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CYCLES OF AIR TEMPERATURE ACCORDING TO LUNAR PARALLAX

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Abstract. This paper proposes to demonstrate that, on Terra's surface, there are cycles of air's temperature (almost perfect), which can be explained just by the lunar parallax's cycles.

It is known that the lunar parallax represents the angle under which the Earth's equatorial horizontal radius can be seen from the moon. It is understood that a higher value of the lunar parallax indicates us a shorter distance between Earth and moon, while a smaller value shows us a longer distance between the two celestial bodies.

Through the atmospheric tides caused mainly by the moon, the sea tides are occurred, which also cause the Rossby waves, those which impose a certain atmospheric circulation, and that makes the high and low of the temperature evolve

Introduction

For a better understanding of the phenomena that occur in the atmosphere linked to the tides of air, we must start from the law of the universal attraction, which says that two celestial bodies attract each other with a force that is directly proportional to the product of the masses of the two celestial bodies and inversely proportional to the square of the distance between them, meaning, $F = K \cdot (M \cdot m) / r^2$, where F = force of attraction, M = Earth's mass, m = Moon's mass, K = constant of universal attraction, which does not change unless Earth's and Moon's mass change.

Therefore, the variation of the force of attraction between the Earth and the Moon depends only on the distance between the two celestial bodies (r^2).

It is known that the Moon performs a motion around the Earth which has an average duration of 27,55 days and is known as the anomalistic revolution. Even the name indicates the fact that it varies over time. The ellipse on which the Moon circulates has in one of her focus the Earth.

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The maximum distance of the Moon against the Earth is located in the spot know as the Apogee, and the minimum one in the spot known as the Perigee.

1. Cycles in the evolution of the lunar Perigee

The anomalies that appear within the anomalistic revolution (period) of the moon are related to the fact that the Perigee executes a complete sidereal revolution in 3232.6 days, but this does not return exactly in the place where it started from. In these conditions, two cycles of the Perigee appear that differ in duration. The first cycle of the Perigee has an average length of 192 days and the second one lasts on average for 220 days.

Cycles of 191 days or 193 days may occur, but the one lasting 220 days can have 219 or 221 days.

The important fact is that these two cycles succeed themselves with regularity. After a 220 days cycle, a 192 days one follows. Together these two cycles form a perigee cycle of 412 days (on average, $192+220$ days), meaning 1 year and 47 days. This is the base cycle of the lunar parallax, in fact of the Perigee itself.

In the figure 1 there are presented two cycles of 192 days of the Perigee, with the daily values of the lunar parallax (sexagesimal minutes and seconds).

It can be noted that the daily values of the lunar parallax drop from a maximum value of $61'20''$ (the upper graphic) on 22.07.2009 and $61'21''$ on 04.06.2008 (the lower graphic) to minimum values of approximately $59'30''$ at the half of the cycle. An increase in the values of the lunar parallax at Perigee follows, reaching values of $61'28''$. 30.01.2010 (the top graphic) and $61'30''$ on 13.12.2008 (the lower graphic)

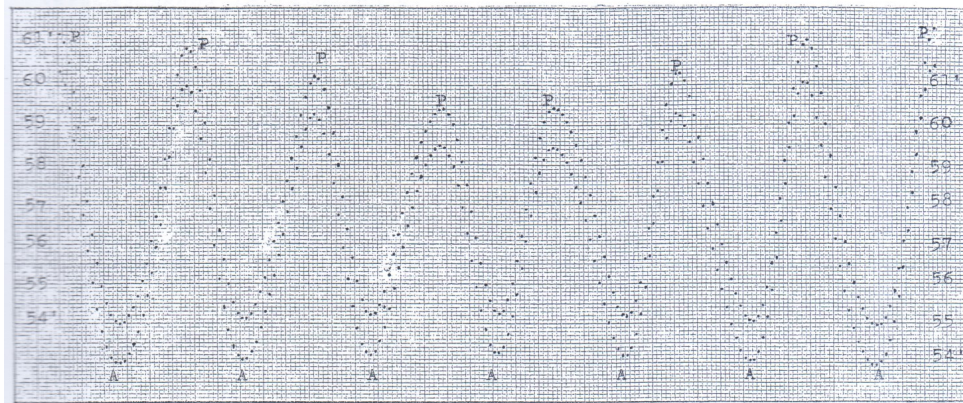


Fig. 1. The 192-day cycles of Perigee. P= Perigee; A= Apogee.

a) The period of the upper cycle: 22.07.2009 (worth: 61'20")- 30.01.2010 (worth: 61'28")

b) The period of the lower cycle: 04.06.2008 (worth: 61'21")- 13.12.2008 (worth: 61'30")

Proportion scale : horizontal scale; 1 day = 1mm; vertical scale: 6"= 1mm

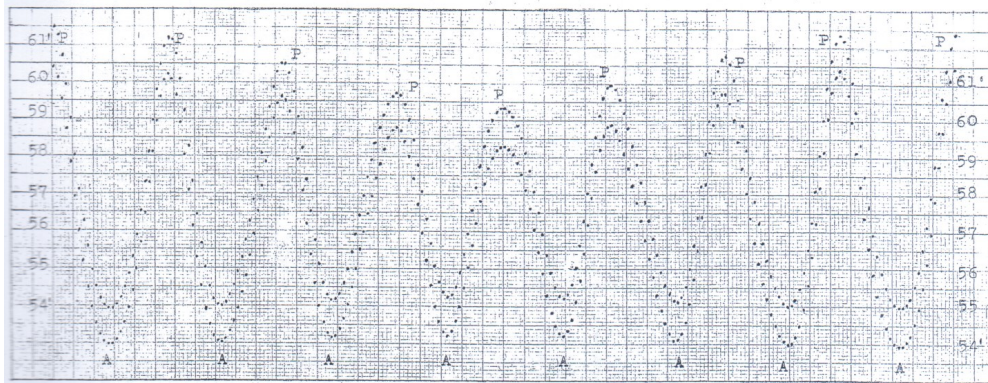


Fig. 2. The 220-day cycles of Perigee. P= Perigee; A= Apogee.

a) The period of the upper cycle: 20.03.2011 (worth: 61'29")- 26.10.2011 (worth: 61'22")

b) The period of the lower cycle: 16.05.1999 (worth: 61'23")- 22.12.1999 (worth: 61'27")

Proportion scale : horizontal scale; 1 day= 1mm; vertical scale: 6"= 1mm

In the figure 2 there are presented two cycles of 220 days of the Perigee, with the daily values of the lunar parallax. In this case, we can notice that the daily values of the lunar parallax drop from 61'29" (the upper graphic) on 20.03.2011 and 61'23" on 16.05.1999 (the lower graphic).

And in this case, the values of the moon parallax at Perigee fall around the value of 59'18" at halfway between both cycles. Next it will be a growth, arriving at the value of 61'22", on the 26th of October 2011 (the upper graphic) and 61'27", on the 22 of December 1999 (the lower graphic).

After this, we will analyze the most significant cycles in the evolution of daily maximum and minimum temperatures which are based on the Perigee moon cycle of 412 days.

2.1 The cycle of 412 days (1 year+47 days)

In this time interval (412 days), approximately 15 tropic and anomalistic revolutions and 14 synodical revolutions of the Moon are produced according to the next calculations:

412 days: 27.32 days (the Moon's tropic period) = 15.08~15;
 412 days: 27.55 days (the Moon's anomalistic period) = 14.95~15 and
 412 days: 29.53 days (the Moon's synodical period) = 13.95~14.

In the figure 3, cycles of 412 days in the evolution of daily maximum and minimum temperatures, are presented through graphs, in several points around the surface of the Earth.

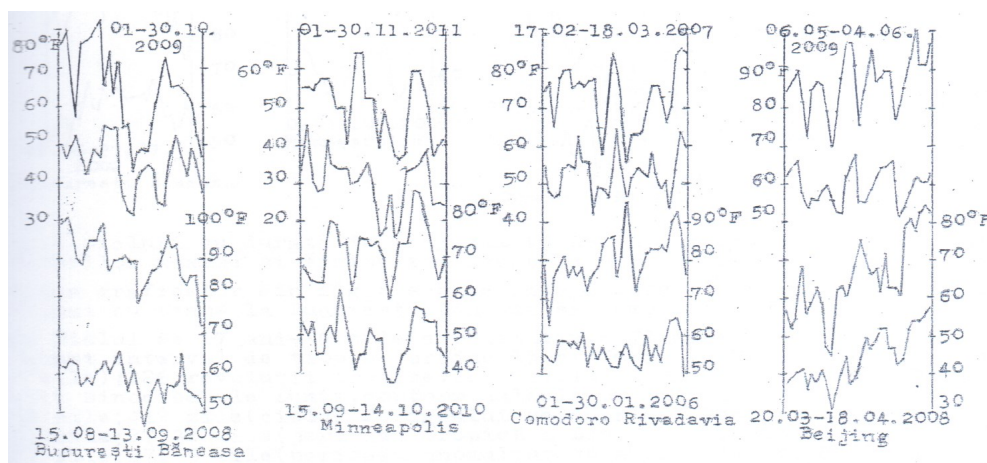


Fig. 3. Cycles with a duration of 412 days in the evolution of maximum and minimum daily temperatures, in different points, on the surface of Terra.

From the analysis of the graphics from figure 3 the clarity of the cycles can be deduced, especially at Minneapolis and Comodoro Rivadavia.

2.2 The 4 years and 192 days (about 1653 days) Cycle

During this period of time it takes place about 4 cycles of the lunar Perigee having the duration of 412 days; 60.5 tropic revolutions; 60 anomalistic revolutions and 56 synodic revolutions of the Moon, according to the calculations below:

1653 days: 412 days (the lunar Perigee cycle) = 4.01 ~ 4;

1653 days: 27.32 days (the tropic period of the Moon) = 60.50 = 60.5;

1653 days: 27.55 days (the anomalistic period of the Moon) = 60.0 = 60 and

1653 days: 29.53 days (the synodic period of the Moon) = 55.97 ~ 56.

This cycle is a cycle for tropical period(revolution) of the moon, knowing the fact that , regardless in which hemisphere the moon is, (northern+) or southern (-), at the same absolute values of declination (positive or negative), the atmospheric tides produce identically. Therefore, those 60.5 tropic revolutions of the Moon that are produced during the 1653 days represent the cycles which will be described. This remark applies to the other cycles that are going to be described too.

In figure 4 there are presented cycles about the evolution of maximum and minimum daily temperatures in more points on the Earth's surface, lasting 1653 days.

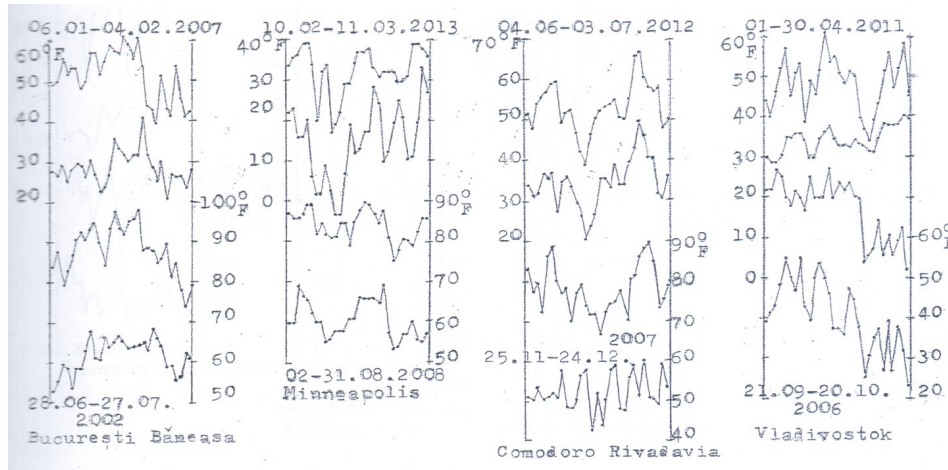


Figure 4. Cycles with a duration of 1653 days (4 years + 192 days) in the evolution of maximum and minimum daily temperatures, on the surface of Terra.

The analyses of the graphics from figure 4 emphasizes the clarity of these cycles, especially at Bucharest Baneasa and Comodoro Rivadavia.

2.3 The cycle of 17 years – 36 days (approximately, 6173 days)

During this period of time there take place 15 cycles of the selenian perigee (412 days); 226 tropic revolution; 224 anomalistic revolutions and 209 synodic revolutions of the Moon, according to the calculations below:

6173 days: 412 days (the lunar Perigee cycle) = 14.98 ~ 15;

6173 days: 27.32 days (the tropic period of the Moon) = 225.95 ~ 226;

6173 days: 27.55 days (the anomalistic period of the Moon) = 224.06 ~ 224

and

6173 days: 29.53 days (the synodic period of the Moon) = 209.04 ~ 209.

In figure 5 there are shown, by charts, cycles in the evolution of maximum and minimum daily temperatures, with a duration of 17 years - 36 days (6173 days).

The analyses of the graphics in figure 5 emphasizes the clarity of these cycles, especially at Bucharest Baneasa and Minneapolis.

2.4 The cycle of 18 years + 11 days (approximately 6585 days)

In astronomy, this cycle is known under the name of Saros' Cycle which, as we will see, appears in Meteorology as well. In Astronomy, it is known that, after a period of 6585 days, the Sun and the Moon eclipses repeat with great accuracy.

In this period of time there take place about 16 cycles of lunar Perigee (of 412 days); 241 tropic revolutions, 239 anomalistic revolutions and 223 synodic revolutions of the Moon, as indicated by the following calculations:

6585 days: 412 days (the lunar Perigee cycle) = 15.98 ~ 16;

6585 days: 27.32 days (the tropic period of the Moon) = 241.03 ~ 241;

6585 days: 27.55 days (the anomalistic period of the Moon) = 239.01 ~ 239

and

6585 days: 29.53 days (the synodic period of the Moon) = 222.99 ~ 223.

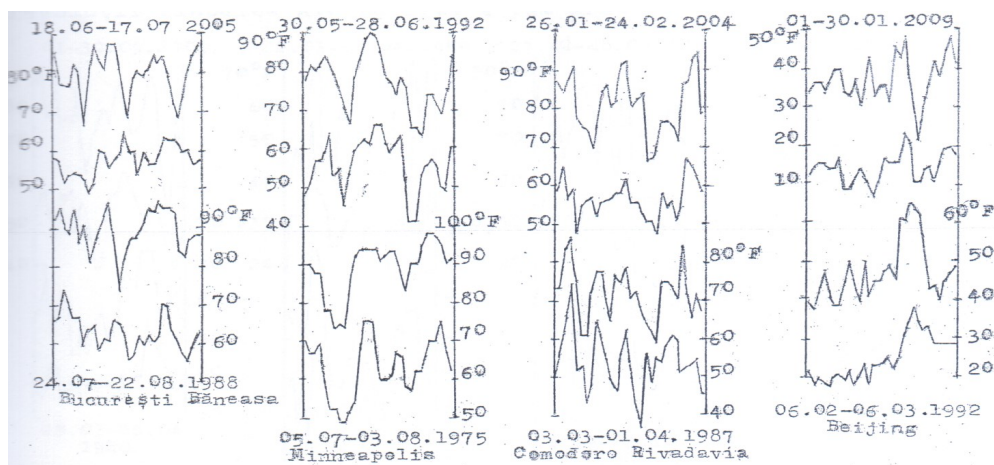


Figure 5 Cycles of 17 years-36 days (6173 days) in the evolution of maximum and minimum daily temperatures in different points, on the surface of Terra.

From the analysis of the graphics from figures 5 and 6, their clarity can be deduced, especially of the ones shown in figure 6 (Saros's Cycle).

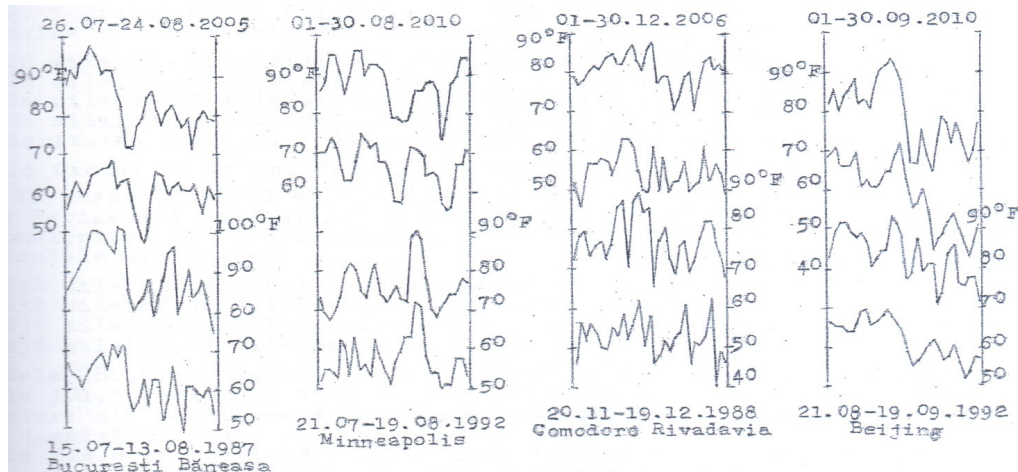


Figure 6 Cycles of 18 years+11 days (6585 days) in the evolution of maximum and minimum daily temperatures in different points, on the surface of Terra.

2.5 The 21 years and 156 days (circa 7826 days) Cycle

During the 7826 days (approximately) 19 412 days long cycles of the lunar perigee, 286.5 tropical revolutions; 284 anomalous and 265 synodical revolutions of the Moon happen, just how the following calculations show:

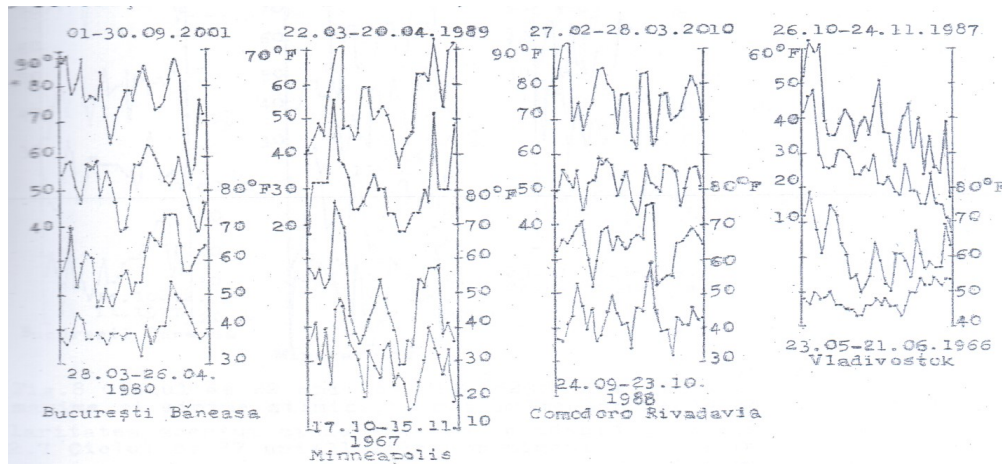


Figure 7. The 21 years+156 days (7826 cycle) in the evolution of maximum and minimum daily temperatures, in different points on Terra's surface.

7826 days:412 days (the cycle of the lunar perigee) = 18.99~19;

7826 days: 27.32 days (the tropic period of the Moon)=286.45~286.5;
 7826 days: 27.55 days (the anomalous period of the Moon)=284.06~284 and
 7826 days: 29.53 days (the synodic period of the Moon) = 265.01~265.
 The clarity of the cycles presented in figure 7 is more obvious in Minneapolis.

2.6. The 22 years and 203 days (about 8238 days) Cycle

During this time period (8238 days) about 20 cycles of the lunar Perigee (412 days); 301.5 tropic revolutions, 299 anomalous revolutions and 279 synodic revolutions of the Moon, according to the following calculations:

8238 days: 412 days (cycle of the Lunar perigee)=19.99~20

8238 days: 27.32 days (tropic period of the Moon)=301.53~301.5

8238 days: 27.55 days (anomalous period of the Moon)=299.01~299 and

8238 days: 29.53 days (synodic period of the Moon)=278.97~279.

The 286.5 tropic revolutions from the 21 years+156 days cycle, as well as the 301.5 tropic revolutions from the 22 years+203 days represent cycles of the Moon, taking into account the previous explications, given at the 4 years+192 days.

In figure 8, there are presented graphics that contain cycles of the maximum and minimum daily temperatures in different points on Terra's surface, with the duration of 22 years+203 days (8238 days).

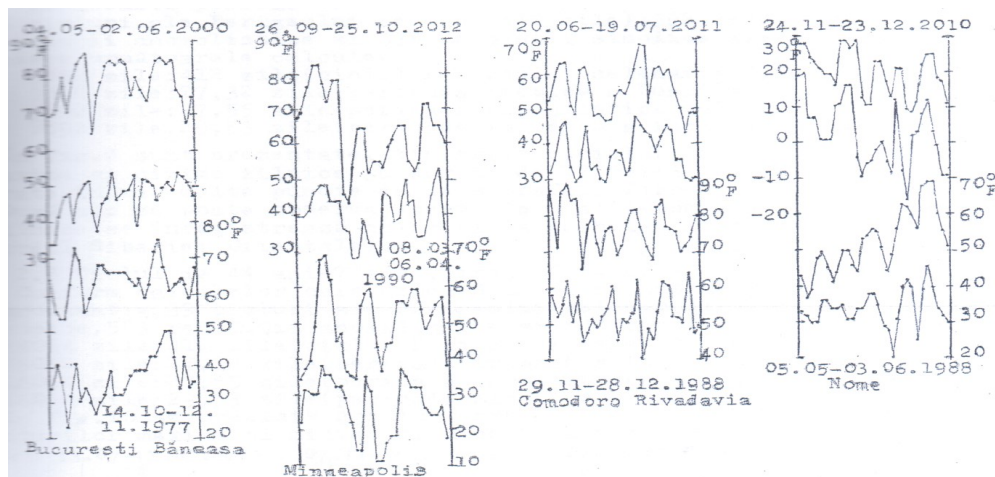


Figure 8. The 22 years+203 days (8238 cycle) in the evolution of maximum and minimum daily temperatures, in different points on Terra's surface.

The clarity of this cycle is more obvious in Minneapolis.

2.7 The 27 years and 31 days (about 9892 days) Cycle

In this period of time (of approximately 9892 days) there are about 24 cycles of the selenic perigee (412 days) which happen: 362 tropical revolutions, 359 anomalistic revolutions and 335 synodic revolutions of the Moon, if we take into consideration the following calculations:

9892 days:421 days (the cycle of the lunar Perigee)=24,00=24;

9892 days:27,32 days (the tropical period of the Moon)=362,07≈362;

9892 days:27,55 days (the anomalistic period of the Moon)=359,05≈359 and

9892 days:29,53 days (the synodic period of the Moon)=334,98≈335.

In figure 9 cycles of the evolution of the daily lowest and highest temperatures of a duration of 27 years+31 days (9892 days), registered in various locations on the surface of Earth, are shown in graphs.

As you can see, this cycle of the highest and lowest daily temperatures are registered even at Verhoiansk (the coldest region in the north of Eastern Siberia).

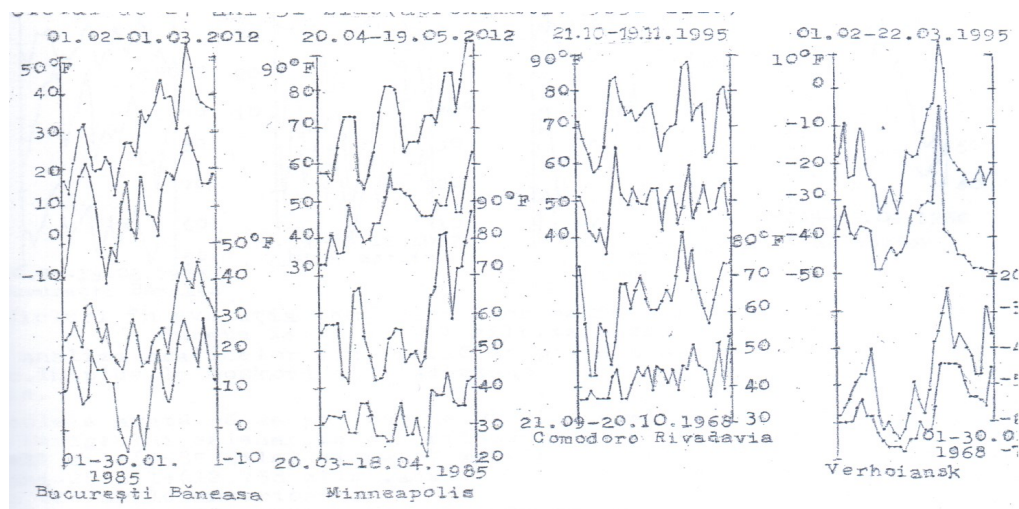


Figure 9. The 27 years+31 days (9892 cycle) in the evolution of maximum and minimum daily temperatures, in different points on Terra's surface.

2.8 The cycle of 77 years-7 days (circa 16064 days)

According to the following calculations, in this period of time there are about 39 cycles of the lunar Perigee (412 days), 588 tropical revolutions, 583 anomalistic revolutions and 544 synodic revolutions of the Moon which happen.

16064 days:412 days (the cycle of the selenic perigee)=38,99≈39;

16064 days:27,32 days (the tropical period of the Moon)=587,99≈588;

16064 days:27,55 days (the anomalistic period of the Moon)=583,08≈583 and

16064 days:29,53 days (the synodic period of the Moon)=543,98≈544.

In figure 10, there are presented graphs which include cycles of the evolution of the highest and lowest daily temperatures, in more points on Earth – of 44 years – 7 days.

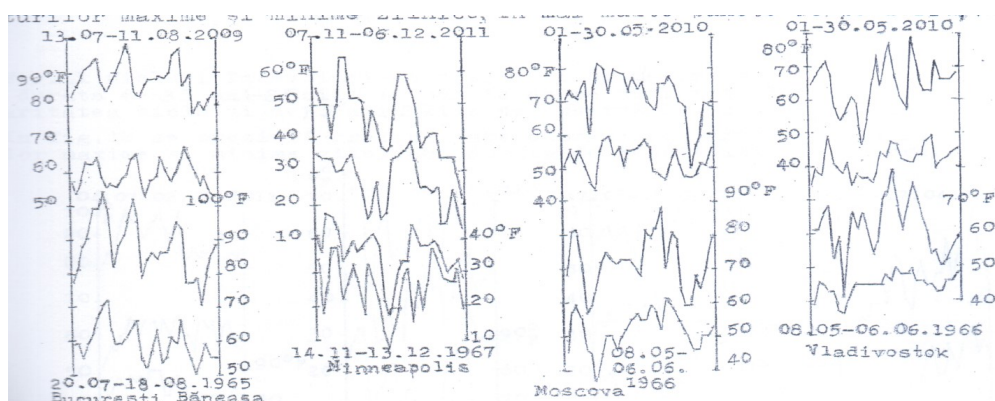


Figure 10. The cycles in the evolution of maximum and minimum daily temperatures lasting 44 years 7 days on Terra's surface.

From the analysis of the graphics in figure 10 it can be noticed the clarity of the resemblances. Moreover. In Moscow and Vladivostok there are the same periods of observation.

The calculations show that we can obtain other cycles which can start from the lunar Perigee cycle of 412 days. For example, from the sum of the cycles of 18 years+ 11 days(6585) and 17 years – 36 days(6173 days) it can be obtained the cycle of 35 years -25 days(12.758 days) This cycle respects all the conditions imposed in the previous cycles.

Another example is the doubled cycle of 18 years +11 days (6585 days) and we can obtain through it the cycle of 36 years + 21 days (13170 days)) which respects the conditions imposed in the previous cycles too.

In figure 11, there are presented, through graphs, the cycles of the maximum and minimum daily temperatures lasting 35 years – 25 days, in more points on Earth.

The clarity of the cycle of 35 years – 25 days is more obvious in Bucharest - Baneasa.

In figure 12, there are presented which contain the cycles in evolution of the maximum and minimum daily temperatures lasting 36 years + 21 days on Earth.

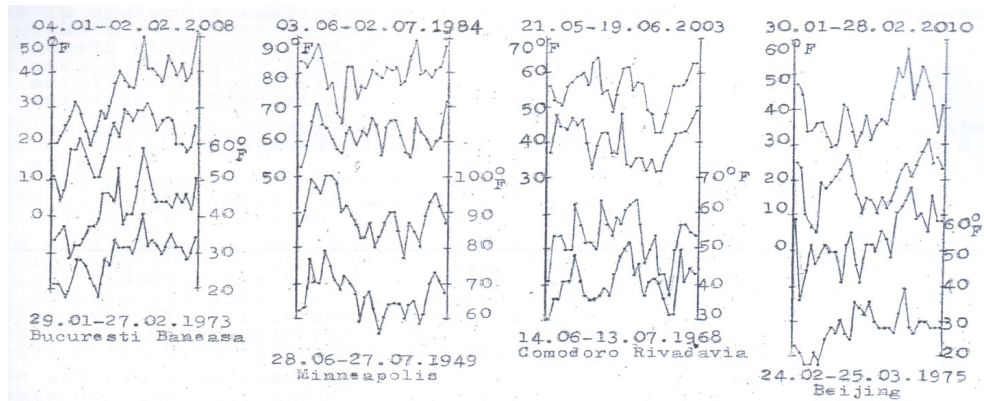


Figure 11. The cycles in the evolution of maximum and minimum daily temperatures lasting 35 years - 25 days in points on the Terra's surface.

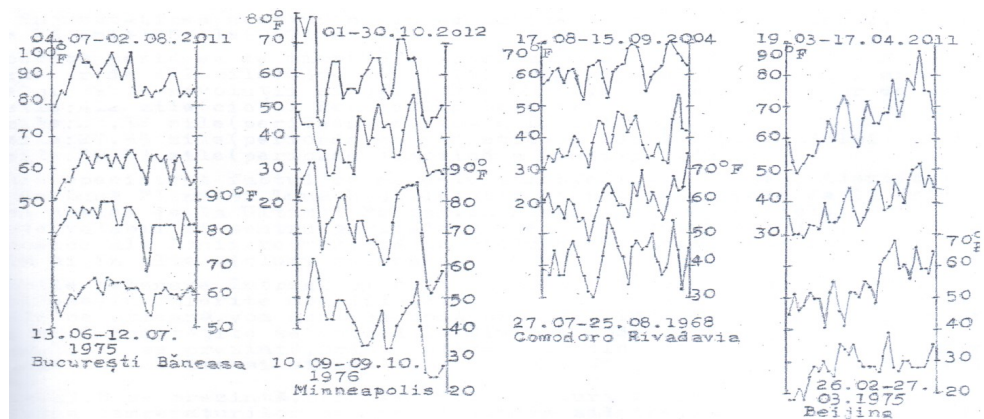


Figure 12. The cycles in the evolution of maximum and minimum daily temperatures lasting 36 years - 21 days in different points on the Terra's surface.

The analysis of the graphics in the figure 12 emphasizes the clarity of the similarities, especially between Bucharest, Baneasa, Comodoro Rivadavia and Beijing.

The calculations show that there are other cycles that follow the imposed requirements for the cycles previously analyzed, but their duration can be cut in half. In this category fit the following cycles, having these periods of time:

10 years + 38 days = 3690 days : 2 = 1845 days (5 years + 19 days);

26 years - 18 days = 9478 days : 2 = 4739 days (13 years - 9 days);

53 years - 15 days = 19342 days : 2 = 9671 days (26 years + 175 days);

$62 \text{ years} + 4 \text{ days} = 22648 \text{ days} : 2 = 11324 \text{ days} (31 \text{ years} + 2 \text{ days}).$

Even the 17-year-minus-36-days (6173 days) cycle, previously proved, can be cut in half in terms of periods of time, which means $6173 \text{ days} : 2 = 3086 \text{ days}$, which means 8 years + 164 days.

A certain cycle of the lunar parallax is made up of the one that takes 19396 days (aprox. 53 years + 38 days), which is the sum of six sidereal revolutions of the lunar Perigee, $3232.6 \text{ days} \times 6 = 19396 \text{ days}$.

In this period of time, there are happened 47 cycles of the lunar Perigee (of 412 days): 710 tropical revolutions, 704 anomalistic revolutions and 657 synodical revolutions of the Moon, as the following calculations show:

$19396 \text{ days} : 412 \text{ days (the lunar Perigee cycle)} = 47.07 \text{ (aprox. 47)};$

$19396 \text{ days} : 27.32 \text{ days (tropical revolution of the Moon)} = 709.95 \text{ (aprox. 710)};$

$19396 \text{ days} : 27.55 \text{ days (anomalistic revolution of the Moon)} = 704.02 \text{ (aprox. 704)};$

$19396 \text{ days} : 29.53 \text{ days (synodic revolution of the Moon)} = 656.82 \text{ (aprox. 657)}.$

Another special lunar cycle, which can be halved, is the one with a 53-year-minus-15-days period of time (aprox. 19343 days). In this period of time there are happening 47 cycles of the lunar Perigee (412 days); 708 tropical revolutions, 702 anomalistic revolutions and 655 synodic revolutions of the Moon, as the following calculations show:

$19343 \text{ days} : 412 \text{ days (the lunar Perigee cycle)} = 46.95 \text{ (aprox. 47)};$

$19343 \text{ days} : 27.32 \text{ days (tropical revolution of the Moon)} = 708.01 \text{ (aprox. 708)};$

$19343 \text{ days} : 27.55 \text{ days (anomalistic revolution of the Moon)} = 702.10 \text{ (aprox. 702)};$

$19343 \text{ days} : 29.53 \text{ days (synodic revolution of the Moon)} = 655.02 \text{ (aprox. 655)}.$

By halving this cycle it is obtained another lunar cycle, lasting 26 years and 175 days (9671 days).

In this period of time (9671 days) take place 23,5 cycles of the lunar Perigee (of 412 days); 354 tropical revolutions, 351 anomalistic revolutions and: 327,5 synodical revolutions of the Moon, according to the calculations below;

$9671 \text{ days} : 412 \text{ days (cycle of the lunar Perigee)} = 23,47 \sim 23,5;$

$9671 \text{ days} : 27,32 \text{ days (the tropical period of the Moon)} = 353,99 \sim 354;$

$9671 \text{ days} : 27,55 \text{ days (the anomalistic period of the Moon)} = 351,03 \sim 351$
and

$9671 \text{ days} : 29,53 \text{ days (synodical period of the Moon)} = 327,49 \sim 327,5.$

It should be specified the fact that the atmospheric tides are produced identically during the Full Moon and the New Moon. They are also produced identically during the First and the Last Quarter. In this situation, the cycle of 9671 days is also available for the synodical period of the Moon. The 327,5 synodical revolutions of the Moon represent a real cycle. This remark is also available in another lunar cycles.

The complete lunar cycles and the halved ones can evolve in different ways.

In the following we will analyze two situations in which the lunar cycles, completed and halved, are succeeding in different ways.

The figure 13.A presents, through graphics, two completed lunar cycles during the evolution of maximum and minimum daily temperatures, at Braila, with the duration of 19396 days each one.

The figure 13.B presents, through graphics, completed and halved cycles during the evolution of maximum and minimum daily temperatures, at Braila, in the period between 2007, 1989 and 1981.

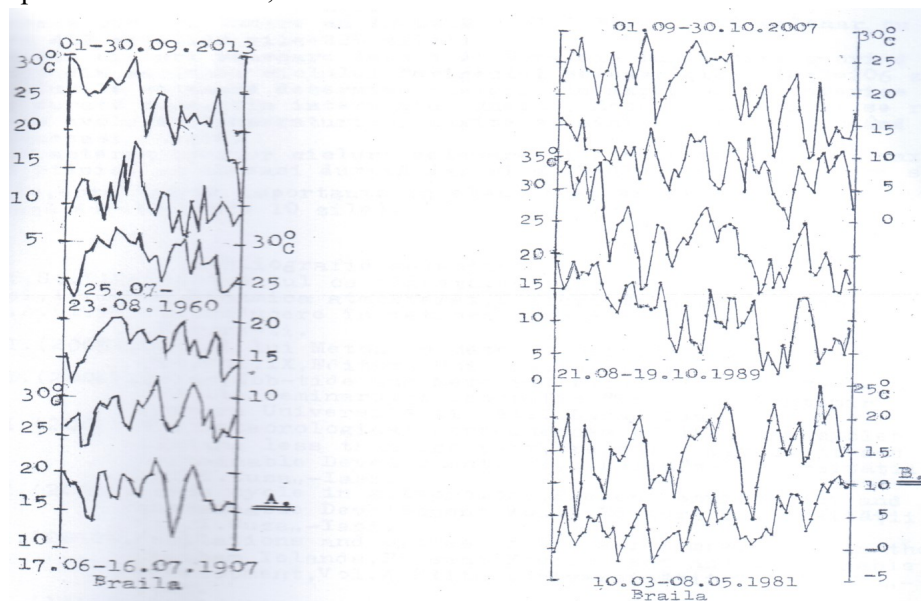


Figure 13. The successive cycles in the evolution of daily maximum and minimum temperatures, in Braila

In figure 13.A, the two lunar cycles totaling 38792 days. Thus said between 1907 and 1960 is 53 years + 38 days (19396 days). The same difference is also between 1960 and 2013.

In figure13.B, the difference in time between the chart below and the middle is 8 years + 164 days (36 days cycle 17 years- halved). Between the middle chart (1989) and the chart above (2007) is a time difference of 18 + 11 days (6585 days, that's Saros Cycle). Between the chart above (2007) and the chart below (1981) is a time difference of 26 years + 175 days (9671 days is half of the cycle of 53 years-15 days = 19343 days).

These are just two examples in succession cycles that reflect the evolution of minimum and maximum daily temperatures. In reality, this sequence is more varied and covers all full and halved cycles lunar parallax related.

Conclusions

From the analysis of lunar cycles that are based on the lunar parallax and how they are reflected in the evolution of daily maximum and minimum temperatures, could be deduced the following conclusions:

All these lunar cycles are just slenar because they do not contain a whole number of years (365, 24 days = tropical year). If they contain a number, throughout the years, then it would be month-solar cycles;

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