PRESENT ENVIRONMENT AND SUSTAINABLE DEVELOPMENT, NR. 4, 2010

OSCILLATIONS AND CYCLES OF THE AIR TEMPERATURE IN THE CHATHAM ISLANDS

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Key words: atmospherical tides, Rossby waves, cycles of air temperatures, spherical teseral function Laplace.

Abstract. The work is trying to demonstrate that there are oscillations of the air temperature in the temperate zone in the south hemisphere in similar cycles with those provided in Romania. With this end in view, it was taken as test the daily course of the minimum and maximum temperatures from 1968 and 1987, at the Chatham Islands meteorological station in New Zeeland. After the analysis it was noticed not only the existence of some cycles with shorter duration, but also some cycles with longer duration than one year. It also has highlighted some similarities between some daily course of the maximum and minimum temperatures in the Chatham Islands and that from several weather stations in Romania. This similarity is attributed to the teseral spherical function Laplace.

Introduction

Up to the present, the cycles in the daily course of the maximum and minimum temperatures have been analyzed and demonstrated in Romania. As it's known there are cycles lasting less than a year(of 28; 55; 82; 110; 137; 164; 192; 220; 246; 274; 301; 328; and 355 days) and more cycles lasting over a year, of which more important there are the cycle of 19 years (Meton's cycle) and cycle of 18 years and 11 days (Saros cycle). If from the duration of Saros and Meton's cycle we reduce or add cycles lasting less than a year we will get other cycles, which also can be demonstrated. For example, if from Meton's cycle duration (about 6940 days) we reduce the cycle of 355 days, we will have as result Saros cycle (about 6585 days). There are also cycles of 7104 days, resulting from Meton's cycle at which we add cycles of 164 days. If from Meton' s cycle we reduce the cycle of 164 days, we will get the cycle of 6776 days.

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In New Zealand, at the Chatham Islands meteorological station, it is to ascertain the existence of some cycles lasting less than a year, but also of the cycles lasting more than a year.

From the comparative analysis of graphics that shows the daily course of the maximum and minimum temperatures from 1968 to 1987 (Meton's cycle) from the Chatham Islands meteorological station, with the same course of more meteorological stations in Romania, there are some obvious similarities, as it will demonstrate in the following lines.

1. Cycles of the air temperature at the Chatham Islands

The Chatham Islands belong to New Zealand and are situated in the east part of this country, having a specific temperate oceanic climate. The Chatham Islands meteorological station has these geographical coordinates: 43°57' south latitude and 176°34' west longitude. The altitude side is 48 meters.

From the analysis of the graphics that represents the daily course of the maximum and minimum air temperatures for 1968 and 1978 have been emphasized much more cycles (almost perfect), as follows:

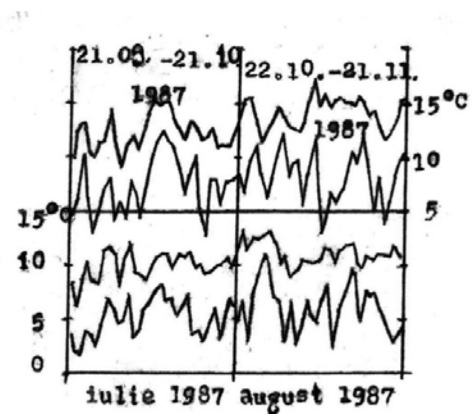

Fig. 1 - The cycle of 82 days

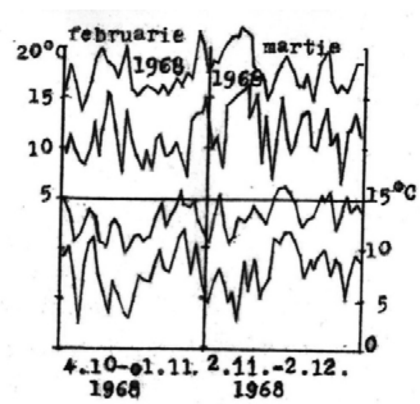

Fig. 2 - The cycle of 246 days (about eight months calendar)

1.1 Cycles lasting just under a year

1.1.a. Cycles of 82 days. In order to demonstrate the existence of this cycle, there were taken to compare the maximum and the minimum daily temperatures in July and August 1987 with those from 21st of September – 21st of November 1987 (the time difference is of 82 days). As it can be noticed after the graphic analysis in fig. 1, the main warm and cold advections are registered at about a difference of

82 days, with the note that the temperatures have higher values in 21st of September – 21st of November, compared with those from July and August, when it is austral winter.

1.1.b. Cycles of 246 days (almost 8 months). The existence of these cycles is highlighted by the graphs in fig. 2, which represent the maximum and the minimum daily temperatures in February and March 1968, compared with 4th October - 2nd December 1968 (with a time difference of 346 days). Also, in this case, the main warm or cold advections from February and March 1968 can be rediscovered after about 246 days. In this case, the temperatures are higher in February and March (austral summer), in comparison with those from 4th October – 2nd December.

1.1.c. The cycle of 123 days (almost 4 months). This cycle represents the half of the 246 days cycle. The existence of this cycle in the Chatham Islands is demonstrated by the graphics in fig. 3, where there are presented the maximum and minimum daily temperatures from January 1968, in comparison with those from 3rd May - 2nd June 1968. In this case the resemblance is obvious, too regarding to the moments when the main warm or cold advections are recorded. Obviously, the temperatures have higher values in January (austral summer).

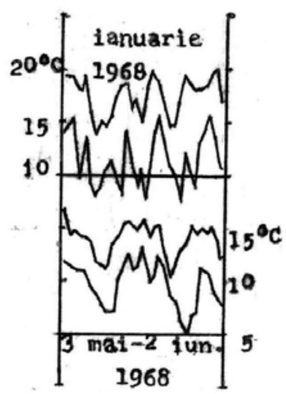

Fig. 3 - The cycle of 123 days
(about four months calendar)

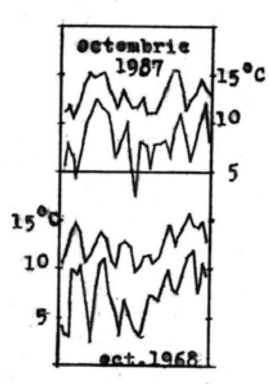

Fig. 4 - The cycle of 19 years
(The cycle of Meton)

1.2 Cycles lasting more than a year

1.2.a Cycles of 19 days(Meton's cycle). In order to demonstrate the existence of this cycle it was taken into consideration the months of October from 1968 and 1987.

In fig. 4 it is represented the daily course of the maximum and minimum temperatures from October 1968 (presented in the graphic below), in comparison with that from October 1987 (presented in the graphic above). The resemblance in this case is obvious.

1.2.b Cycles of 6776 days(19 years – 164 days). This cycle can be achieved though the difference between the duration of the 19 year cycle (almost 940 days) and the 164 day cycle. Like in Romania, this cycle appears clearest in January. The graphic in fig. 5 presents the daily course of the maximum and minimum temperatures from January 1987 compared with the period of 13th June – 13th July 1968 (with 6776 days after). As it can be seen, the main hot and cold advections are produced at the same difference of time (6776 days).

1.2.c Cycle of 7104 days (19 years+164 days). The graphics in fig.6 presents the daily course of the maximum and minimum temperatures from November 1987, compared with the daily course of the maximum and minimum temperatures from 21st May – 19th June 1968 (with a 7104 day difference). This cycle is recorded in Romania as well with a likelihood of 94%. It can be noticed that the main hot and cold advections can be recorded at differences of 7104 days. Some of the little differences are linked to the values of the temperatures and not to the characteristics of the oscillations.

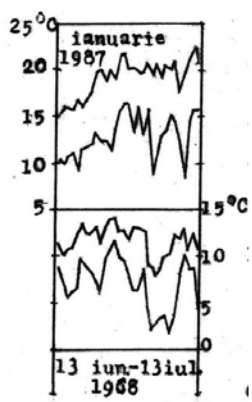

Fig. 5 - The cycle of 6776 days (19 years – 164 days)

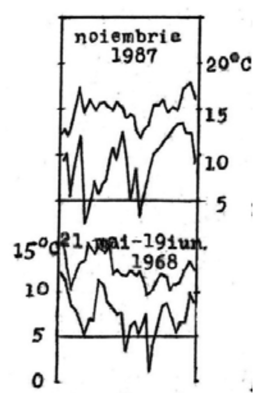

Fig. 6 - The cycle of 7104 days (19 years + 164 days)

In the following we shall examine some similarities between the course of daily maximum and minimum temperatures from the Chatham Islands meteorological station and the same course from more weather stations from Romania.

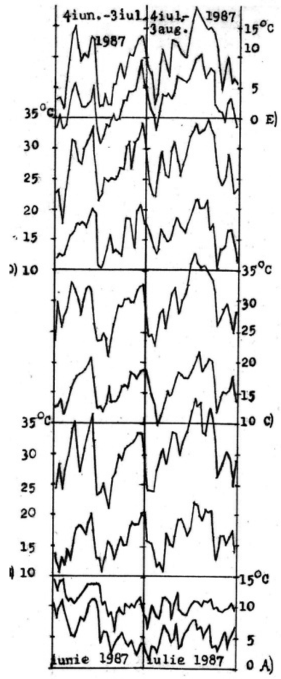

Fig. 7 - Evolution of maximum and minimum daily temperatures in June and July nineteen 1987 at The Chatham Island and at some weather stations in Romania

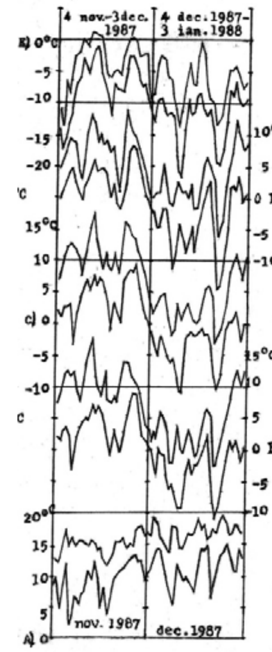

Fig. 8 - Evolution of maximum and minimum daily temperatures in November and December 1987 at The Chatham Island and at some weather stations in Romania

The graphics in fig. 7 presents daily course of maximum and minimum temperatures in June and July 1987 from the Chatham Islands (denoted with A), compared with the same course, but from the period of 4thJune – 3rd August 1987 at more weather stations from Romania, Faurei (denoted with B), Braila (denoted by C), Iasi (denoted by D) and "Varful Omu" meteorological station (denoted by E). The similarities are obvious, but it should mention the fact that there is a difference in time (three day phase shift).

The graphics in fig. 8 show the daily maximum and minimum temperatures in November and December 1987 from the Chatham Islands meteorological station, compared with the periods of 4th November 1987-3rd January 1988, at the weather stations: Faurei (denoted by B), Braila (denoted by C), Iasi (denoted by D) and "Varful Omu" (denoted by E). The Chatham Island meteorological station is marked with A.

As you can see from these charts, the main hot and cold advections are registered at the same time, but a time difference (phase shift) of 3 days.

The similarities between the daily course maximum and minimum temperatures in June, July, November and December 1987 from the Chatham Islands meteorological station and those from the periods 4th June – 3rd August, 1987 (fig. 7) and the one from 4th November 1987 – 3rd January 1988 (fig. 8) from many meteorological stations from Romania, but the phase shift of 3 days can be explained by the way how the atmospheric tides are produced in the spherical harmonic function Laplace of the second type (teseral). This function ($y=\sin^2 \varphi \cos H$) describes, mathematically , the tide potential of the atmosphere (but also of the oceanic water and of lithosphere) for the latitude of 45° North and South, in which φ = latitude and H = hour angle of the Moon (the main sky part responsible for the production of the terrestrial tides.

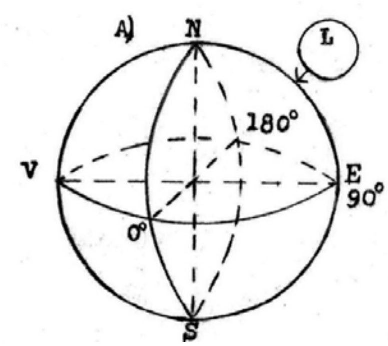

Fig. 9 A - Nodal lines of the Laplace spherical functions $y = \sin^2\varphi\cos H$ (The Equator and the meridians of 0° and 180°)

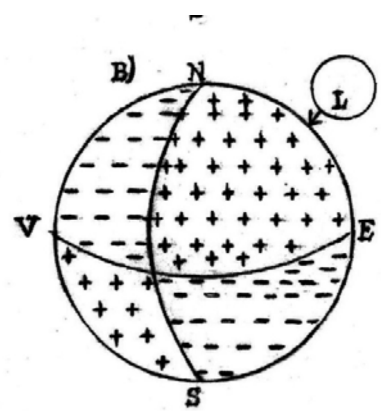

Fig. 9 B - Tidal potential distribution on the Earth surface on the function $y = \sin^2\varphi\cos H$

In fig. 9 the nodal lines of this function are presented, meaning the place where the function gets the zero value. As you can see, these lines are given by the meridians of 90°, on one part and another of the meridian where the Moon is at one moment. If the Moon is, for example, at the meridian of 90° east longitude (like in the drawing from fig.9 A), the nodal lines are given by the meridians of 0° and 180° longitude (east or west), because cos90°= 0(zero). Another nodal line is the Equator(φ= 0° latitude), because sin (2x0°)= 0(zero). In this way, the Earth surface is divided into 4 equal portions, in which the tidal potential is alternately positive and negative (+ and -), like in the fig.9 B. These portions are symmetrical to the Equator, but also to the meridian of 0° and 180°. This means that two points located on globe at 45° north latitude and 45° south latitude have the tidal potential identical , if they are located at a longitudinal distance of 180°.

The atmospherical tides produced identical in the two points from the temperate zones(northern and southern), at latitude of 45°, determines also a similarity to the planetary wave (Rossby).These determine a similar baric field, which causes an atmospheric circulation almost identical. Further the atmospheric circulation almost identical determines an evolution similar to the warm and cold advections, emphasized by the daily course of maximum and minimum temperatures from the air.

If instead the weather stations from Romania (taken into account) it were the weather station from Bordeaux (which has about 45° north longitude and 0°), the similarities would be more obvious, because both weather stations(Chatham Island and Bordeaux) are situated in a temperate oceanic climate, and furthermore, the phase shift of 3 days would have disappeared.

The phase shift of 3 days can be explained by the time which the planetary waves (Rossby) need to go through the longitudinal distance of 13° (Braila = 27°55' east longitude; Chatham Island = 176°34 west longitude. Even the Moon traverses, in its movement from west to east, about 13° longitude (the right height). From here you can deduct that the phase shift shown previously can be also identified between the weather stations from Romania (taken by comparison) and the one from Bordeaux.

Of those shown above it can conclude that the recorded phase shift decreases as we move westward, keeping about the same latitude (45 north).This thing is true, because in Timisoara the phase shift is reduced to two days.

In fig.10 it is presented the daily course of the maximum and minimum temperatures. At the Chatham Islands weather station, for the months June, July and August 1968, in comparison with the same course, but from Timisoara weather station, for the period 3rd June - 2nd September 1968. In this case the similarities are much more obvious and we can put them on the fact that at the Chatham Islands it was used a bigger scale for temperature (in the graphic, 2° temperature = 1 cm).

Going further with the deductions, it can be said that between the Chatham Islands and Milano the phase shift would be only of one day, and at Bordeaux, this would not be.

All the proofs and deductions described above are referring to the points from the terrestrial surface or from the atmosphere located symmetrically about the Equator, at latitude 45° N and 45° S and at one longitudinal difference of 180°.The maximum amplitude of the tides is at the latitude of 45° because sin(2x45°) = sin90° = 1 (maximum value).

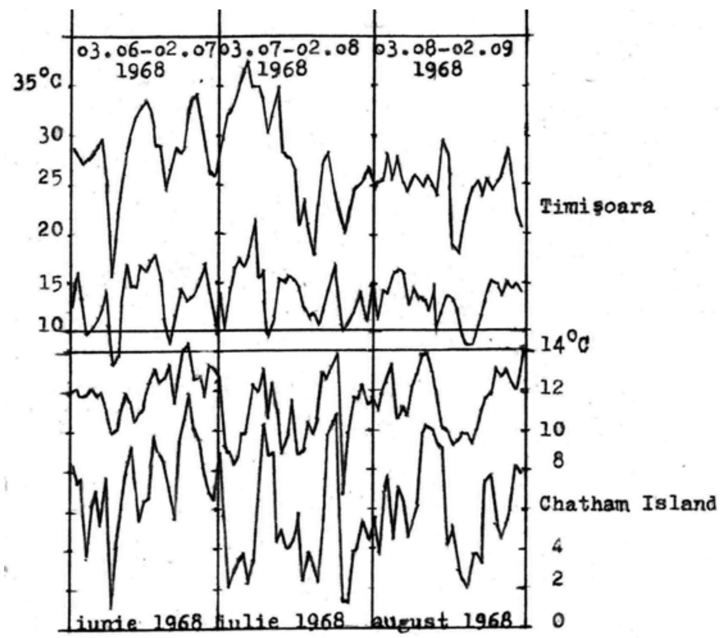

Fig. 10 - Evolution of maximum and minimum daily temperatures
at The Chatham Island and in Timisoara in June, July and August 1968

For the points located on the Equator (φ= 0°), Laplace has inferred the spherical harmonic function of the type 3 or sectoral, having the form: y = cos2φcos 2H (φ and have the same significations). The nodal lines , meaning where the function receives the zero value, they are given by the meridians of 45°, located on one side and another of the meridian where the moon is located sometimes, because coe2H = cos(2x45°) = cos90° = 0(zero). Also, the two poles represent points where the function receives the zero value. In this way, the meridians where the function receives the zero value are passing through the two poles, sharing the surface of Terra (being considered spherical) in four equal, symmetrical sectors separated by meridians which have one longitudinal difference between them of 90°. The Equator is the line where the amplitude of the tides is maximum, because cos0° = 1 (maximum value).

From those demonstrated in connection with this spherical function it results that the two points located on the Equator, at one longitudinal difference of 90°, will have oscillations of the very similar daily maximum and minimum temperatures. For example, the cities Iquitos (The South America); Brazzaville

(Africa) and Djakarta (Indonesia) , all of them located next to the Equator , should have, at least in some periods, the very similar daily course of the maximum and minimum temperatures.

For the points on the Terre's surface located between the Equator (0°) and 45° north and south latitude, there is also one longitudinal symmetry. contented between 90° and 180°. In this way, it must be mentioned the fact that the meteorologists noticed that the most severe droughts from India (between 10° and 20° north latitude) are simultaneous produced with those from Peru(between 10° and 20° south latitude), but they couldn't explain this symmetry. The ones from Peru are put by the phenomena "El Nino" (The Baby). The two countries, affected simultaneously by the drought , have the territories covered by the drought situated between 70° and 80° west longitude (Peru) and between 70° and 80° west longitude (India). In this case, the symmetry about the Equator is contained approximately between 10° and 20° latitude, but in the longitudinal sense it is 150° (so it's contained between 90° and 180°). The two regions simultaneously affected by the drought are symmetrical about the 0° meridian (Greenwich). And other spectacular meteorological phenomena are produced in a symmetrical way on the surface of the Terra. The explanation of this symmetry and simultaneity must be searched in the other spherical functions Laplace.

Conclusions

From the analyzed and demonstrated in this work, it results the followings:

- the oscillations of the air temperature and the cycles in which they are carried out are the same on the whole surface of the earth; therefore, the cycles of the air temperature demonstrated in Romania can be found in New Zealand, too;

- the causes that determine this similarity are given by how the atmospheric tides occur in cycles caused mainly by the attraction of the Moon, the moon-solar cycles also being tidal cycles;

- through the planetary waves (Rossby), moon-solar tidal cycles are reflected in the oscillations and air temperature cycles, as a consequence of some atmospheric oscillations in cycles;

- cycles and air temperature oscillations are not perfect, because the modifiers of physical and geographical nature or the antropical factors are involved, with changes from one year to another;

- similarities between the course of the air temperature from more weather stations in Romania and that from the Chatham Islands meteorological station (New Zealand) is due mainly to the way how the atmospherical tides are produced (which generates Rossby waves) in the weaving spherical function (type two) Laplace;

- longitudinal and latitudinal symmetry (about the Equator) which is observed in the manifestation of several major weather events (droughts, floods, etc..) is due to all the same reasons, that are based on Laplace spherical functions in producing the tidal potential of the atmosphere (generated mainly by the attraction of the Moon);

- future research will demonstrate the existence of other symmetries in the production of major weather phenomena; all based on Laplace spherical functions in producing the tidal potential of the atmosphere;

Based on these longitudinal and latitudinal symmetries there can be produced long-term weather forecasts.

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