The 206-day lunar cycle of temperature anomalies in 2016/17

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The spring of 2017 presented an unusual surprise in the development of weather processes in the European territory of Russia (ETR). As early as the second week of February, the air temperature rose to freezing, and in March the average daily temperature became positive. On March 1, in many cities of the ETR, the absolute maximum temperatures were above average with values more like those expected for the middle of April. There was a rapid melting of the snow cover. Much earlier than normal, the rivers Don, Oka, Dnieper, Zapadnaya Dvina, Volga were opened for navigation.

By the second week of April, the temperature rise was reversed and the resulting negative temperature anomalies persisted until the last days of April. After a four-day wave of summer-like heat, starting on May 4th, the temperature returned to the cooler values of April. In the third week of May, the temperature began to return to more normal values. However, in the first days of June, a wave of cold Arctic air again invaded, bringing temperatures closer to the extremely low values experience earlier in the year. In many areas of ETR in June, there were still frosts.

Now let us consider more closely the evolution of the temperature anomalies in the ETR using data from the weather station of the VDNKh (Moscow). Fig. 1 shows the anomalies in the average daily temperature over 2016/17. The daily data are smoothed by calculating their moving averages over 27 days values. The smoothed data are represented by a thick curve. The graphs of temperature in the cities of Samara, Krasnodar and Rostov on Don have the same appearance as in Moscow.

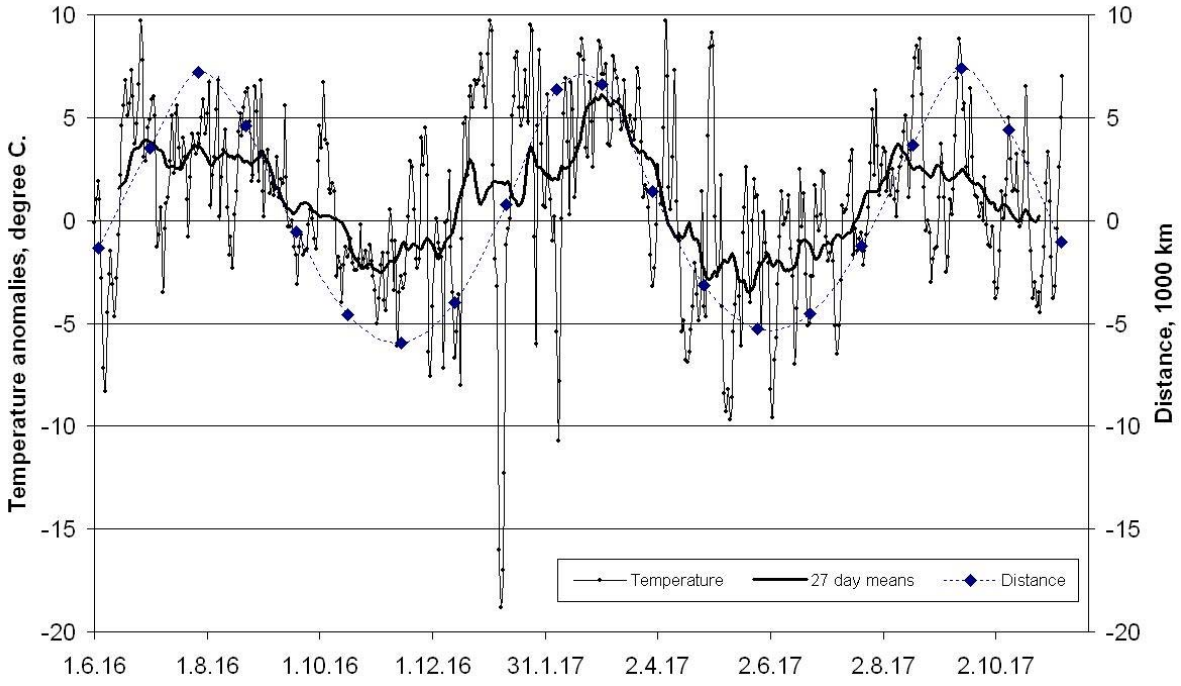

Figure 1. Deviation of the perigee distance of the Moon from 362464 km. (Rhombuses) and the course of anomalies in the average daily air temperature in Moscow in 2016/17 (a thin curve - the average daily values, a thick curve - moving average for 27 days values).

In Fig. 1 the smoothed curve exhibits a distinct sinusoidal-like wave, with minimums in November 2016 and June 2017 and maximums in July 2016, March and September 2017. The swing of the temperature anomaly fluctuations reaches 10 degrees, and the period (the time interval between the minima) is about 205 days. This period is almost precisely the same as the 206-day period that we obtained in the periodogram for the 43-year-old series of temperature anomalies for Moscow [2, 3]. The 206-day cycle is well known to astronomers as being half of the Full Moon Cycle of 411.78 days. From the physical point of view, the cycle of 206 days is the period of the beating of the frequencies of the anomalistic (27.55 days) and the synodic (29.53 days) months [Sidorenkov, 2015], or the synodic month and the evection period of the lunar orbit (31.81 days).

The perigee end of the line-of-apse of the lunar orbit is continuously shifting from west to east (i.e. in a pro- grade direction) in the sky, returning to roughly the same position with respect to the stars once every 8.85 year. As a direct consequence of this pro-grade movement, if the Perigee end of the lunar line-of-apse starts out points directly at the Sun, it will take another 1.127 years or 411.8 days before it returns to pointing at the Sun again. This true because:

$$\frac{1}{1} - \frac{1}{8.85} = \frac{1}{1.127}$$

This means that Perigee end of the lunar orbit will go from pointing directly at the Sun, to pointing directly away from the Sun once every 206 days.

In addition, the distance between the Moon and the Earth the magnitude of perigee also varies from 370,000 km to 356,000 km over the same period of 206 days. This phenomenon is illustrated in Fig. 1, where diamonds are marked by deviations of perigee distances from their average value of 362,464 km, and their dynamics are represented by a dashed curve. The duration of the lunar anomalistic month (that is, the time interval between two consecutive passages of the moon through the perigee) also changes with a period of 206 days from 28.5 to 24.8 days.

The Earth in its motion around the barycentr of the Earth- Moon system reflects all the movements of the Moon on a scale of 1:81. Therefore, the Earth has similar variations of the pericentric distance and the angular velocity of the monthly circulation around the Earth-Moon barycenter with a period of 206 days. [2, 3]. The 206-day cyclicity of the monthly movement of the Earth is reflected in processes in the earth's shells, primarily in the hydrosphere [1] and the atmosphere.

The 206-day temperature anomaly cycle leads to violations of seasonal temperature variations. For example, due to its contribution, the 2016 winter over European Russia began nearly one month earlier, while the 2017 summer set in one month later than its usual time. As a result, the "top" of the summer shifted to August, and the fall, to the end of September.

References

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