positive precipitation.....(Pp): 405

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	3	6	1	0	2

Latitudinal Belt...: Low eutemperate
 Continentality.....: Continental - High Subcontinental
 Bioclimate (Variant): **MEDITERRANEAN PLUVISEASONAL-CONTINENTAL (STEPP)**
 Bioclimatic belt...: **LOW SUPRAMEDITERRANEAN UPPER DRY**

BOLGRAD (UKRAINE) 81 m
 P= 477 45° 40'N 28° 37'E 11/11 y.
 T= 10.7° Ic= 25.6 Tp= 1320 Tn= 36
 m= -6.1° M= -0.6° Itc= 124 Io= 3.1



MEDITERRANEAN PLUVISEASONAL-CONTINENTAL (STEPPIC)
LOW SUPRAMEDITERRANEAN UPPER DRY

Mediterranean Pluviseasonal Continental Bioclimate,
 Steppic Variant

Figure 34

22

DUSHANBE (TAJIKISTAN)

Altitude: 824 m.

Latitude: 38° 35'N Longitude: 68° 47'E
 Temperature observation period.: 1984-1994 (11)
 Rainfall observation period....: 1984-1994 (11)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	4.44	9.44	-0.56	21.11	-17.78	21.6	5.83
Feb.	6.12	10.56	1.67	22.78	-13.89	65.8	9.83
Mar.	10.56	15.56	5.56	27.78	-10.00	113.3	29.93
Apr.	15.00	20.56	9.44	32.22	0.00	116.1	57.37
May.	19.72	26.11	13.33	37.78	6.11	65.5	101.21
Jun.	25.28	32.78	17.78	40.00	11.11	11.9	154.36
Jul.	27.50	35.56	19.44	42.22	13.89	5.8	180.82
Aug.	25.83	34.44	17.22	40.00	10.00	0.3	152.25
Sep.	21.39	30.00	12.78	37.22	3.89	4.6	98.00
Oct.	15.56	23.33	7.78	32.78	-2.22	32.8	53.23
Nov.	9.45	15.56	3.33	25.00	-6.11	49.3	20.29
Dec.	5.56	10.56	0.56	20.00	-10.00	50.8	8.18
Year	15.53	22.04	9.03	31.57	-1.25	538	871.30

BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 244
 Compensated thermicity index.....(Itc): 290
 Simple continentality index.....(Ic): 23.1
 Diurnality index.....(Id): 17.2
 Annual ombrothermic index.....(Io): 2.89
 Monthly estival ombrothermic index.....(Ios1): 0.01
 Bimonthly estival ombrothermic index.....(Ios2): 0.11
 Threemonthly estival ombrothermic index.....(Ios3): 0.23
 Fourmonthly estival ombrothermic index.....(Ios4): 0.85
 Annual ombro-evaporation index.....(Ioe): 0.62
 Annual positive temperature.....(Tp): 1864
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 786
 Positive precipitation.....(Pp): 538

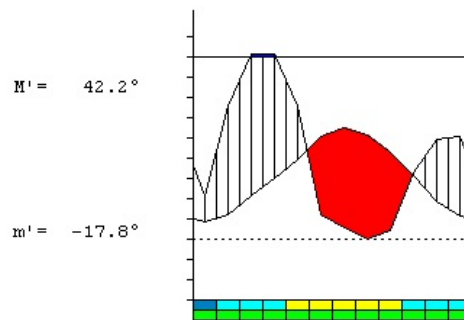
N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	6	2	0	4	0

Latitudinal Belt....: Low eutemperate
 Continentality.....: Continental - Low Subcontinental
 Bioclimate.....: MEDITERRANEAN PLUVISEASONAL-CONTINENTAL
 Bioclimatic belt....: LOW MESOMEDITERRANEAN UPPER DRY

DUSHANBE (TAJIKISTAN)

824 m

P= 538 38° 35'N 68° 47'E 11/11 y.
 T= 15.5 ° Ic= 23.1 Tp= 1864 Tn= 0
 m= -0.6 ° M= 9.4 ° Itc= 290 Io= 2.9



MEDITERRANEAN PLUVISEASONAL-CONTINENTAL
LOW MESOMEDITERRANEAN UPPER DRY

Mediterranean Pluviseasonal Continental Bioclimate,
 Steppic Variant

Figure 35

23

CORONEL J.J.GOMEZ (ARGENTINA) Altitude: 242 m.
 Latitude: 39° 1'S Longitude: 67° 39'W
 Temperature observation period.: 1941-1950 (10)
 Rainfall observation period.....: 1941-1950 (10)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPi
Jan.	22.50	31.60	13.10	40.80	1.00	26.0	134.09
Feb.	21.00	30.20	11.90	39.80	1.00	13.0	103.01
Mar.	17.00	26.60	8.80	37.20	-2.30	14.0	75.79
Apr.	13.00	22.40	5.50	32.20	-6.10	14.0	44.61
May.	8.70	16.70	2.40	26.70	-7.20	29.0	23.29
Jun.	5.70	13.70	-0.80	24.50	-11.60	10.0	11.44
Jul.	5.40	13.20	-1.40	22.60	-11.70	16.0	11.38
Aug.	7.00	15.90	-0.30	27.60	-12.70	11.0	18.15
Sep.	11.00	19.60	3.10	32.80	-8.10	14.0	37.63
Oct.	15.40	24.30	6.40	34.70	-3.30	8.0	70.56
Nov.	18.90	27.50	9.50	38.50	-1.70	8.0	98.31
Dec.	21.80	30.60	11.90	40.00	2.00	10.0	130.11
Year	13.95	22.69	5.84	33.12	-5.06	173	758.37

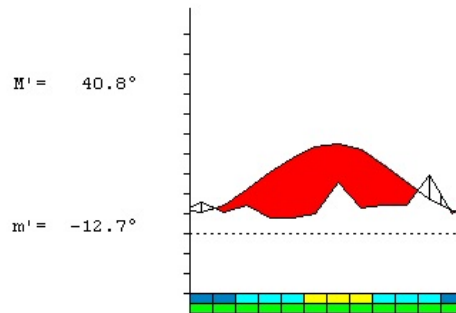
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 258
 Compensated thermicity index.....(Itc): 258
 Simple continentality index.....(Ic): 17.1
 Diurnality index.....(Id): 18.7
 Annual ombrothermic index.....(Io): 1.03
 Monthly estival ombrothermic index.....(Ios1): 0.46
 Bimonthly estival ombrothermic index.....(Ios2): 0.90
 Threemonthly estival ombrothermic index.....(Ios3): 0.75
 Fourmonthly estival ombrothermic index.....(Ios4): 0.68
 Annual ombro-evaporation index.....(Ioe): 0.23
 Annual positive temperature.....(Tp): 1674
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 653
 Positive precipitation.....(Pp): 173

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	0	2	5	5	0

Latitudinal Belt...: Low eutemperate
 Continentality.....: Oceanic - Low Semicontinental
 Bioclimate(Variant): MEDITERRANEAN XERIC-OCEANIC (STEPPIC)
 Bioclimatic belt...: UPPER MESOMEDITERRANEAN LOW SEMIARID

CORONEL J.J.GOMEZ (ARGENTINA) 242 m
 P= 173 39° 1'S 67° 39'W 10/10 y.
 T= 13.9° Ic= 17.1 Tp= 1674 Tn= 0
 m= -1.4° M= 13.2° Itc= 258 Io= 1.0



MEDITERRANEAN XERIC-OCEANIC (STEPPIC)
UPPER MESOMEDITERRANEAN LOW SEMIARID

Mediterranean Xeric Oceanic Bioclimate,
 Steppic Variant

Figure 36

24

IDRIS (LIBYA) Altitude: 80 m.
 Latitude: 32° 40'N Longitude: 13° 9'E
 Temperature observation period.: 1975-1994 (20)
 Rainfall observation period....: 1971-1994 (24)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPi
Jan.	11.67	17.78	5.56	28.89	-3.89	63.5	18.34
Feb.	13.06	19.44	6.67	33.89	0.00	50.8	23.17
Mar.	15.28	22.78	7.78	45.00	0.56	27.9	39.69
Apr.	19.45	27.78	11.11	45.00	1.67	12.7	72.79
May.	22.50	30.56	14.44	48.33	2.78	5.1	110.77
Jun.	26.11	34.44	17.78	49.44	7.22	2.5	155.50
Jul.	27.78	36.67	18.89	51.11	12.22	1.3	176.35
Aug.	28.06	36.67	19.44	51.67	10.56	1.3	170.19
Sep.	26.11	33.89	18.33	49.44	9.44	10.2	134.59
Oct.	23.34	30.56	16.11	42.78	6.67	25.4	98.16
Nov.	18.06	24.44	11.67	41.67	3.33	35.6	49.07
Dec.	13.06	18.89	7.22	29.44	0.00	76.2	23.17
Year	20.37	27.83	12.92	43.06	4.21	313	1071.8

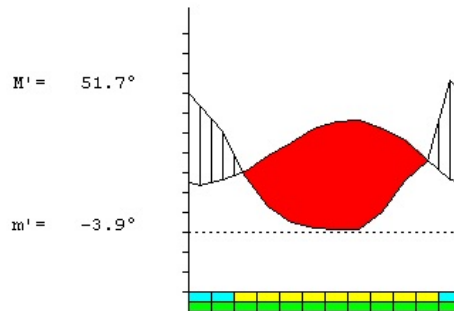
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 437
 Compensated thermicity index.....(Itc): 437
 Simple continentality index.....(Ic): 16.4
 Diurnality index.....(Id): 17.8
 Annual ombrothermic index.....(Io): 1.28
 Monthly estival ombrothermic index.....(Ios1): 0.05
 Bimonthly estival ombrothermic index.....(Ios2): 0.05
 Threemonthly estival ombrothermic index.....(Ios3): 0.06
 Fourmonthly estival ombrothermic index.....(Ios4): 0.10
 Annual ombro-evaporation index.....(Ioe): 0.29
 Annual positive temperature.....(Tp): 2445
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 820
 Positive precipitation.....(Pp): 313

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	2	1	3	6	0

Latitudinal Belt...: Subtropical
 Continentality.....: Oceanic - Low Euoceanic
 Bioclimate.....: MEDITERRANEAN XERIC-OCEANIC
 Bioclimatic belt...: LOW THERMOMEDITERRANEAN LOW SEMIARID

IDRIS (LIBYA) 80 m
 P= 313 32° 40'N 13° 9'E 20/24 y.
 T= 20.4° Ic= 16.4 Tp= 2445 Tn= 0
 m= 5.6° M= 17.8° Itc= 437 Io= 1.3



MEDITERRANEAN XERIC-OCEANIC
LOW THERMOMEDITERRANEAN LOW SEMIARID

Mediterranean Xeric Oceanic Bioclimate,
 Normal Variant

Figure 37

25

PAVLODAR (KAZAKHSTAN)

Altitude: 146 m.

Latitude: 52° 17'N Longitude: 76° 57'E
 Temperature observation period.: 1954-1994 (41)
 Rainfall observation period....: 1984-1994 (11)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPi
Jan.	-18.06	-13.33	-22.78	5.00	-47.22	10.4	0.00
Feb.	-17.22	-12.22	-22.22	6.11	-43.89	13.5	0.00
Mar.	-10.56	-5.56	-15.56	22.22	-37.78	14.7	0.00
Apr.	3.33	9.44	-2.78	28.89	-26.11	13.5	18.47
May.	12.78	19.44	6.11	37.22	-12.22	29.0	86.00
Jun.	19.17	25.56	12.78	38.89	0.00	27.4	133.53
Jul.	21.39	27.78	15.00	40.00	5.00	42.9	150.58
Aug.	18.89	25.00	12.78	40.00	0.00	26.2	120.08
Sep.	12.50	18.89	6.11	36.11	-6.11	17.8	66.00
Oct.	3.61	8.89	-1.67	27.22	-27.22	22.4	15.75
Nov.	-7.22	-3.33	-11.11	16.11	-40.00	18.8	0.00
Dec.	-15.00	-10.56	-19.44	6.11	-46.11	12.4	0.00
Year	1.97	7.50	-3.56	25.32	-23.47	249	590.41

BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -341
 Compensated thermicity index.....(Itc): 65
 Simple continentality index.....(Ic): 39.4
 Diurnality index.....(Id): 13.3
 Annual ombrothermic index.....(Io): 1.95
 Monthly estival ombrothermic index.....(Ios1): 1.39
 Bimonthly estival ombrothermic index.....(Ios2): 1.72
 Threemonthly estival ombrothermic index.....(Ios3): 1.62
 Fourmonthly estival ombrothermic index.....(Ios4): 1.74
 Annual ombro-evaporation index.....(Ioe): 0.42
 Annual positive temperature.....(Tp): 917
 Annual negative temperature.....(Tn): 681
 Estival temperature.....(Ts): 595
 Positive precipitation.....(Pp): 179

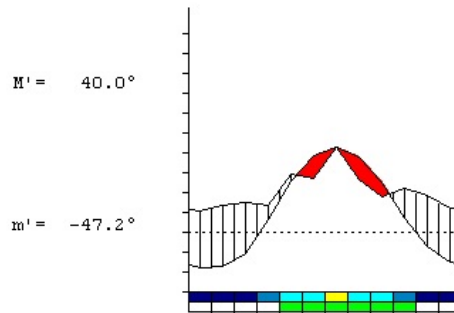
N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	2	2	3	0	5

Latitudinal Belt...: High eutemperate
 Continentality.....: Continental - High Eucontinental
 Bioclimate(Variant): MEDITERRANEAN XERIC-CONTINENTAL (STEPPIC)
 Bioclimatic belt...: UPPER SUPRAMEDITERRANEAN UPPER SEMIARID

PAVLODAR (KAZAKHSTAN)

146 m

P= 249 52° 17'N 76° 57'E 41/11 y.
 T= 2.0 ° Ic= 39.4 Tp= 917 Tn= 681
 m= -22.8 ° M= -13.3 ° Itc= 65 Io= 2.0



MEDITERRANEAN XERIC-CONTINENTAL (STEPPIC)
UPPER SUPRAMEDITERRANEAN UPPER SEMIARID

**Mediterranean Xeric Continental Bioclimate,
 Steppic Variant**

Figure 38

26

JEREVAN (ARMENIA) Altitude: 907 m.
 Latitude: 40° 8'N Longitude: 44° 28'E
 Temperature observation period.: 1984-1994 (11)
 Rainfall observation period.....: 1984-1994 (11)

(C/mmo)	Ti	Mi	mi	M'i	m'i	Pi	Epi
Jan.	-1.67	2.22	-5.56	20.00	-22.22	19.1	0.00
Feb.	0.83	5.56	-3.89	17.78	-16.11	24.1	0.74
Mar.	6.39	11.67	1.11	22.22	-15.00	16.5	17.65
Apr.	12.50	18.33	6.67	27.78	-6.11	34.5	50.36
May.	18.06	24.44	11.67	35.00	0.00	45.2	95.95
Jun.	21.94	29.44	14.44	38.89	2.78	21.8	128.29
Jul.	25.84	32.78	18.89	42.22	5.00	16.0	165.27
Aug.	25.00	32.22	17.78	40.00	12.22	7.9	146.36
Sep.	20.56	27.78	13.33	35.00	5.00	20.6	97.14
Oct.	14.17	20.56	7.78	31.11	-3.89	24.1	52.25
Nov.	8.06	13.33	2.78	22.22	-6.11	19.3	19.92
Dec.	1.67	5.56	-2.22	13.89	-12.22	12.2	1.98
Year	12.78	18.66	6.90	28.84	-4.72	261	775.91

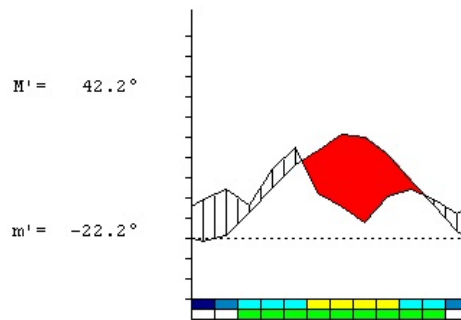
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 94
 Compensated thermicity index.....(Itc): 207
 Simple continentality index.....(Ic): 27.5
 Diurnality index.....(Id): 15.0
 Annual ombrothermic index.....(Io): 1.56
 Monthly estival ombrothermic index.....(Ios1): 0.32
 Bimonthly estival ombrothermic index.....(Ios2): 0.47
 Threemonthly estival ombrothermic index.....(Ios3): 0.63
 Fourmonthly estival ombrothermic index.....(Ios4): 1.00
 Annual ombro-evaporation index.....(Ioe): 0.34
 Annual positive temperature.....(Tp): 1550
 Annual negative temperature.....(Tn): 17
 Estival temperature.....(Ts): 728
 Positive precipitation.....(Pp): 242

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	2	4	2	3	1

Latitudinal Belt...: Low eutemperate
 Continentality.....: Continental - High Subcontinental
 Bioclimate.....: MEDITERRANEAN XERIC-CONTINENTAL
 Bioclimatic belt...: UPPER MESOMEDITERRANEAN UPPER SEMIARID

JEREVAN (ARMENIA) 907 m
 P= 261 40° 8'N 44° 28'E 11/11 y.
 T= 12.8 ° Ic= 27.5 Tp= 1550 Tn= 17
 m= -5.6 ° M= 2.2 ° Itc= 207 Io= 1.6



MEDITERRANEAN XERIC-CONTINENTAL
UPPER MESOMEDITERRANEAN UPPER SEMIARID

Mediterranean Xeric Continental Bioclimate,
 Normal Variant

Figure 39

27

FARINA (AUSTRALIA) Altitude: 92 m.
 Latitude: 30° 5'S Longitude: 138° 8'E
 Temperature observation period.: 1948-1994 (47)
 Rainfall observation period....: 1964-1994 (31)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	27.78	35.56	20.00	47.78	10.56	12.7	174.90
Feb.	27.78	35.56	20.00	45.56	10.56	15.2	150.12
Mar.	24.45	31.67	17.22	43.89	8.33	12.7	120.07
Apr.	19.45	26.67	12.22	38.89	3.89	10.2	65.38
May.	14.73	21.67	7.78	32.78	-1.67	15.2	34.56
Jun.	11.67	17.78	5.56	30.00	-2.78	15.2	19.23
Jul.	10.56	17.22	3.89	30.00	-3.89	7.6	16.37
Aug.	12.78	20.00	5.56	32.78	-2.22	7.6	26.47
Sep.	16.11	23.89	8.33	37.78	0.56	7.6	45.65
Oct.	20.56	28.33	12.78	42.78	2.78	12.7	86.98
Nov.	24.17	32.22	16.11	43.89	5.56	12.7	125.93
Dec.	26.67	34.44	18.89	38.33	8.33	12.7	165.60
Year	19.73	27.08	12.36	38.71	3.33	142	1031.3

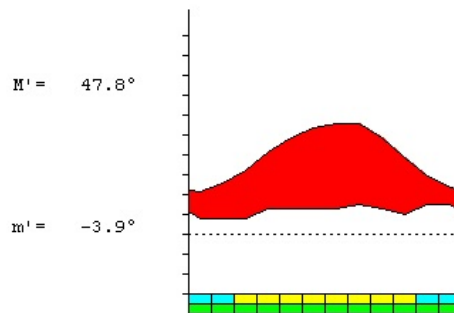
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 408
 Compensated thermicity index.....(Itc): 408
 Simple continentality index.....(Ic): 17.2
 Diurnality index.....(Id): 16.1
 Annual ombrothermic index.....(Io): 0.60
 Monthly estival ombrothermic index.....(Ios1): 0.46
 Bimonthly estival ombrothermic index.....(Ios2): 0.50
 Threemonthly estival ombrothermic index.....(Ios3): 0.49
 Fourmonthly estival ombrothermic index.....(Ios4): 0.50
 Annual ombro-evaporation index.....(Ioe): 0.14
 Annual positive temperature.....(Tp): 2367
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 822
 Positive precipitation.....(Pp): 142

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	0	0	2	10	0

Latitudinal Belt...: Subtropical
 Continentality.....: Oceanic - Low Semicontinental
 Bioclimate(Variant): MEDITERRANEAN DESERTIC-OCEANIC (STEPPIC)
 Bioclimatic belt...: LOW THERMOMEDITERRANEAN LOW ARID

FARINA (AUSTRALIA) 92 m
 P= 142 30° 5'S 138° 8'E 47/31 y.
 T= 19.7° Ic= 17.2 Tp= 2367 Tn= 0
 m= 3.9° M= 17.2° Itc= 408 Io= 0.6



MEDITERRANEAN DESERTIC-OCEANIC (STEPPIC)
LOW THERMOMEDITERRANEAN LOW ARID

Mediterranean Desertic Oceanic Bioclimate,
 Steppic Variant

Figure 40

28

SALUM (EGYPT) Altitude: 174 m.

Latitude: 31° 33'N Longitude: 25° 11'E
 Temperature observation period.: 1983-1994 (12)
 Rainfall observation period....: 1983-1994 (12)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPi
Jan.	12.50	17.22	7.78	23.89	2.78	22.6	24.97
Feb.	13.33	18.33	8.33	31.11	0.00	12.2	27.60
Mar.	15.56	20.56	10.56	35.00	3.89	6.9	45.67
Apr.	18.34	23.89	12.78	40.00	3.89	0.3	67.50
May.	20.56	25.56	15.56	42.78	8.89	4.6	94.43
Jun.	23.33	28.33	18.33	43.89	12.22	0.0	121.93
Jul.	25.00	30.00	20.00	38.89	16.11	0.3	144.46
Aug.	25.28	30.00	20.56	43.89	16.11	0.0	140.53
Sep.	23.89	28.89	18.89	41.11	13.89	0.3	111.84
Oct.	21.95	27.22	16.67	37.78	11.11	2.3	89.16
Nov.	18.61	23.33	13.89	33.89	6.11	23.6	56.71
Dec.	14.72	19.44	10.00	27.22	-2.22	21.6	34.35
Year	19.42	24.40	14.45	36.62	7.73	95	959.16

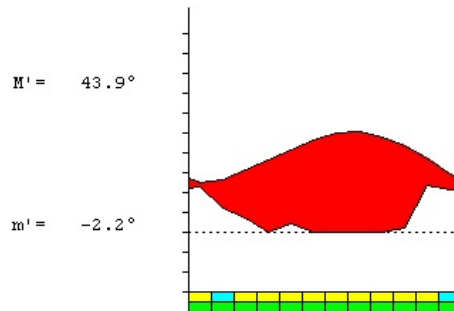
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 444
 Compensated thermicity index.....(Itc): 444
 Simple continentality index.....(Ic): 12.8
 Diurnality index.....(Id): 11.1
 Annual ombrothermic index.....(Io): 0.41
 Monthly estival ombrothermic index.....(Ios1): No
 Bimonthly estival ombrothermic index.....(Ios2): 0.01
 Threemonthly estival ombrothermic index.....(Ios3): 0.00
 Fourmonthly estival ombrothermic index.....(Ios4): 0.05
 Annual ombro-evaporation index.....(Ioe): 0.10
 Annual positive temperature.....(Tp): 2331
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 736
 Positive precipitation.....(Pp): 95

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	0	0	3	9	0

Latitudinal Belt...: Subtropical
 Continentality.....: Oceanic - Low Semihyperoceanic
 Bioclimate.....: MEDITERRANEAN DESERTIC-OCEANIC
 Bioclimatic belt...: LOW THERMOMEDITERRANEAN LOW ARID

SALUM (EGYPT) 174 m
 P= 95 31° 33'N 25° 11'E 12/12 y.
 T= 19.4 ° Ic= 12.8 Tp= 2331 Tn= 0
 m= 7.8 ° M= 17.2 ° Itc= 444 Io= 0.4



MEDITERRANEAN DESERTIC-OCEANIC
LOW THERMOMEDITERRANEAN LOW ARID

Mediterranean Desertic Oceanic Bioclimate,
 Normal Variant

Figure 41

29

DZHEZKAZGAN (KAZAKHSTAN) Altitude: 345 m.

Latitude: 47° 48'N Longitude: 67° 43'E
 Temperature observation period.: 1968-1994 (27)
 Rainfall observation period....: 1984-1994 (11)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-16.11	-11.11	-21.11	7.78	-50.00	14.5	0.00
Feb.	-14.72	-9.44	-20.00	10.00	-41.11	16.0	0.00
Mar.	-7.23	-1.67	-12.78	25.00	-38.89	25.9	0.00
Apr.	6.39	13.33	-0.56	28.89	-22.78	6.6	31.03
May.	15.00	23.33	6.67	37.78	-8.89	14.0	93.30
Jun.	20.83	29.44	12.22	41.11	-1.11	22.6	137.16
Jul.	23.06	31.67	14.44	42.78	3.89	19.8	154.98
Aug.	20.83	29.44	12.22	41.11	0.00	8.1	126.85
Sep.	13.89	22.78	5.00	37.22	-10.00	8.4	68.57
Oct.	5.00	12.22	-2.22	30.00	-20.00	17.0	19.20
Nov.	-4.72	0.56	-10.00	18.89	-38.89	9.7	0.00
Dec.	-13.06	-7.78	-18.33	6.11	-41.11	13.2	0.00
Year	4.10	11.06	-2.87	27.22	-22.41	176	631.09

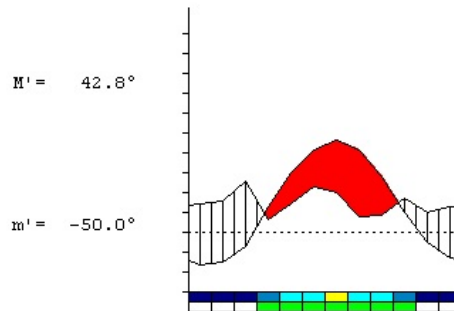
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -281
 Compensated thermicity index.....(Itc): 118
 Simple continentality index.....(Ic): 39.2
 Diurnality index.....(Id): 17.8
 Annual ombrothermic index.....(Io): 0.92
 Monthly estival ombrothermic index.....(Ios1): 0.39
 Bimonthly estival ombrothermic index.....(Ios2): 0.64
 Threemonthly estival ombrothermic index.....(Ios3): 0.78
 Fourmonthly estival ombrothermic index.....(Ios4): 0.81
 Annual ombro-evaporation index.....(Ioe): 0.28
 Annual positive temperature.....(Tp): 1050
 Annual negative temperature.....(Tn): 558
 Estival temperature.....(Ts): 647
 Positive precipitation.....(Pp): 97

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	0	1	2	4	5

Latitudinal Belt...: Low eutemperate
 Continentality.....: Continental - High Eucontinental
 Bioclimate(Variant): MEDITERRANEAN DESERTIC-CONTINENTAL (STEPPIC)
 Bioclimatic belt...: UPPER SUPRAMEDITERRANEAN UPPER ARID

DZHEZKAZGAN (KAZAKHSTAN) 345 m
 P= 176 47° 48'N 67° 43'E 27/11 y.
 T= 4.1° Ic= 39.2 Tp= 1050 Tn= 558
 m= -21.1° M= -11.1° Itc= 118 Io= 0.9



MEDITERRANEAN DESERTIC-CONTINENTAL (STEPPIC)
UPPER SUPRAMEDITERRANEAN UPPER ARID

Mediterranean Desertic Continental Bioclimate,
 Steppic Variant

Figure 42

30

AK-BAYTAL (UZBEKISTAN) Altitude: 233 m.
 Latitude: 43° 9'N Longitude: 64° 20'E
 Temperature observation period.: 1984-1994 (11)
 Rainfall observation period....: 1984-1994 (11)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-6.95	-2.22	-11.67	18.89	-37.22	15.2	0.00
Feb.	-2.78	2.22	-7.78	23.89	-27.78	12.7	0.00
Mar.	4.45	10.56	-1.67	33.89	-25.00	22.1	9.51
Apr.	13.34	20.00	6.67	37.78	-10.00	33.0	54.05
May.	20.83	28.33	13.33	42.78	0.00	19.1	118.52
Jun.	25.84	32.78	18.89	45.00	5.00	6.1	166.26
Jul.	28.62	35.56	21.67	47.22	10.00	4.6	196.69
Aug.	25.83	33.33	18.33	45.00	7.22	6.1	155.78
Sep.	20.00	27.22	12.78	40.00	-1.11	5.1	92.05
Oct.	11.39	18.33	4.44	37.22	-15.00	5.8	36.19
Nov.	1.66	7.22	-3.89	27.78	-28.89	17.0	1.72
Dec.	-4.45	0.00	-8.89	17.78	-35.00	18.5	0.00
Year	11.48	17.78	5.18	34.77	-13.15	165	830.77

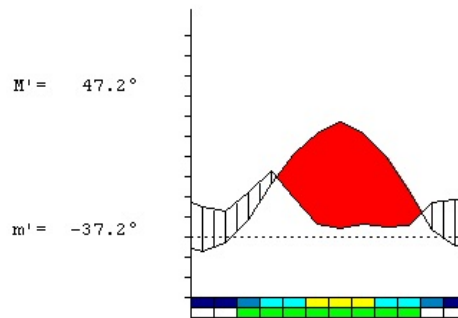
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -24
 Compensated thermicity index.....(Itc): 285
 Simple continentality index.....(Ic): 35.6
 Diurnality index.....(Id): 15.0
 Annual ombrothermic index.....(Io): 0.78
 Monthly estival ombrothermic index.....(Ios1): 0.16
 Bimonthly estival ombrothermic index.....(Ios2): 0.20
 Threemonthly estival ombrothermic index.....(Ios3): 0.21
 Fourmonthly estival ombrothermic index.....(Ios4): 0.36
 Annual ombro-evaporation index.....(Ioe): 0.20
 Annual positive temperature.....(Tp): 1520
 Annual negative temperature.....(Tn): 142
 Estival temperature.....(Ts): 803
 Positive precipitation.....(Pp): 119

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	2	1	0	6	3

Latitudinal Belt...: Low eutemperate
 Continentality.....: Continental - Low Eucontinental
 Bioclimate.....: MEDITERRANEAN DESERTIC-CONTINENTAL
 Bioclimatic belt...: UPPER MESOMEDITERRANEAN UPPER ARID

AK-BAYTAL (UZBEKISTAN) 233 m
 P= 165 43° 9'N 64° 20'E 11/11 y.
 T= 11.5 ° Ic= 35.6 Tp= 1520 Tn= 142
 m= -11.7 ° M= -2.2 ° Itc= 285 Io= 0.8



MEDITERRANEAN DESERTIC-CONTINENTAL
UPPER MESOMEDITERRANEAN UPPER ARID

Mediterranean Desertic Continental Bioclimate,
 Normal Variant

Figure 43

31

GIALO (LIBYA) Altitude: 52 m.
 Latitude: 29° 2'N Longitude: 21° 34'E
 Temperature observation period.: 1986-1994 (9)
 Rainfall observation period.....: 1986-1994 (9)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPi
Jan.	13.61	20.56	6.67	30.00	-0.56	6.1	20.30
Feb.	14.45	21.67	7.22	33.89	1.11	3.6	22.82
Mar.	18.06	25.56	10.56	42.78	2.78	1.3	49.46
Apr.	22.50	30.56	14.44	43.89	7.22	1.8	93.22
May.	26.11	33.89	18.33	48.89	10.00	3.0	152.58
Jun.	29.73	37.78	21.67	47.78	17.22	0.0	187.17
Jul.	29.72	37.22	22.22	47.22	17.78	0.0	191.91
Aug.	29.72	37.22	22.22	43.89	16.67	0.0	182.24
Sep.	27.78	35.00	20.56	43.89	15.00	0.3	150.12
Oct.	23.89	31.11	16.67	41.11	8.33	2.0	100.45
Nov.	19.45	26.67	12.22	39.44	2.78	1.0	52.25
Dec.	15.27	22.22	8.33	32.22	0.00	6.9	27.12
Year	22.52	29.96	15.09	41.25	8.19	26	1229.6

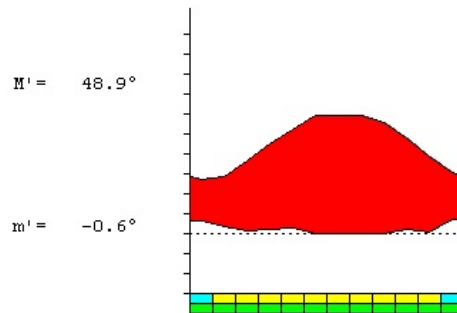
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 498
 Compensated thermicity index.....(Itc): 498
 Simple continentality index.....(Ic): 16.1
 Diurnality index.....(Id): 16.1
 Annual ombrothermic index.....(Io): 0.10
 Monthly estival ombrothermic index.....(Ios1): No
 Bimonthly estival ombrothermic index.....(Ios2): No
 Threemonthly estival ombrothermic index.....(Ios3): No
 Fourmonthly estival ombrothermic index.....(Ios4): 0.03
 Annual ombro-evaporation index.....(Ioe): 0.02
 Annual positive temperature.....(Tp): 2703
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 892
 Positive precipitation.....(Pp): 26

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	0	0	0	12	0

Latitudinal Belt....: Subtropical
 Continentality.....: Oceanic - Low Euoceanic
 Bioclimate.....: MEDITERRANEAN HYPERDESERTIC OCEANIC
 Bioclimatic belt....: UPPER INFRAMEDITERRANEAN LOW ULTRAHYPERARID

GIALO (LIBYA) 52 m
 P= 26 29° 2'N 21° 34'E 9/9 y.
 T= 22.5° Ic= 16.1 Tp= 2703 Tn= 0
 m= 6.7° M= 20.6° Itc= 498 Io= 0.1



MEDITERRANEAN HYPERDESERTIC OCEANIC
UPPER INFRAMEDITERRANEAN LOW ULTRAHYPERARID

**Mediterranean Hyperdesertic Oceanic Bioclimate,
 Normal Variant**

Figure 44

32

YAZD (IRAN) Altitude: 1240 m.
 Latitude: 31° 54'N Longitude: 54° 24'E
 Temperature observation period.: 1990-1994 (5)
 Rainfall observation period....: 1991-1994 (4)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	7.23	13.89	0.56	22.22	-7.78	9.9	7.47
Feb.	7.23	13.89	0.56	23.89	-7.22	0.3	7.22
Mar.	15.00	22.22	7.78	32.22	-2.22	4.3	41.17
Apr.	19.45	26.67	12.22	37.22	6.11	1.3	75.22
May.	24.45	31.67	17.22	36.11	10.00	0.5	135.17
Jun.	29.17	37.22	21.11	42.22	16.11	0.0	185.11
Jul.	31.39	38.89	23.89	43.89	16.11	0.0	211.31
Aug.	29.73	37.78	21.67	42.22	12.78	0.0	185.56
Sep.	25.56	34.44	16.67	40.00	7.22	0.0	128.64
Oct.	19.17	27.22	11.11	33.89	2.78	0.3	66.17
Nov.	10.83	17.22	4.44	26.11	-7.78	16.5	17.53
Dec.	7.78	14.44	1.11	22.22	-10.00	0.3	8.55
Year	18.92	26.30	11.53	33.52	3.01	33	1069.1

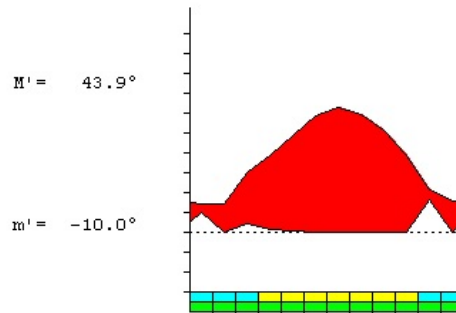
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 334
 Compensated thermicity index.....(Itc): 396
 Simple continentality index.....(Ic): 24.2
 Diurnality index.....(Id): 17.8
 Annual ombrothermic index.....(Io): 0.15
 Monthly estival ombrothermic index.....(Ios1): No
 Bimonthly estival ombrothermic index.....(Ios2): No
 Threemonthly estival ombrothermic index.....(Ios3): No
 Fourmonthly estival ombrothermic index.....(Ios4): 0.00
 Annual ombro-evaporation index.....(Ioe): 0.03
 Annual positive temperature.....(Tp): 2270
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 903
 Positive precipitation.....(Pp): 33

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	0	0	2	10	0

Latitudinal Belt...: Subtropical
 Continentality.....: Continental - High Subcontinental
 Bioclimate.....: MEDITERRANEAN HYPERDESERTIC CONTINENTAL
 Bioclimatic belt...: LOW THERMOMEDITERRANEAN UPPER ULTRAHYPERARID

YAZD (IRAN) 1240 m
 P= 33 31° 54'N 54° 24'E 5/4 y.
 T= 18.9° Ic= 24.2 Tp= 2270 Tn= 0
 m= 0.6° M= 13.9° Itc= 396 Io= 0.1



MEDITERRANEAN HYPERDESERTIC CONTINENTAL
LOW THERMOMEDITERRANEAN UPPER ULTRAHYPERARID

Mediterranean Hyperdesertic Continental Bioclimate,
 Normal Variant

Figure 45

33

WIGRAM (NEW ZEALAND) Altitude: 23 m.

Latitude: 43° 33'S Longitude: 172° 33'E
 Temperature observation period.: 1970-1994 (25)
 Rainfall observation period.....: 1964-1994 (31)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	16.39	21.67	11.11	35.56	2.78	53.3	99.32
Feb.	16.67	21.67	11.67	34.44	2.22	43.2	84.20
Mar.	14.72	19.44	10.00	32.22	0.00	40.6	71.94
Apr.	12.22	17.22	7.22	28.89	-2.22	43.2	49.57
May.	8.89	13.89	3.89	27.22	-5.00	71.1	30.63
Jun.	6.39	11.11	1.67	22.22	-6.11	61.0	18.44
Jul.	5.84	10.56	1.11	21.11	-9.44	55.9	18.13
Aug.	6.95	11.67	2.22	22.78	-5.00	55.9	24.78
Sep.	9.44	14.44	4.44	25.56	-5.00	45.7	39.24
Oct.	11.39	16.67	6.11	28.33	-3.89	48.3	57.48
Nov.	13.89	19.44	8.33	31.11	-2.22	48.3	77.18
Dec.	15.00	20.00	10.00	32.22	2.22	55.9	91.45
Year	11.48	16.48	6.48	28.47	-2.64	622	662.34

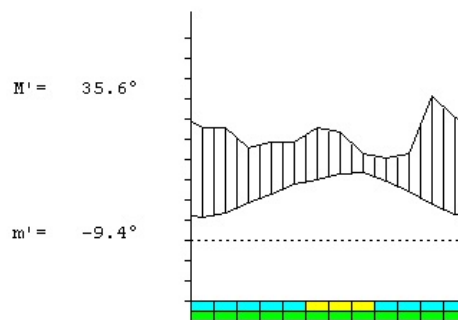
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 232
 Compensated thermicity index.....(Itc): 232
 Simple continentality index.....(Ic): 10.8
 Diurnality index.....(Id): 11.1
 Annual ombrothermic index.....(Io): 4.52
 Monthly estival ombrothermic index.....(Ios1): 2.59
 Bimonthly estival ombrothermic index.....(Ios2): 2.92
 Threemonthly estival ombrothermic index.....(Ios3): 3.17
 Fourmonthly estival ombrothermic index.....(Ios4): 3.24
 Annual ombro-evaporation index.....(Ioe): 0.94
 Annual positive temperature.....(Tp): 1378
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 481
 Positive precipitation.....(Pp): 622

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	6	6	0	0	0

Latitudinal Belt...: Low eutemperate
 Continentality.....: Hyperoceanic - Low Subhyperoceanic
 Bioclimate(Variant): TEMPERATE HYPEROCEANIC (SUBMEDITERRANEAN)
 Bioclimatic belt...: UPPER MESOTEMPERATE LOW SUBHUMID

WIGRAM (NEW ZEALAND) 23 m
 P= 622 43° 33'S 172° 33'E 25/31 y.
 T= 11.5 ° Ic= 10.8 Tp= 1378 Tn= 0
 m= 1.1 ° M= 10.6 ° Itc= 232 Io= 4.5



TEMPERATE HYPEROCEANIC (SUBMEDITERRANEAN)
UPPER MESOTEMPERATE LOW SUBHUMID

**Temperate Hyperoceanic Bioclimate,
 Submediterranean Variant**

Figure 46

34

VALENTIA (IRELAND) Altitude: 14 m.
 Latitude: 51° 56'N Longitude: 10° 15'W
 Temperature observation period.: 1939-1994 (56)
 Rainfall observation period....: 1927-1994 (68)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	7.22	9.44	5.00	13.89	-6.67	154.2	23.21
Feb.	6.94	9.44	4.44	14.44	-5.56	126.0	23.76
Mar.	7.50	10.00	5.00	18.89	-5.00	109.2	34.29
Apr.	8.89	11.67	6.11	21.11	-1.67	92.5	47.04
May.	11.39	14.44	8.33	23.89	1.11	81.3	71.95
Jun.	13.62	16.67	10.56	27.22	1.67	86.9	89.58
Jul.	15.00	17.78	12.22	29.44	4.44	100.8	100.36
Aug.	15.00	17.78	12.22	27.22	4.44	123.4	90.98
Sep.	13.89	16.67	11.11	26.11	1.67	113.3	70.31
Oct.	10.83	13.33	8.33	21.67	-2.22	142.2	45.87
Nov.	8.61	11.11	6.11	17.22	-4.44	142.2	28.97
Dec.	7.50	10.00	5.00	13.89	-5.00	164.6	23.19
Year	10.53	13.19	7.87	21.25	-1.44	1437	649.51

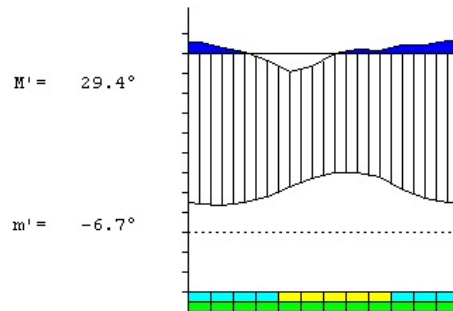
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 244
 Compensated thermicity index.....(Itc): 244
 Simple continentality index.....(Ic): 8.1
 Diurnality index.....(Id): 6.1
 Annual ombrothermic index.....(Io): 11.37
 Monthly estival ombrothermic index.....(Ios1): 6.38
 Bimonthly estival ombrothermic index.....(Ios2): 7.47
 Three monthly estival ombrothermic index.....(Ios3): 7.13
 Four monthly estival ombrothermic index.....(Ios4): 7.13
 Annual ombro-evaporation index.....(Ioe): 2.21
 Annual positive temperature.....(Tp): 1264
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 436
 Positive precipitation.....(Pp): 1437

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	12	0	0	0	0

Latitudinal Belt...: Low eutemperate
 Continentality.....: Hyperoceanic - High Subhyperoceanic
 Bioclimate.....: TEMPERATE HYPEROCEANIC
 Bioclimatic belt...: LOW MESOTEMPERATE UPPER HUMID

VALENTIA (IRELAND) 14 m
 P= 1437 51° 56'N 10° 15'W 56/68 y.
 T= 10.5 ° Ic= 8.1 Tp= 1264 Tn= 0
 m= 4.4 ° M= 9.4 ° Itc= 244 Io= 11.4



TEMPERATE HYPEROCEANIC
LOW MESOTEMPERATE UPPER HUMID

Temperate Hyperoceanic Bioclimate,
 Normal Variant

Figure 47

35

MATSU (CHINA) Altitude: 91 m.

Latitude: 26° 10'N Longitude: 119° 56'E
 Temperature observation period.: 1984-1994 (11)
 Rainfall observation period.....: 1986-1994 (9)

(C/mo)	Ti	Mi	mi	M'i	m'i	Pi	Epi
Jan.	11.11	13.33	8.89	21.67	2.22	33.3	19.13
Feb.	10.56	12.78	8.33	22.22	0.56	96.3	16.41
Mar.	12.78	15.00	10.56	23.89	3.33	96.3	28.95
Apr.	16.67	18.89	14.44	28.89	7.22	89.2	53.26
May.	20.56	22.78	18.33	28.33	12.78	189.5	90.67
Jun.	25.00	26.67	23.33	33.33	17.22	137.4	136.90
Jul.	27.78	30.00	25.56	33.33	22.78	65.8	170.52
Aug.	28.34	30.56	26.11	35.56	23.33	127.5	168.26
Sep.	26.67	28.89	24.44	34.44	18.33	160.8	139.60
Oct.	22.78	25.00	20.56	30.56	11.67	33.3	96.48
Nov.	18.34	20.56	16.11	26.67	8.33	28.2	55.63
Dec.	13.89	16.11	11.67	24.44	5.00	34.8	30.59
Year	19.54	21.71	17.36	28.61	11.06	1092	1006.4

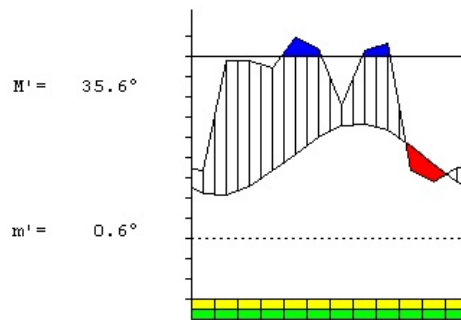
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 407
 Compensated thermicity index.....(Itc): 407
 Simple continentality index.....(Ic): 17.8
 Diurnality index.....(Id): 4.5
 Annual ombrothermic index.....(Io): 4.66
 Monthly estival ombrothermic index.....(Ios1): 2.37
 Bimonthly estival ombrothermic index.....(Ios2): 3.44
 Threemonthly estival ombrothermic index.....(Ios3): 4.08
 Fourmonthly estival ombrothermic index.....(Ios4): 5.12
 Annual ombro-evaporation index.....(Ioe): 1.09
 Annual positive temperature.....(Tp): 2345
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 811
 Positive precipitation.....(Pp): 1092

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	7	3	2	0	0

Latitudinal Belt...: Subtropical
 Continentality.....: Oceanic - Low Semicontinental
 Bioclimate (Variant): TEMPERATE OCEANIC (STEPPIC)
 Bioclimatic belt...: LOW THERMOTEMPERATE LOW SUBHUMID

MATSU (CHINA) 91 m
 P= 1092 26° 10'N 119° 56'E 11/9 y.
 T= 19.5 ° Ic= 17.8 Tp= 2345 Tn= 0
 m= 8.3 ° M= 12.8 ° Itc= 407 Io= 4.7



TEMPERATE OCEANIC (STEPPIC)
LOW THERMOTEMPERATE LOW SUBHUMID

**Temperate Oceanic Bioclimate,
 Steppic Variant**

Figure 48

36

RAB (CROATIA) Altitude: 6 m.
 Latitude: 44° 45'N Longitude: 14° 47'E
 Temperature observation period.: 1986-1994 (9)
 Rainfall observation period.....: 1978-1994 (17)

(C/mo)	Ti	Mi	mi	M'i	m'i	Pi	Epi
Jan.	5.00	7.78	2.22	14.44	-10.00	77.0	10.56
Feb.	5.84	8.89	2.78	17.78	-10.00	52.1	13.27
Mar.	8.06	11.11	5.00	18.33	-5.00	78.0	26.20
Apr.	11.67	15.00	8.33	24.44	-1.11	77.0	48.63
May.	15.56	18.89	12.22	28.33	3.89	101.1	82.28
Jun.	20.00	23.33	16.67	33.89	11.11	86.1	117.69
Jul.	22.78	26.67	18.89	32.78	11.67	47.0	143.31
Aug.	21.67	25.56	17.78	32.78	8.89	46.0	123.46
Sep.	18.62	21.67	15.56	30.00	5.00	121.9	85.88
Oct.	13.89	16.67	11.11	23.89	2.22	142.0	51.58
Nov.	10.84	13.89	7.78	21.67	0.56	130.1	30.67
Dec.	6.11	8.33	3.89	14.44	-10.00	105.9	13.09
Year	13.34	16.48	10.19	24.40	0.60	1064	746.61

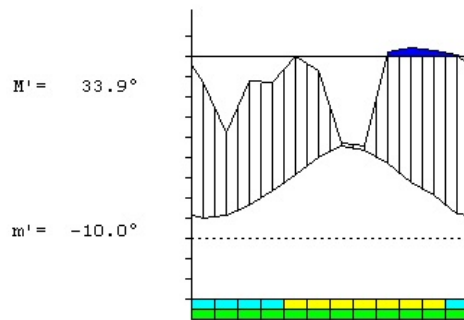
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 233
 Compensated thermicity index.....(Itc): 233
 Simple continentality index.....(Ic): 17.8
 Diurnality index.....(Id): 7.8
 Annual ombrothermic index.....(Io): 6.65
 Monthly estival ombrothermic index.....(Ios1): 2.06
 Bimonthly estival ombrothermic index.....(Ios2): 2.09
 Threemonthly estival ombrothermic index.....(Ios3): 2.78
 Fourmonthly estival ombrothermic index.....(Ios4): 3.50
 Annual ombro-evaporation index.....(Ioe): 1.43
 Annual positive temperature.....(Tp): 1600
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 645
 Positive precipitation.....(Pp): 1064

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	10	2	0	0	0

Latitudinal Belt...: Low eutemperate
 Continentality.....: Oceanic - Low Semicontinental
 Bioclimate (Variant): TEMPERATE OCEANIC (SUBMEDITERRANEAN)
 Bioclimatic belt...: UPPER MESOTEMPERATE LOW HUMID

RAB (CROATIA) 6 m
 P= 1064 44° 45'N 14° 47'E 9/17 y.
 T= 13.3 ° Ic= 17.8 Tp= 1600 Tn= 0
 m= 2.2 ° M= 7.8 ° Itc= 233 Io= 6.6



TEMPERATE OCEANIC (SUBMEDITERRANEAN)
UPPER MESOTEMPERATE LOW HUMID

**Temperate Oceanic Bioclimate,
 Submediterranean Variant**

Figure 49

37

ARTIGAS (URUGUAY)

Altitude: 117 m.

Latitude: 30° 24'S Longitude: 56° 23'W
 Temperature observation period.: 1981-1994 (14)
 Rainfall observation period.....: 1944-1994 (51)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	Epi
Jan.	25.56	32.78	18.33	41.11	8.33	110.2	150.15
Feb.	25.28	32.22	18.33	40.00	8.89	97.8	125.99
Mar.	23.06	29.44	16.67	40.56	6.11	119.1	107.27
Apr.	18.89	25.00	12.78	36.11	2.22	128.3	63.71
May.	15.84	21.67	10.00	30.56	-1.11	105.4	42.91
Jun.	13.89	18.89	8.89	29.44	-4.44	104.4	30.23
Jul.	12.77	18.33	7.22	29.44	-3.89	70.1	26.92
Aug.	15.27	21.11	9.44	32.78	-3.89	75.7	41.51
Sep.	16.67	22.22	11.11	33.89	-1.11	101.9	51.82
Oct.	18.06	23.89	12.22	33.89	1.11	119.4	68.46
Nov.	21.67	28.89	14.44	39.44	5.56	97.3	101.48
Dec.	24.17	31.67	16.67	41.67	6.11	104.1	134.91
Year	19.26	25.51	13.01	35.74	1.99	1234	945.36

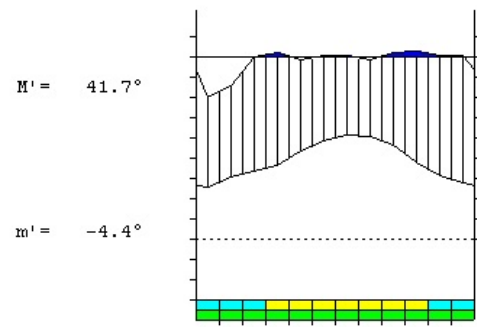
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 448
 Compensated thermicity index.....(Itc): 448
 Simple continentality index.....(Ic): 12.8
 Diurnality index.....(Id): 15.0
 Annual ombrothermic index.....(Io): 5.34
 Monthly estival ombrothermic index.....(Ios1): 3.87
 Bimonthly estival ombrothermic index.....(Ios2): 4.09
 Threemonthly estival ombrothermic index.....(Ios3): 4.16
 Fourmonthly estival ombrothermic index.....(Ios4): 4.23
 Annual ombro-evaporation index.....(Ioe): 1.31
 Annual positive temperature.....(Tp): 2311
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 750
 Positive precipitation.....(Pp): 1234

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	11	1	0	0	0

Latitudinal Belt....: Subtropical
 Continentality.....: Oceanic - Low Semihyperoceanic
 Bioclimate.....: TEMPERATE OCEANIC
 Bioclimatic belt....: INFRATEMPERATE UPPER SUBHUMID

ARTIGAS (URUGUAY) 117 m
 P= 1234 30° 24'S 56° 23'W 14/51 y.
 T= 19.3 ° Ic= 12.8 Tp= 2311 Tn= 0
 m= 7.2 ° M= 18.3 ° Itc= 448 Io= 5.3



TEMPERATE OCEANIC
INFRATEMPERATE UPPER SUBHUMID

Temperate Oceanic Bioclimate,
Normal Variant

Figure 50

38

PECS (HUNGARY) Altitude: 141 m.
 Latitude: 46° 5'N Longitude: 18° 15'E
 Temperature observation period.: 1955-1980 (26)
 Rainfall observation period.....: 1950-1980 (31)

(C/mo)	Ti	Mi	mi	M'i	m'i	Pi	Epi
Jan.	-0.70	2.40	-3.70	17.10	-27.00	41.0	0.00
Feb.	1.30	4.40	-3.10	18.70	-23.40	46.0	2.15
Mar.	6.10	10.10	0.40	24.20	-14.10	41.0	20.46
Apr.	11.90	16.60	5.50	29.90	-7.60	58.0	54.01
May.	16.90	21.70	10.30	33.80	-2.60	66.0	97.25
Jun.	20.40	25.10	13.60	38.90	3.10	69.0	125.16
Jul.	22.60	27.50	15.80	41.30	3.10	64.0	145.17
Aug.	21.90	27.60	15.00	39.60	3.40	55.0	128.80
Sep.	17.90	23.50	11.60	34.40	0.90	47.0	84.48
Oct.	11.80	16.50	6.60	29.40	-5.60	64.0	44.44
Nov.	6.20	9.00	2.60	22.40	-9.60	71.0	16.18
Dec.	1.80	4.50	-1.40	16.30	-16.60	45.0	3.04
Year	11.51	15.74	6.10	28.83	-8.00	667	721.13

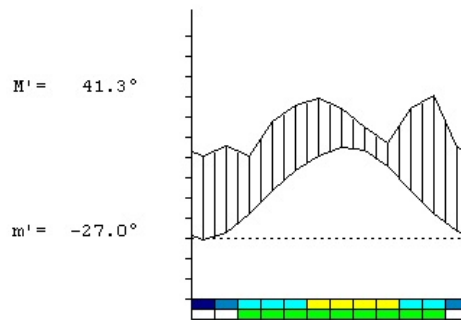
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 102
 Compensated thermicity index.....(Itc): 152
 Simple continentality index.....(Ic): 23.3
 Diurnality index.....(Id): 12.6
 Annual ombrothermic index.....(Io): 4.51
 Monthly estival ombrothermic index.....(Ios1): 2.51
 Bimonthly estival ombrothermic index.....(Ios2): 2.67
 Threemonthly estival ombrothermic index.....(Ios3): 2.90
 Fourmonthly estival ombrothermic index.....(Ios4): 3.11
 Annual ombro-evaporation index.....(Ioe): 0.92
 Annual positive temperature.....(Tp): 1388
 Annual negative temperature.....(Tn): 7
 Estival temperature.....(Ts): 649
 Positive precipitation.....(Pp): 626

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	6	5	0	0	1

Latitudinal Belt...: Low eutemperate
 Continentality.....: Continental - Low Subcontinental
 Bioclimate (Variant): TEMPERATE CONTINENTAL (STEPIC)
 Bioclimatic belt...: LOW SUPRATEMPERATE LOW SUBHUMID

PECS (HUNGARY) 141 m
 P= 667 46° 5'N 18° 15'E 26/31 y.
 T= 11.5 ° Ic= 23.3 Tp= 1388 Tn= 7
 m= -3.7 ° M= 2.4 ° Itc= 152 Io= 4.5



TEMPERATE CONTINENTAL (STEPIC)
LOW SUPRATEMPERATE LOW SUBHUMID

**Temperate Continental Bioclimate,
 Stepic Variant**

Figure 51

39

SRINAGAR (INDIA) Altitude: 1586 m.
 Latitude: 34° 5'N Longitude: 74° 50'E
 Temperature observation period.: 1935-1980 (46)
 Rainfall observation period.....: 1950-1980 (31)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPi
Jan.	1.10	4.40	-2.30	17.20	-14.40	73.0	1.13
Feb.	3.60	7.90	-0.80	20.60	-20.00	72.0	6.27
Mar.	8.50	13.40	3.50	29.60	-5.60	104.0	26.37
Apr.	13.90	19.30	7.40	31.10	0.00	78.0	57.27
May.	17.90	24.60	11.20	35.60	2.80	63.0	91.26
Jun.	22.00	29.50	14.40	37.80	7.20	36.0	123.37
Jul.	24.60	30.80	18.40	38.30	10.60	61.0	147.68
Aug.	23.90	29.90	17.90	36.70	10.00	63.0	134.62
Sep.	20.50	28.30	12.70	35.00	4.40	32.0	95.51
Oct.	14.20	22.60	5.70	33.90	-1.70	29.0	52.58
Nov.	7.70	15.50	-0.10	23.90	-7.80	18.0	19.27
Dec.	3.50	8.80	-1.80	18.30	-11.70	36.0	6.02
Year	13.45	19.58	7.18	29.83	-2.18	665	761.35

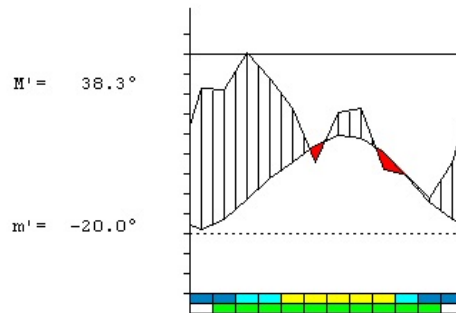
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 156
 Compensated thermicity index.....(Itc): 208
 Simple continentality index.....(Ic): 23.5
 Diurnality index.....(Id): 16.9
 Annual ombrothermic index.....(Io): 4.12
 Monthly estival ombrothermic index.....(Ios1): 1.64
 Bimonthly estival ombrothermic index.....(Ios2): 2.56
 Threemonthly estival ombrothermic index.....(Ios3): 2.27
 Fourmonthly estival ombrothermic index.....(Ios4): 2.52
 Annual ombro-evaporation index.....(Ioe): 0.87
 Annual positive temperature.....(Tp): 1614
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 705
 Positive precipitation.....(Pp): 665

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	5	5	2	0	0

Latitudinal Belt...: Subtropical
 Continentality.....: Continental - Low Subcontinental
 Bioclimate(Variant): TEMPERATE CONTINENTAL (SUBMEDITERRANEAN)
 Bioclimatic belt...: UPPER MESOTEMPERATE LOW SUBHUMID

SRINAGAR (INDIA) 1586 m
 P= 665 34° 5'N 74° 50'E 46/31 y.
 T= 13.4° Ic= 23.5 Tp= 1614 Tn= 0
 m= -2.3° M= 4.4° Itc= 208 Io= 4.1



TEMPERATE CONTINENTAL (SUBMEDITERRANEAN)
UPPER MESOTEMPERATE LOW SUBHUMID

**Temperate Continental Bioclimate,
 Submediterranean Variant**

Figure 52

40

BREST (BYELARUS) Altitude: 144 m.
 Latitude: 52° 7'N Longitude: 23° 41'E
 Temperature observation period.: 1984-1994 (11)
 Rainfall observation period.....: 1984-1994 (11)

(C/mo)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-5.56	-3.33	-7.78	8.89	-27.78	38.6	0.00
Feb.	-3.61	-1.11	-6.11	12.78	-26.11	41.7	0.00
Mar.	0.56	3.89	-2.78	22.78	-20.00	37.8	2.38
Apr.	8.61	13.33	3.89	27.78	-6.11	43.7	48.00
May.	13.33	18.33	8.33	28.89	-2.78	61.0	88.51
Jun.	17.50	22.78	12.22	32.78	3.89	65.0	120.50
Jul.	18.34	23.89	12.78	35.00	6.11	76.2	127.52
Aug.	17.50	22.78	12.22	35.00	2.22	60.5	110.02
Sep.	14.17	19.44	8.89	30.00	-2.78	43.4	74.12
Oct.	8.89	12.78	5.00	26.11	-5.00	43.7	38.95
Nov.	3.06	5.00	1.11	18.89	-18.89	54.4	10.30
Dec.	-2.50	-0.56	-4.44	13.89	-22.78	37.1	0.00
Year	7.52	11.44	3.61	24.40	-10.00	603	620.30

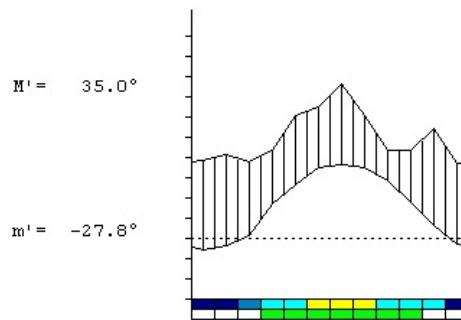
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -36
 Compensated thermicity index.....(Itc): 23
 Simple continentality index.....(Ic): 23.9
 Diurnality index.....(Id): 11.1
 Annual ombrothermic index.....(Io): 4.76
 Monthly estival ombrothermic index.....(Ios1): 3.46
 Bimonthly estival ombrothermic index.....(Ios2): 3.81
 Threemonthly estival ombrothermic index.....(Ios3): 3.78
 Fourmonthly estival ombrothermic index.....(Ios4): 3.94
 Annual ombro-evaporation index.....(Ioe): 0.97
 Annual positive temperature.....(Tp): 1020
 Annual negative temperature.....(Tn): 117
 Estival temperature.....(Ts): 533
 Positive precipitation.....(Pp): 486

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	6	3	0	0	3

Latitudinal Belt...: High eutemperate
 Continentality.....: Continental - Low Subcontinental
 Bioclimate.....: TEMPERATE CONTINENTAL
 Bioclimatic belt...: UPPER SUPRATEMPERATE LOW SUBHUMID

BREST (BYELARUS) 144 m
 P= 603 52° 7'N 23° 41'E 11/11 y.
 T= 7.5 ° Ic= 23.9 Tp= 1020 Tn= 117
 m= -7.8 ° M= -3.3 ° Itc= 23 Io= 4.8



TEMPERATE CONTINENTAL
UPPER SUPRATEMPERATE LOW SUBHUMID

**Temperate Continental Bioclimate,
 Normal Variant**

Figure 53

41

ALTAI (MONGOLIA) Altitude: 2147 m.
 Latitude: 46° 24'N Longitude: 96° 15'E
 Temperature observation period.: 1986-1994 (9)
 Rainfall observation period....: 1987-1994 (8)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-19.45	-13.33	-25.56	-2.78	-37.22	0.0	0.00
Feb.	-16.67	-9.44	-23.89	7.78	-38.89	7.9	0.00
Mar.	-8.06	-1.11	-15.00	10.00	-28.89	2.5	0.00
Apr.	-0.83	5.56	-7.22	22.22	-18.89	0.0	0.00
May.	6.11	12.22	0.00	22.78	-13.89	19.1	58.25
Jun.	12.22	18.33	6.11	27.22	-6.11	17.8	98.88
Jul.	13.33	18.33	8.33	28.89	0.00	4.1	107.19
Aug.	12.50	18.33	6.67	28.89	-1.11	99.6	94.39
Sep.	7.22	13.33	1.11	22.22	-7.78	7.9	53.24
Oct.	-1.95	3.89	-7.78	17.22	-27.78	8.4	0.00
Nov.	-10.00	-3.89	-16.11	8.89	-35.00	9.1	0.00
Dec.	-14.72	-8.33	-21.11	6.11	-36.11	0.0	0.00
Year	-1.69	4.49	-7.87	16.62	-20.97	176	411.96

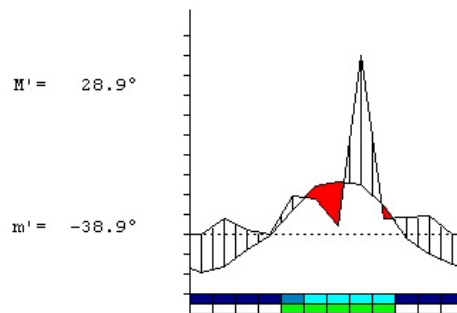
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -406
 Compensated thermicity index.....(Itc): -166
 Simple continentality index.....(Ic): 32.8
 Diurnality index.....(Id): 14.4
 Annual ombrothermic index.....(Io): 2.89
 Monthly estival ombrothermic index.....(Ios1): 0.31
 Bimonthly estival ombrothermic index.....(Ios2): 4.01
 Threemonthly estival ombrothermic index.....(Ios3): 3.19
 Fourmonthly estival ombrothermic index.....(Ios4): 3.18
 Annual ombro-evaporation index.....(Ioe): 0.43
 Annual positive temperature.....(Tp): 514
 Annual negative temperature.....(Tn): 717
 Estival temperature.....(Ts): 381
 Positive precipitation.....(Pp): 149

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	1	1	2	1	7

Latitudinal Belt...: Low eutemperate
 Continentality.....: Continental - Low Eucontinental
 Bioclimate(Variant): TEMPERATE XERIC (STEPPIC)
 Bioclimatic belt...: UPPER OROTEMPERATE UPPER DRY

ALTAI (MONGOLIA) 2147 m
 P= 176 46° 24'N 96° 15'E 9/8 y.
 T= -1.7° Ic= 32.8 Tp= 514 Tn= 717
 m= -25.6° M= -13.3° Itc= -166 Io= 2.9



TEMPERATE XERIC (STEPPIC)
 UPPER OROTEMPERATE UPPER DRY

Temperate Xeric Bioclimate,
 Steppic Variant

Figure 54

42

KHARKOV (UKRAINE) Altitude: 152 m.
 Latitude: 49° 56'N Longitude: 36° 17'E
 Temperature observation period.: 1984-1994 (11)
 Rainfall observation period.....: 1984-1994 (11)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	Epi
Jan.	-7.22	-5.00	-9.44	6.11	-27.78	57.4	0.00
Feb.	-5.56	-2.78	-8.33	11.11	-30.00	43.4	0.00
Mar.	-0.28	2.78	-3.33	20.00	-32.22	30.0	0.00
Apr.	8.89	13.33	4.44	26.11	-7.78	31.2	45.02
May.	15.84	21.67	10.00	32.22	0.00	38.9	100.32
Jun.	19.17	25.00	13.33	33.89	2.78	50.3	127.39
Jul.	21.11	27.22	15.00	36.11	7.22	40.4	143.18
Aug.	20.27	26.11	14.44	37.22	2.22	68.8	124.75
Sep.	14.72	20.00	9.44	31.11	-2.22	39.4	73.56
Oct.	8.33	12.78	3.89	25.00	-7.22	20.1	33.45
Nov.	1.67	3.89	-0.56	17.22	-18.89	50.5	4.46
Dec.	-2.50	-1.11	-3.89	12.22	-23.89	72.6	0.00
Year	7.87	11.99	3.75	24.03	-11.48	543	652.12

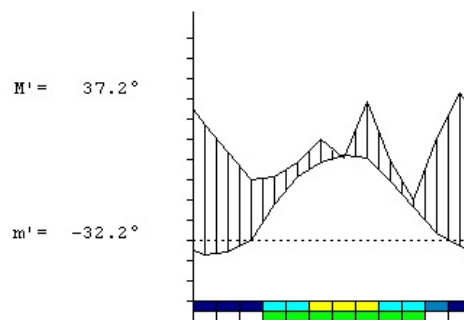
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -66
 Compensated thermicity index.....(Itc): 63
 Simple continentality index.....(Ic): 28.3
 Diurnality index.....(Id): 12.2
 Annual ombrothermic index.....(Io): 3.09
 Monthly estival ombrothermic index.....(Ios1): 1.91
 Bimonthly estival ombrothermic index.....(Ios2): 2.64
 Threemonthly estival ombrothermic index.....(Ios3): 2.63
 Fourmonthly estival ombrothermic index.....(Ios4): 2.60
 Annual ombro-evaporation index.....(Ioe): 0.83
 Annual positive temperature.....(Tp): 1100
 Annual negative temperature.....(Tn): 156
 Estival temperature.....(Ts): 606
 Positive precipitation.....(Pp): 340

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	1	6	1	0	4

Latitudinal Belt...: Low eutemperate
 Continentality.....: Continental - Low Eucontinental
 Bioclimate(Variant): TEMPERATE XERIC (SUBMEDITERRANEAN)
 Bioclimatic belt...: LOW SUPRATEMPERATE UPPER DRY

KHARKOV (UKRAINE) 152 m
 P= 543 49° 56'N 36° 17'E 11/11 y.
 T= 7.9 ° Ic= 28.3 Tp= 1100 Tn= 156
 m= -9.4 ° M= -5.0 ° Itc= 63 Io= 3.1



TEMPERATE XERIC (SUBMEDITERRANEAN)
LOW SUPRATEMPERATE UPPER DRY

**Temperate Xeric Bioclimate,
 Submediterranean Variant**

Figure 55

43

VILLA MERCEDES (ARGENTINA) Altitude: 514 m.

Latitude: 33° 41'S Longitude: 65° 29'W
 Temperature observation period.: 1987-1994 (8)
 Rainfall observation period.....: 1987-1994 (8)

(C/mn)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	24.73	32.78	16.67	42.22	7.22	69.9	144.88
Feb.	23.34	31.11	15.56	40.00	6.11	85.9	112.29
Mar.	20.28	27.78	12.78	37.78	0.00	56.9	87.89
Apr.	17.22	24.44	10.00	36.11	-2.22	42.9	57.95
May.	14.17	21.11	7.22	32.22	-3.89	12.7	38.98
Jun.	10.56	17.22	3.89	28.89	-7.78	22.6	21.10
Jul.	10.56	17.78	3.33	30.00	-8.89	32.3	22.38
Aug.	11.94	19.44	4.44	31.11	-6.11	11.7	30.17
Sep.	14.72	22.22	7.22	37.22	-3.89	35.8	46.40
Oct.	17.50	25.00	10.00	37.22	1.11	60.7	71.73
Nov.	20.56	28.33	12.78	37.78	2.78	56.6	98.59
Dec.	23.34	31.11	15.56	41.11	7.22	80.5	132.61
Year	17.41	24.86	9.95	35.97	-0.69	569	864.99

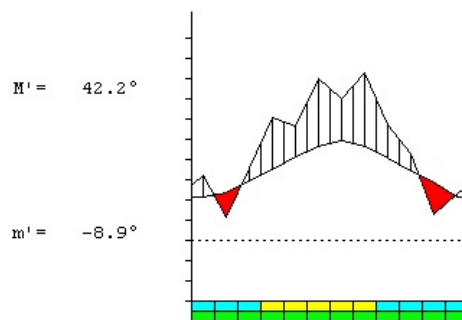
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 385
 Compensated thermicity index.....(Itc): 385
 Simple continentality index.....(Ic): 14.2
 Diurnality index.....(Id): 16.1
 Annual ombrothermic index.....(Io): 2.72
 Monthly estival ombrothermic index.....(Ios1): 2.83
 Bimonthly estival ombrothermic index.....(Ios2): 3.24
 Threemonthly estival ombrothermic index.....(Ios3): 3.31
 Fourmonthly estival ombrothermic index.....(Ios4): 3.18
 Annual ombro-evaporation index.....(Ioe): 0.66
 Annual positive temperature.....(Tp): 2089
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 714
 Positive precipitation.....(Pp): 569

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	0	10	0	2	0

Latitudinal Belt...: Subtropical
 Continentality.....: Oceanic - High Euoceanic
 Bioclimate.....: TEMPERATE XERIC
 Bioclimatic belt...: LOW THERMOTEMPERATE LOW DRY

VILLA MERCEDES (ARGENTINA) 514 m
 P= 569 33° 41'S 65° 29'W 8/8 y.
 T= 17.4 ° Ic= 14.2 Tp= 2089 Tn= 0
 m= 3.9 ° M= 17.2 ° Itc= 385 Io= 2.7



TEMPERATE XERIC
 LOW THERMOTEMPERATE LOW DRY

Temperate Xeric Bioclimate,
 Normal Variant

Figure 56

44

NAVARINO (CHILE) Altitude: 8 m.
 Latitude: 55° 10'S Longitude: 67° 30'W
 Temperature observation period.: 1962-1975 (14)
 Rainfall observation period.....: 1954-1975 (22)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	9.80	12.30	5.20	0.00	0.00	52.0	90.20
Feb.	9.30	12.40	6.00	0.00	0.00	44.0	69.76
Mar.	8.40	11.70	4.60	0.00	0.00	41.0	61.68
Apr.	6.10	9.10	2.90	0.00	0.00	38.0	37.71
May.	3.80	6.90	1.00	0.00	0.00	44.0	21.91
Jun.	2.60	5.00	-0.50	0.00	0.00	27.0	14.08
Jul.	2.20	5.00	0.00	0.00	0.00	35.0	13.16
Aug.	1.80	5.10	-0.30	0.00	0.00	43.0	13.95
Sep.	3.90	7.50	1.00	0.00	0.00	26.0	30.32
Oct.	6.20	9.80	2.90	0.00	0.00	26.0	53.56
Nov.	7.20	10.50	4.10	0.00	0.00	34.0	66.56
Dec.	9.60	11.80	5.00	0.00	0.00	39.0	91.23
Year	5.91	8.93	2.66	0.00	0.00	449	564.13

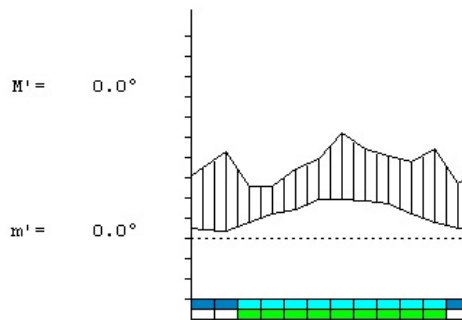
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 107
 Compensated thermicity index.....(Itc): 107
 Simple continentality index.....(Ic): 8.0
 Diurnality index.....(Id): 7.1
 Annual ombrothermic index.....(Io): 6.33
 Monthly estival ombrothermic index.....(Ios1): 5.31
 Bimonthly estival ombrothermic index.....(Ios2): 4.69
 Threemonthly estival ombrothermic index.....(Ios3): 4.70
 Fourmonthly estival ombrothermic index.....(Ios4): 4.71
 Annual ombro-evaporation index.....(Ioe): 0.80
 Annual positive temperature.....(Tp): 709
 Annual negative temperature.....(Tn): 0
 Estival temperature.....(Ts): 287
 Positive precipitation.....(Pp): 449

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	12	0	0	0	0

Latitudinal Belt...: High subtemperate
 Continentality.....: Hyperoceanic - High Subhyperoceanic
 Bioclimate.....: BOREAL (ANTIBOREAL) HYPEROCEANIC
 Macrobioclimate.....: UPPER THERMOBOREAL LOW HUMID

NAVARINO (CHILE) 8 m
 P= 449 55° 10'S 67° 30'W 14/22 y.
 T= 5.9 ° Ic= 8.0 Tp= 709 Tn= 0
 m= -0.3 ° M= 5.1 ° Itc= 107 Io= 6.3



BOREAL (ANTIBOREAL) HYPEROCEANIC
UPPER THERMOBOREAL LOW HUMID

Boreal Hyperoceanic Bioclimate,
Normal Variant

Figure 57

45

HUSAVIK (ICELAND) Altitude: 10 m.
 Latitude: 66° 2'N Longitude: 17° 21'W
 Temperature observation period.: 1980-1994 (15)
 Rainfall observation period.....: 1982-1994 (13)

(C/mo)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-1.39	1.11	-3.89	13.89	-18.33	35.1	0.00
Feb.	-0.83	1.67	-3.33	12.78	-17.22	22.1	0.00
Mar.	-0.28	2.78	-3.33	13.33	-15.00	32.0	0.00
Apr.	1.94	5.00	-1.11	16.11	-12.22	22.1	27.97
May.	6.11	10.00	2.22	20.56	-8.89	17.3	82.05
Jun.	8.89	12.22	5.56	26.11	-1.67	44.2	118.45
Jul.	10.83	14.44	7.22	28.33	0.00	52.3	129.62
Aug.	10.28	13.89	6.67	24.44	-2.22	65.0	104.46
Sep.	7.78	11.11	4.44	21.11	-2.78	59.9	64.32
Oct.	2.50	5.00	0.00	17.22	-11.11	102.9	21.28
Nov.	1.11	3.33	-1.11	12.78	-12.22	56.6	7.01
Dec.	0.55	2.78	-1.67	13.89	-13.89	49.5	1.60
Year	3.96	6.94	0.97	18.38	-9.63	559	556.76

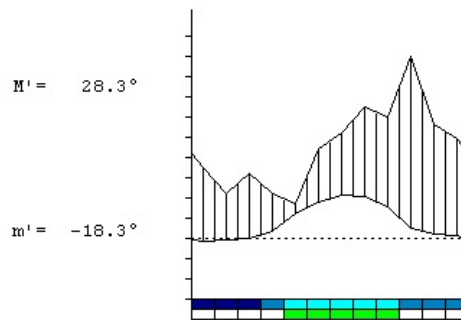
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): 12
 Compensated thermicity index.....(Itc): 12
 Simple continentality index.....(Ic): 12.2
 Diurnality index.....(Id): 7.8
 Annual ombrothermic index.....(Io): 9.40
 Monthly estival ombrothermic index.....(Ios1): 4.83
 Bimonthly estival ombrothermic index.....(Ios2): 5.56
 Threemonthly estival ombrothermic index.....(Ios3): 5.38
 Fourmonthly estival ombrothermic index.....(Ios4): 4.95
 Annual ombro-evaporation index.....(Ioe): 1.00
 Annual positive temperature.....(Tp): 500
 Annual negative temperature.....(Tn): 25
 Estival temperature.....(Ts): 300
 Positive precipitation.....(Pp): 470

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	8	1	0	0	3

Latitudinal Belt...: Low subtemperate
 Continentality.....: Oceanic - Low Semihyperoceanic
 Bioclimate.....: BOREAL OCEANIC
 Bioclimatic belt...: UPPER SUPRABOREAL UPPER HUMID

HUSAVIK (ICELAND) 10 m
 P= 559 66° 2'N 17° 21'W 15/13 y.
 T= 4.0 ° Ic= 12.2 Tp= 500 Tn= 25
 m= -3.9 ° M= 1.1 ° Itc= 12 Io= 9.4



BOREAL OCEANIC
UPPER SUPRABOREAL UPPER HUMID

**Boreal Oceanic Bioclimate,
 Normal Variant**

Figure 58

46

BJUROKLUBB (SWEDEN) Altitude: 36 m.

Latitude: 64° 29'N Longitude: 21° 35'E
 Temperature observation period.: 1989-1994 (6)
 Rainfall observation period....: 1964-1994 (31)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-8.06	-5.56	-10.56	6.11	-32.22	19.1	0.00
Feb.	-9.16	-7.22	-11.11	7.22	-27.22	17.0	0.00
Mar.	-4.72	-1.11	-8.33	8.89	-22.78	21.1	0.00
Apr.	-1.67	1.67	-5.00	12.78	-17.22	25.9	0.00
May.	5.28	8.89	1.67	20.00	-5.00	30.0	59.61
Jun.	10.83	14.44	7.22	23.89	2.22	39.1	115.11
Jul.	15.28	18.89	11.67	27.22	5.00	34.0	147.21
Aug.	14.45	17.78	11.11	25.00	5.00	57.9	119.12
Sep.	10.00	12.78	7.22	22.78	1.11	56.1	68.28
Oct.	4.17	6.11	2.22	16.11	-6.11	51.1	25.92
Nov.	-0.55	0.56	-1.67	7.78	-13.89	39.1	0.00
Dec.	-5.56	-3.89	-7.22	5.00	-23.89	35.1	0.00
Year	2.52	5.28	-0.23	15.23	-11.25	426	535.24

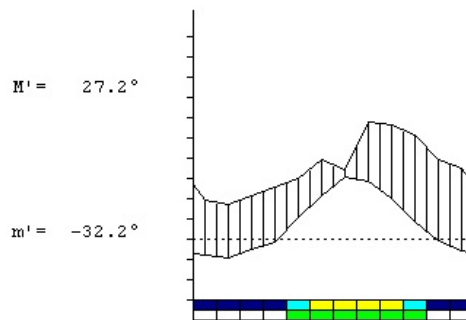
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -158
 Compensated thermicity index.....(Itc): -91
 Simple continentality index.....(Ic): 24.4
 Diurnality index.....(Id): 7.2
 Annual ombrothermic index.....(Io): 4.47
 Monthly estival ombrothermic index.....(Ios1): 2.23
 Bimonthly estival ombrothermic index.....(Ios2): 3.09
 Three-monthly estival ombrothermic index.....(Ios3): 3.23
 Four-monthly estival ombrothermic index.....(Ios4): 3.51
 Annual ombro-evaporation index.....(Ioe): 0.79
 Annual positive temperature.....(Tp): 600
 Annual negative temperature.....(Tn): 297
 Estival temperature.....(Ts): 406
 Positive precipitation.....(Pp): 268

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	4	2	0	0	6

Latitudinal Belt....: High eutemperate
 Continentality.....: Continental - High Subcontinental
 Bioclimate(Variant): BOREAL SUBCONTINENTAL (STEPPIC)
 Bioclimatic belt....: UPPER MESOBOREAL LOW SUBHUMID

BJUROKLUBB (SWEDEN) 36 m
 P= 426 64° 29'N 21° 35'E 6/31 y.
 T= 2.5 ° Ic= 24.4 Tp= 600 Tn= 297
 m= -11.1 ° M= -7.2 ° Itc= -91 Io= 4.5



BOREAL SUBCONTINENTAL (STEPPIC)
UPPER MESOBOREAL LOW SUBHUMID

**Boreal Subcontinental Bioclimate,
 Steppic Variant**

Figure 59

47

OULU (FINLAND)

Altitude: 13 m.

Latitude: 64° 55'N Longitude: 25° 21'E
 Temperature observation period.: 1954-1994 (41)
 Rainfall observation period....: 1964-1994 (31)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	Epi
Jan.	-9.17	-6.11	-12.22	5.56	-35.00	33.0	0.00
Feb.	-9.72	-6.11	-13.33	5.00	-37.78	27.9	0.00
Mar.	-6.67	-2.22	-11.11	10.00	-33.89	26.9	0.00
Apr.	0.00	3.89	-3.89	23.89	-26.67	31.0	0.00
May.	6.67	11.11	2.22	29.44	-8.89	38.1	72.04
Jun.	12.23	16.67	7.78	32.22	-6.11	52.1	129.55
Jul.	16.39	21.11	11.67	32.22	1.67	59.9	158.04
Aug.	14.45	18.89	10.00	32.22	-2.22	64.0	119.54
Sep.	9.17	12.78	5.56	25.56	-6.11	52.1	62.62
Oct.	2.50	5.00	0.00	17.22	-17.78	49.0	16.40
Nov.	-2.22	0.00	-4.44	10.56	-28.33	43.9	0.00
Dec.	-6.11	-3.33	-8.89	8.33	-32.78	37.1	0.00
Year	2.29	5.97	-1.39	19.35	-19.49	515	558.19

BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -171
 Compensated thermicity index.....(Itc): -80
 Simple continentality index.....(Ic): 26.1
 Diurnality index.....(Id): 9.4
 Annual ombrothermic index.....(Io): 5.13
 Monthly estival ombrothermic index.....(Ios1): 3.65
 Bimonthly estival ombrothermic index.....(Ios2): 4.02
 Threemonthly estival ombrothermic index.....(Ios3): 4.09
 Fourmonthly estival ombrothermic index.....(Ios4): 4.30
 Annual ombro-evaporation index.....(Ioe): 0.92
 Annual positive temperature.....(Tp): 614
 Annual negative temperature.....(Tn): 339
 Estival temperature.....(Ts): 431
 Positive precipitation.....(Pp): 315

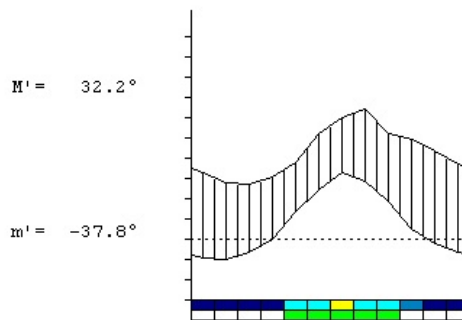
N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	6	1	0	0	5

Latitudinal Belt....: High eutemperate
 Continentality.....: Continental - High Subcontinental
 Bioclimate.....: BOREAL SUBCONTINENTAL
 Bioclimatic belt....: UPPER MESOBOREAL UPPER SUBHUMID

OULU (FINLAND)

13 m

P= 515 64° 55'N 25° 21'E 41/31 y.
 T= 2.3 ° Ic= 26.1 Tp= 614 Tn= 339
 m= -13.3 ° M= -6.1 ° Itc= -80 Io= 5.1



BOREAL SUBCONTINENTAL
UPPER MESOBOREAL UPPER SUBHUMID

Boreal Subcontinental Bioclimate,
Normal Variant

Figure 60

48

ANAVGAY KAMCHATK (RUSSIA)

Altitude: 335 m.

Latitude: 56° 6'N Longitude: 158° 53'E
 Temperature observation period.: 1984-1994 (11)
 Rainfall observation period....: 1984-1994 (11)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	Epi
Jan.	-17.77	-12.22	-23.33	3.89	-40.00	31.8	0.00
Feb.	-17.22	-11.11	-23.33	2.22	-38.89	19.1	0.00
Mar.	-11.67	-4.44	-18.89	6.11	-35.00	21.1	0.00
Apr.	-4.45	1.11	-10.00	12.22	-25.00	27.2	0.00
May.	3.61	8.89	-1.67	23.89	-13.89	25.1	47.37
Jun.	9.17	15.56	2.78	26.11	-6.11	20.3	94.71
Jul.	13.06	19.44	6.67	28.89	0.00	74.2	122.37
Aug.	11.94	18.33	5.56	28.89	-6.11	76.5	101.50
Sep.	6.11	12.22	0.00	22.22	-10.00	43.9	52.48
Oct.	-1.39	3.33	-6.11	18.89	-20.00	51.1	0.00
Nov.	-11.39	-6.67	-16.11	5.00	-28.89	44.7	0.00
Dec.	-16.39	-11.67	-21.11	1.11	-37.78	48.8	0.00
Year	-3.03	2.73	-8.80	14.95	-21.81	484	418.43

BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -386
 Compensated thermicity index.....(Itc): -195
 Simple continentality index.....(Ic): 30.8
 Diurnality index.....(Id): 14.4
 Annual ombrothermic index.....(Io): 5.47
 Monthly estival ombrothermic index.....(Ios1): 5.68
 Bimonthly estival ombrothermic index.....(Ios2): 6.03
 Threemonthly estival ombrothermic index.....(Ios3): 5.00
 Fourmonthly estival ombrothermic index.....(Ios4): 5.19
 Annual ombro-evaporation index.....(Ioe): 1.16
 Annual positive temperature.....(Tp): 439
 Annual negative temperature.....(Tn): 803
 Estival temperature.....(Ts): 342
 Positive precipitation.....(Pp): 240

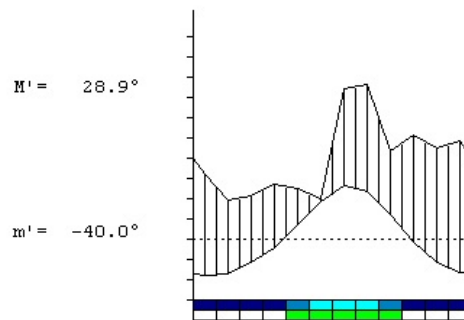
N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	4	1	0	0	7

Latitudinal Belt....: High eutemperate
 Continentality.....: Continental - Low Eucontinental
 Bioclimate(Variant): BOREAL CONTINENTAL (STEPPIC)
 Bioclimatic belt....: LOW OROBOREAL UPPER SUBHUMID

ANAVGAY KAMCHATK (RUSSIA)

335 m

P= 484 56° 6'N 158° 53'E 11/11 y.
 T= -3.0 ° Ic= 30.8 Tp= 439 Tn= 803
 m= -23.3 ° M= -12.2 ° Itc= -195 Io= 5.5



BOREAL CONTINENTAL (STEPPIC)
LOW OROBOREAL UPPER SUBHUMID

**Boreal Continental Bioclimate,
 Steppic Variant**

Figure 61

49

BULGAN (MONGOLIA) Altitude: 1210 m.
 Latitude: 48° 48'N Longitude: 103° 33'E
 Temperature observation period.: 1986-1994 (9)
 Rainfall observation period.....: 1986-1994 (9)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-19.17	-11.67	-26.67	2.22	-40.00	2.3	0.00
Feb.	-16.39	-8.89	-23.89	7.78	-40.00	2.8	0.00
Mar.	-7.78	0.56	-16.11	16.11	-35.00	3.0	0.00
Apr.	1.39	8.89	-6.11	22.22	-17.78	2.5	13.86
May.	8.34	16.67	0.00	28.89	-12.78	7.9	69.10
Jun.	13.61	20.56	6.67	30.00	-8.89	65.0	104.80
Jul.	15.84	21.67	10.00	32.22	0.00	129.0	119.56
Aug.	14.45	21.11	7.78	30.00	-1.11	68.1	101.86
Sep.	8.06	15.56	0.56	25.00	-10.00	17.8	53.44
Oct.	0.00	7.78	-7.78	22.78	-22.78	10.9	0.00
Nov.	-10.00	-3.33	-16.67	12.78	-31.11	12.4	0.00
Dec.	-15.84	-8.89	-22.78	5.00	-35.00	5.8	0.00
Year	-0.62	6.67	-7.92	19.58	-21.20	327	462.61

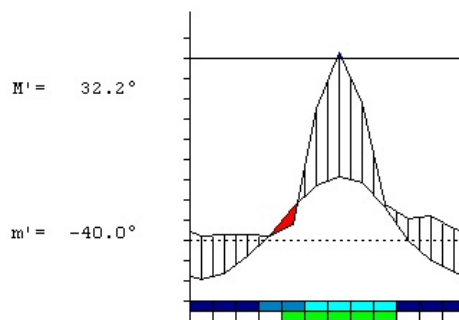
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -390
 Compensated thermicity index.....(Itc): -94
 Simple continentality index.....(Ic): 35.0
 Diurnality index.....(Id): 16.7
 Annual ombrothermic index.....(Io): 4.71
 Monthly estival ombrothermic index.....(Ios1): 8.14
 Bimonthly estival ombrothermic index.....(Ios2): 6.51
 Threemonthly estival ombrothermic index.....(Ios3): 5.97
 Fourmonthly estival ombrothermic index.....(Ios4): 5.17
 Annual ombro-evaporation index.....(Ioe): 0.71
 Annual positive temperature.....(Tp): 617
 Annual negative temperature.....(Tn): 692
 Estival temperature.....(Ts): 439
 Positive precipitation.....(Pp): 290

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	4	1	1	1	5

Latitudinal Belt...: Low eutemperate
 Continentality.....: Continental - Low Eucontinental
 Bioclimate.....: BOREAL CONTINENTAL
 Bioclimatic belt...: UPPER MESOBOREAL LOW SUBHUMID

BULGAN (MONGOLIA) 1210 m
 P= 327 48° 48'N 103° 33'E 9/9 y.
 T= -0.6° Ic= 35.0 Tp= 617 Tn= 692
 m= -26.7° M= -11.7° Itc= -94 Io= 4.7



BOREAL CONTINENTAL
UPPER MESOBOREAL LOW SUBHUMID

**Boreal Continental Bioclimate,
 Normal Variant**

Figure 62

50

VERJOYANSKIJ PEREVOZ (RUS YAKUTSKAYA) Altitude: 90 m.
 Latitude: 63° 25'N Longitude: 133° 5'E
 Temperature observation period.: 1948-1960 (13)
 Rainfall observation period....: 1942-1965 (24)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-44.50	-41.10	-47.20	-26.00	-62.00	6.0	0.00
Feb.	-38.10	-33.00	-43.00	-20.00	-64.00	4.0	0.00
Mar.	-23.60	-15.60	-32.00	-4.00	-51.00	6.0	0.00
Apr.	-9.20	-1.70	-17.90	7.00	-41.00	11.0	0.00
May.	4.50	10.20	-1.50	22.00	-25.00	23.0	51.23
Jun.	14.40	20.80	8.00	28.00	-4.00	36.0	140.14
Jul.	17.70	24.20	11.40	30.00	-1.00	46.0	161.44
Aug.	14.00	20.50	8.30	29.00	-9.00	45.0	114.31
Sep.	5.50	11.20	0.50	20.00	-13.00	33.0	41.78
Oct.	-9.30	-5.50	-12.70	6.00	-40.00	26.0	0.00
Nov.	-30.50	-26.30	-33.70	-12.00	-54.00	12.0	0.00
Dec.	-41.00	-37.30	-43.90	-23.00	-58.00	7.0	0.00
Year	-11.67	-6.13	-16.97	4.75	-35.17	255	508.89

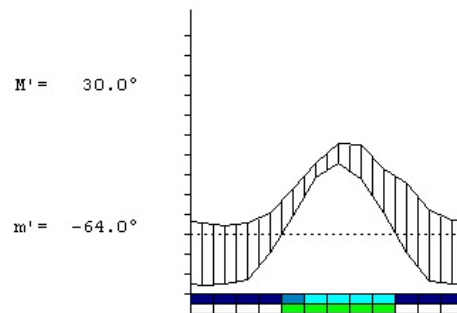
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -1000
 Compensated thermicity index.....(Itc): 56
 Simple continentality index.....(Ic): 62.2
 Diurnality index.....(Id): 16.4
 Annual ombrothermic index.....(Io): 3.26
 Monthly estival ombrothermic index.....(Ios1): 2.60
 Bimonthly estival ombrothermic index.....(Ios2): 2.55
 Threemonthly estival ombrothermic index.....(Ios3): 2.75
 Fourmonthly estival ombrothermic index.....(Ios4): 2.96
 Annual ombro-evaporation index.....(Ioe): 0.50
 Annual positive temperature.....(Tp): 561
 Annual negative temperature.....(Tn): 1962
 Estival temperature.....(Ts): 461
 Positive precipitation.....(Pp): 183

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	2	3	0	0	7

Latitudinal Belt...: High eutemperate
 Continentality.....: Continental - High Hypercontinental
 Bioclimate(Variant): BOREAL HYPERCONTINENTAL (STEPPIC)
 Bioclimatic belt...: LOW SUPRABOREAL UPPER DRY

VERJOYANSKIJ PEREVOZ (RUS YAKUTSKAYA) 90 m
 P= 255 63° 25'N 133° 5'E 13/24 y.
 T= -11.7° Ic= 62.2 Tp= 561 Tn= 1962
 m= -47.2° M= -41.1° Itc= 56 Io= 3.3



BOREAL HYPERCONTINENTAL (STEPPIC)
LOW SUPRABOREAL UPPER DRY

**Boreal Hypercontinental Bioclimate,
 Steppic Variant**

Figure 63

51

KOMAKA (RUS YAKUTSKAYA) Altitude: 300 m.
 Latitude: 60° 13'N Longitude: 111° 30'E
 Temperature observation period.: 1944-1960 (17)
 Rainfall observation period....: 1944-1965 (22)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-31.20	-25.50	-37.30	-9.00	-62.00	21.0	0.00
Feb.	-26.30	-17.00	-34.80	-6.00	-60.00	13.0	0.00
Mar.	-17.50	-6.10	-28.40	6.00	-55.00	11.0	0.00
Apr.	-4.80	3.10	-14.30	13.00	-42.00	16.0	0.00
May.	5.00	12.00	-3.50	24.00	-25.00	29.0	55.97
Jun.	13.50	21.60	3.70	30.00	-8.00	53.0	126.33
Jul.	16.40	24.40	7.60	32.00	-5.00	62.0	145.72
Aug.	12.20	20.20	4.60	30.00	-11.00	62.0	100.41
Sep.	4.60	12.10	-1.50	21.00	-18.00	38.0	38.32
Oct.	-4.80	0.50	-9.90	12.00	-39.00	37.0	0.00
Nov.	-21.40	-15.30	-27.60	-1.00	-55.00	32.0	0.00
Dec.	-29.20	-24.10	-35.10	-8.00	-61.00	23.0	0.00
Year	-6.96	0.49	-14.71	12.00	-36.75	397	466.75

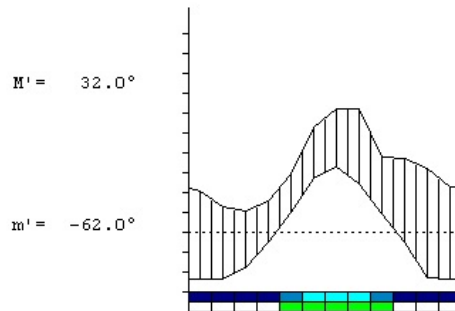
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -698
 Compensated thermicity index.....(Itc): -80
 Simple continentality index.....(Ic): 47.6
 Diurnality index.....(Id): 22.3
 Annual ombrothermic index.....(Io): 4.72
 Monthly estival ombrothermic index.....(Ios1): 3.78
 Bimonthly estival ombrothermic index.....(Ios2): 3.85
 Threemonthly estival ombrothermic index.....(Ios3): 4.20
 Fourmonthly estival ombrothermic index.....(Ios4): 4.37
 Annual ombro-evaporation index.....(Ioe): 0.85
 Annual positive temperature.....(Tp): 517
 Annual negative temperature.....(Tn): 1352
 Estival temperature.....(Ts): 421
 Positive precipitation.....(Pp): 244

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	3	2	0	0	7

Latitudinal Belt...: High eutemperate
 Continentality.....: Continental - Low Hypercontinental
 Bioclimate.....: BOREAL HYPERCONTINENTAL
 Bioclimatic belt...: UPPER SUPRABOREAL LOW SUBHUMID

KOMAKA (RUS YAKUTSKAYA) 300 m
 P= 397 60° 13'N 111° 30'E 17/22 y.
 T= -7.0 ° Ic= 47.6 Tp= 517 Tn= 1352
 m= -37.3 ° M= -25.5 ° Itc= -80 Io= 4.7



BOREAL HYPERCONTINENTAL
UPPER SUPRABOREAL LOW SUBHUMID

**Boreal Hypercontinental Bioclimate,
 Normal Variant**

Figure 64

52

FORT YUKON (USA ALASKA) Altitude: 129 m.
 Latitude: 66° 34'N Longitude: 145° 15'W
 Temperature observation period.: 1954-1994 (41)
 Rainfall observation period....: 1955-1994 (40)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-29.17	-24.44	-33.89	4.44	-56.11	11.4	0.00
Feb.	-25.84	-20.00	-31.67	5.00	-56.67	10.2	0.00
Mar.	-18.06	-11.67	-24.44	10.00	-46.11	7.9	0.00
Apr.	-5.83	1.67	-13.33	18.33	-40.56	6.4	0.00
May.	6.11	12.78	-0.56	29.44	-19.44	9.9	73.36
Jun.	14.72	21.11	8.33	37.78	-3.89	18.5	163.66
Jul.	16.11	22.22	10.00	36.11	-3.89	23.6	166.56
Aug.	12.78	18.89	6.67	31.11	-5.56	28.7	114.39
Sep.	5.28	10.56	0.00	26.11	-15.56	18.8	42.58
Oct.	-6.39	-2.22	-10.56	16.11	-38.33	15.7	0.00
Nov.	-20.27	-16.11	-24.44	4.44	-51.67	11.2	0.00
Dec.	-28.89	-24.44	-33.33	2.78	-57.22	9.7	0.00
Year	-6.62	-0.97	-12.27	18.47	-32.92	172	560.56

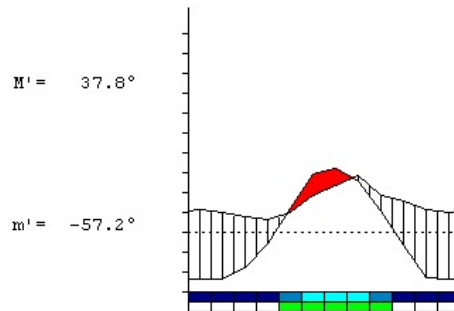
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -650
 Compensated thermicity index.....(Itc): -98
 Simple continentality index.....(Ic): 45.3
 Diurnality index.....(Id): 15.0
 Annual ombrothermic index.....(Io): 1.81
 Monthly estival ombrothermic index.....(Ios1): 1.46
 Bimonthly estival ombrothermic index.....(Ios2): 1.37
 Threemonthly estival ombrothermic index.....(Ios3): 1.62
 Fourmonthly estival ombrothermic index.....(Ios4): 1.62
 Annual ombro-evaporation index.....(Ioe): 0.31
 Annual positive temperature.....(Tp): 550
 Annual negative temperature.....(Tn): 1345
 Estival temperature.....(Ts): 436
 Positive precipitation.....(Pp): 100

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	0	2	3	0	7

Latitudinal Belt...: Low subtemperate
 Continentality.....: Continental - High Eucontinental
 Bioclimate(Variant): BOREAL XERIC (STEPPIC)
 Bioclimatic belt...: LOW SUPRABOREAL UPPER SEMIARID

FORT YUKON (USA ALASKA) 129 m
 P= 172 66° 34'N 145° 15'W 41/40 y.
 T= -6.6 ° Ic= 45.3 Tp= 550 Tn= 1345
 m= -33.9 ° M= -24.4 ° Itc= -98 Io= 1.8



BOREAL XERIC (STEPPIC)
LOW SUPRABOREAL UPPER SEMIARID

**Boreal Hypercontinental Bioclimate,
 Normal Variant**

Figure 65

53

JAN MAYEN (NORWAY) Altitude: 23 m.

Latitude: 70° 59'N Longitude: 8° 20'W
 Temperature observation period.: 1950-1980 (31)
 Rainfall observation period.....: 1950-1980 (31)

(C/mn)	Ti	Mi	mi	M'i	m'i	Pi	Epi
Jan.	-3.90	-1.40	-6.30	6.60	-26.60	66.0	0.00
Feb.	-5.00	-2.20	-7.80	6.80	-27.90	47.0	0.00
Mar.	-4.60	-1.80	-7.40	4.80	-24.80	48.0	0.00
Apr.	-3.30	-0.70	-5.80	7.00	-21.40	44.0	0.00
May.	-0.20	1.90	-2.30	9.40	-11.60	25.0	0.00
Jun.	2.70	4.80	0.60	18.10	-4.70	27.0	98.12
Jul.	5.40	7.30	3.50	16.20	-1.60	36.0	144.24
Aug.	5.80	7.70	3.90	15.70	-2.30	54.0	120.82
Sep.	4.00	5.90	2.10	13.40	-5.00	74.0	70.20
Oct.	1.20	3.70	-1.30	11.60	-13.40	75.0	23.44
Nov.	-0.90	1.70	-3.50	10.00	-15.20	67.0	0.00
Dec.	-2.80	-0.20	-5.40	6.80	-22.50	65.0	0.00
Year	-0.13	2.23	-2.47	10.53	-14.75	628	456.82

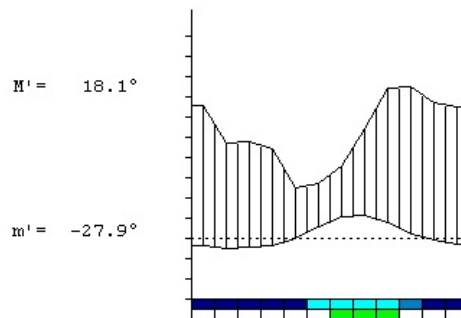
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -101
 Compensated thermicity index.....(Itc): -101
 Simple continentality index.....(Ic): 10.8
 Diurnality index.....(Id): 5.6
 Annual ombrothermic index.....(Io): 13.93
 Monthly estival ombrothermic index.....(Ios1): 9.31
 Bimonthly estival ombrothermic index.....(Ios2): 8.04
 Threemonthly estival ombrothermic index.....(Ios3): 10.79
 Fourmonthly estival ombrothermic index.....(Ios4): 10.67
 Annual ombro-evaporation index.....(Ioe): 1.37
 Annual positive temperature.....(Tp): 191
 Annual negative temperature.....(Tn): 207
 Estival temperature.....(Ts): 152
 Positive precipitation.....(Pp): 266

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	5	0	0	0	7

Latitudinal Belt...: Low subtemperate
 Continentality.....: Hyperoceanic - Low Subhyperoceanic
 Bioclimate.....: POLAR HIPEROCEANIC
 Bioclimatic belt...: LOW MESOPOLAR LOW HYPERHUMID

JAN MAYEN (NORWAY) 23 m
 P= 628 70° 59'N 8° 20'W 31/31 y.
 T= -0.1 ° Ic= 10.8 Tp= 191 Tn= 207
 m= -7.8 ° M= -2.2 ° Itc= -101 Io= 13.9



POLAR HIPEROCEANIC
LOW MESOPOLAR LOW HYPERHUMID

**Polar Hyperoceanic Bioclimate,
 Normal Variant**

Figure 66

54

IVIGTUT (GREENLAND -DNK-) Altitude: 30 m.

Latitude: 61° 12'N Longitude: 48° 10'W
 Temperature observation period.: 1945-1994 (50)
 Rainfall observation period....: 1944-1994 (51)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-7.78	-4.44	-11.11	13.33	-27.78	83.8	0.00
Feb.	-7.22	-3.33	-11.11	14.44	-28.89	66.0	0.00
Mar.	-4.73	-0.56	-8.89	15.56	-27.22	86.4	0.00
Apr.	-0.56	3.33	-4.44	16.11	-20.56	63.5	0.00
May.	4.45	8.33	0.56	23.33	-10.56	88.9	67.27
Jun.	8.06	12.22	3.89	30.00	-2.22	81.3	105.00
Jul.	9.73	13.89	5.56	23.33	0.56	78.7	117.24
Aug.	8.89	12.78	5.00	21.67	-1.67	94.0	95.84
Sep.	5.28	8.33	2.22	21.11	-5.56	149.9	53.79
Oct.	1.39	4.44	-1.67	19.44	-12.78	144.8	18.14
Nov.	-2.78	0.00	-5.56	17.78	-17.78	116.8	0.00
Dec.	-5.84	-2.78	-8.89	15.56	-26.67	78.7	0.00
Year	0.74	4.35	-2.87	19.31	-15.09	1133	457.28

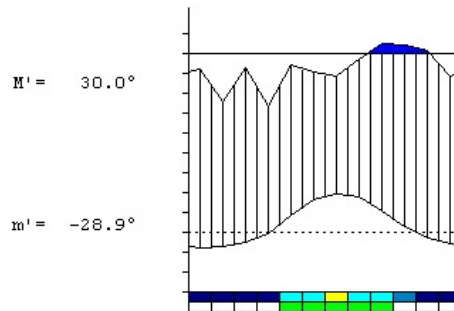
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -148
 Compensated thermicity index.....(Itc): -148
 Simple continentality index.....(Ic): 17.5
 Diurnality index.....(Id): 8.3
 Annual ombrothermic index.....(Io): 16.87
 Monthly estival ombrothermic index.....(Ios1): 8.09
 Bimonthly estival ombrothermic index.....(Ios2): 9.27
 Threemonthly estival ombrothermic index.....(Ios3): 9.52
 Fourmonthly estival ombrothermic index.....(Ios4): 11.02
 Annual ombro-evaporation index.....(Ioe): 2.48
 Annual positive temperature.....(Tp): 378
 Annual negative temperature.....(Tn): 289
 Estival temperature.....(Ts): 267
 Positive precipitation.....(Pp): 638

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	6	0	0	0	6

Latitudinal Belt...: High eutemperate
 Continentality.....: Oceanic - Low Semicontinental
 Bioclimate.....: POLAR OCEANIC
 Bioclimatic belt...: LOW THERMOPOLAR LOW HYPERHUMID

IVIGTUT (GREENLAND -DNK-) 30 m
 P= 1133 61° 12'N 48° 10'W 50/51 y.
 T= 0.7° Ic= 17.5 Tp= 378 Tn= 289
 m= -11.1° M= -4.4° Itc= -148 Io= 16.9



POLAR OCEANIC
LOW THERMOPOLAR LOW HYPERHUMID

**Polar Oceanic Bioclimate,
 Normal Variant**

Figure 67

55

CAMBRIDGE BAY (CANADA) Altitude: 27 m.
 Latitude: 69° 6'N Longitude: 105° 8'W
 Temperature observation period.: 1972-1994 (23)
 Rainfall observation period....: 1982-1994 (13)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-32.78	-28.89	-36.67	-6.11	-52.78	8.9	0.00
Feb.	-34.45	-31.11	-37.78	-11.67	-50.56	4.1	0.00
Mar.	-29.73	-25.56	-33.89	-5.00	-46.67	5.1	0.00
Apr.	-21.39	-16.67	-26.11	6.11	-41.11	3.6	0.00
May.	-9.45	-5.56	-13.33	11.11	-35.00	5.6	0.00
Jun.	1.67	4.44	-1.11	22.22	-14.44	5.3	71.51
Jul.	8.33	12.22	4.44	23.89	-1.11	23.6	171.41
Aug.	6.95	10.00	3.89	24.44	-8.89	50.0	123.68
Sep.	-0.28	1.67	-2.22	15.56	-13.89	28.2	0.00
Oct.	-11.11	-7.78	-14.44	3.89	-31.67	14.5	0.00
Nov.	-23.89	-20.56	-27.22	-2.78	-42.22	13.7	0.00
Dec.	-30.00	-26.67	-33.33	2.22	-49.44	9.7	0.00
Year	-14.68	-11.21	-18.15	6.99	-32.32	172	366.60

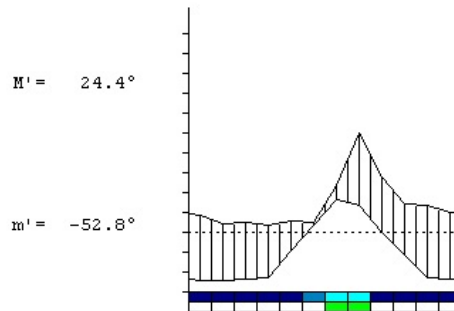
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -836
 Compensated thermicity index.....(Itc): -346
 Simple continentality index.....(Ic): 42.8
 Diurnality index.....(Id): 9.4
 Annual ombrothermic index.....(Io): 4.65
 Monthly estival ombrothermic index.....(Ios1): 2.83
 Bimonthly estival ombrothermic index.....(Ios2): 4.82
 Threemonthly estival ombrothermic index.....(Ios3): 4.65
 Fourmonthly estival ombrothermic index.....(Ios4): 11.27
 Annual ombro-evaporation index.....(Ioe): 0.47
 Annual positive temperature.....(Tp): 170
 Annual negative temperature.....(Tn): 1931
 Estival temperature.....(Ts): 170
 Positive precipitation.....(Pp): 79

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	1	2	0	0	9

Latitudinal Belt...: Low subtemperate
 Continentality.....: Continental - High Eucontinental
 Bioclimate(Variant): POLAR CONTINENTAL (STEPPIC)
 Bioclimatic belt...: UPPER MESOPOLAR LOW SUBHUMID

CAMBRIDGE BAY (CANADA) 27 m
 P= 172 69° 6'N 105° 8'W 23/13 y.
 T= -14.7° Ic= 42.8 Tp= 170 Tn= 1931
 m= -37.8° M= -31.1° Itc= -346 Io= 4.7



POLAR CONTINENTAL (STEPPIC)
UPPER MESOPOLAR LOW SUBHUMID

Polar Continental Bioclimate,
 Steppic Variant

Figure 68

56

YAMSK (RUSSIA)

Altitude: 5 m.

Latitude: 59° 35'N Longitude: 154° 9'E
 Temperature observation period.: 1933-1960 (28)
 Rainfall observation period....: 1933-1964 (32)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-20.60	-16.80	-24.30	-6.00	-37.00	31.0	0.00
Feb.	-21.00	-16.90	-25.40	-5.00	-38.00	25.0	0.00
Mar.	-17.20	-12.40	-22.20	-3.00	-35.00	21.0	0.00
Apr.	-9.10	-4.50	-14.30	1.00	-28.00	24.0	0.00
May.	-0.60	2.70	-4.30	9.00	-14.00	22.0	0.00
Jun.	5.80	9.70	2.20	19.00	-2.00	26.0	78.13
Jul.	12.00	15.70	8.80	22.00	5.00	41.0	126.98
Aug.	12.10	15.70	9.10	22.00	5.00	56.0	110.40
Sep.	7.70	10.80	4.90	17.00	-1.00	53.0	65.52
Oct.	-1.50	2.00	-4.00	9.00	-13.00	72.0	0.00
Nov.	-10.50	-7.30	-13.40	1.00	-23.00	54.0	0.00
Dec.	-16.50	-13.00	-19.70	-2.00	-30.00	35.0	0.00
Year	-4.95	-1.19	-8.55	7.00	-17.58	460	381.03

BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -473
 Compensated thermicity index.....(Itc): -225
 Simple continentality index.....(Ic): 33.1
 Diurnality index.....(Id): 9.8
 Annual ombrothermic index.....(Io): 4.68
 Monthly estival ombrothermic index.....(Ios1): 4.63
 Bimonthly estival ombrothermic index.....(Ios2): 4.02
 Threemonthly estival ombrothermic index.....(Ios3): 4.72
 Fourmonthly estival ombrothermic index.....(Ios4): 4.68
 Annual ombro-evaporation index.....(Ioe): 1.21
 Annual positive temperature.....(Tp): 376
 Annual negative temperature.....(Tn): 970
 Estival temperature.....(Ts): 318
 Positive precipitation.....(Pp): 176

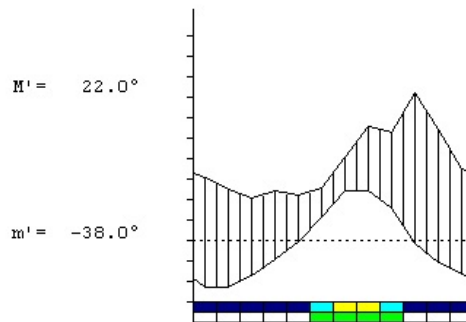
N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	3	1	0	0	8

Latitudinal Belt...: High eutemperate
 Continentality.....: Continental - Low Eucontinental
 Bioclimate.....: POLAR CONTINENTAL
 Bioclimatic belt...: LOW THERMOPOLAR LOW SUBHUMID

YAMSK (RUSSIA)

5 m

P= 460 59° 35'N 154° 9'E 28/32 y.
 T= -4.9 ° Ic= 33.1 Tp= 376 Tn= 970
 m= -25.4 ° M= -16.9 ° Itc= -225 Io= 4.7



POLAR CONTINENTAL
LOW THERMOPOLAR LOW SUBHUMID

**Polar Continental Bioclimate,
 Normal Variant**

Figure 69

57

SREDNE-KOLYMSK (RUS YAKUTSKAYA) Altitude: 23 m.

Latitude: 67° 28'N Longitude: 153° 38'E
 Temperature observation period.: 1887-1960 (74)
 Rainfall observation period....: 1891-1965 (75)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-37.60	-34.40	-41.10	-21.00	-59.00	13.0	0.00
Feb.	-34.70	-30.90	-38.70	-19.00	-60.00	9.0	0.00
Mar.	-26.40	-20.50	-32.90	-8.00	-54.00	7.0	0.00
Apr.	-14.50	-8.20	-22.40	2.00	-51.00	6.0	0.00
May.	-0.70	4.30	-6.40	16.00	-30.00	8.0	0.00
Jun.	11.00	16.40	5.90	27.00	-11.00	25.0	147.20
Jul.	13.60	18.90	8.80	29.00	-2.00	32.0	161.26
Aug.	9.80	14.80	5.40	26.00	-6.00	27.0	106.29
Sep.	2.90	7.10	-0.80	18.00	-13.00	17.0	34.59
Oct.	-11.00	-7.90	-14.30	4.00	-36.00	16.0	0.00
Nov.	-27.10	-23.80	-30.50	-11.00	-49.00	15.0	0.00
Dec.	-35.00	-31.70	-38.50	-18.00	-58.00	13.0	0.00
Year	-12.47	-7.99	-17.13	3.75	-35.75	188	449.34

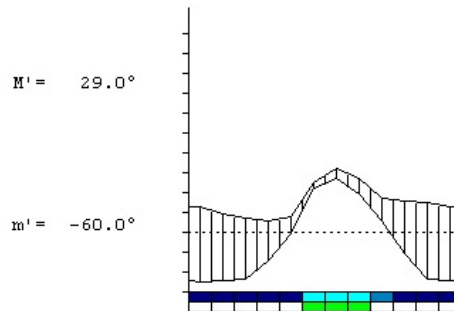
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -880
 Compensated thermicity index.....(Itc): -154
 Simple continentality index.....(Ic): 51.2
 Diurnality index.....(Id): 14.2
 Annual ombrothermic index.....(Io): 2.71
 Monthly estival ombrothermic index.....(Ios1): 2.35
 Bimonthly estival ombrothermic index.....(Ios2): 2.32
 Threemonthly estival ombrothermic index.....(Ios3): 2.44
 Fourmonthly estival ombrothermic index.....(Ios4): 2.73
 Annual ombro-evaporation index.....(Ioe): 0.42
 Annual positive temperature.....(Tp): 373
 Annual negative temperature.....(Tn): 1870
 Estival temperature.....(Ts): 344
 Positive precipitation.....(Pp): 101

N. of Months	P>4T	P:2T-4T	PT-2T	P<T	T<0
	1	3	0	0	8

Latitudinal Belt...: Low subtemperate
 Continentality.....: Continental - Low Hypercontinental
 Bioclimate(Variant): POLAR XERIC (STEPPIC)
 Bioclimatic belt...: LOW THERMOPOLAR LOW DRY

SREDNE-KOLYMSK (RUS YAKUTSKAYA) 23 m
 P= 188 67° 28'N 153° 38'E 74/75 y.
 T= -12.5° Ic= 51.2 Tp= 373 Tn= 1870
 m= -41.1° M= -34.4° Itc= -154 Io= 2.7



POLAR XERIC (STEPPIC)
LOW THERMOPOLAR LOW DRY

**Polar Xeric Bioclimate,
 Steppic Variant**

Figure 70

58

UMANAK (GREENLAND -DNK-) Altitude: 8 m.
 Latitude: 70° 41'N Longitude: 52° 0'W
 Temperature observation period.: 1984-1994 (11)
 Rainfall observation period....: 1984-1994 (11)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	EPI
Jan.	-10.83	-8.33	-13.33	9.44	-32.22	22.9	0.00
Feb.	-14.72	-12.22	-17.22	8.89	-35.00	10.2	0.00
Mar.	-13.89	-10.56	-17.22	8.33	-35.00	10.2	0.00
Apr.	-11.11	-7.78	-14.44	8.33	-30.00	12.7	0.00
May.	-0.84	2.22	-3.89	13.89	-20.56	10.2	0.00
Jun.	5.28	8.33	2.22	16.67	-5.00	7.6	123.82
Jul.	7.78	10.56	5.00	17.78	0.56	12.7	155.24
Aug.	7.22	9.44	5.00	16.11	0.00	12.7	119.64
Sep.	2.78	4.44	1.11	14.44	-6.11	20.3	48.97
Oct.	-1.67	0.00	-3.33	13.33	-9.44	17.8	0.00
Nov.	-5.00	-3.33	-6.67	11.11	-17.78	25.4	0.00
Dec.	-8.06	-6.11	-10.00	7.22	-26.67	25.4	0.00
Year	-3.59	-1.11	-6.06	12.13	-18.10	188	447.67

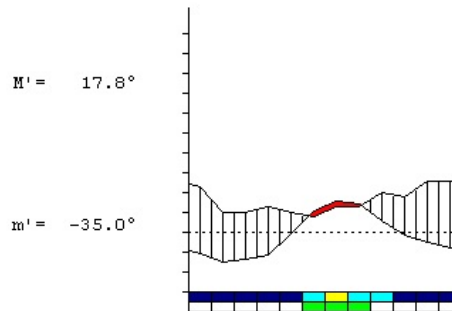
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -330
 Compensated thermicity index.....(Itc): -293
 Simple continentality index.....(Ic): 22.5
 Diurnality index.....(Id): 6.7
 Annual ombrothermic index.....(Io): 2.31
 Monthly estival ombrothermic index.....(Ios1): 1.63
 Bimonthly estival ombrothermic index.....(Ios2): 1.69
 Threemonthly estival ombrothermic index.....(Ios3): 1.63
 Fourmonthly estival ombrothermic index.....(Ios4): 2.22
 Annual ombro-evaporation index.....(Ioe): 0.42
 Annual positive temperature.....(Tp): 231
 Annual negative temperature.....(Tn): 661
 Estival temperature.....(Ts): 203
 Positive precipitation.....(Pp): 53

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	1	0	3	0	8

Latitudinal Belt...: Low subtemperate
 Continentality.....: Continental - Low Subcontinental
 Bioclimate.....: POLAR XERIC
 Bioclimatic belt...: LOW MESOPOLAR LOW DRY

UMANAK (GREENLAND -DNK-) 8 m
 P= 188 70° 41'N 52° 0'W 11/11 y.
 T= -3.6° Ic= 22.5 Tp= 231 Tn= 661
 m= -17.2° M= -12.2° Itc= -293 Io= 2.3



POLAR XERIC
LOW MESOPOLAR LOW DRY

**Polar Xeric Bioclimate,
 Normal Variant**

Figure 71

59

MCMURDO STATION (ANTARCTICA TERR.) Altitude: 2 m.

Latitude: 77° 53'S Longitude: 166° 48'W
 Temperature observation period.: 1984-1994 (11)
 Rainfall observation period....: 1984-1994 (11)

(C/mm)	Ti	Mi	mi	M'i	m'i	Pi	Epi
Jan.	-3.61	-1.11	-6.11	5.56	-15.56	12.2	0.00
Feb.	-9.17	-6.67	-11.67	3.89	-21.67	16.5	0.00
Mar.	-19.17	-16.11	-22.22	-3.33	-34.44	8.9	0.00
Apr.	-21.67	-18.33	-25.00	-5.00	-39.44	9.7	0.00
May.	-23.61	-20.00	-27.22	-7.22	-42.78	10.2	0.00
Jun.	-23.61	-20.00	-27.22	-7.78	-39.44	8.1	0.00
Jul.	-26.95	-22.78	-31.11	-4.44	-50.56	5.8	0.00
Aug.	-28.89	-24.44	-33.33	-1.67	-49.44	8.4	0.00
Sep.	-24.17	-20.00	-28.33	-7.78	-41.11	9.9	0.00
Oct.	-20.56	-16.67	-24.44	-4.44	-39.44	5.8	0.00
Nov.	-9.17	-6.11	-12.22	2.78	-27.78	5.1	0.00
Dec.	-3.89	-1.67	-6.11	5.56	-16.67	7.6	0.00
Year	-17.87	-14.49	-21.25	-1.99	-34.86	108	0.00

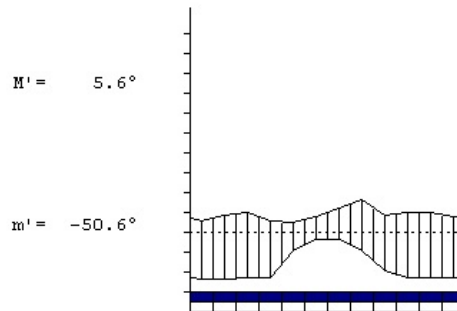
BIOCLIMATIC INDICES AND DIAGNOSIS

Thermicity index.....(It): -756
 Compensated thermicity index.....(Itc): -677
 Simple continentality index.....(Ic): 25.3
 Diurnality index.....(Id): 8.9
 Annual ombrothermic index.....(Io): No
 Monthly estival ombrothermic index.....(Ios1): No
 Bimonthly estival ombrothermic index.....(Ios2): No
 Threemonthly estival ombrothermic index.....(Ios3): No
 Fourmonthly estival ombrothermic index.....(Ios4): No
 Annual ombro-evaporation index.....(Ioe): No
 Annual positive temperature.....(Tp): 0
 Annual negative temperature.....(Tn): 2145
 Estival temperature.....(Ts): 0
 Positive precipitation.....(Pp): 0

N. of	P>4T	P:2T-4T	PT-2T	P<T	T<0
Months	0	0	0	0	12

Latitudinal Belt....: Low polar
 Continentality.....: Continental - High Subcontinental
 Bioclimate.....: POLAR PERGELID
 Bioclimatic belt....: GELID Scanty-Snowy

MCMURDO STATION (ANTARCTICA TERR.) 2 m
 P= 108 77° 53'S 166° 48'W 11/11 y.
 T= -17.9 ° Ic= 25.3 Tp= 0 Tn= 2145
 m= -33.3 ° M= -24.4 ° Itc= -677 Io=9999.9



POLAR PERGELID
GELID Scanty-Snowy

Polar Pergelid Bioclimate,
 Normal Variant

9.- ASSESSMENT OF SUMMER ARIDITY, WITH EXAMPLES

Summer aridity, $Ios2 \leq 2$ (see Chapter 3, Ombrothermal Indexes, and Chapter 4, Mediterranean, Temperate and Boreal Macrobioclimates), differentiates the Mediterranean Macrobioclimate from the Temperate and Boreal Macrobioclimates, which do not have such summer aridity. However, there are circumstances where the soil field capacity supplements this summer aridity, If the month, or the two months, prior to the summer drought, provide enough rain, to have the soil recharged: in those cases, neither the vegetation nor the Macrobioclimate are Mediterranean. In order to evaluate this possible soil compensation for summer aridity, Summer Compensatory Ombrothermal Indexes, $Iosc3$ e $Iosc4$, are used (see Chapter 3). The values of these Compensable Summer Ombrothermal Indices, $Iosc3$ e $Iosc4$, have a high discriminatory value in the Mediterranean-Temperate and Mediterranean-Boreal border territories.

9.1.- Assessment of summer aridity.

From what has been said, if the $Ios2$ of our weather station is less than or equal to 2, $Ios2 \leq 2$, we can not categorically state that our weather station has summer aridity, but we must study the possible edaphic compensation to this summer aridity, with the help of $Iosc3$ and $Iosc4$ values. However, the possible compensatory effect of precipitation falling in the month, or in the two months preceding the summer drought, is related to three factors: a), the annual water comfort, measured by the **annual Io**; b), the magnitude of $Ios2$; and c), the own value of the compensable Ombrothermal Indices, $Iosc3$ and $Iosc4$. Which is understandable: Not any value of **Io** allows the compensation, but this can only occur with an **Io** annual greater than 2. But, in addition, and depending on the magnitude of the annual **Io**, the possibly compensable values of $Ios2$ vary. In figures 72 and 73, the values of **Io** and $Ios2$, which allow for compensation, are given. If our weather station allows the compensation of a deficient $Ios2$, three cases may occur: 1), that our $Iosc3$ value were greater than two, which would suppose directly that the summer aridity is compensated, that is to say, there is no summer aridity; 2), that our $Iosc3$ value were below the corresponding intervals in the table, which would indicate, directly, that there is no compensation to summer aridity; and 3), that our $Iosc3$ value were in between the intervals shown in the table to allow compensation with $Iosc4$. Already in the column of $Iosc4$, there are only two possibilities: 1), that our $Iosc4$ were greater than two, which indicates that there is edaphic compensation of summer aridity; and 2), that our $Iosc4$ were less than or equal to 2, which finally indicates that there is no edaphic compensation of summer aridity. (The reading and interpretation of Figure 72 is explained in Figure 73).

Figure 72.- Compensation table to evaluate summer aridity, as a function of I_o , I_{os2} , I_{osc3} and I_{osc4} .

I_o	I_{os2}	I_{osc3}	I_{osc4}
$2.0 < I_o \leq 2.8$	$1.9 \leq I_{os2} \leq 2.0$	$I_{osc3} = 2.0$	if - $I_{osc4} > 2.0$: Compensable aridity if - $I_{osc4} \leq 2.0$: Non-compensable aridity
$2.8 < I_o \leq 3.6$	$1.8 \leq I_{os2} \leq 2.0$	$1.9 \leq I_{osc3} \leq 2.0$	
$3.6 < I_o \leq 4.8$	$1.8 \leq I_{os2} \leq 2.0$	$1.9 \leq I_{osc3} \leq 2.0$	
$4.8 < I_o \leq 6.0$	$1.7 \leq I_{os2} \leq 2.0$	$1.9 \leq I_{osc3} \leq 2.0$	
$6.0 < I_o \leq 7.0$	$1.5 \leq I_{os2} \leq 2.0$	$1.8 \leq I_{osc3} \leq 2.0$	
$7.0 < I_o \leq 8.0$	$1.4 \leq I_{os2} \leq 2.0$	$1.8 \leq I_{osc3} \leq 2.0$	
$8.0 < I_o \leq 9.0$	$1.3 \leq I_{os2} \leq 2.0$	$1.8 \leq I_{osc3} \leq 2.0$	
$9.0 < I_o \leq 10.0$	$1.2 \leq I_{os2} \leq 2.0$	$1.8 \leq I_{osc3} \leq 2.0$	
$10.0 < I_o \leq 11.0$	$1.1 \leq I_{os2} \leq 2.0$	$1.7 \leq I_{osc3} \leq 2.0$	
$11.0 < I_o \leq 12.0$	$1.0 \leq I_{os2} \leq 2.0$	$1.7 \leq I_{osc3} \leq 2.0$	
$12.0 < I_o$	$0.9 \leq I_{os2} \leq 2.0$	$1.7 \leq I_{osc3} \leq 2.0$	

Figure 73: Reading and interpretation of figure 72.

I_o	I_{os2}	I_{osc3}	I_{osc4}
$2.0 < I_o \leq 2.8$	With I_{os2} from 1.9 to 2.0, the weather station is compensable with I_{osc3} If I_{os2} is less than 1.9, the weather station is Mediterranean	If I_{osc3} is higher than 2.0, the weather station is Temperate , or Boreal If I_{osc3} equals 2.0, the weather station is compensable with I_{osc4} If I_{osc3} is less than 2.0, the meteorological station is Mediterranean	If I_{osc4} is greater than 2.0, the weather station is Temperate , or Boreal If I_{osc4} is less than or equal to 2.0, the weather station is Mediterranean
$2.8 < I_o \leq 3.6$	With I_{os2} from 1.8 to 2.0, the weather station is compensable with I_{osc3} If I_{os2} is less than 1.8, the weather station is Mediterranean	If I_{osc3} is higher than 2.0, the weather station is Temperate , or Boreal If I_{osc3} goes from 1.9 to 2.0, the weather station is compensable with I_{osc4} If I_{osc3} is less than 1.9, the meteorological station is Mediterranean	If I_{osc4} is greater than 2.0, the weather station is Temperate , or Boreal If I_{osc4} is less than or equal to 2.0, the weather station is Mediterranean

<p>$3.6 < I_o \leq 4.8$</p>	<p>With Ios2 from 1.8 to 2.0, the weather station is compensable with Iosc3</p> <p>If Ios2 is less than 1.8, the weather station is Mediterranean</p>	<p>If Iosc3 is higher than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc3 goes from 1.9 to 2.0, the weather station is compensable with Iosc4</p> <p>If Iosc3 is less than 1.9, the meteorological station is Mediterranean</p>	<p>If Iosc4 is greater than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc4 is less than or equal to 2.0, the weather station is Mediterranean</p>
<p>$4.8 < I_o \leq 6.0$</p>	<p>With Ios2 from 1.7 to 2.0, the weather station is compensable with Iosc3</p> <p>If Ios2 is less than 1.7, the weather station is Mediterranean</p>	<p>If Iosc3 is higher than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc3 goes from 1.9 to 2.0, the weather station is compensable with Iosc4</p> <p>If Iosc3 is less than 1.9, the meteorological station is Mediterranean</p>	<p>If Iosc4 is greater than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc4 is less than or equal to 2.0, the weather station is Mediterranean</p>
<p>$6.0 < I_o \leq 7.0$</p>	<p>With Ios2 from 1.5 to 2.0, the weather station is compensable with Iosc3</p> <p>If Ios2 is less than 1.5, the weather station is Mediterranean</p>	<p>If Iosc3 is higher than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc3 goes from 1.8 to 2.0, the weather station is compensable with Iosc4</p> <p>If Iosc3 is less than 1.8, the meteorological station is Mediterranean</p>	<p>If Iosc4 is greater than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc4 is less than or equal to 2.0, the weather station is Mediterranean</p>
<p>$7.0 < I_o \leq 8.0$</p>	<p>With Ios2 from 1.4 to 2.0, the weather station is compensable with Iosc3</p> <p>If Ios2 is less than 1.4, the weather station is Mediterranean</p>	<p>If Iosc3 is higher than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc3 goes from 1.8 to 2.0, the weather station is compensable with Iosc4</p> <p>If Iosc3 is less than 1.8, the meteorological station is Mediterranean</p>	<p>If Iosc4 is greater than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc4 is less than or equal to 2.0, the weather station is Mediterranean</p>
<p>$8.0 < I_o \leq 9.0$</p>	<p>With Ios2 from 1.3 to 2.0, the weather station is compensable with Iosc3</p> <p>If Ios2 is less than 1.3, the weather station is Mediterranean</p>	<p>If Iosc3 is higher than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc3 goes from 1.8 to 2.0, the weather station is compensable with Iosc4</p> <p>If Iosc3 is less than 1.8, the meteorological station is Mediterranean</p>	<p>If Iosc4 is greater than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc4 is less than or equal to 2.0, the weather station is Mediterranean</p>

<p>$9.0 < I_o \leq 10.0$</p>	<p>With Ios2 from 1.2 to 2.0, the weather station is compensable with Iosc3</p> <p>If Ios2 is less than 1.2, the weather station is Mediterranean</p>	<p>If Iosc3 is higher than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc3 goes from 1.8 to 2.0, the weather station is compensable with Iosc4</p> <p>If Iosc3 is less than 1.8, the meteorological station is Mediterranean</p>	<p>If Iosc4 is greater than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc4 is less than or equal to 2.0, the weather station is Mediterranean</p>
<p>$10.0 < I_o \leq 11.0$</p>	<p>With Ios2 from 1.1 to 2.0, the weather station is compensable with Iosc3</p> <p>If Ios2 is less than 1.1, the weather station is Mediterranean</p>	<p>If Iosc3 is higher than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc3 goes from 1.7 to 2.0, the weather station is compensable with Iosc4</p> <p>If Iosc3 is less than 1.7, the meteorological station is Mediterranean</p>	<p>If Iosc4 is greater than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc4 is less than or equal to 2.0, the weather station is Mediterranean</p>
<p>$11.0 < I_o \leq 12.0$</p>	<p>With Ios2 from 1.0 to 2.0, the weather station is compensable with Iosc3</p> <p>If Ios2 is less than 1.0, the weather station is Mediterranean</p>	<p>If Iosc3 is higher than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc3 goes from 1.7 to 2.0, the weather station is compensable with Iosc4</p> <p>If Iosc3 is less than 1.7, the meteorological station is Mediterranean</p>	<p>If Iosc4 is greater than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc4 is less than or equal to 2.0, the weather station is Mediterranean</p>
<p>$12.0 < I_o$</p>	<p>With Ios2 from 0.9 to 2.0, the weather station is compensable with Iosc3</p> <p>If Ios2 is less than 0.9, the weather station is Mediterranean</p>	<p>If Iosc3 is higher than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc3 goes from 1.7 to 2.0, the weather station is compensable with Iosc4</p> <p>If Iosc3 is less than 1.7, the meteorological station is Mediterranean</p>	<p>If Iosc4 is greater than 2.0, the weather station is Temperate, or Boreal</p> <p>If Iosc4 is less than or equal to 2.0, the weather station is Mediterranean</p>

9.2.- Examples for the valuation of summer aridity

Using the tables in figures 72 and 73, the possible compensation of the summer aridity, $I_{os2} \leq 2$, is evaluated, analyzing the values of I_o , I_{os2} , I_{osc3} and I_{osc4} . To explain the

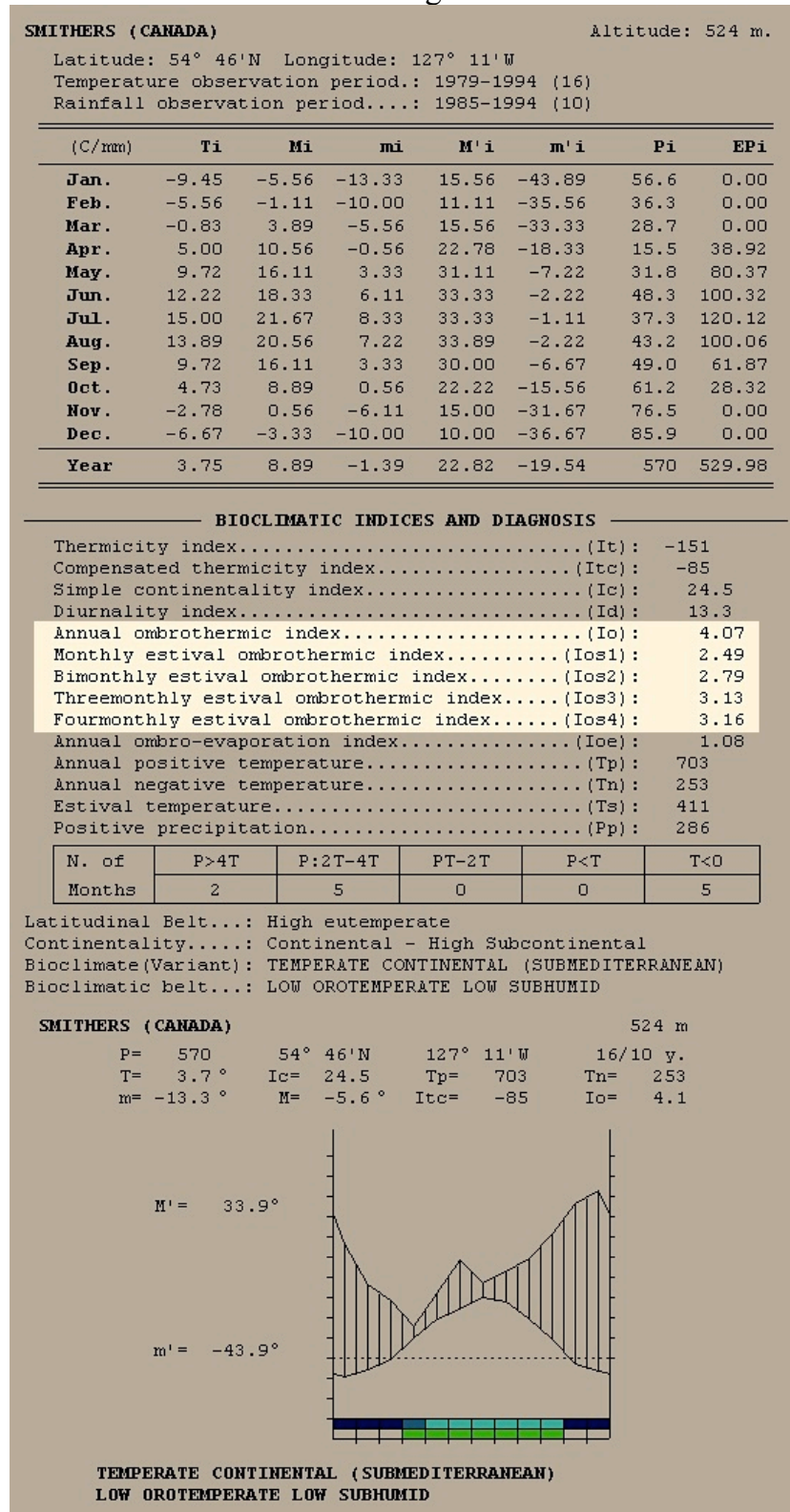
use of the compensation tables, we will use figures 74-79, whose information is taken from Rivas Martínez website: www.globalbioclimatics.org.

The possible edaphic compensation of the summer aridity has to be evaluated only when the **Ios2** of our station is between 2 and 0.9, $0.9 \leq \mathbf{Ios2} \leq 2$, because if the station's **Ios2** is greater than two ($\mathbf{Ios2} > 2$), the station has no summer aridity, and does not need any compensation (figure 74): Smithers, Canada; however, if the station's **Ios2** is less than 0.9, $\mathbf{Ios2} < 0.9$, the station, with such a low **Ios2**, does not allow compensation for summer aridity (figure 75: Dzhahal-Abad, Kyrgyzstan); but if the station's **Ios2** is greater than or equal to 0.9, and equal to or less than two: $0.9 \leq \mathbf{Ios2} \leq 2$, the existing summer aridity may, or may not, be compensable, and in order to elucidate it, one must go again to the two tables in Figures 72 and 73, that show how a deficient **Ios2** can be compensated according to the value of the annual **Io**, the **Ios2** itself, and the **Iosc3** and **Iosc4**. (See Figures 76 and 78, non-compensable, and figures 77 and 79, compensable).

Procedure: Specifically, in order to analyze the possible edaphic compensation of summer aridity, we look at the first column of Figures 72 and 73, to locate in which interval of their first columns is our **Io**, and to work, then, on that row. Already in the **Ios2** column, two things can happen: or that our **Ios2** is less than the indicated interval, which would automatically qualify the station as summer arid, without possible compensation (figure 76: Skopje, Macedonia); or that our **Ios2** is included in the indicated interval, which allows to try the compensation with **Iosc3**. Then we go to the **Iosc3** column: if our **Iosc3** is greater than two, the summer aridity is compensated (figure 77: Alustante, Guadalajara, Spain); if our **Iosc3** is less than the indicated interval, the summer aridity is definitely not compensable (Figure 78: Pounds Field, Texas); but if our **Iosc3** is within the indicated range, the summer aridity can still be compensated with the **Iosc4**. In the **Iosc4** column, two things can happen: or that our **Iosc4** is greater than two, which indicates that summer aridity is compensated by edaphic moisture (Figure 79: Atlanta, Georgia, USA); or that our **Iosc4** is equal to or less than two, indicating that the summer aridity would be, definitely, not compensable (we have not found on the website of Rivas Martínez, www.globalbioclimatics.org, any station of these characteristics).

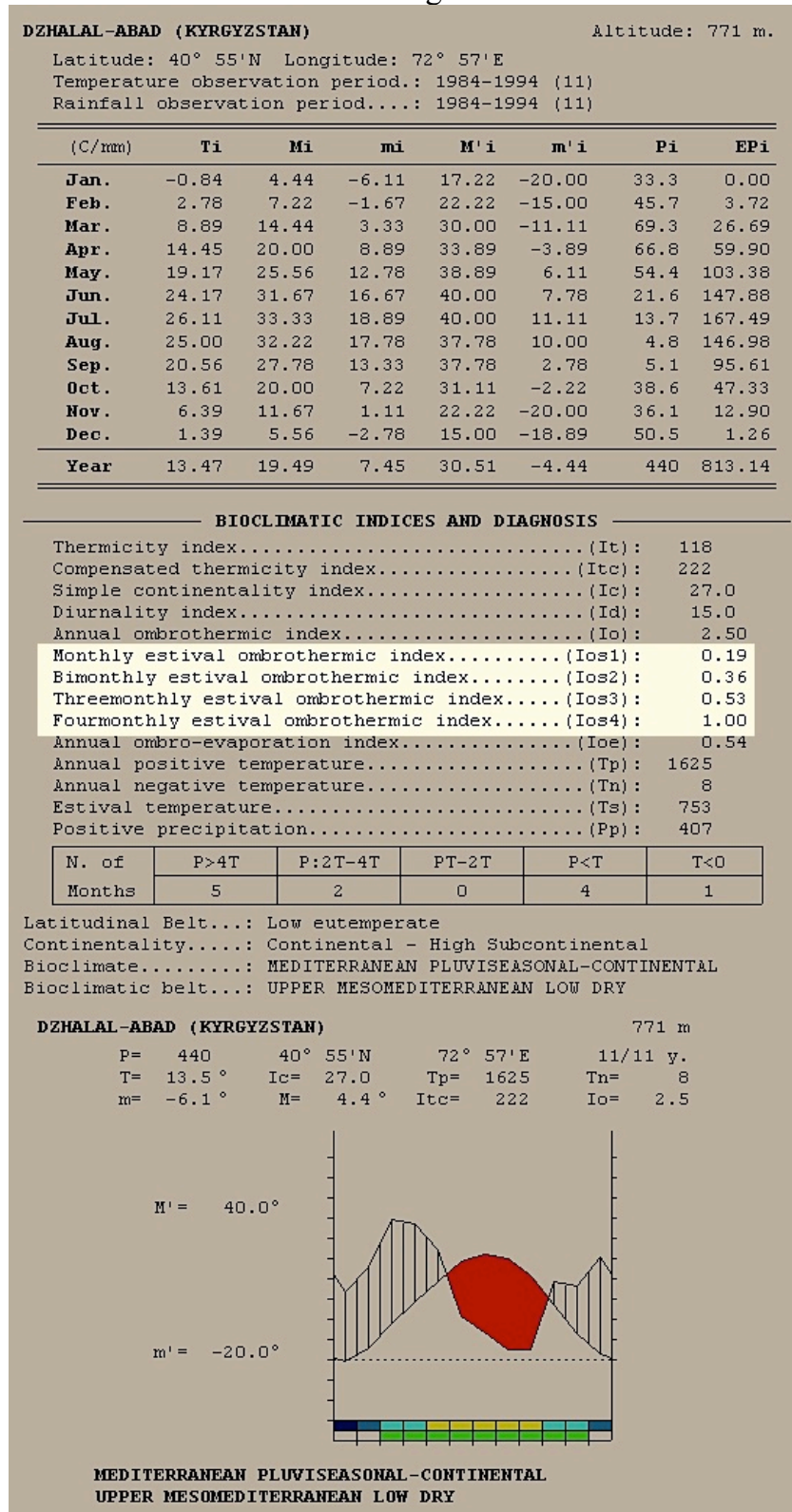
As we have said above, the values of the Ombrothermic Indexes used in the compensation - **Iosc3** and **Iosc4** -, have a high discriminatory value in the Mediterranean-Temperate and Mediterranean-Boreal border territories.

Figure 74



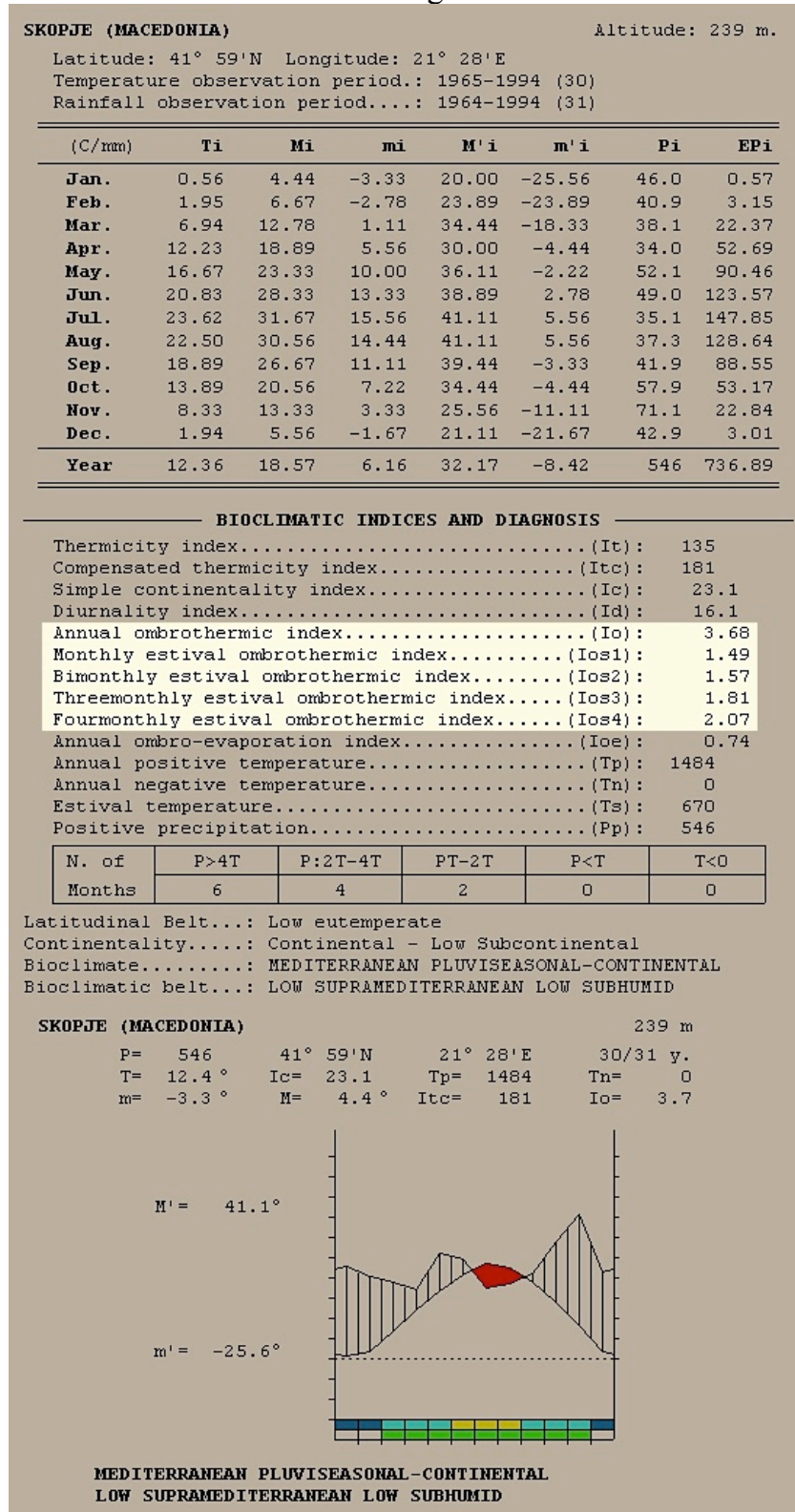
Bioclimatic Diagnosis: Temperate Continental Bioclimate, Submediterranean Variant

Figure 75



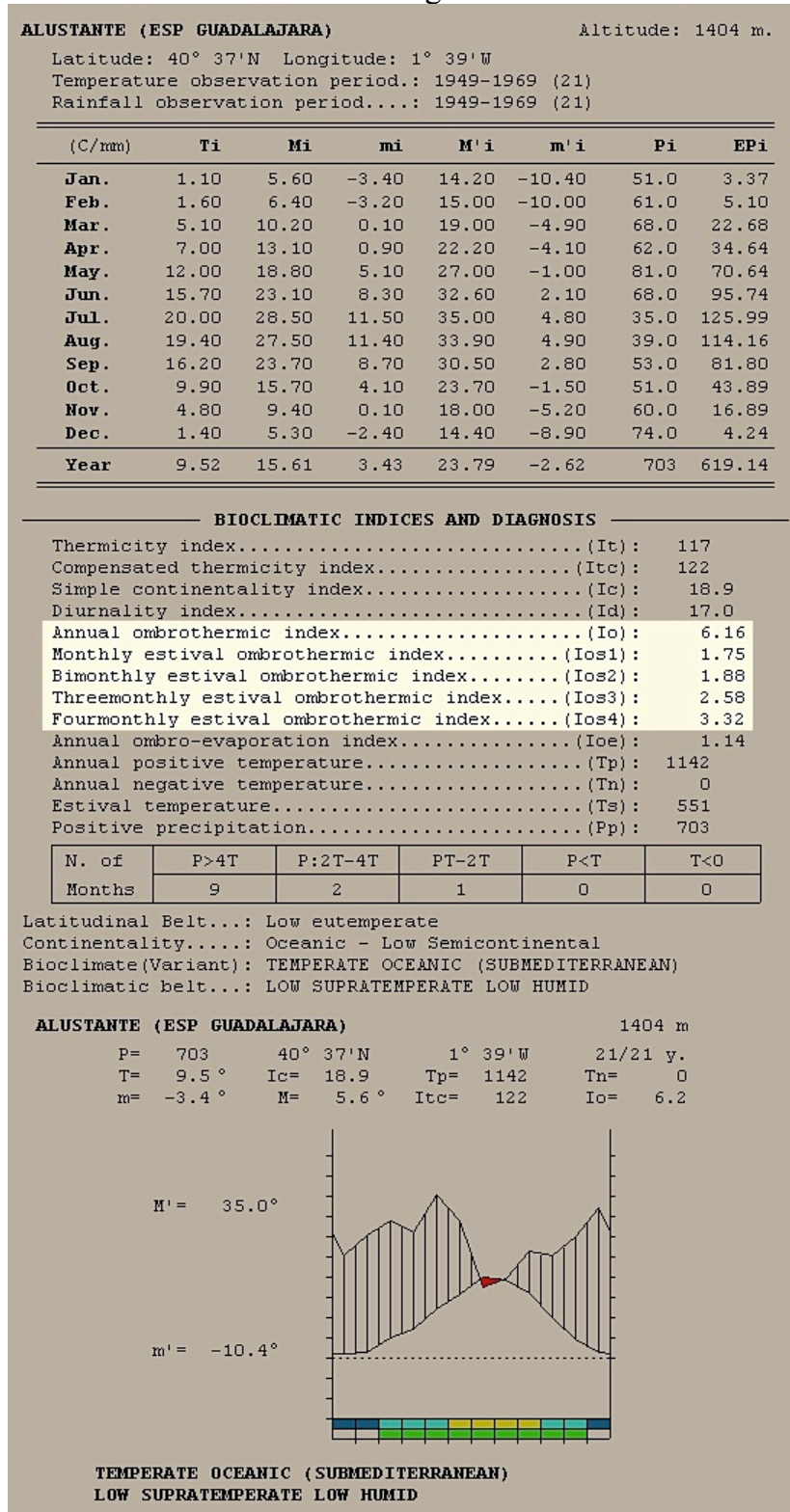
Bioclimatic Diagnosis: Mediterranean Pluviseasonal Continental Bioclimate, Normal Variant

Figure 76



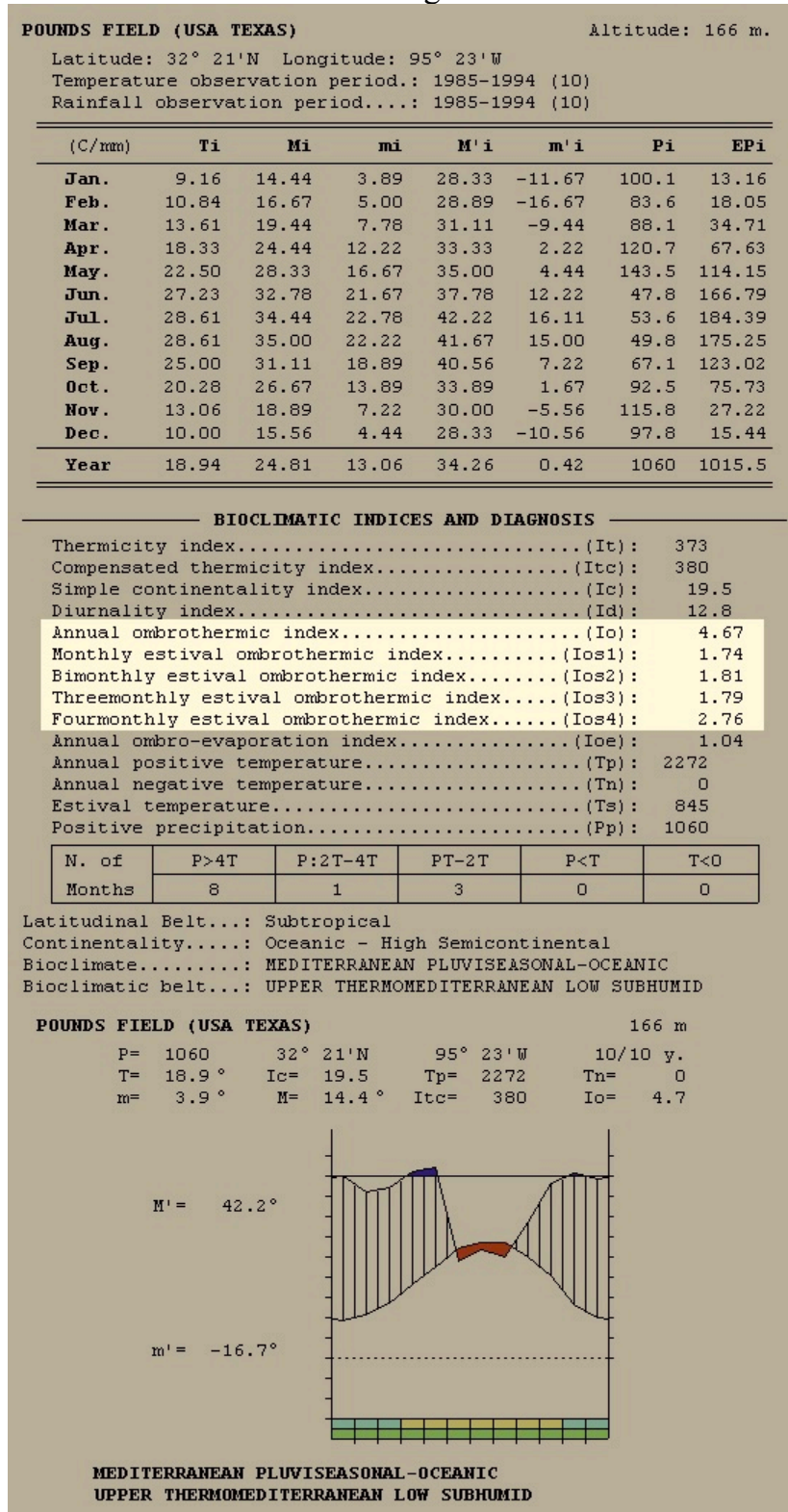
Bioclimatic Diagnosis: Mediterranean Pluviseasonal Continental Bioclimate, Normal Variant

Figure 77



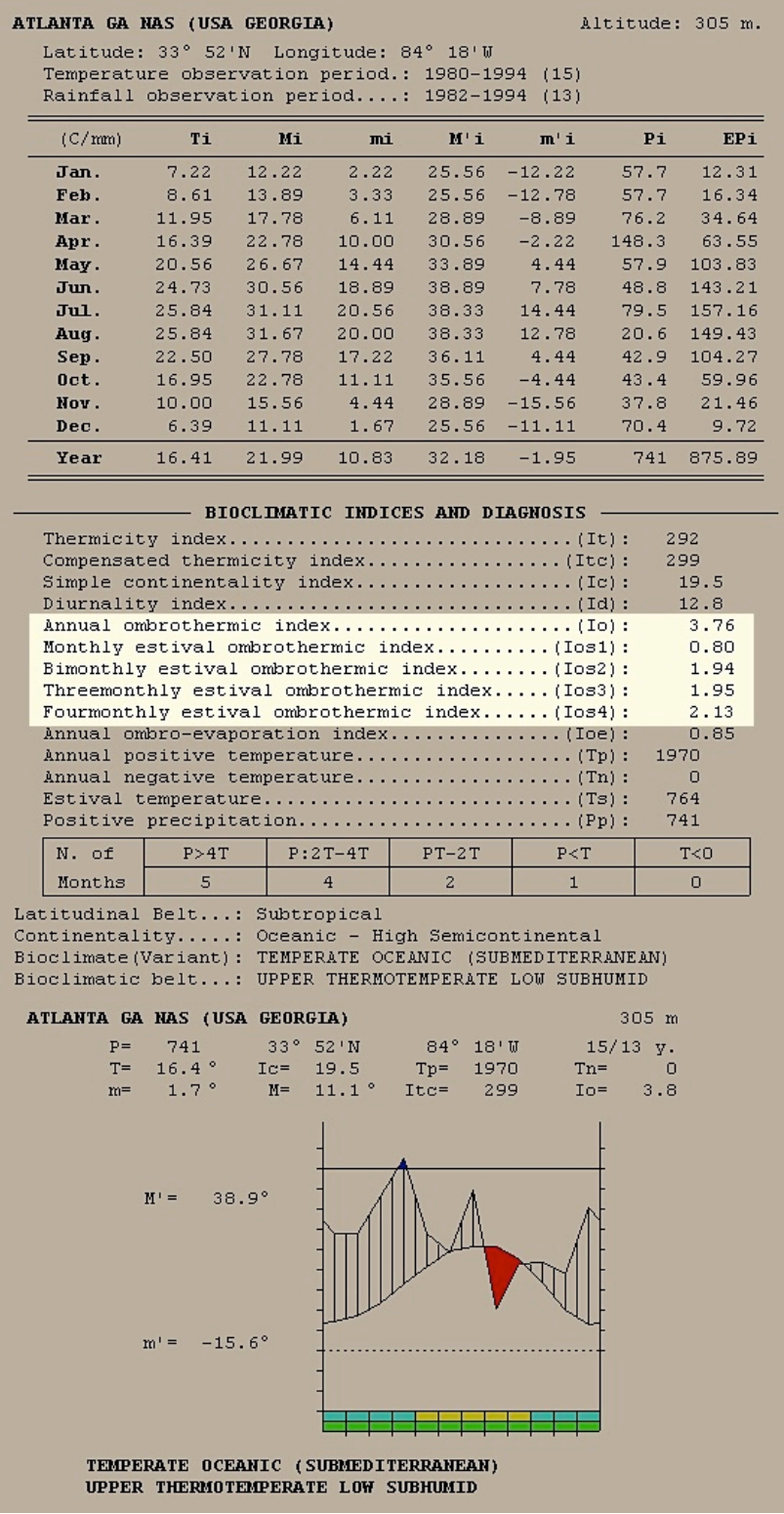
Bioclimatic Diagnosis: Temperate Oceanic Bioclimate, Submediterranean Variant

Figure 78



Bioclimatic Diagnosis: Mediterranean Pluviseasonal Oceanic Bioclimate, Normal Variant

Figure 79



Bioclimatic Diagnosis: Temperate Oceanic Bioclimate, Submediterranean Variant

10.- **I_{tc}** and **C_i** CALCULATIONS

The **Compensated Thermicity Index** is used to distinguish the Tropical, Mediterranean and Temperate Macrobioclimates, as well as their Thermotypes. For its calculation it is necessary to take into account the Latitude and the Continentality, since it is necessary to apply a progressive correction factor, **f_i**, according to the excess of cold or heat due to the Continentality / Oceanicity of the meteorological station under study. To facilitate **I_{tc}** calculation and knowledge, we will explain here, in detail, the procedure to be used.

In Chapter 3 we saw that the Compensated Thermicity Index is:

$$\mathbf{I_{tc} = I_t + C_i = (T + M + m) 10 + C_i}$$

Expression convertible into:

$$\mathbf{I_{tc} \approx (T + 2 T_{min}) 10 + C_i}$$

The first part of the expression offers no calculation difficulties. But, as the compensation value, **C_i**, varies according to Latitude and Continentality, in Figure 80, we have collected, the Latitude and Continentality intervals, as well as the progressive correction factor, **f_i**, to be applied at each of their intervals, and, finally, we have collected the calculations of **C_i**. The Continentality progressive correction factor - **f_i** - reaches values between (-10) and (+30).

Figure 80. - Calculation of the compensation values, **C_i**, to obtain the Compensated Thermicity Index - **I_{tc}** -, according to the Latitude and thresholds of Continentality, according to Rivas-Martínez.

Latitude	-I_c- Thresholds of Continentality	f_i	C_i	C_i Calculations
Up to 23° N and S	--- ---	---	C _i = 0	--- --- --- --- ---
Higher than 23°N or 23°S	I _c ≤ 8	f ₀ = (-10)	C _i = C ₀ ;	C ₀ = f ₀ (8 - I _c)
	8 < I _c ≤ 17	f _i = 0	C _i = 0	--- --- --- --- ---
	17 < I _c ≤ 21	f ₁ = 5	C _i = C ₁ ;	C ₁ = f ₁ (I _c - 17)
	21 < I _c ≤ 28	f ₂ = 15	C _i = C ₁ + C ₂	C ₁ = f ₁ (21 - 17) = 20; C ₂ = f ₂ (I _c - 21)
	28 < I _c ≤ 46	f ₃ = 25	C _i = C ₁ + C ₂ + C ₃	C ₁ = 20; C ₂ = f ₂ (28 - 21) = 105; C ₃ = f ₃ (I _c - 28)
46 < I _c ≤ 65	f ₄ = 30	C _i = C ₁ + C ₂ + C ₃ + C ₄ ;	C ₁ = 20; C ₂ = 105; C ₃ = f ₃ (46 - 28) = 450; C ₄ = f ₄ (I _c - 46)	

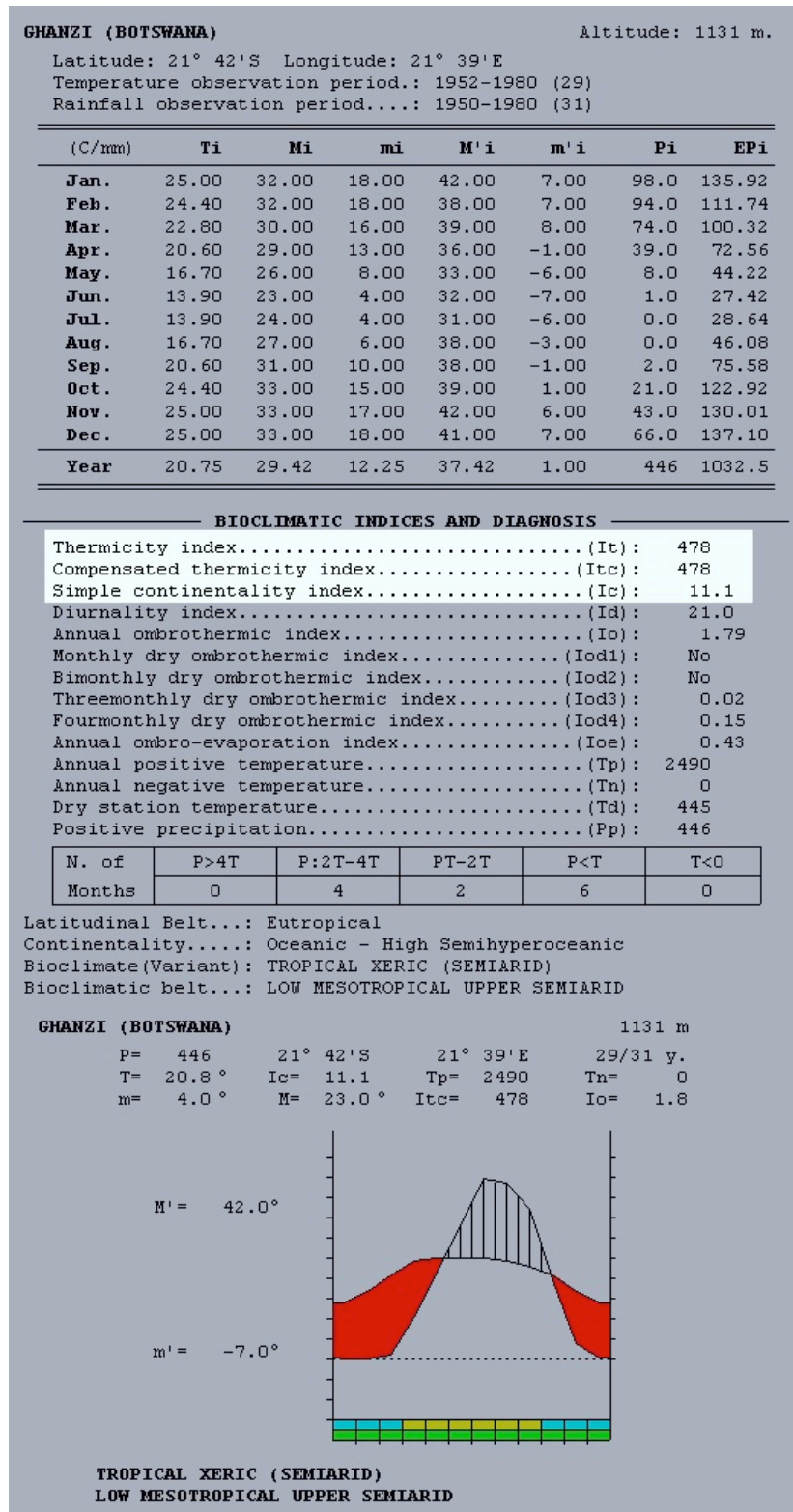
In figures 81-87, we can see some case studies, with specific meteorological stations, of the results for the I_{tc} calculations, shown in figure 80, as detailed below:

.) **Between 23° N and S**, the compensation value, C_i , is equal to 0, because, at those latitudes, it is not necessary to compensate neither the excess of cold nor the heat, due to low or high Continentality. So in those latitudes: $I_t = I_{tc}$ (See figure 81, Ghanzi, Botswana).

.) **At more than 23° N and S**,

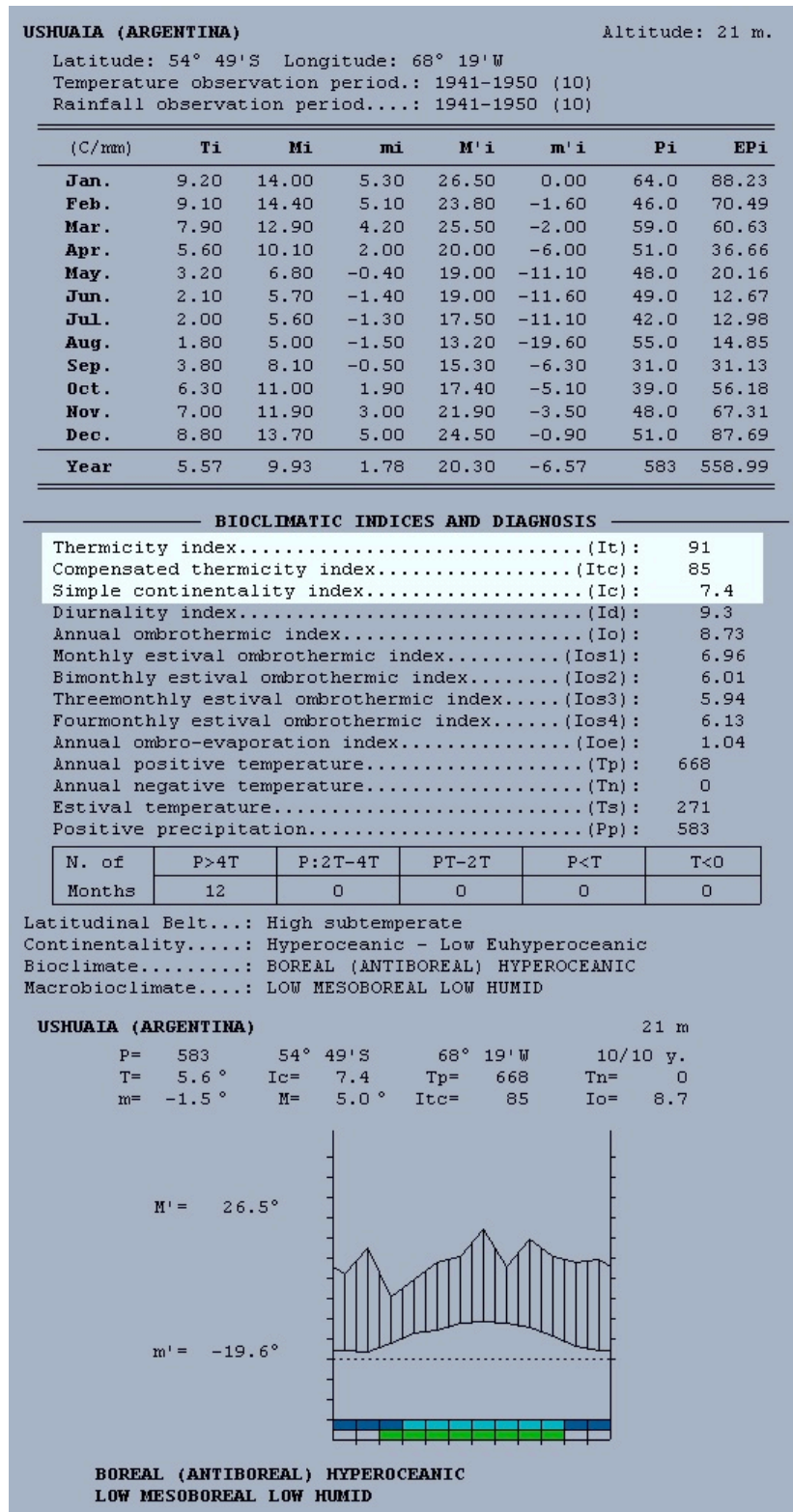
- A) in the strongly hyperoceanic areas ($I_c \leq 8$), the compensation value, C_0 , is calculated by multiplying by $f_0 = (-10)$ the difference between 8.0 and the I_c of the locality: $C_0 = (-10) \times (8.0 - I_c)$. (See Figure 82, Ushuaia, Argentina).
- B) in low Continental areas ($8 < I_c \leq 17$), the value of C_i is considered equal to 0, so, in these cases: $I_t = I_{tc}$ (See figure 83, Torgilsbu, Greenland-DNK).
- C) in intermediate Continental areas ($17 < I_c \leq 21$), the compensation value, C_1 , is calculated by multiplying by f_1 ($f_1 = 5$) the difference between the I_c of the locality and the value 17: $C_1 = f_1 (I_c - 17)$. (See Figure 84, Pingwu, China).
- D) in the high Continental areas ($21 < I_c \leq 28$), the compensation value C_i is calculated by a sum whose partial values $C_i = C_1 + C_2$, are as follows: $C_1 = f_1 (21 - 17) = 20$; y $C_2 = f_2 (I_c - 21)$. See figure 85, Teheran-Doshant, Iran).
- E) in very high Continental areas ($28 < I_c \leq 46$), the compensation value C_i is calculated by a sum whose partial values $C_i = C_1 + C_2 + C_3$, are as follows: $C_1 = f_1 (21 - 17) = 20$; $C_2 = f_2 (28 - 21) = 105$; y $C_3 = f_3 (I_c - 28)$. (See Figure 86, Lamaiin Huryee, Mongolia).
- F) in extremely high Continental areas ($46 < I_c \leq 65$), the compensation value C_i is calculated by a sum whose partial values $C_i = C_1 + C_2 + C_3 + C_4$, are as follows: $C_1 = f_1 (21 - 17) = 20$; $C_2 = f_2 (28 - 21) = 105$; $C_3 = f_3 (46 - 28) = 450$; y $C_4 = f_4 (I_c - 46)$. (See figure 87, Vakjanka, Russia).

Figure 81



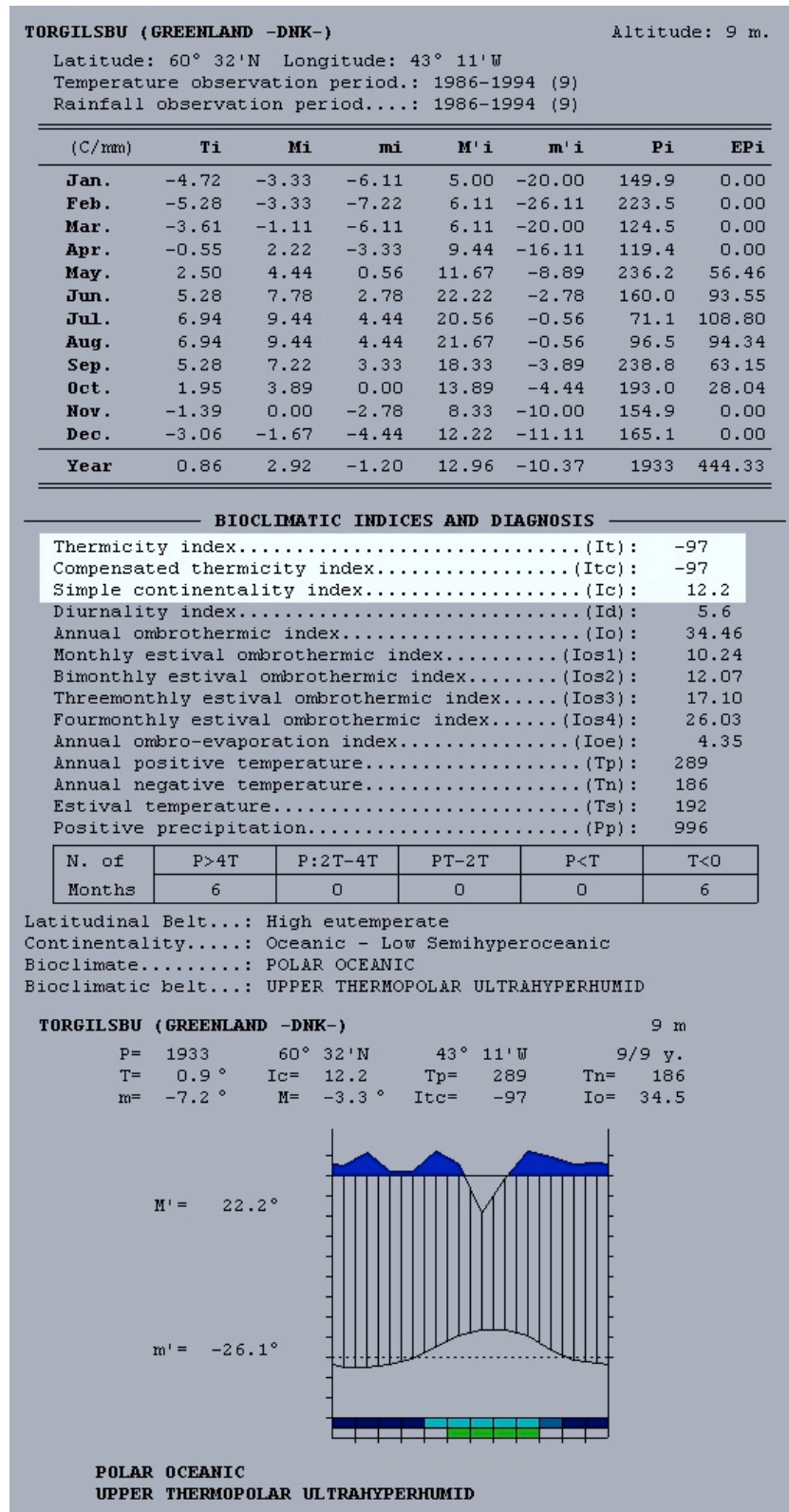
Bioclimatic Diagnosis: Tropical Xeric Bioclimate,
 Normal Variant

Figure 82



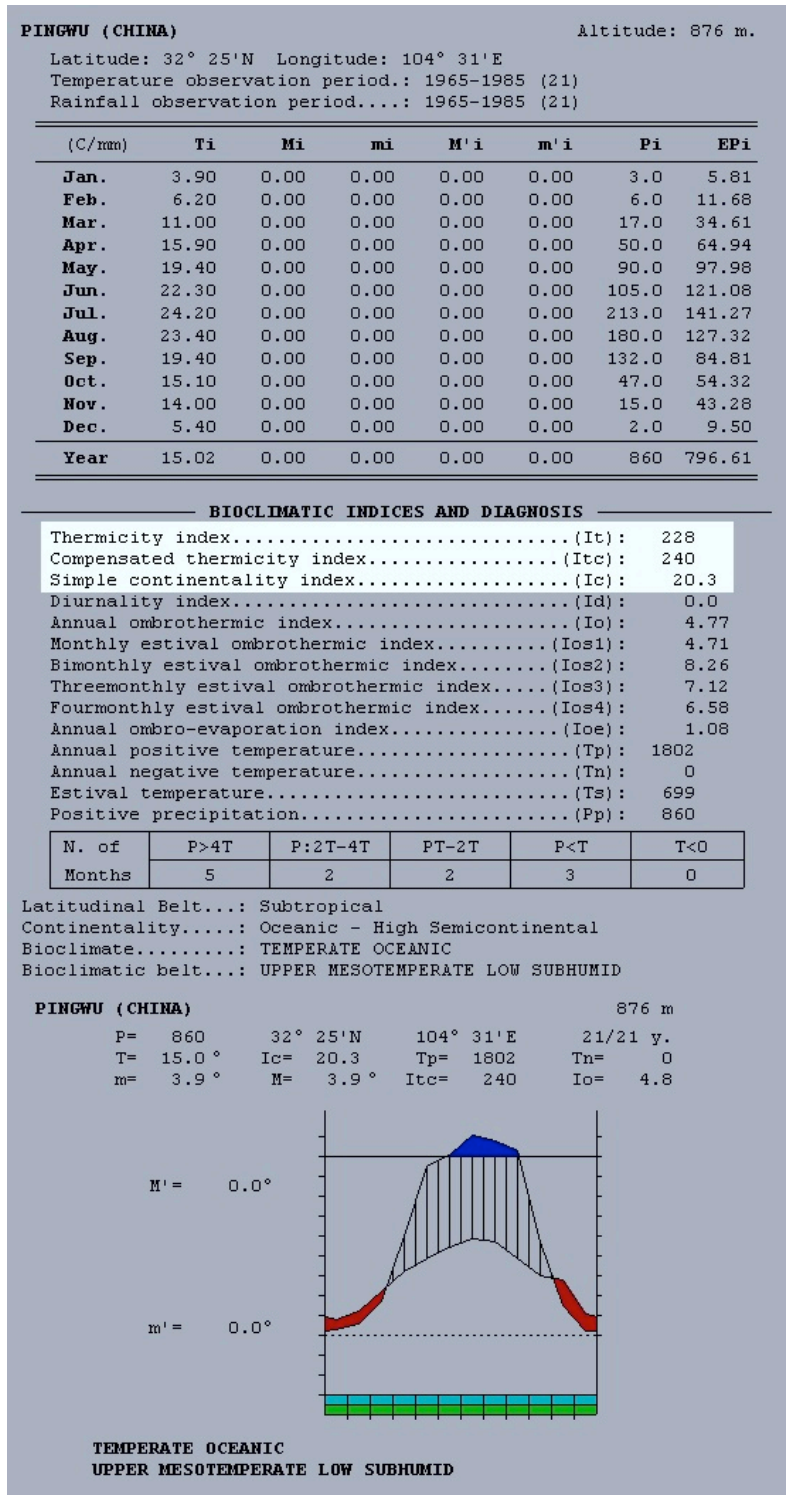
Bioclimatic Diagnosis: Boreal Hyperoceanic Bioclimate, Normal Variant

Figure 83



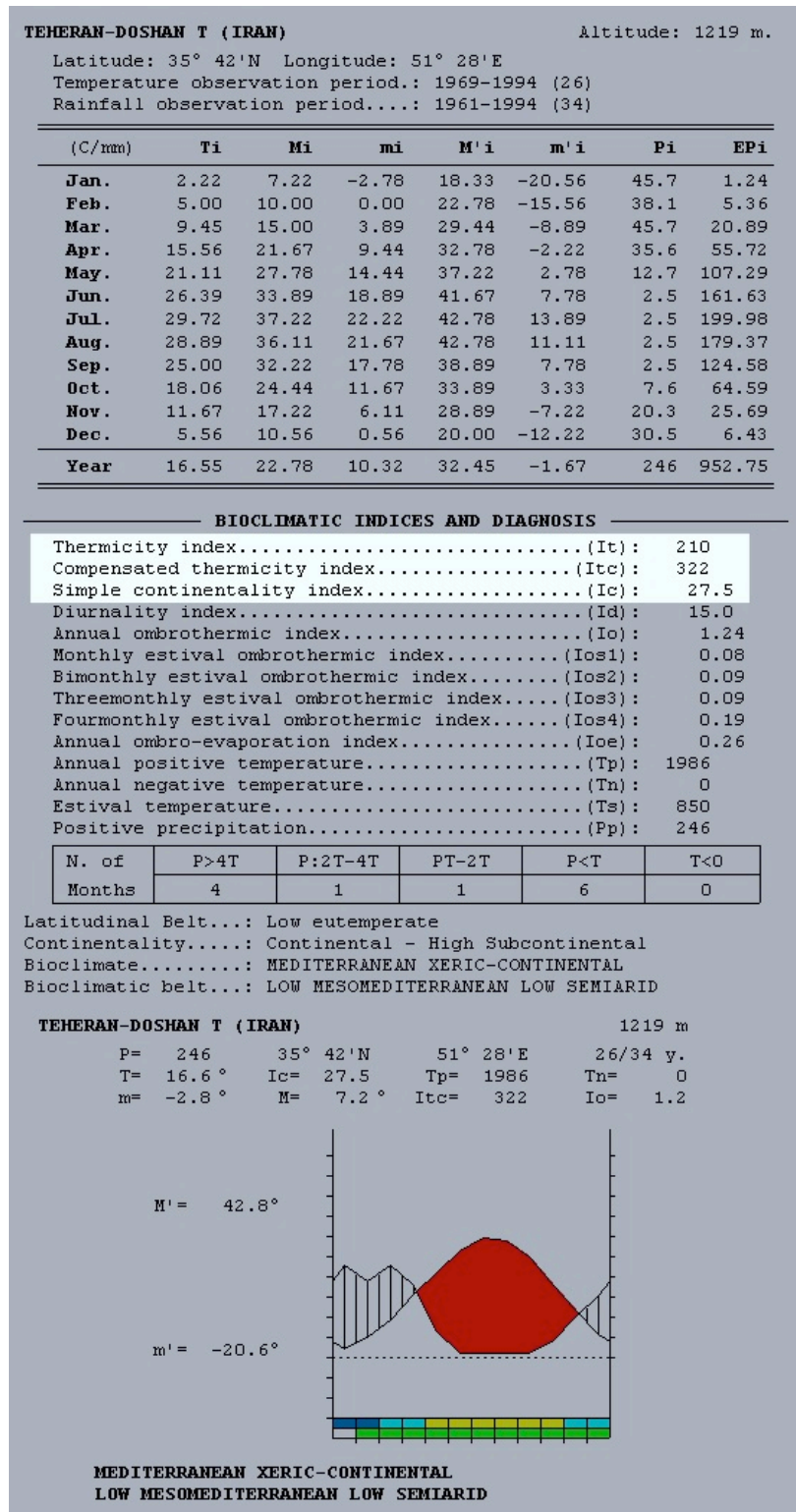
Bioclimatic Diagnosis: Polar Oceanic Bioclimate,
 Normal Variant

Figure 84



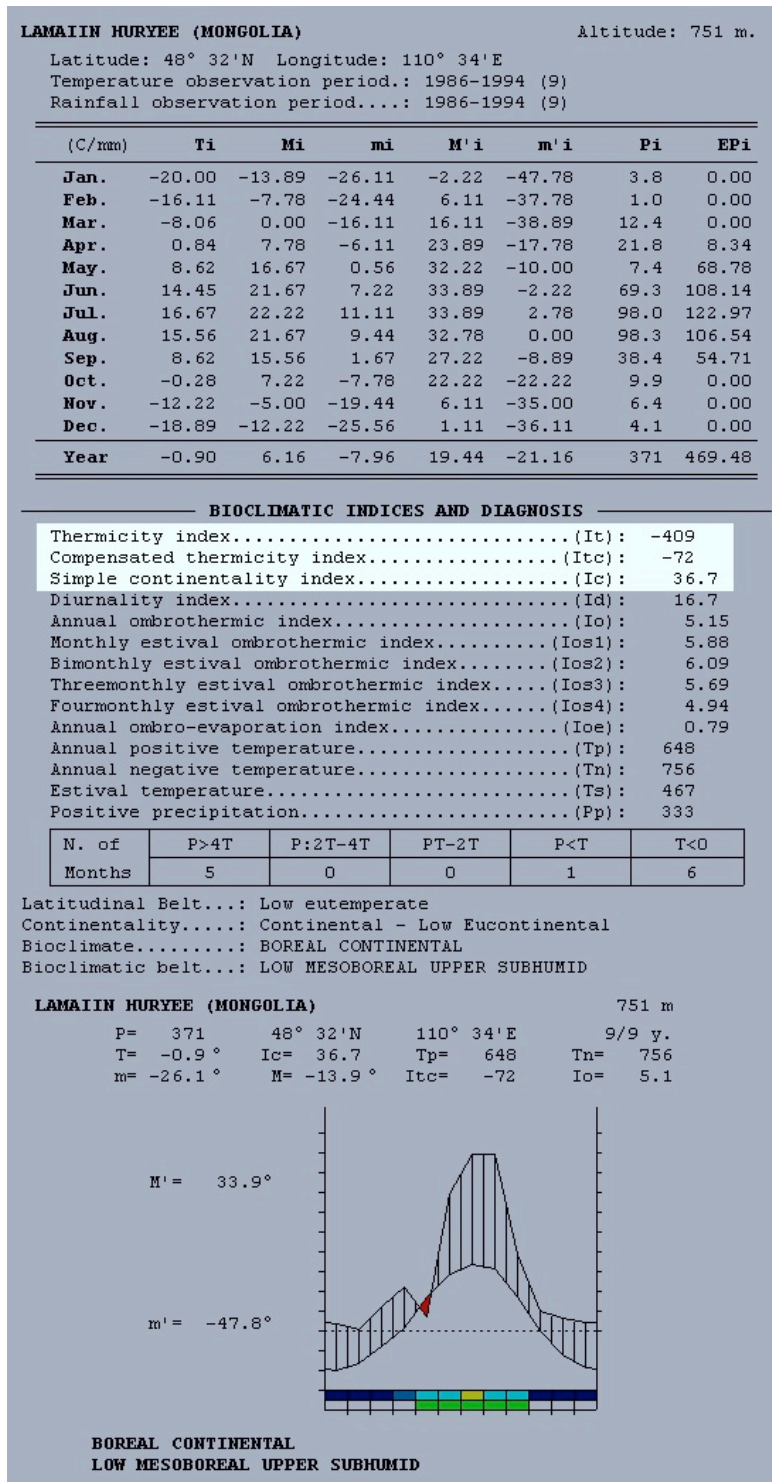
Bioclimatic Diagnosis: Temperate Oceanic Bioclimate,
 Normal Variant

Figure 85



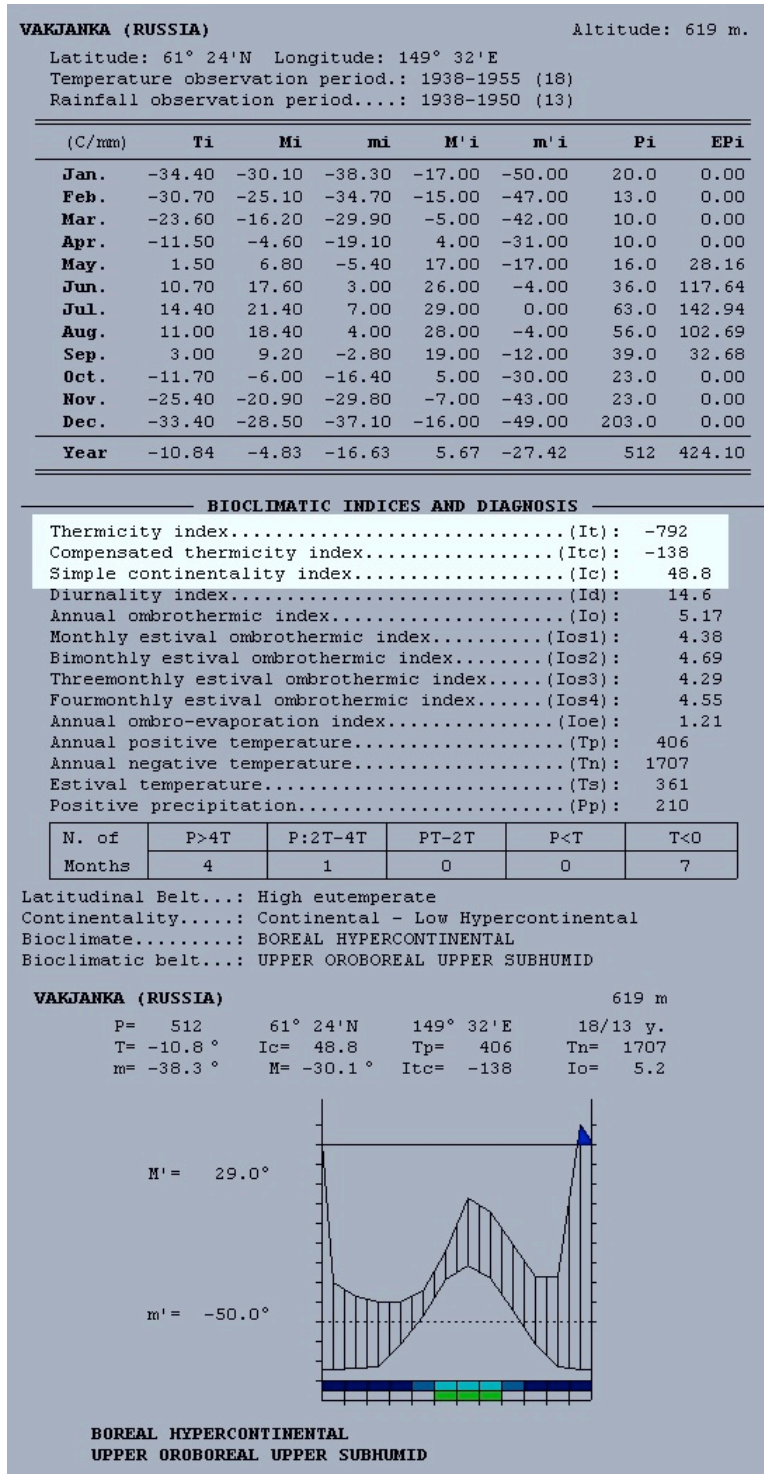
Bioclimatic Diagnosis: Mediterranean Xeric Continental Bioclimate, Normal Variant

Figure 86



Bioclimatic Diagnosis: Boreal Continental Bioclimate,
 Normal Variant

Figure 87



Bioclimatic Diagnosis: Boreal Hypercontinental Bioclimate, Normal Variant

11.- PRACTICAL EXAMPLE of a meteorological station complete bioclimatic characterization, with the use of the Synoptic Table.

In order to facilitate the bioclimatic characterization of a meteorological station, we will carry out, in detail, all the steps and calculations necessary for that study, taking as a model the station of DZHEZKAZGÁN, located in the center of Kazakstan. All the climatic data in this section are taken from Prof. Rivas-Martínez's website: <http://www.globalbioclimatics.org>. (2008), but the classification follows Rivas-Mart. & al., 2011.

We will do the practical example according to the following scheme:

11.1.- Climatic data of departure

11.2.- Bioclimatic diagnosis of a weather station

11.2.a.- Location of the weather station: Latitude, longitude and altitude

11.2.b.- Calculation of the necessary values and indexes.

Three THERMAL INDEXES:

Ic Continentality / Oceanicity Index

Tp Positive Annual Temperature

Itc Compensated Thermicity Index

One OMBRIC (Rainfall) INDEX

Pp Annual positive precipitation

Four OMBROTHERMIC INDEXES

Io Annual Ombrothermic Index, **Io = (Pp/Tp)10**.

Ios2 Ombrothermic Index of the hottest bimester of the summer trimester

Iosc3 (= Ios3), Compensable Ombrothermic Index of the summer trimester, necessary to evaluate the summer aridity

Iosc4 (= Ios4), Compensable Summer Ombrothermic Index for the four-month period resulting from adding, to the summer trimester, the month immediately preceding. This index is also used to assess summer aridity

11.2.c.- Recognition of the bioclimatic units of the station, using the General Synoptic Table.

MACROBIOCLIMATE

BIOCLIMATE AND BIOCLIMATIC VARIANT

. BIOCLIMATE

. BIOCLIMATIC VARIANT

BIOCLIMATIC BELT: Thermotype and Ombrotype

11.2.d.- Expression of the complete bioclimatic diagnosis -Isobioclimate-

11.3.- Synthesis and graphic expression of bioclimatic study: Bioclimograph

11.1.- Climatic data of departure

Figure 88 collects the information provided by a weather station, in this case, DZHEZKAZGAN, Kazakhstan. It contains: a) latitude, longitude and altitude geographic data; b), chronological data: temperatures and precipitation observation periods; And c), climatic data: for the considered periods, the average monthly values of **Ti** (monthly average temperature), **Mi** (average of the maximums of each month), **mi** (average of the minimum of each month), **M'i** (average monthly temperature of absolute maximums), **m'i** (average monthly temperature of the absolute minimums), and of **Pi** (mean of the monthly precipitations). Of all these data, those columns that we need for our study, and that we are going to use are: **Ti**, **Mi**, **mi**, and **Pi**.

Figure 88.- Necessary data for the bioclimatic study of a meteorological station: DZHEZKAZGAN

DZHEZKAZGAN, Kazakhstan						
Latitude: 47° 48'N Longitude: 067° 43'E Altitude: 345m						
Temperature observation period: 1968 -1994 (27)						
Rainfall observation period : 1984 -1994 (11)						
	Ti	Mi	mi	M'i	m'i	Pi
Jan	-16,1	-11,1	- 21,0	7,8	-50,0	14,5
Feb	-14,7	- 9,4	-20,0	10,0	-41,1	16,0
Mar	-7,2	-1,7	-12,8	25,0	-38,9	25,9
Apr	6,4	13,3	-0,6	28,9	-22,8	6,6
May	15,0	23,3	6,7	67,8	- 8,9	14,0
Jun	20,8	29,4	12,2	41,1	-1,1	22,6
Jul	23,1	31,7	14,4	42,8	3,9	19,8
Aug	20,8	29,4	12,2	41,1	0,0	8,1
Sep	13,9	22,8	5,0	37,2	-10,0	8,4
Oct	5,0	12,2	- 2,2	30,0	- 20,0	17,0
Nov	- 4,7	0,6	-10,0	18,9	- 38,9	9,7
Dec	-13,1	-7,8	-18,3	6,1	- 41,1	13,2
Year	---	---	---	---	---	---

Note: The data source can already give us the annual values, but if not, we ourselves calculate them: the annual temperature values are the arithmetic mean of the corresponding monthly mean values; with respect to annual rainfall, simply add up all the monthly values: Figure 89.

Figure 89.- Mean annual data of temperatures and average total rainfall calculated for the DZHEZKAZGAN Meteorological Station:

DZHEZKAZGAN, Kazakhstan						
Latitude: 47° 48'N Longitude: 067° 43'E Altitude: 345m						
Temperature observation period: 1968 -1994 (27)						
Rainfall observation period : 1984 -1994 (11)						
..	Ti	Mi	mi	M'i	m'i	Pi
Jan	-16,1	-11,1	- 21,0	7,8	-50,0	14,5
Feb	-14,7	- 9,4	-20,0	10,0	-41,1	16,0
Mar	-7,2	-1,7	-12,8	25,0	-38,9	25,9
Apr	6,4	13,3	-0,6	28,9	-22,8	6,6
May	15,0	23,3	6,7	67,8	- 8,9	14,0
Jun	20,8	29,4	12,2	41,1	-1,1	22,6
Jul	23,1	31,7	14,4	42,8	3,9	19,8
Aug	20,8	29,4	12,2	41,1	0,0	8,1
Sep	13,9	22,8	5,0	37,2	-10,0	8,4
Oct	5,0	12,2	- 2,2	30,0	- 20,0	17,0
Nov	- 4,7	0,6	-10,0	18,9	- 38,9	9,7
Dec	-13,1	-7,8	-18,3	6,1	- 41,1	13,2
Year	T = 4,1	---	---	---	---	P = 175,8

11.2.- Bioclimatic diagnosis of a weather station

From the climatic data emitted by the meteorological station, collected and synthesized in Figures 88 and 89, four are the necessary steps to perform the bioclimatic diagnosis of the locality: **a**, take into account the geographic location - latitude, longitude and altitude - of the weather station; **b**, calculation of the necessary values and indexes; **c**, recognition of the bioclimatic units of the station, with the help of the Synoptic General Table; and **d**, complete formulation of Isobioclimate.

11.2.a. - Location of the weather station: Latitude, longitude and altitude

When starting the bioclimatic study of a station / locality, since that geographical position conditions the monthly distribution of the seasons spring, summer, autumn and winter. The table, as it is usually written, always starts in January. If the station was located in the Southern Hemisphere, it is convenient to draw, in the data table, a

horizontal line of separation between May and June, because in that hemisphere the winter begins in June.

11.2.b.- Calculation of the necessary values and indexes.

For more ease, we are going to first compute three Thermal Indices, then one Index of rainfall, to end up with four Ombrothermal Indexes.

Three THERMAL INDEXES:

Continentalty / Oceanicity Index: Annual thermal amplitude - **Ic** - The Index expresses the difference, in degrees centigrade, between the highest and lowest monthly average temperatures of the year:

$$Ic = T_{max} - T_{min}$$

To calculate it at our station - Figure 90- we go to the Ti column, of average monthly temperatures, and we look for the months with the highest and lowest values, which are those of July and January.

Figure 90.- The data for the calculation of the Continental Index are marked

DZHEZKAZGAN, Kazakhstan						
Latitude: 47° 48'N, Longitude: 067° 43'E Altitude: 345m						
Temperature observation period: 1968 -1994 (27)						
Rainfall observation period: 1984 -1994 (11)						
	Ti	Mi	mi	M'i	m'i	Pi
Jan	-16,1	-11,1	- 21,0	7,8	-50,0	14,5
Feb	-14,7	- 9,4	-20,0	10,0	-41,1	16,0
Mar	-7,2	-1,7	-12,8	25,0	-38,9	25,9
Apr	6,4	13,3	-0,6	28,9	-22,8	6,6
May	15,0	23,3	6,7	67,8	- 8,9	14,0
Jun	20,8	29,4	12,2	41,1	-1,1	22,6
Jul	23,1	31,7	14,4	42,8	3,9	19,8
Aug	20,8	29,4	12,2	41,1	0,0	8,1
Sep	13,9	22,8	5,0	37,2	-10,0	8,4
Oct	5,0	12,2	- 2,2	30,0	- 20,0	17,0
Nov	- 4,7	0,6	-10,0	18,9	- 38,9	9,7
Dec	-13,1	-7,8	-18,3	6,1	- 41,1	13,2
Year	T = 4,1	---	---	---	---	P = 175,8

$$Ic = +23,1 - (-16,1) = 39,2$$

Positive Annual Temperature - T_p -: It is the sum, expressed in tenths of degree centigrade, of the average monthly temperatures of those months that exceed 0°C : $T_i > 0^\circ\text{C}$. $T_p = \sum T_i (T_i > 0) \times 10$, being i : 1 = January, ..., 12 = December.

Figure 91.- The data for the calculation of the Annual Positive Temperature in the station of DZHEZKAZGAN are marked

DZHEZKAZGAN, Kazakhstan						
Latitude: $47^\circ 48'\text{N}$, Longitude: $067^\circ 43'\text{E}$ Altitude: 345m						
Temperature observation period: 1968 -1994 (27)						
Rainfall observation period: 1984 -1994 (11)						
	T_i	M_i	m_i	$M'i$	$m'i$	P_i
Jan	-16,1	-11,1	- 21,0	7,8	-50,0	14,5
Feb	-14,7	- 9,4	-20,0	10,0	-41,1	16,0
Mar	-7,2	-1,7	-12,8	25,0	-38,9	25,9
Apr	6,4	13,3	-0,6	28,9	-22,8	6,6
May	15,0	23,3	6,7	67,8	- 8,9	14,0
Jun	20,8	29,4	12,2	41,1	-1,1	22,6
Jul	23,1	31,7	14,4	42,8	3,9	19,8
Aug	20,8	29,4	12,2	41,1	0,0	8,1
Sep	13,9	22,8	5,0	37,2	-10,0	8,4
Oct	5,0	12,2	- 2,2	30,0	- 20,0	17,0
Nov	- 4,7	0,6	-10,0	18,9	- 38,9	9,7
Dec	-13,1	-7,8	-18,3	6,1	- 41,1	13,2
Year	$T = 4,1$	---	---	---	---	$P = 175,8$

In our station - Figure 91- we have to add T_i from April to October inclusive and multiply the result by 10, to express it in tenths of a degree, so our

$$T_p = (6,4 + 15,0 + 20,8 + 23,1 + 20,8 + 13,9 + 5,0) 10 = 1050$$

Compensated Thermicity Index -Itc-

It is the sum, in tenths of a degree, of T (annual mean temperature), M (average temperature of the maximum of the coldest month, ie of the month with the lowest T_i)

and **m** (average temperature of the minimums of the coldest month, that is the month with the lowest **Ti**), plus a compensation value, **Ci**:

$$I_{tc} = (T + M + m)10 + C_i$$

The compensation value **Ci** must be applied to correct the excess of "temperance" or "cold" that occurs when the Continentality Index is extremely low (**Ic** ≤ 8), or high (**Ic** > 18), compared to cases where the **Ic** has mean values, between 8-18: thus, the values obtained with the **I_{tc}** are comparable.

Performing the calculations:

1st stage: Calculation of the first part of the formula: **(T + M + m) 10**. At our DZHEZKAZGAN station, the coldest month-the one with the lowest monthly average temperature-is January, Figure 92, so that

$$(T + M + m) 10 = [(+4,1) + (-11,1) + (-21)]10 = (-28,1 \times 10) = - 281$$

Figure 92.- The data for the calculation of the Index of Thermicity Compensated 2nd stage in the station of DZHEZKAZGAN are marked

DZHEZKAZGAN, Kazakhstan						
Latitude: 47° 48'N, Longitude: 067° 43'E Altitude: 345m						
Temperature observation period: 1968 -1994 (27)						
Rainfall observation period: 1984 -1994 (11)						
..	Ti	Mi	mi	M'i	m'i	Pi
Jan	-16,1	-11,1	- 21,0	7,8	-50,0	14,5
Feb	-14,7	- 9,4	-20,0	10,0	-41,1	16,0
Mar	-7,2	-1,7	-12,8	25,0	-38,9	25,9
Apr	6,4	13,3	-0,6	28,9	-22,8	6,6
May	15,0	23,3	6,7	67,8	- 8,9	14,0
Jun	20,8	29,4	12,2	41,1	-1,1	22,6
Jul	23,1	31,7	14,4	42,8	3,9	19,8
Aug	20,8	29,4	12,2	41,1	0,0	8,1
Sep	13,9	22,8	5,0	37,2	-10,0	8,4
Oct	5,0	12,2	- 2,2	30,0	- 20,0	17,0
Nov	- 4,7	0,6	-10,0	18,9	- 38,9	9,7
Dec	-13,1	-7,8	-18,3	6,1	- 41,1	13,2
Year	T = 4,1	---	---	---	---	P = 175,8

2nd stage: Ci calculation. As we saw in Chapter 10, Ci value is calculated according to the latitude and to the different thresholds of Continentality, established by Rivas-Martínez (see Figure 93). Latitude thresholds: up to 23° N and S, and greater than 23° N and S. Continentality thresholds: from 0 to 8, up to 17, up to 21, up to 28, up to 46 and up to 65. The last column gives the highest values of Ci that can be reached at each Continental threshold.

For our weather station of DZHEZKAZGAN, we have to take into account the Index of Continentality previously calculated: $I_c = 39.2$. That is why we have to apply the content of the threshold line $28 < I_c \leq 46$. (Figure 93), in which our $C_i = C_1 + C_2 + C_3$, being $C_1=20$; $C_2=105$; and $C_3=f_3 (I_c - 28) = 25(39,2-28) = 25 \times 11,2 = 280$. With it $C_i = C_1 + C_2 + C_3 = 15 + 105 + 280 = +405$. So:

$$C_i = +405$$

Figure 93. Calculation of compensation values Ci for obtaining the Compensated Thermicity Index - I_{tc}, according to the thresholds of Continentality of Rivas Martínez. The calculation of the Compensated Thermicity Index for the DZHEZKAZGAN station has been indicated.

Latitude	-I _c - Thresholds of Continen- tality	f _i	C _i	C _i Calculations	Valores Extremos de C _i
Up to 23° N and S	--- ---	---	C _i = 0	--- --- --- --- ---	C _i = 0
Higher than 23°N or 23°S	$I_c \leq 8$	$f_0 = (-10)$	$C_i = C_0$	$C_0 = f_0 (8 - I_c)$	$C_0 = - 80$
	$8 < I_c \leq 17$	$f_1 = 0$	$C_i = 0$	--- --- --- --- ---	$C_i = 0$
	$17 < I_c \leq 21$	$f_1 = 5$	$C_i = C_1$	$C_1 = f_1 (I_c - 17)$	$C_1 = + 20$
	$21 < I_c \leq 28$	$f_2 = 15$	$C_i = C_1 + C_2$	$C_1 = f_1 (21 - 17) = 20$; $C_2 = f_2 (I_c - 21)$	$C_2 = + 105$
	$28 < I_c \leq 46$	$f_3 = 25$	$C_i = C_1 + C_2 + C_3$	$C_1 = 20$; $C_2 = f_2 (28 - 21) = 105$; $C_3 = f_3 (I_c - 28)$	$C_3 = + 450$
	$46 < I_c \leq 65$	$f_4 = 30$	$C_i = C_1 + C_2 + C_3 + C_4$	$C_1 = 20$; $C_2 = 105$; $C_3 = f_3 (46 - 28) = 450$; $C_4 = f_4 (I_c - 46)$	$C_4 = +570$

3rd stage: Calculation of I_{tc}. Finally, we only need, in this third stage, to make the final calculation:

$$I_{tc} = (T + M + m)10 + C_i = -281 + 405 = 124$$

Note: I_{tc} can be calculated, even if the averages of the monthly maximums and minimums are not available, because $(M + m)$ is approximately $2T_{min}$ (T_{min} : Monthly average temperature of the coldest month of the year):

$$I_{tc} \approx (T + 2T_{min})10 + C_i = [4,1 + 2(-16,1)]10 + 405 = -281 + 405 = 124$$

One RAINFALL INDEX

Annual Positive Precipitation –Pp- is the sum of P_i of all months of the year, whose T_i is greater than 0°C . $P_p = \sum P_i (T_i > 0)$, being i : 1 = January, ..., 12 = December.

In our case - Figure 94 - we must add the monthly precipitations from April to October: $P_p = 97$. (rounding off 96.5).

$$P_p = 6,6 + 14,0 + 22,6 + 19,8 + 8,1 + 8,4 + 17,0 = 97$$

Figure 94.- The data for the calculation of the Positive Precipitation in the meteorological station of DZHEZKAZGAN are marked

DZHEZKAZGAN, Kazakhstan						
Latitude: 47° 48'N, Longitude: 067° 43'E Altitude: 345m						
Temperature observation period: 1968 -1994 (27)						
Rainfall observation period: 1984 -1994 (11)						
..	T_i	M_i	m_i	$M'i$	$m'i$	P_i
Jan	-16,1	-11,1	- 21,0	7,8	-50,0	14,5
Feb	-14,7	- 9,4	-20,0	10,0	-41,1	16,0
Mar	-7,2	-1,7	-12,8	25,0	-38,9	25,9
Apr	6,4	13,3	-0,6	28,9	-22,8	6,6
May	15,0	23,3	6,7	67,8	- 8,9	14,0
Jun	20,8	29,4	12,2	41,1	-1,1	22,6
Jul	23,1	31,7	14,4	42,8	3,9	19,8
Aug	20,8	29,4	12,2	41,1	0,0	8,1
Sep	13,9	22,8	5,0	37,2	-10,0	8,4
Oct	5,0	12,2	- 2,2	30,0	- 20,0	17,0
Nov	- 4,7	0,6	-10,0	18,9	- 38,9	9,7
Dec	-13,1	-7,8	-18,3	6,1	- 41,1	13,2
Year	$T = 4,1$	---	---	---	---	$P = 175,8$

Four OMBROTHERMIC INDEXES

Their values are ten times the quotient between Positive Precipitation and Positive Temperature of the considered period, $I_o = (P_p / T_p) \cdot 10$. In addition to the I_o , Annual Ombrothermic Index, it is necessary to calculate the Ombrothermic Indexes for the summer period - Jun-Jul-Aug, in the Northern Hemisphere; Dec-Jan-Feb, in the Southern Hemisphere:

I_o Annual Ombrothermic Index

I_{os2} Ombrothermic Index of the hottest bimester of the summer trimester (Tr3)

I_{osc3} (= I_{os3}) Compensable Ombrothermic Index of the summer trimester (Tr3)

I_{osc4} (= I_{os4}) Compensable Summer Ombrothermic Index for the four-month period resulting from adding, to the summer trimester (Tr3), the month immediately preceding.

We calculate each of them: Figure 95.

Figure 95.- The data for the calculation of the Summer Ombrothermic Indexes are marked in the meteorological station of DZHEZKAZGAN.

DZHEZKAZGAN, Kazakhstan						
Latitude: 47° 48'N, Longitude: 067° 43'E Altitude: 345m						
Temperature observation period: 1968 -1994 (27)						
Rainfall observation period: 1984 -1994 (11)						
..	T_i	M_i	m_i	$M'i$	$m'i$	P_i
Jan	-16,1	-11,1	- 21,0	7,8	-50,0	14,5
Feb	-14,7	- 9,4	-20,0	10,0	-41,1	16,0
Mar	-7,2	-1,7	-12,8	25,0	-38,9	25,9
Apr	6,4	13,3	-0,6	28,9	-22,8	6,6
May	15,0	23,3	6,7	67,8	- 8,9	14,0
Jun	20,8	29,4	12,2	41,1	-1,1	22,6
Jul	23,1	31,7	14,4	42,8	3,9	19,8
Aug	20,8	29,4	12,2	41,1	0,0	8,1
Sep	13,9	22,8	5,0	37,2	-10,0	8,4
Oct	5,0	12,2	- 2,2	30,0	- 20,0	17,0
Nov	- 4,7	0,6	-10,0	18,9	- 38,9	9,7
Dec	-13,1	-7,8	-18,3	6,1	- 41,1	13,2
Year	T = 4,1	---	---	---	---	P = 175,8

Annual Ombrothermic Index, $I_o = (P_p/T_p)10$.

With the values of P_p and T_p , calculated above, $P_p = 97$; $T_p = 1050$:

$$I_o = (P_p/T_p)10 = (97 / 1050)10 = \mathbf{0,92}$$

Ombrothermic Index of the hottest bimester of the summer trimester (Tr_3):

$I_{os2} = (P_{p2}/T_{p2}) 10$

As $P_{p2} = 19,8+8,1=27,9$; and $T_{p2} = (23,1+20,8) \times 10 = 439$:

$$I_{os2} = (P_{p2}/T_{p2}) 10 = (27,9 / 439)10 = \mathbf{0,64}$$

Compensable Ombrothermic Index of the summer trimester (Tr_3): $I_{osc3} = (P_{p3}/T_{p3}) 10$:

As $P_{p3} = 19,8+8,1+22,6=50,5$; and $T_{p3} = (20,8+23,1+20,8) \times 10 = 647$:

$$I_{osc3} = (50,5 / 647) 10 = \mathbf{0,78}$$

Compensable Summer Ombrothermic Index for the four-month period resulting from adding, to the summer trimester (Tr_3), the month immediately preceding.

$I_{osc4} = (P_{p4}/T_{p4}) 10$:

As $P_{p4}=19,8+8,1+22,6+14=64,5$; and $T_{p4}= (20,8+23,1+20,8+15) \times 10 = 797$:

$$I_{osc4} = (64,5 / 797) 10 = \mathbf{0,81}$$

11.2.c.- Recognition of the bioclimatic units of the station, using the General Synoptic Table.

Once the latitude, longitude and height data are recognized, and the calculations of the indices of our DZHEZKAZGAN station are carried out, we will identify its Bioclimatology having in view the General Synoptic Table of the Bioclimatic Classification of the Earth (figure 7). We have to find out what Macrobioclimate, what Bioclimate and Bioclimatic Variant, and what Bioclimatic Belt correspond to it, to finally define the Isobioclimate of DZHEZKAZGAN.

MACROBIOCLIMATE

In the Macrobioclimates column of the Synoptic General Table, the first thing we encounter is the call: **(1)**. And is that to identify the Macrobioclimate, in addition to latitude, thermal thresholds **T**, **M**, **m**, **Itc** and **Tp** are used, all of them highly conditioned by the altitude of the meteorological station. As the Synoptic Table gives the thresholds of those indices referred to 200m, if our station exceeds that altitude, we must add a certain amount for every 100m that exceeds 200m. The amount to be added to each index is indicated in the call **(1)** of the Synoptic Table, column of Macrobioclimates, column shown in figure 96.

Figure 96. Recognition of the Macrobioclimate at the DZHEZKAZGAN station. First column of the Synoptic Table

M a c r o b i o c l i m a t e s⁽¹⁾
Name, Acronym and Differential Characters
<p>Tropical Tr</p> <p>Warm zone: equatorial, eutropical and subtropical (0°-35° N & S). In subtropical (23° - 35° N & S) at < 200 m, at least two values: $T \geq 25^\circ$, $m \geq 10^\circ$, $I_{tc} \geq 580$; or, if $P_{ss} > P_{sw}$, or $P_{cm_2} < P_{cm_1} > P_{cm_3}$, at least two values: $T \geq 21^\circ$, $M \geq 18^\circ$, $I_{tc} \geq 470$. In Eurasia, from 25° to 35° N, height $\geq 2000m$: it is not tropical.</p>
<p>Mediterranean Me</p> <p>Subtropical warm zone (23°-35° N & S) and eutemperate temperate zone (35°-52° N & S), with summer aridity at least bimonthly after the summer solstice: $I_{os2} \leq 2$, $I_{osc4} \leq 2$. In Subtropical, at least two of the three thermal values: $T < 25^\circ$, $m < 10^\circ$, $I_{tc} < 580$.</p>
<p>Temperate Te</p> <p>Subtropical warm zone (23°-35° N & S) and temperate zone (35°-66° N & 35°-54° S). Without summer aridity: $I_{os2} > 2$, $I_{osc4} > 2$. A <200 m, $T_p \geq 380$. Besides: a), 23°-35° N & S, at <200m, at least two values: $T < 21^\circ$, $M < 18^\circ$, $I_{tc} < 470$; or b), In contrast to Boreal, at <200m: if $I_c \leq 11$: $T > 6^\circ$, $T_{max} > 10^\circ$ and $T_{ps} > 320$; if $11 < I_c \leq 21$: $T_p > 720$ and $T > 5.3^\circ$; if $21 < I_c \leq 28$: $T_p > 740$ and $T > 4.8^\circ$; if $28 < I_c \leq 46$: $T_p > 800$ and $T > 3.8^\circ$; and if $46 < I_c$: $T_p > 800$ and $T > 0^\circ$.</p>
<p>Boreal Bo</p> <p>Temperate and cold zones (42°-72° N, 49°-56° S). Without summer aridity: $I_{os2} > 2$, $I_{osc4} > 2$. A <200 m, $T_p \geq 380$. If $I_c \leq 11$: $T \leq 6^\circ$, $T_{max} \leq 10^\circ$, $380 \leq T_p \leq 720$ and $T_{ps} \leq 320$; if $11 < I_c \leq 21$: $380 \leq T_p \leq 720$ and $T \leq 5.3^\circ$; if $21 < I_c \leq 28$: $380 \leq T_p \leq 740$ and $T \leq 4.8^\circ$; if $28 < I_c \leq 46$: $380 \leq T_p \leq 800$ and $T \leq 3.8$; and if $46 < I_c$: $380 \leq T_p \leq 800$ and $T \leq 0^\circ$.</p>

Polar Po

Temperate and cold zones (51°-90° N & S). Altitude < 100m: $T_p < 380$.

(Rivas-Mart. et al., 2011)

(Modificado M.L. López y M.S. López, 26 diciembre 2016)

(1) Between 23° - 48° N and 23° - 51° S, if the locality is to 200 m, or more, of altitude, the thermal values must theoretically be calculated at such a height increasing T by 0.6°; M and m, by 0.5 °; and Itc by 13 units, per every 100 m that exceeds that altitude. At more than 48 ° N or 51 ° S, it is necessary to calculate the theoretical values of the average annual temperature, the average of the maximums of the coldest month, and the annual positive temperature, increasing T by 0.4 °, M by 0.5 ° and T_p by 12 units, for every 100 m exceeding said altitude.

DZHEZKAZGAN is located at 345m s.n.m., so that exceeds in 145m the 200m of reference. In Figure 97, the real values of de **T**, **M**, **Itc** and **Tp** are collected, as well as the theoretical values that result from theoretically positioning the station at 200m.

Figure 97.- Calculation of the theoretical values of the station of DZHEZKAZGAN, at 200m.

Increase per every 100m	DZHEZKAZGAN, at 345m	DZHEZKAZGAN, at 200m
$T + 0,6^\circ/100m$	$T = 4,1$	$T + 0,6^\circ = 4,7$
$M + 0,5^\circ/100m$	$M = -11,1$	$M + 0,5^\circ = -10,6$
$I_{tc} + 13/100m$	$I_{tc} = 119$	$I_{tc} + 13 = 132$
$T_p + 55/100m$	1050	$T_p + 55 = 1105$

Once we have met the call (1), we can begin to analyze the Macrobioclimate of our meteostation. We look at the Macrobioclimates column of Figure 96: The first character mentioned is latitude. Latitude of Dzhezkazgán, 47°48'N. We have shaded the latitudes

of the three possible Macrobioclimates, which could fit Dzhezkazgan: Mediterranean, Temperate and Boreal.

To distinguish now between these three Macrobioclimates, we analyze the following character: summer aridity, that is, if **Ios2** is less than or equal to 2, or greater than 2. As our **Ios2** = 0.64, it seems that our meteostation is Mediterranean: but before giving it as definitive, we have to check for a possible compensation by the moisture retained in the soil, due to rainfall in the month, or in the previous two months, by using the values of **Iosc3**, **Iosc4**.

To analyze the possible compensation, we look at figure 72. It is clear that, in order to assess the possible compensation of the summer aridity of an **Ios2** ≤ 2, the annual **Io** must be equal to or greater than 2. In our case of DZHEZKAZGAN, its **Io** = 0.92, less than 2, does not even allow us to start the query of possible compensation, so our station has, definitely, summer aridity and is, therefore, Mediterranean.

From the Macrobioclimates column, figure 96, it follows that, of the three possible Macrobioclimates by latitude, only the Mediterranean Macrobioclimate has summer aridity, which leads us to conclude that:

Dzhezkazgán has a Mediterranean Macrobioclimate

BIOCLIMATE AND BIOCLIMATIC VARIANT

Once we know the Macrobioclimate of our station as Mediterranean, we proceed as follows for the identification of the Bioclimate / Bioclimatic Variant:

Figure 98. Differential characteristics of the Mediterranean Bioclimates, according to the Bioclimatic Synopsis of the Earth.

Mediterranean Bioclimates	Bioclimatic intervals		Acronyms
	Io	Ic	
Me. Pluviseasonal Oceanic	$2.0 \leq I_o$	≤ 21	Mepo
Me. Pluviseasonal Continental	$2.0 \leq I_o$	> 21	Mepc
Me. Xeric Oceanic	$1.0 \leq I_o < 2.0$	≤ 21	Mexo
Me. Xeric Continental	$1.0 \leq I_o < 2.0$	> 21	Mexc
Me. Desertic Oceanic	$0.2 \leq I_o < 1.0$	≤ 21	Medo
Me. Desertic Continental	$0.2 \leq I_o < 1.0$	> 21	Medc
Me. Hyperdesertic Oceanic	$I_o < 0.2$	≤ 21	Meho
Me. Hyperdesertic Continental	$I_o < 0.2$	> 21	Mehc

For the **BIOCLIMATE**, we go to the second column-second row of the General Synopsis (Figure 7), which is reproduced in Figure 98. Analyzing the bioclimatic intervals that define each of the Mediterranean Bioclimates, we see that the Ombrothermal Index of our station, $I_o = 0.92$, is in between 0.2 and 1.0, making it a Mediterranean Desertic Bioclimate. As there are two Bioclimates with that denomination, we now look at the Station's Continentality Index, which is $I_c = 39.2$, continental. So that:

Dzhezkazgan has a Mediterranean Desertic Continental Bioclimate

Regarding the **BIOCLIMATIC VARIANT**, in the General Synoptic Table, (figure 7), we found that, in that Bioclimate, only two variants - Steppe and Normal-, have been observed. We now check if our meteostation meets the requirements of the Steppic Variant, because otherwise, it would be the Normal Variant.

Figure 99.- The data to be used for analyzing the possible existence of a Steppic Variant in DZHEZKAZGAN, are selected.

DZHEZKAZGAN, Kazakhstan						
Latitude: 47° 48'N, Longitude: 067° 43'E Altitude: 345m						
Temperature observation period: 1968 -1994 (27)						
Rainfall observation period: 1984 -1994 (11)						
..	Ti	Mi	mi	M'i	m'i	Pi
Jan	-16,1	-11,1	- 21,0	7,8	-50,0	14,5
Feb	-14,7	- 9,4	-20,0	10,0	-41,1	16,0
Mar	-7,2	-1,7	-12,8	25,0	-38,9	25,9
Apr	6,4	13,3	-0,6	28,9	-22,8	6,6
May	15,0	23,3	6,7	67,8	- 8,9	14,0
Jun	20,8	29,4	12,2	41,1	-1,1	22,6
Jul	23,1	31,7	14,4	42,8	3,9	19,8
Aug	20,8	29,4	12,2	41,1	0,0	8,1
Sep	13,9	22,8	5,0	37,2	-10,0	8,4
Oct	5,0	12,2	- 2,2	30,0	- 20,0	17,0
Nov	- 4,7	0,6	-10,0	18,9	- 38,9	9,7
Dec	-13,1	-7,8	-18,3	6,1	- 41,1	13,2
Year	T = 4,1	---	---	---	---	P =175,8

The Steppic Variant implies: 1, a medium or high Continentaity: $Ic > 17$; 2, an Ombrothermal Index between the lower hyperarid and the upper sub-humid: $6.0 \geq Io > 0.2$; 3, at least one summer month with the precipitation, in mm, less than three times its temperature, in degrees centigrade: $Psi < 3Ti$; -, and 4, the summer trimester positive precipitation needs to be higher than the winter trimester positive precipitation: $Pps > Ppw$.

According to the results of our previous calculations, in Dzhezkazgan: $Ic = 39.2$; and $Io = 0.92$: we see that it fulfills those two conditions. For the relation of the precipitation of each summer month with its corresponding temperature, we take the data selected in figure 99, and analyze them in figure 100.

Figure 100.- Calculations to check if the $Psi < 3Ti$ relation is fulfilled in the DZHEZKAZGAN station.

Mes	Psi	Ti	Ti x 3	Relation Psi - 3Ti
Jun	22,6	20,8	62,4	$22,6 < 62,4$
Jul	19,8	23,1	69.3	$19,8 < 69.3$
Aug	8,1	20,8	62.4	$8,1 < 62.4$

We find that not only one, but all the summer months have $Psi < 3Ti$. That is, the station fulfills the third condition. Let us see that the fourth condition is also fulfilled, that $PpS > PpW$. To check this fourth condition, we also take the data from Figure 98, and analyze them in Figure 99, where we see how $PpS > PpW$: see figure 101.

Figure 101.- Calculations to check the relation $PpS > PpW$, in the station of DZHEZKAZGAN

Summer Trimester Positive Precipitation, Pps		Winter Trimester Positive Precipitation, Ppw		Relation Pps: Ppw
Jun	22,6	Dec	0,0	
Jul	19,8	Jan	0,0	
Aug	8,1	Feb.	0,0	
Total	50,5	Total	0,0	Pps > Ppw

As our station fulfills the four conditions of the Steppic Variant, we can state that Dzhezkazgán has the following Bioclimate and Variant:

Mediterranean Desertic Continental, Steppic Variant

BIOCLIMATIC BELT -Thermotype and Ombrotype-

Bioclimatic Belts are each one of the environments that follow each other in a latitudinal, longitudinal or altitudinal cliserie. Each Bioclimatic Belt corresponds to certain formations and plant communities: a vegetation belt. Each one of those environments delimits values intervals of **I_{tc}**, **T_p** -Termotypes-, and of **I_o** -Ombrotypes-

To determine the Bioclimatic belt we have to go to the General Synopsis (figure 7) and observe the columns corresponding to Bioclimatic Belts of the row Mediterranean Macrobioclimate, columns that we have copied in Figures 102 and 103. In Termotypes there is a call, clarified in the last lines of the table, which warns us that, if the Continentality is high, **I_c ≥ 21**, or if the Compensated Thermicity Index is low, **I_{tc} < 120**, the Thermotype is evaluated as a function of **T_p**.

Recall that **Dzhezkazgán** has **I_c = 39.2**, **I_{tc} = 119**, **T_p = 1050** and **I_o = 0.92**. As our **I_c** is high and, in addition, our **I_{tc}** is low, we turn to the value of **T_p = 1050**, between 900 and 1500, so our Thermotype is **Supramediterranean**. As for the Ombrotype, our **I_o = 0.92** falls into the range 0.4 - 1.0, that is, the meteostation is **Arid**.

Thus, the Bioclimatic Belt corresponding to Dzhezkazgán is:

Supramediterranean Arid

Figure 102.- Bioclimatic Belts -Termotypes- of the Mediterranean Macrobioclimate, extracted from the General Synopsis.

Bioclimatic Belt	Thermotype (2)		Acronym
	I _{tc}	T _p (2)	
1 Inframediterranean	450 < I _{tc} ≤ 580	2400 < T _p	I _{me}
2 Termomediterranean	350 < I _{tc} ≤ 450	2100 < T _p ≤ 2400	T _{me}
3 Mesomediterranean	220 < I _{tc} ≤ 350	1500 < T _p ≤ 2100	M _{me}
4 Supramediterranean	I _{tc} ≤ 220	900 < T _p ≤ 1500	S _{me}
5 Oromediterranean	.	450 < T _p ≤ 900	O _{me}
6 Crioromediterranean	..	0 < T _p ≤ 450	C _{me}
7 Gelid-mediterranean	.	T _p = 0	G _{me}

(2) When **I_c ≥ 21** (Continental) or when the values of **I_{tc} < 120**, the Thermotype is calculated as a function of **T_p**, and the theoretical values of **T_p** at 200 are calculated by increasing 55 units per each 100m that exceeds said altitude.

Figure 103.- Bioclimatic Belts -Ombrotypes- of the Mediterranean Macrobioclimate, extracted from the General Synopsis

Bioclimatic Belt	Ombrotype I_o	Acronym
1 Ultrahyperarid	$I_o < 0.2$	Uha
2 Hyperarid	$0.2 \leq I_o < 0.4$	Har
3 Arid	$0.4 \leq I_o < 1.0$	Ari
4 Semiarid	$1.0 \leq I_o < 2.0$	Sar
5 Dry	$2.0 \leq I_o < 3.6$	Dry
6 Subhumid	$3.6 \leq I_o < 6.0$	Shu
7 Humid	$6.0 \leq I_o < 12.0$	Hum
8 Hyperhumid	$12.0 \leq I_o < 24.0$	Hhu
9 Ultrahyperhumid	$24.0 \leq I_o$	Uhh

If we wanted to express the Bioclimatic Belt as Thermotypic and Ombrotypic Bioclimatic Horizons, we would look at whether the values of T_p and I_o are in the lower half, or in the upper half, of the thermal and ombric intervals of the Bioclimatic Belt.

In our meteostation of Dzhezkazgan, the Bioclimatic Horizons are:

Upper Supra-Mediterranean, Upper Arid

11.2.d.- Expression of the complete bioclimatic diagnosis -Isobioclimate-.

The Isobioclimate, the basic unit of "Global Bioclimatics", expresses all the climatic factors that operate in an area, and factors that explain the presence in such area of a certain type of life. To name each Isobioclimate is used a phrase that includes: Bioclimate / Bioclimatic Variant, together with a Bioclimatic Belt - Thermotype + Ombrotype-.

With all the known data we can, therefore, express the **Isobioclimate** of our station of **Dzhezkazgán**, like this:

**Mediterranean Desertic Continental, Steppic Variant,
Supramediterranean, Arid**

In addition to words, the Isobioclimate can also be expressed by acronyms, recorded in the General Synoptic Table:

Medc Stp Sme Ari

If more detail is needed, for a finer approximation to the distribution of vegetation, We have discussed above that the Bioclimatic Belt can be expressed as Bioclimatic Horizons, the upper half or the lower half of the Thermotype and the Ombrotype. It is how Rivas-Martínez names the Isobioclimate in his web, and as it also appears named in Rivas-Mart. et al. 2011:

**Mediterranean Desertic Continental, Steppic Variant, Upper
Supramediterranean, Upper Arid,**

which, if we express it in acronyms, results:

Medc *Stp* USme Uari

11.3.- Synthesis and graphic expression of bioclimatic study: Bioclimograph

Everything done in this practical example for the bioclimatic characterization of a meteorological station appears in figure 104 (page 140), which is how the climatic stations studied in the web "globalbioclimatics.org", of Rivas-Mart. & Rivas-Sáenz (1996-2017), appear.

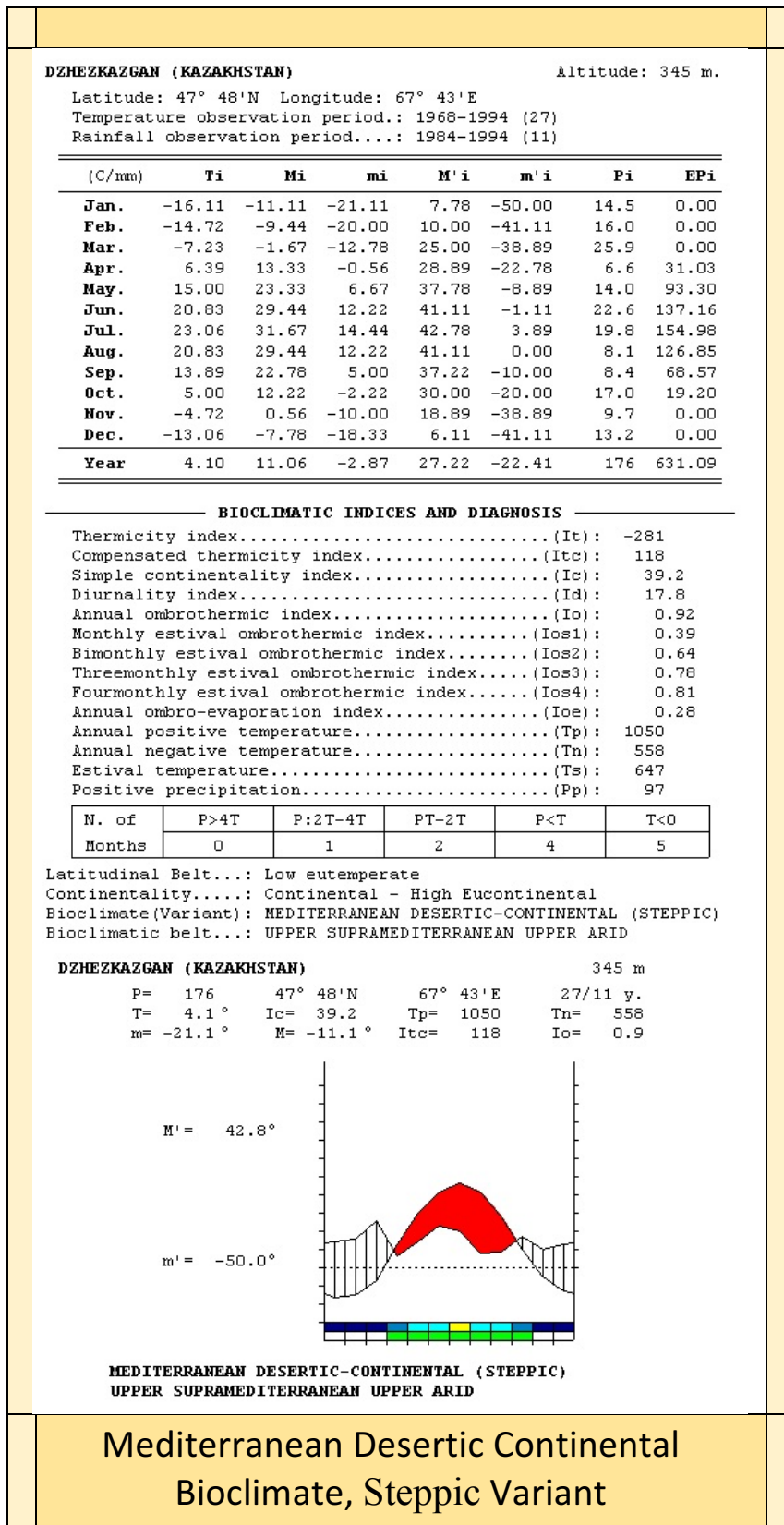
Figure 104 has three parts: The first one contains the climatic data emitted by the station in question, as well as its name, its geographic location and its periods of observation. The second part shows the results of the necessary calculations to know the Bioclimatic Indexes, as well as the resulting Bioclimatic Diagnosis. And in the third part, the graphical representation of the Isobioclimate is given, that is to say, its Bioclimogram (Ombro-Thermoclimograph or Ombro-Thermoclimogram).

12.- BIOCLIMATIC CARTOGRAPHY

Knowing the bioclimatic diagnosis of the meteorological stations of a continent, a region, or a nation, etc., It is possible to draw the boundaries of their Macrobioclimates, their Bioclimates, their Bioclimatic Variants, their Continentality, their Thermotypes, their Ombrotypes and their Isobioclimates, on the map, by interpolating the values of its Parameters and corresponding Indexes, from the data of the available meteorological stations, and taking into account prevailing winds and geographical features such as topography and orientation, which influence the climate in the study area (López, López & Piñas, 2009).

In order to illustrate the possibilities of Bioclimatic Cartography, carried out with the results of applying the "Worldwide Bioclimatic Classification System", by Rivas-Mart. & Rivas-Sáenz (1996-2017), to our climate data, next we reproduce some maps realized by the authors, in collaboration with other investigators, always based on our own climatic and bioclimatic data, or provided by Prof. Rivas-Martínez (contained in his worldwide climatic and bioclimatic database).

Figure 104.- Bioclimatic study of Dzhezkazgán



In 2000 we worked on the Macrobioclimates - Bioclimates and the Termotypes maps of Australia, together with Rivas-Martínez and P. Cantó, maps published by the University of León Cartographic Service (Rivas-Mart., López & Cantó, 2000a and b) (Figures 105-106).

Figure 105.- Macrobioclimates and Bioclimates Maps of Australia. [\(Link to its quality file\).](#)

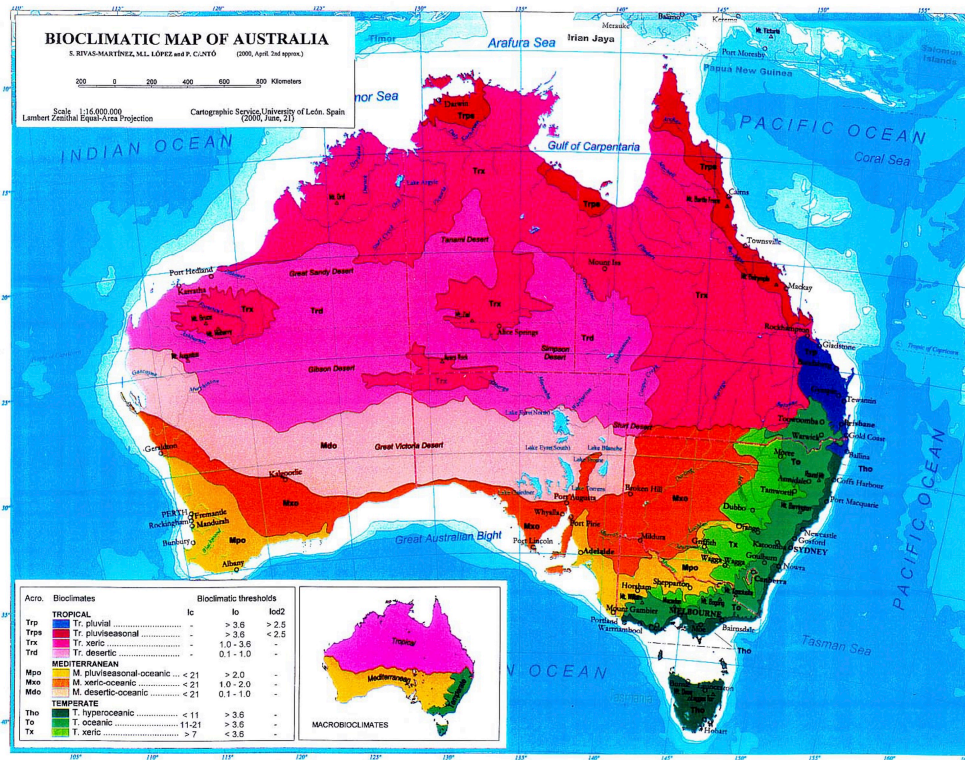
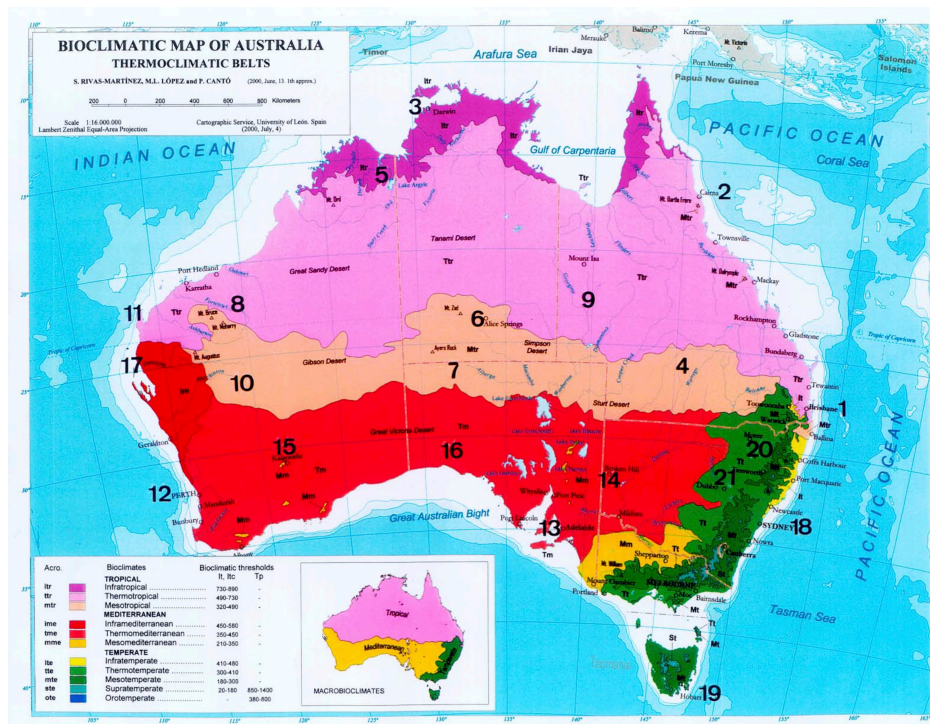


Figure 106. Thermotypes Map of Australia. [\(Link to its quality file\).](#)



In 2002, Rivas-Martínez, Ogar, Raskovskaja, López Fernández, Marinish, López, Amezketa and Gelidief presented to Congress "Itogi i perspektivi rasvitiia botanicheskoi nauki v Kazajstane. Alma-Ata, "the Bioclimates Map of Kazakhstan (Figure 107). Also from Kazakhstan, Rivas-Mart., López, Amezqueta and López made a Continentality Map (Figure 108), which López Fernández & López Fernández are about to publish (Documentos Aljibe "on line", in press).

Figure 107.- Bioclimatic Map of Kazakhstan. [\(Link to its quality file\).](#)

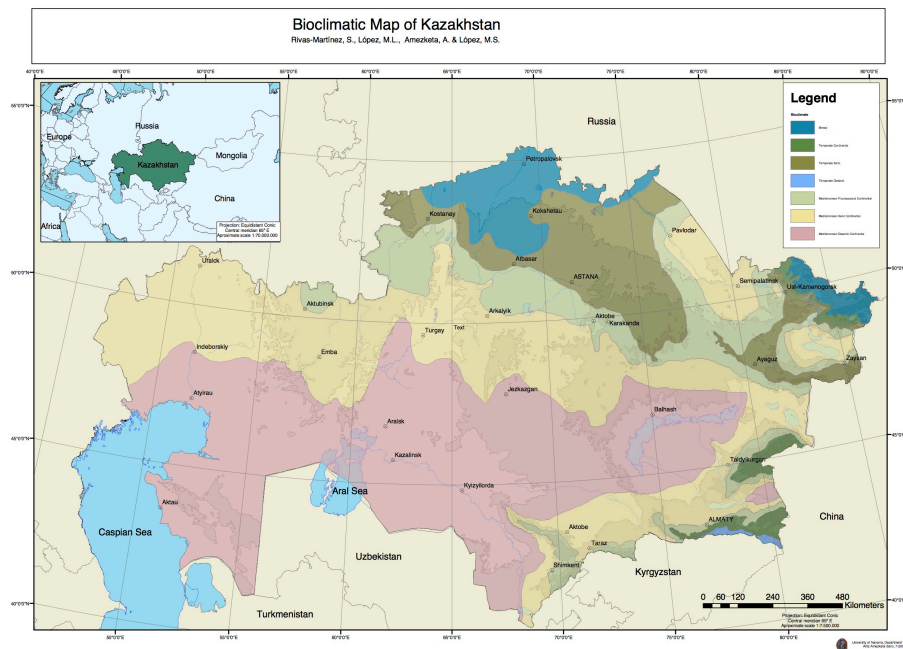
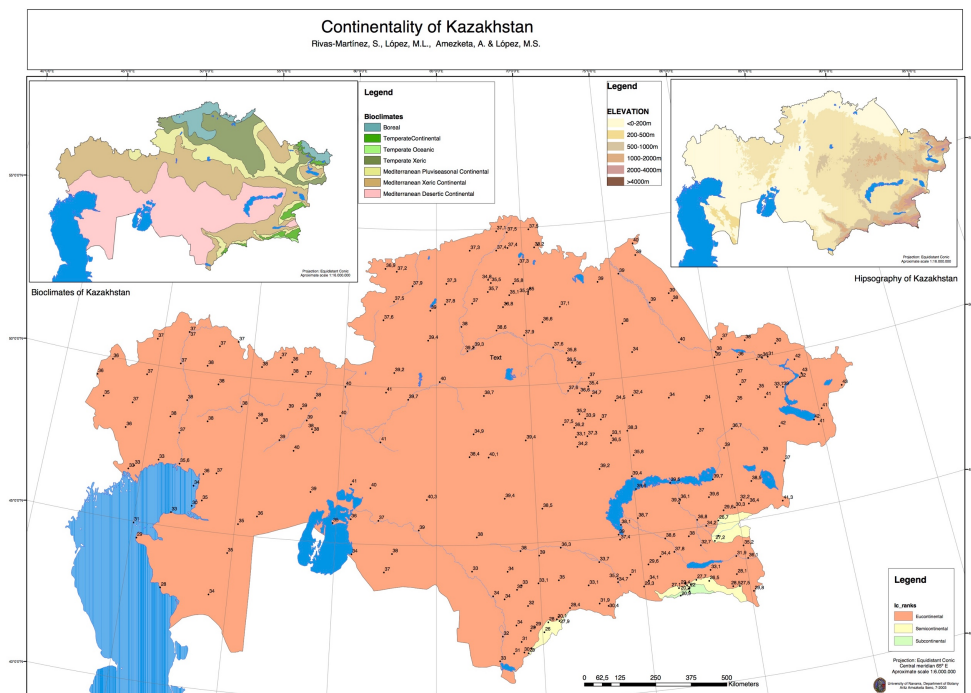


Figure 108. Continentality Map of Kazakhstan. Most of the country is Eucontinental, while the levels of Semicontinental and Subcontinental only appear in the southeastern mountainous border of the country. [\(Link to its quality file\).](#)



In 2003, Rivas-Martínez, López Fernández, Amezketa, López, Aquerreta and Piñas, produced Macrobioclimates and Continentality maps of the Far East Russian, maps presented at the conference "Phytogeography of Northeast Asia: task for the 21st century", held in Vladivostok (Russia). (Figures 109-110). Rivas-Mart., López & al., 2003 a y b).

Figure 109.- Far East Russian Macrobioclimates Map. [\(Link to its quality file\).](#)

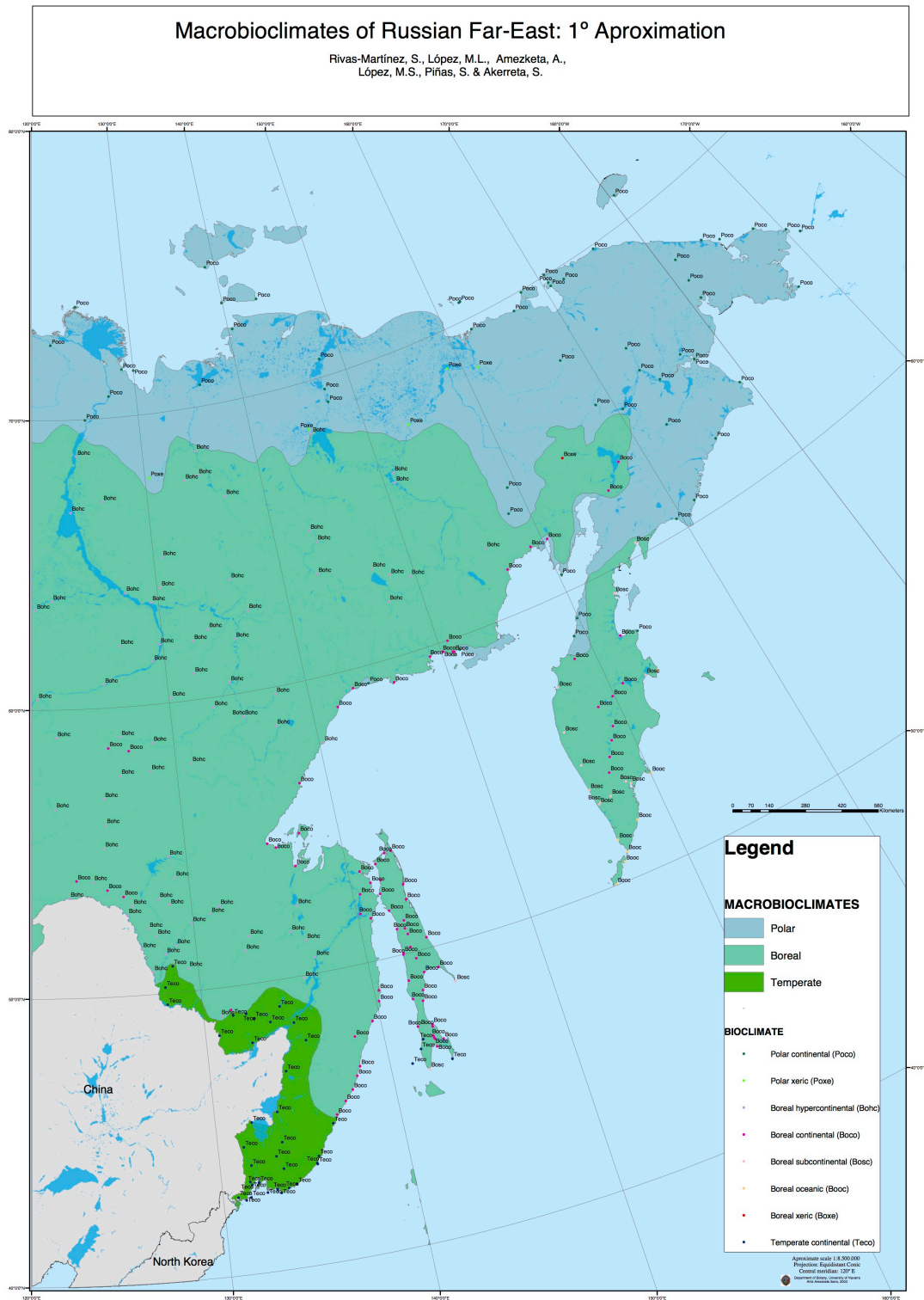
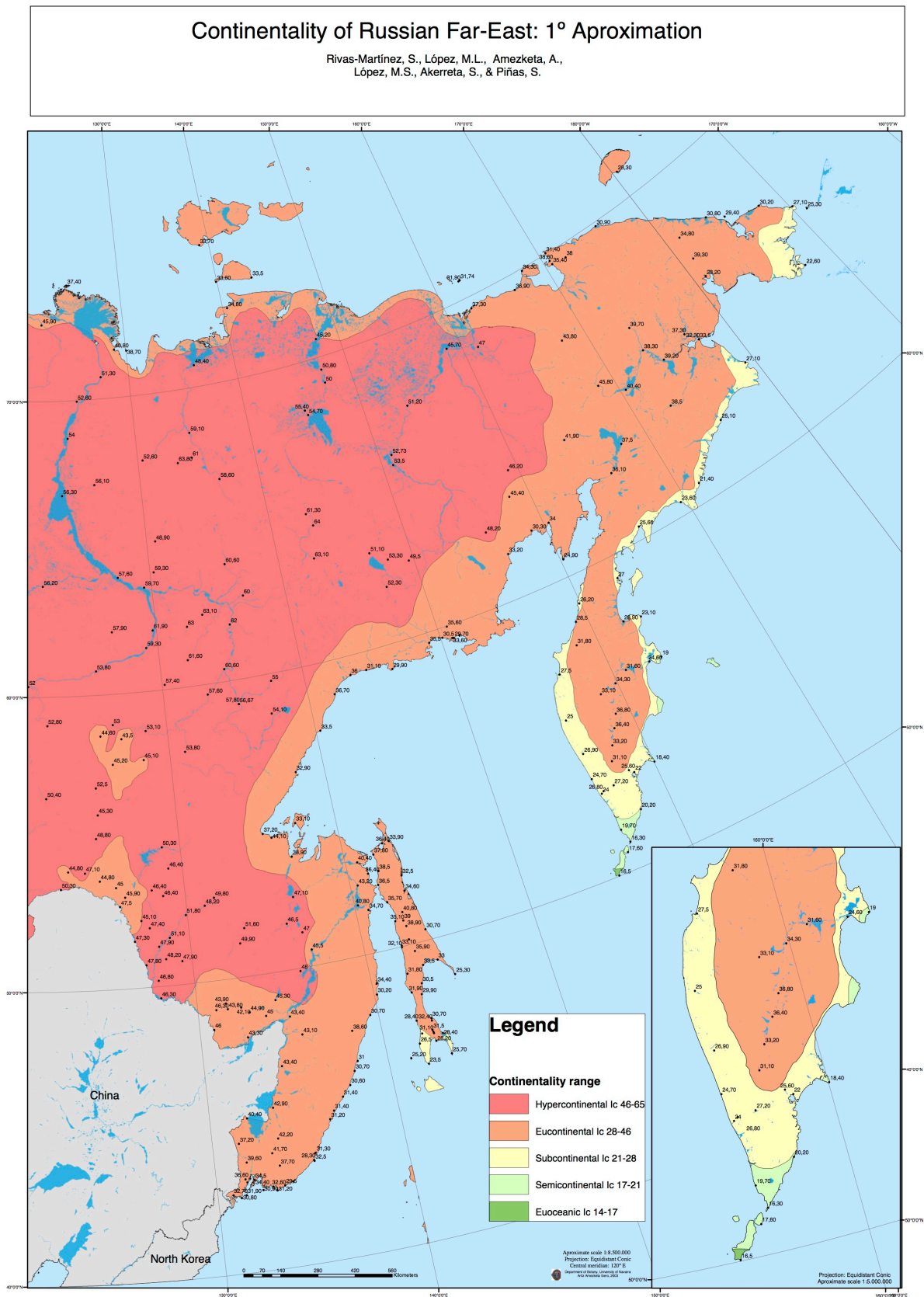


Figure 110. Far East Russian Continentality Map. [\(Link to its quality file\).](#)



Between 2007 and 2015, a very complete bioclimatic study of Peninsular and Balearic Spain, has been published: we offer it fully in Figures 111-116 - Maps of Macrobioclimates, of Bioclimates, of Bioclimates / Variants, of Thermotypes, of Ombrotypes, of Continentality and of Isobioclimates-(Piñas, 2007; López & al., 2008; Piñas, López et al., 2008 a y b; López, Marco et al., 2015). This cartographic study is completed with the Continental Map of the same territory, figure 117, which López Fdez & López Fdez are preparing for publication. (Documentos Aljibe, in press).

Figure 111.- Macrobioclimates of Peninsular and Balearic Spain. [\(Link to its quality file\).](#)



Figure 112.- Bioclimates of Peninsular and Balearic Spain. [\(Link to its quality file\).](#)



Figure 113.- Bioclimates/Variants Map of Peninsular and Balearic Spain. Note: if the name of the Bioclimate appears alone, it is understood to mean the Normal Variant. (Thus: if it is written "Mepo", it means "Mepo Nor", that is to say, "Bioclimate Mepo Normal Variant"; "Teho" means "Bioclimate Teho Normal Variant". [\(Link to its quality file\).](#)

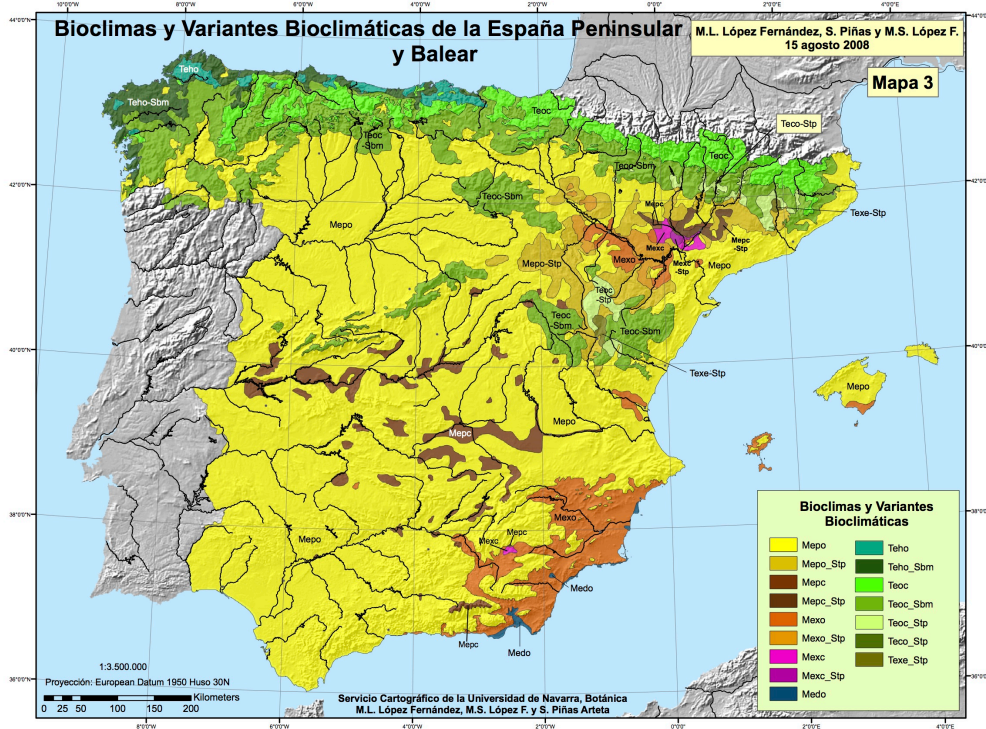


Figure 114.- Thermotypes Map of Peninsular and Balearic Spain. [\(Link to its quality file\).](#)

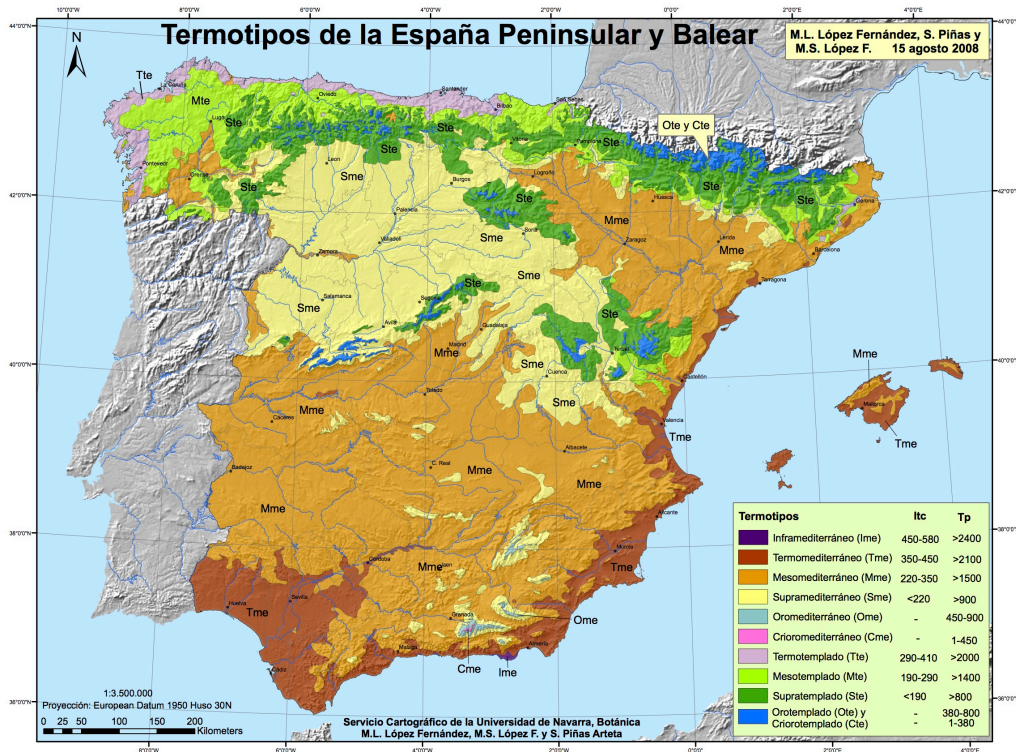


Figure 115.- Ombrotypes Map of Peninsular and Balearic Spain. (Link to its quality file).

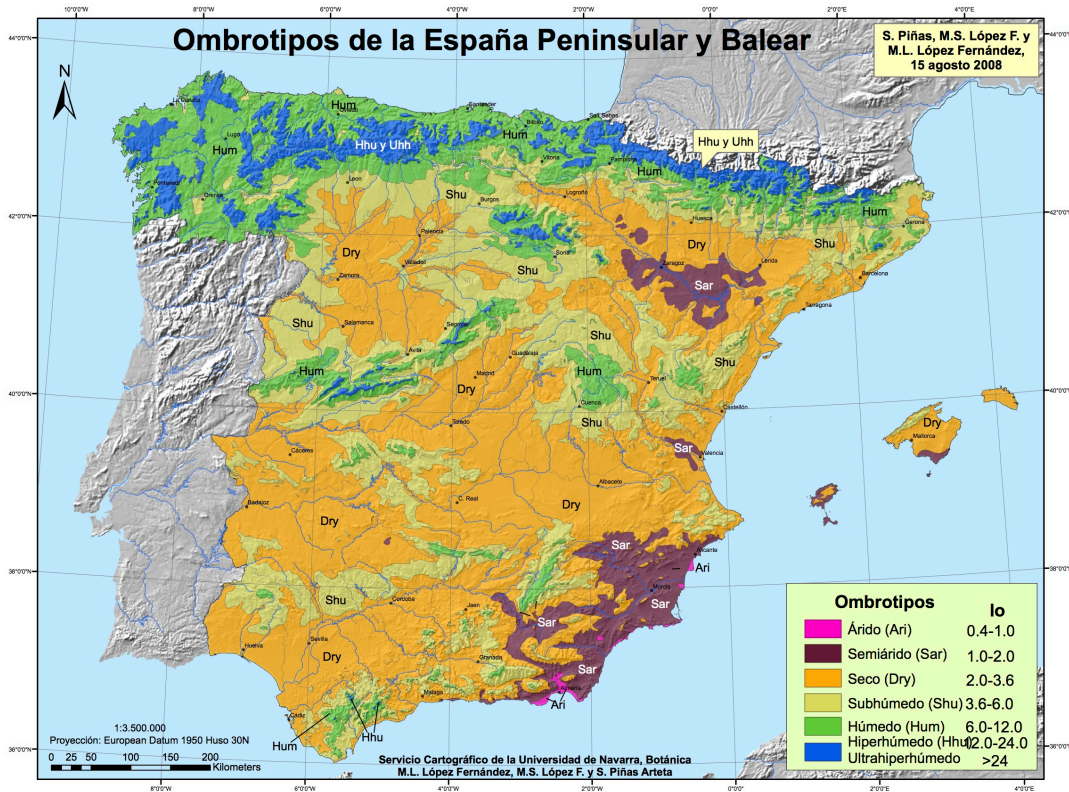
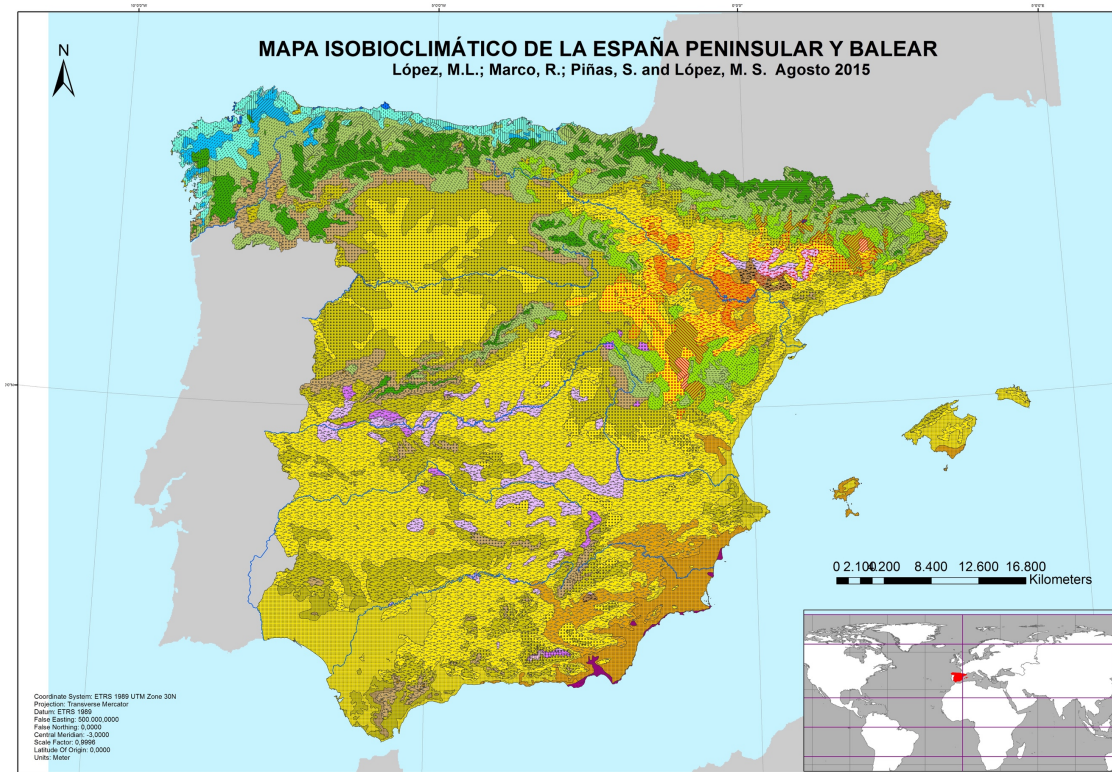


Figure 116.- Isobioclimates Map of Peninsular and Balearic Spain, and its legend. (Note: in the Isobioclimates without mention of variant Steppic -Stp-, nor Submediterranean -Sbm-, it is understood that it is the Normal Variant -Nor-). (Link to its quality files).



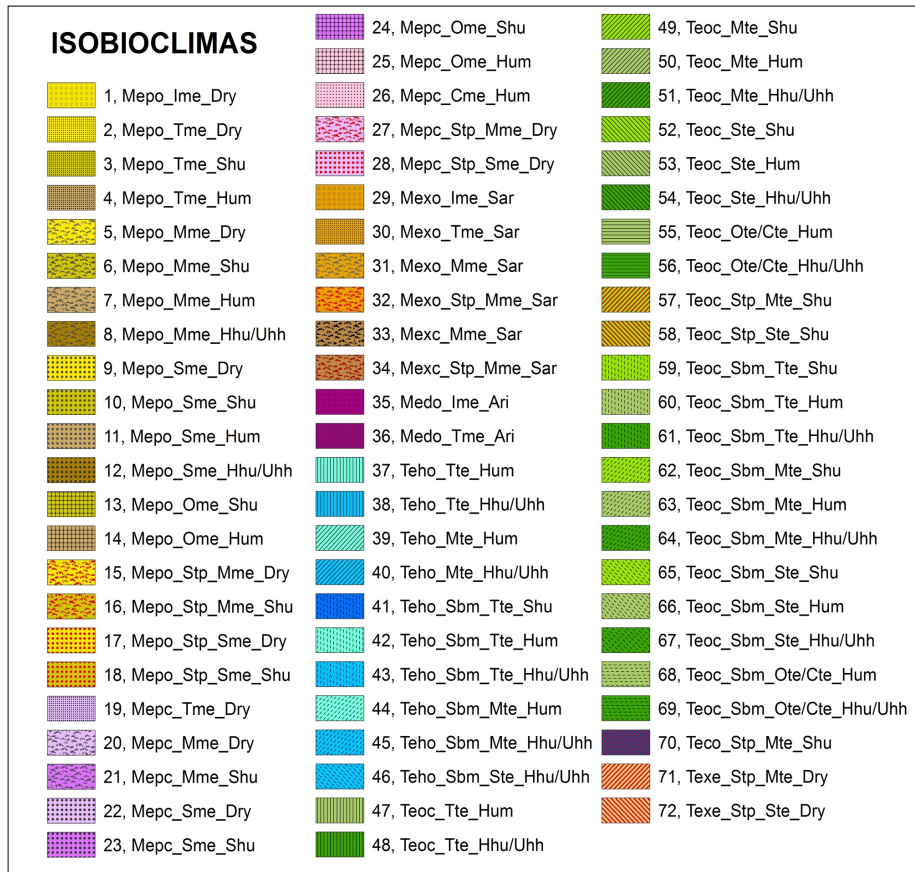
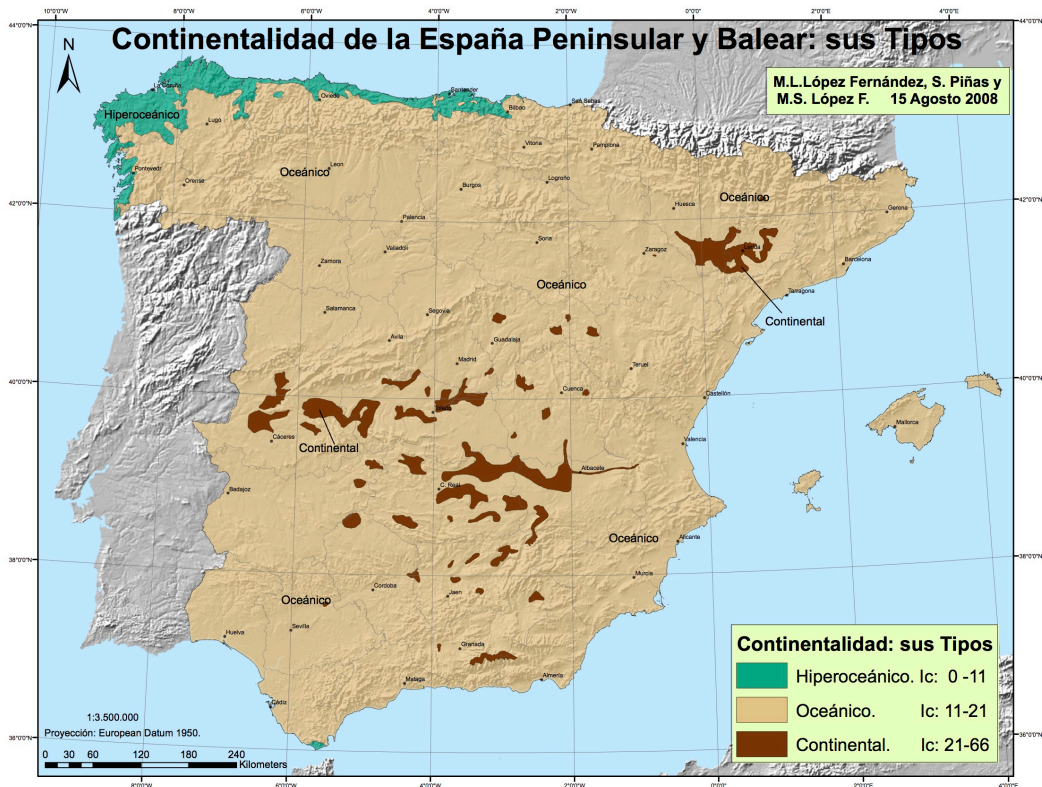


Figure 117.- Continuality Map of Peninsular and Balearic Spain. [\(Link to its quality file\).](#)



And finally, in 2011, Rivas-Mart. et al. published maps of the worldwide distribution of Bioclimates, Thermotypes, Ombrotypes and Continentality. It can be very instructive to see them in the original publication: Rivas-Martínez, S., Rivas Sáenz, S., Penas, Á. & col. (2011).

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