Is Global Cooling Process Real or Not?

Victor Ermakov, Victor Okhlopkov, and Yuri Stozhkov

Abstract—**Two years ago (2006) at the ECRS in Lisbon the physical mechanism of global change of climate was presented. Since two years elapsed and new data on global temperature changes ΔT in the boundary air layer were presented in INTERNET. The analysis of all ΔT values including new ones is made and it is shown that from the beginning of the 21-st century till now the increase of ΔT is not observed.**

1. Introduction

In the last tens of years the mass-media has discussed the question on global warming of the Earth's climate. The warming at ~ (+1°C) occurred in the 20th century. As is believed, the main reason of this process is the anthropogenic influence on the atmosphere. This influence has to increase with time, and the proponents of this point of view give the following prognosis: the global temperature T near the Earth's surface will increase to the end of the 21st century by $\Delta T \approx (1.4 – 5.8)\ ^{o}C$. Such warming can give catastrophic impact on the environment.

However, in our papers published in the last three years a prognosis on the cooling of climate in the first half of the current century was made. This conclusion was obtained from the results of the spectral analysis of the data on the global temperature T near the Earth's surface for the period of 1880 – 2007 [1], [2].

In this paper the following question is under discussion: What occurs during recent years – warming or cooling of climate, and what is its cause?

2. Anthropogenic Influence on Climate

Anthropogenic activity produces greenhouse gases (CO_2, and others) which are added to the atmosphere. The increase of the concentrations of these gases leads to the warming of the climate. The calculations show that for the last 100 years the thermal flux entering from the atmosphere to the Earth's surface increased by 1.6 W m^{-2}. This effect is due to the anthropogenic activity only.

From the thermal balance equation the increase of thermal flux by 1.6 W m^{-2} is not enough to increase the value of T by ~ 1°C. To get the observed growth of T it needs to increase the thermal flux by ~ 10 times.

2. Temperature Data for 1880-2008

In Fig. 1 the yearly averages of global surface temperature changes ΔT, obtained at the global network of meteorological stations, are presented [ftp://ftp.ncdc.noaa.gov/pub/data/anomalies/monthly.land_and_ocean.90S.90N.df_1901-2000 mean.dat]. One can see that during the 20th century the climate warming by ~ 1 °C occurred.

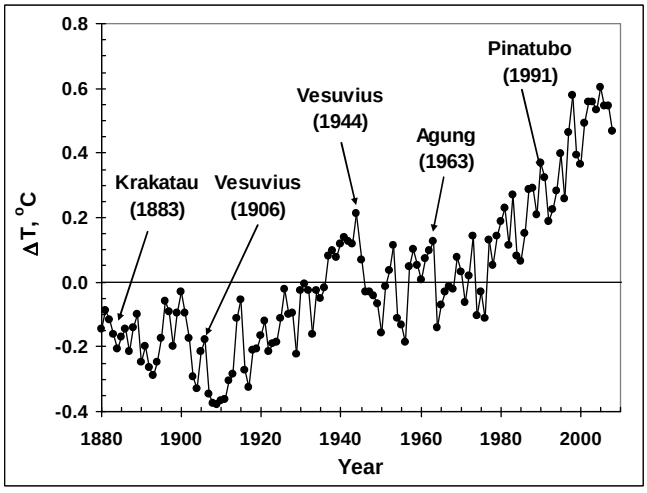

Fig. 1. Yearly averages of global air surface temperature changes ΔT relative to the averaged T for 1901-2000 obtained at the global network of meteorological stations. The arrows show powerful eruptions of volcanoes.

However, this process was not monotonic. In 1880-1910 and 1945-1975 a small cooling of climate took place, but in 1910-1945 and 1975-1998 a warming was observed. It is difficult to explain such changes of climate by anthropogenic influence, because during the period under consideration human activity increased permanently.

3. Effect of Dust on the Earth's Climate

As is seen from Fig. 1, during ~2 years after strato-volcano eruptions global air surface temperature decreases by $\Delta T \approx$

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0.2°C were observed (see Fig. 1). During such eruptions a huge amount of dust is vented to the atmosphere. This dust lives in the atmosphere about 2 years. This fact demonstrates that the dust entering into the atmosphere influences the Earth's climate. It is known that water droplets grow on fine particles of dust and reflect part of solar irradiation back to space. So, more dust, more cloud, and cooler climate**.**

The dust has terrestrial or cosmic origin. From the Earth's surface the dust enters the stratosphere during the strato-volcano eruptions that occur not so often. Cosmic dust falls upon the atmosphere permanently.

4. Cosmic Dust in the Earth's Atmosphere

In the interplanetary space between the Sun and the Mars the zodiacal dust cloud exists. The dust is concentrated to the ecliptic plane and falls upon the Earth's atmosphere.

The zodiacal light observed from the ground and in space proves the existence of the dust cloud.

The long-periodical comets arriving to the solar system from the Oort's comet cloud in the interstellar space are the main sources of dust in the zodiacal cloud. The periods of such comet rotations around the Sun are about 200 years. In the interstellar medium the cold comets accumulate a large amount of dust and gas on their surface.

The planets influence the motion of comets towards the Sun. They are gravitational lenses for all flying nearby bodies including comets. Some part of comets falls on planet surfaces. Another part is deflected from the direction to the Sun. As a result, each planet modulates the comet flux moving towards the Sun. The planet farther from the Sun modulates the comet flux flying near a planet less removed from the Sun. Therefore, the number of comets moving towards the Sun depends on the mutual arrangement of planets.

At the distances from the Sun $r < 2$ a. u. the comets begin to release gases and dust frozen on them during their travel in the interstellar medium. In doing so, huge gas-dust clouds are produced and zodiacal dust cloud is formed in the region between the Sun and Mars orbit.

Thus, the changes of the comet flux in the solar system will change the dust concentrations in the zodiacal cloud and in turn it will influence climate on Earth. The changes of the Earth's climate have to depend on the mutual arrangement of planets.

5. Time Variations of the Earth's Climate

We have data on the climate changes for the last 400 thousand years [3]. These data tell us that the climate of the Earth has steadily changed. The spectral analysis of these data shows that in the changes of climate the following periodicities are present: ~ 100, ~ 43, ~ 21 thousand years. These periodicities are observed in the changes of the Earth's orbit parameters and it is due to the influence of mutual planet arrangement. In the changes of dust concentrations in the ice cores of Greenland and Antarctica there are the periodicities of ~ 200, ~ 65, ~20, and ~ 10 years. These periodicities are present in the variations of heavy planet rotations around the Sun.

6. Prediction on the Cooling Climate in the 1st half of 21st Century

The results of spectral analysis of the global temperature data shown in Fig. 2 (thin curve) are given in the Table. Using the values of wave amplitudes, periods, and phases from the Table we made the prognosis on a cooling climate during the 1st half of the 21st century. Our prognosis is given in Fig. 2 (see thick curve). To do it we used only the first 4 harmonics from the Table (marked bold), namely, with the periods of 196, 64, 33, and 21 years.

TABLE
Spectrum of Global Temperature Changes for 1880-2007

Amplitude	Period	Phase
0.285	**195.91**	**124.95**
0.171	**64.48**	**25.24**
0.078	**33.07**	**19.28**
0.084	**21.00**	**7.59**
0.027	17.50	3.17
0.042	14.92	13.84
0.039	12.93	7.25
0.028	11.59	5.15
0.025	10.61	5.43

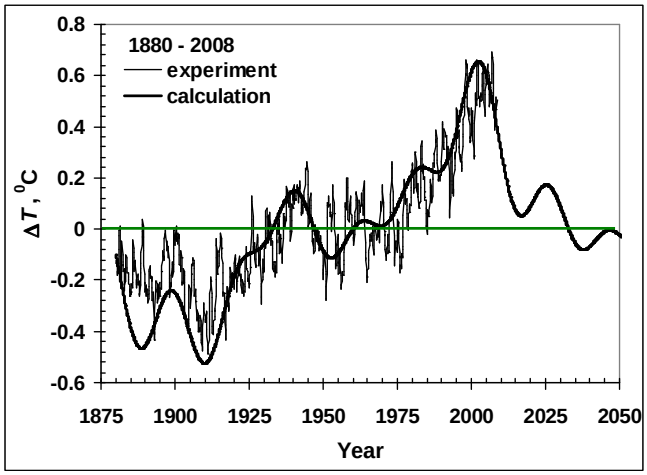

Fig. 2. Monthly averages of global temperature of surface air changes ΔT smoothed with 5 points [ftp://ftp.ncdc.noaa.gov/pub/data/anomalies/monthly.land_and_ocean.90S.90N.df_1901-2000mean.dat] and calculated ones (thin and thick curves respectively).

It is seen that our prognosis predicts a cooling of climate in the current century.

7. Is Prognosis on the Cooling Climate Justified or Not?

In Fig. 3 the changes of ΔT over the globe are shown for the period from 1992 to the present time. One can see that in the

beginning of the 21st century the warming process was stopped and during the recent years a climate cooling is observed (a small decrease of temperature took place).

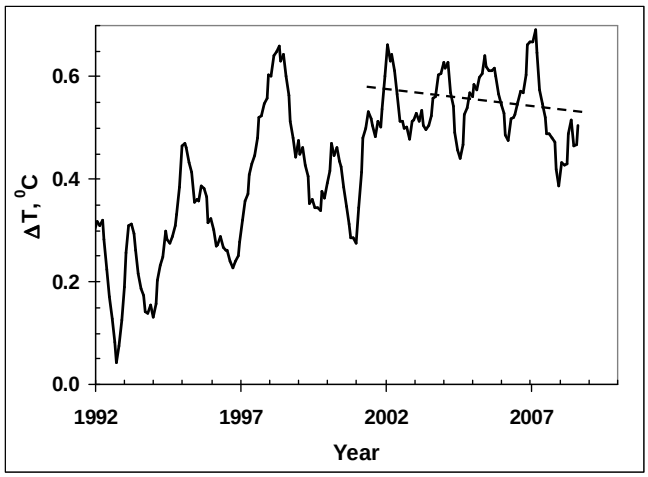

Fig.6. Monthly values of ΔT smoothed with 5 points. Dashed line shows gradual decrease of ΔT during the latest years.

8. Conclusion

It is shown that cosmic dust influences the Earth's climate via the process of cloud formation. The climate changes that occurred during the past 500 hundred years were due to the changes of cosmic dust concentrations in the interplanetary space (in the zodiacal cloud).

The comets are the main sources of cosmic dust. The planets and the Sun control the motion of comets in the solar system. Thus, the mutual arrangement of planets influence the climate via changes of cosmic dust concentration in the zodiacal cloud.

Analysis of the global data on surface air temperature changes for the period of 1880 - 2007 leads to the conclusion that in the first half of the current century a climate cooling will occur. The experimental data obtained so far in this century show the beginning of the cooling process.

References

[1] Victor Ermakov, Victor Okhlopkov, and Yuri Stozhkov, "Influence of Zodiacal Dust on the Earth's Climate", *Proc. 20th ECRS*, Lisboa, Portugal, 2006.

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[3] Petit J.R., Jouzel J., Raunaud D., et al., "Climate and atmospheric history of the past 420,000 years from the Vostok ice core, Antarctica", *Nature*, 1999, vol. 399, pp. 429 –436.