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THE METEOROLOGICAL CONSEQUENCES OF THE MOON CYCLES LASTING LESS THAN ONE YEAR

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Mots cléfs: révolution tropique, révolution anomalistique, révolution synodique, cycle de la marée, cycle météorologique.

Résumé. Cet oeuvre essaie de prouver que la prévision météorologique à long terme a une probabilité aggrandie si on prend conscience des cycles des marées atmosphériques (provoquées en principal, par la Lune) même celles-là qui ont une durée plus réduite qu'un an (365,24 jours). Dans cette catégorie on compte aussi les cycles de 25, 55, 82, 110, 164, 192, 220, 246, 274, 301, 328 et 355 jours solaires moyens. Ces cycles sont en fait des nombres qui représentent (approximativement) les multiples de la durée de la revolution tropique de la Lune, équivalente aux 27,32 jours solaires moyens.

Introduction

The well-known tide cycles of the atmosphere, expressed in multiples of the tropic year and demonstrated in other paper works showed that most of them reflect in the daily progress of the main meteorological elements (temperature, atmospheric rainfalls and atmospheric pressure etc.). In the present paperwork were taken in consideration only the monthly cycles (in fact tides) lasting less than a year.

Although they last less than a year, reason for why we can say that the Sun tide influence was neglected, these cycles reflect in the daily progress of the maximum and minimum temperatures in the air, too.

In order to prove the existence of these tide cycles (almost perfect), but also to prove the fact that they reflect in the daily progress of the maximum and minimum temperatures from the air, meteorological data from the meteorological station in Braila were used between the years 1975-2006 and in smaller parts from other meteorological stations.

In the paperwork the cycles of a few years are highlighted, although they appear every year.

1. Tide cycles (almost perfect) lasting less than a year

The amplitude and the size of the atmospheric tides are determined, mainly, by the Moon attraction. The solar attraction interferes just in the size of the amplitudes or in the anticipation and delay of the tides, but not in the lasting of some tide cycles. In fact, all the cycles connected to the Earth's natural satellite evolution represent the same number of tide cycles of the atmosphere (almost perfect).

The Moon cycles are the ones which refer to the tropic revolution (27.32 days); anomalistic revolution (27.55days) and the sinodal revolution (29.53 days). The numbers which are divided almost exactly to the 3 revolutions and which are, in fact, medium solar days, represent moon cycles (tide cycles in the same time)

The calculations reveal that:
28:27,32=1,024; 28:27,55=1,016; 28:29,53=0,948
55:27,32=2,013; 55:27,55=1,996; 55:29,53=1,862
82:27,32=3,001; 82:27,55=2,976; 82:29,53=2,776
110:27,32=4,025; 110:27,55=3,992; 110:29,53=3,725
137:27,32=5,014; 137:27,55=4,972; 137:29,53=4,639
164:27,32=6,002; 164:27,55=5,952; 164:29,53=5,553
192:27,32=7,027; 192:27,55=6,969; 192:29,53=6,501
220:27,32=8,052; 220:27,55=7,985; 220:29,53=7,450
246:27,32=9,004; 246:27,55=8,829; 246:29,53=8,330
247:27,32=10,029; 274:27,55=9,945; 274:29,53=9,728
301:27,32=11,017; 301:27,55=10,925; 301:29,53=10,193
328:27,32=12,005; 328:27,55=11,905; 328:29,53=11,107
355:27,32=12,994; 355:27,55=12,885; 355:29,53=12,021

According to the previous calculations, it can be noticed that some cycles are almost perfect because they also include, besides a whole number of tropic revolutions, a whole number of anomalistic or sinodal revolutions. In this category are included the cycles of 55, 82, 164,192 and 355 days.

Considering that atmospheric tides are produced identically in the Earth's two hemispheres (Northern and Southern) no matter the declination sign of the Moon (+ or -, in the tropic revolution), but also considering that atmospheric tides are produced identically in the period from the full moon to the new moon with the ones from the new moon to the full moon, (in the sinodal revolution), they can be used as half cycles also.

According to the things sustained previously, one can say that the Moon evolution is restricted to the same characteristics (approximately) after completing an entire cycle. In these conditions, I analyzed the 82 days cycle, taking as an example the periods from 1-31 December 2004 and 23 March-22 April 2004 as well.

In fig. 1 it can be seen represented the Moon evolution between the two periods (a 82 days period), through the two equatorial coordinates of the Moon the right declination and right ascension, (in the tropic revolution) As it can be observed, the points represent the moon position in each day of the 2 periods, which almost interfere and they even have the same coordinates in some days. That means that the Moon evolution during the two compared periods was almost identical, meaning that the atmospheric tides (caused mainly by the moon) were almost identical.

In order not to supercharge the paperwork with too many figures, the other cycles (almost perfect) of the moon evolution, and so of the atmospheric tides, were not presented graphically through the two equatorial coordinates. Of course, the results are the same: a striking resemblance in the Moon evolution during these cycles.

2. Meteorological cycles lasting under a year.

The tide cycles lasting under a year previously proved, although they are not perfect, they reflect, mainly, in the air temperature evolution, more exactly, in the daily progress of the maximum and minimum temperatures. This reflection is realized by the help of the Rossby waves (the planetary waves). Considering the latitudinal variation of the Coriolis ($2\omega \sin\rho$) parameter and the atmospheric tides as causes, the earth waves (Rossby) are the ones which guide the evolution of the weather state in the temperate areas of Earth (mainly in the northern hemisphere) through the evolution of the baric field in altitude and at the ground level

In fig.2 there is represented a diagram of the way the earth waves appear and develop, having as a base the atmospheric tide progress.

Taking in consideration the "Z" level from the atmosphere where the atmospheric tides are emphasized, then in the tidal areas (the ascending movement of the air particles) barometric maxims will be formed (marked with M in fig.2a) and in the areas where the air particles descend (at ebb-tide), barometric minims will appear (marked with D in fig2.a). This statement can be mathematically proved, using the next relation regarding the atmospheric pressure variation, at the "Z" level, previously considered,

in which $\frac{\partial p}{\partial t}$ means the differential of the atmospheric pressure in comparison with time, at the "Z" level.

If we ignore the first two terms from the second member of the expression (1), which indicates the divergence – convergence in the horizontal plan of the air masses with different densities (the horizontal speeds "u" and "v", and the " ρ " density, then the last term from the second member of the expression (1) indicates

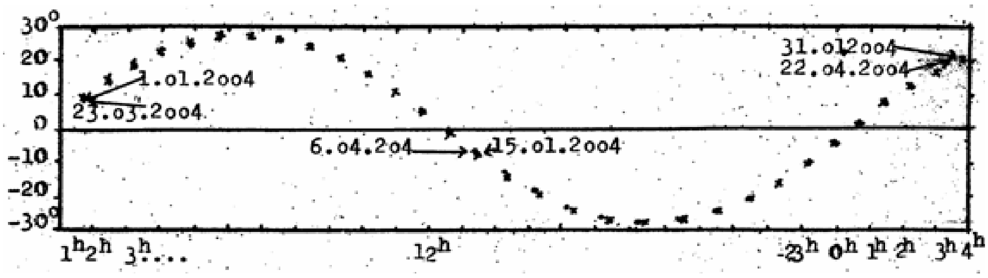

Fig.1 - The Moon progress (represented through the equatorial coordinates: the vertical declination, from +30 to -30 degrees, and the straight horizontal ascent , in 27 hours, from 1 o'clock to 4o'clock) during the period from 1-31 January 2004 as compared to the period 23 March-22 April 2004

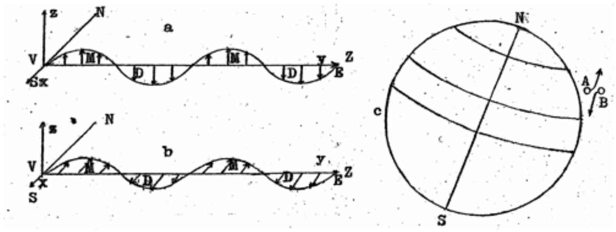

Fig. 2 - The forming of the planetary waves (Rossby), through the evolution of the atmospheric tides in the temperate area.

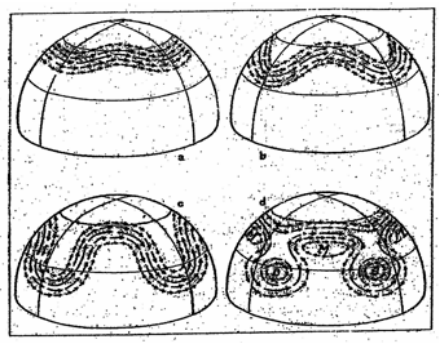

Fig. 3 - The evolution of the planetary waves (Rossby), transversal-horizontal waves having a wave length (^) between 3000 and 6000 km

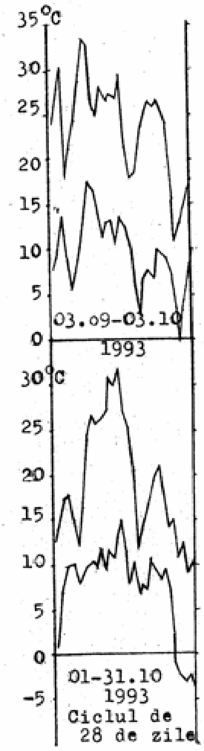

Fig.4 - The daily progress of the maximum and minimum temperatures in October 1993, in comparison with that in 3. 09 - 3.10. 1993 (the 28 days cycle)in Braila.

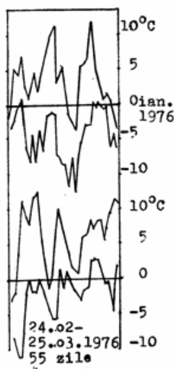

Fig.5 - The daily progress of the maximum and minimum temperatures in January1976, in comparison with those from 24.02-25.03 1976 (the 55 days cycle) in Braila.

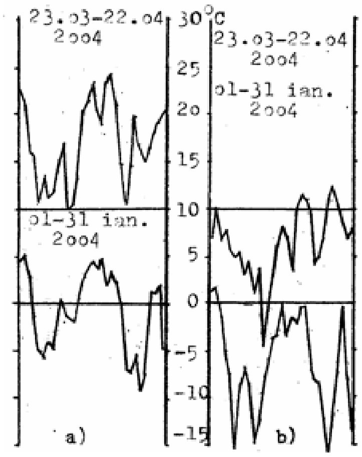

Fig.6 - The daily progress of the maximum and minimum temperatures in January 2004. (a = for maximum temperature; b = for minimum temperature) in comparison with those from 23.03-22.04.2004 (the 82 days cycle) in Braila.

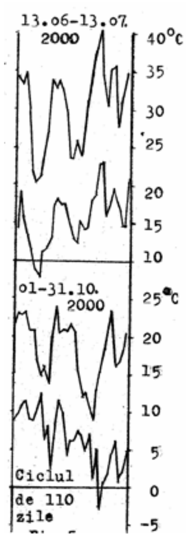

Fig.7 - The daily progress of the maximum and minimum temperatures in October 2000, in comparison with that in 13.06-13.07.2000 (the110 days cycle) in Braila.

the vertical transport through “Z” level. For ascending movements of the air particles (w›0, positive), results $\frac{\partial p}{\partial t} > 0$, so a positive variation of the atmospheric pressure (maximum barometrical at tide), and when the air particles descend (w < 0, negative) results that $\frac{\partial p}{\partial t} < 0$, so a negative variation of the atmospheric pressure (under pressure baric, at ebb-tide).

The ascending air particles (at tide) will have to move north too, in order to preserve the kinetic moment (angular) that means the same distance towards the Earth axis (fig.2.c). the descending air particles (at ebb-tide) will have to move to the south too, in order to preserve the angular moment (the same distance towards the Earth axis).

Thus, the transversal-vertical waves (the atmospheric tides) turn in time into transversal-horizontal waves (Rossby waves). This demonstration is proved in practice by the fact that inside the Rossby waves, the maximum barometric always direct towards north and the barometric depression towards south (in the northern hemisphere), as it can be seen in fig.3. This disposal is due to the initial movements during the tide and ebb-tide, illustrated in fig. 2, c. the A particle moves ascending (during tide), but to the north too, while the B particle moves descending (during the ebb-tide) but to the south too.

The (Rossby) planetary waves were formed millions of years ago, together with the arrangement of the nowadays general movement of the atmosphere. The atmospheric tides nowadays, determined mainly by the Moon’s attraction change ceasesly the amplitude and the wave length of the planetary waves, giving them the unsteady characteristics. Their modification takes place at certain time periods (cycles). The cycles smaller than one year are introduced here too.

Once being formed, the planetary waves, related to the medium (atmosphere), always spread to the west just like the oceanic tides. Because the atmosphere has its own movement from the east to the east (the western winds), the Rossby waves, related to the continents and of the oceans surface will move to the west when their wave length (λ) is bigger than 5400km, and they will move to the east when λ is smaller than 5400 km. when they have this length, the Rossby waves become stationary. This process takes place only in the temperate area, where the west winds blow. That is why, the Rossby waves are formed only here.

In fig. 4 it is presented the daily progress of the maximum and minimum temperatures in October (1-31 October) 1993, in comparison with that in 3 September -3 October 1993 (the 28 days cycle). As you can see, the main hot and cold advections from 03.09-03.10.1993 are the same (as moment of their production) with those from October 1993.

In fig. 5 it is presented the daily progress of the maximum and minimum temperatures in January1976, in comparison with those from 24 February-25 March 1976 (the 55 days cycle). The same evident resemblances can be seen in connection with the moment of the production of hot and cold advections from the two periods.

In fig. 6 it is presented the daily progress of the maximum and minimum temperatures in January 2004. (a = for maximum temperature; b = for minimum temperature) in comparison with those from 23.03-22.04.2004 (the 82 days cycle). As you can see, the resemblances, in this case, seem to become identical, with the difference that the thermal oscillations take place between other limits, at limits, at high and at low daily temperatures too. The resemblances in the case of small thermal oscillations are even rendered evident.

All these evident resemblances can be explained due to the very similar tidal potential (because of the attraction of the Moon)from the two periods (01-31 January 2004 and 23.03-22.04.2004), presented in fig.1, through the almost identical evolution of the Selena during the two periods, in the tropic revolution through the equatorial coordinates (the straight declination and ascension) in fact, in the 82 days period take place approximately 3 tropic revolutions (82:27,32=3,001) and 3 anomalistic revolutions (82:27,55=2,976).

The almost the same tidal potential of the 82 days cycle is reflected in almost the same aspect of the Rossby waves (planetary), concerning the wave length and their amplitude. The Rossby waves continually determine resemblances in the atmospheric pressure field from the ground and in altitude. Then follow the resemblances from the atmospheric circulation, which finally bring very evident resemblances in the aspect of thermical oscillations revealed by the daily progress of the maximum and minimum temperatures.

That means that, in the area of our country (at least), the air movement was almost identical between the two periods, only that this one’s temperature was different. The oscillations were almost the same, but not the temperatures.

The same resemblances can be noticed when analysing the graphics from fig. 7-12, where there are presented the cycles of 110, 137, 164, 220, 246, 274, 301 and 328 days.

In fig. 13 it is presented the daily progress of the maximum and minimum temperatures from October 1994, in comparison with those from 23.03-22.04.1994(the 355 days cycle) there can be seen the same striking resemblances when the main hot and cold adventives take place.

From the same picture, it can be seen the resemblances from 11.10-10.11.1993 and 23.03-22.04.1994. The time difference between the two periods is

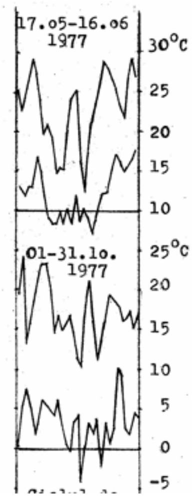

Fig. 8 - The daily progress of the maximum and minimum temperatures in October 1977, in comparison with that in 17.05-16.06.1977 (the137 days cycle) in Braila.

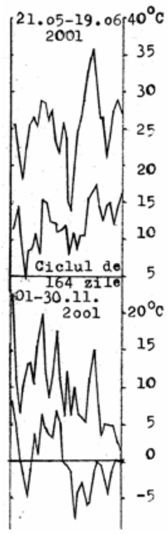

Fig. 9 - The daily progress of the maximum and minimum temperatures in November 2001, in comparison with that in 21.05-19.06.2001 (the164 days cycle) in Braila.

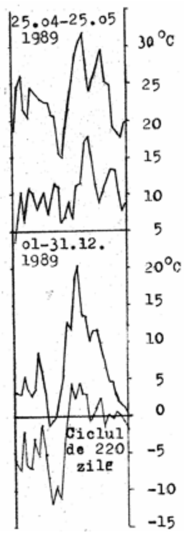

Fig. 10 - The daily progress of the maximum and minimum temperatures in December 1989, in comparison with that in 25.04-25.05.1989 (the 220 days cycle) in Braila.

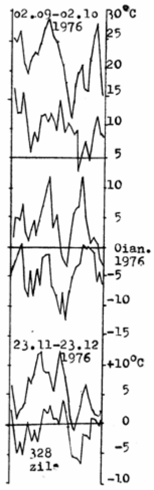

Fig. 11 - The daily progress of the maximum and minimum temperatures in January 1976, in comparison with that in 2.09-2.10. 1976 (the 245 days cycle) and 23.11-23.12.1976 (the 328 days cycle) in Braila.

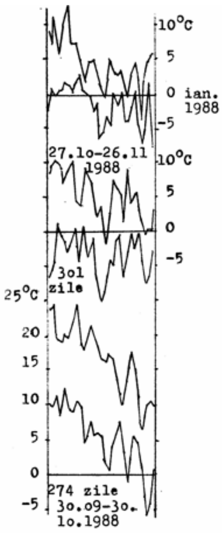

Fig.12 - The daily progress of the maximum and minimum temperatures in January 1988, in comparison with that in 27.10-26.11.1988 (the 301 days cycle) and 30.09-30.10.1988 (the 274 days cycle) in Braila.

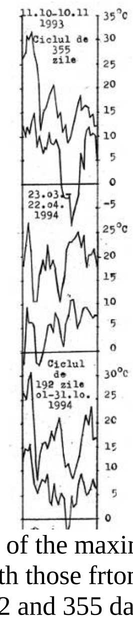

Fig. 13 - The dauly progress of the maximum and minimum temperatures from October 1994, in comparasion with those frtom: 23.03 – 22.04.1994 and 11.10 – 10.11.1993 (the 192 and 355 days cycles) in Braila.

of 164 days, meaning that in this case the 164 days cycle is highlighted again, presented previously in fig.9.

For a thorough demonstration, in fig.14 the variable characteristics of the moon are presented graphically (the sinodal revolution, the anomalistic revolution, the straight ascension and the tropic revolution), those which generate the tidal potential during a 355 days cycle and a 192 days cycle.

In fig. 14, a, there are presented the moments when the Moon phases take place (N =New Moon; P = Full Moon; I = The First Quarter; II = The Last Quarter). During the 355 days cycle (the upper part and the lower part), the Moon phases are the same, because during this period of time 12 sinodal revolutions take place (355:29, 53=12,021). During the 192 days cycle, the Moon phases take place in the opposite order, meaning that P is the same as N, and II is the same as I. this thing results from the anterior calculation (192:29, 53=6,501), this means that during this time period 6,5 sinodal revolutions take place.

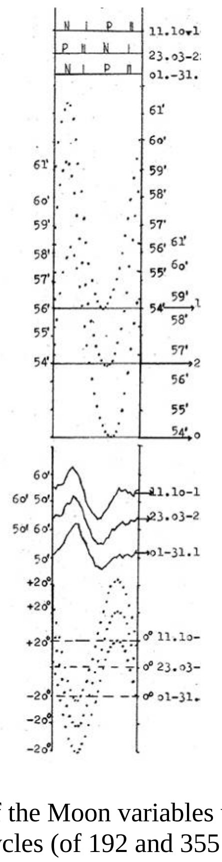

Fig. 14 - The characteristics of the Moon variables which generates the tidal force during the 2 cycles (of 192 and 355 days)

Being known the fact that the tidal potential between the period from New Moon (N) to the First Quarter (I) is the same to that from the Full Moon (P) to the second Quarter (II), as well as the fact that the tidal potential from the Second Quarter (II) to the New Moon (N) is identical to that from the First Quarter (I) to the Full Moon (II) (in the first case, the phenomenon is called the anticipation of tides, in the second case – the lateness of the tides), that means that under the sinodal revolution aspect (the Moon phases), the tidal potential is the same in all the periods.(01-31.10.1994; 23.03-22.04.1994 and 11.10-10.11.1993). From Fig. 14a, it can also be seen the fact that the Moon phases (P, II, N, I) from the period 23.03-22.04.1994 have a small phase in comparison with the others two periods (2 days lead). This explains in a good measure the lead for the same period in developing the hot (Fig. 13, the middle part, the 192 days cycle) and the cold advections, in comparison with the other two periods.

In order to demonstrate and analyse the meteorological cycles (almost perfect) under one year there could have been used meteorological data from meteorological stations too. The results would have been the same.

Conclusions

The tidal cycles of the atmosphere (almost perfect) under one year represent a reality caused by astronomic factors and can be checked through the tidal evolution of the hydrosphere (of the oceans)

The resulted meteorological cycles, also less than one year duration) are not perfect, because not even the tidal cycles of the atmosphere are perfect.

Being familiar with these cycles has practical and theoretical importance too.

The theoretical importance consists in the fact that the atmosphere is subjected not only to the heating and cooling processes from which finally results the general circulation of the atmosphere. This is also under the influence of the attraction forces of the Moon in principal, forces that take place cyclically according to the evolution of the Earth’s natural satellite. The atmospheric tides (which take place in almost perfect cycles), through the Rossby waves (planetary), finally reflect in the air temperatures oscillations, especially in the daily progress of the maximum and minimum temperatures.

The practical importance takes into consideration the possibility of elaborating some long term meteorological forecasts (over 10 days), having as basis these selenar cycles (in fact, tidal) under one year.

These tidal and meteorological cycles are not all evident very clearly during one year. Most of the time one can remark the cycles of 82, 164, 246, 274 and 355 days.

In order to make a meteorological forecast with a great probability the cycle where the Moon development is almost identical is chosen (the points that represent this one's evolution through the two equatorial coordinates are the same or are very close to each other, as in fig. 1). The values of the equatorial coordinates can be taken from the astronomic annuals or from the Internet (NASA).

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