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Trends of solar-geomagnetic activity, cosmic rays, atmosphere, and climate changes

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The results are presented of the analysis of trends in the solar-geomagnetic activity and intensity of galactic cosmic rays (GCR) for the several eleven-year solar cycles. The indication has been revealed of the change of signs in the long-term changes in geomagnetic activity (aa-index) and the GCR in recent years. These changes correspond to the changes of sings in long-term trends in some of atmospheric parameters (transparency, albedo, cloudness, the content of water vapour, methane, ozone, the erythemal radiation flux). These global changes in atmosphere is most important problem of the up-to-date science. The global warming observed during the several past decades presents a real danger for the mankind. Till present the predominant point of view has been that the main cause of the increase of mean surface air temperature is the increase of concentrations of the anthropogenic gases first of all carbon dioxide CO_2 and methane CH_4. Indeed, from the beginning of nineteen century the concentration of CO_2 in the atmosphere has been growing and now it exceeds the initial level by the factor of 1.4 and the speed of this increase being growing too. This was the reason of international efforts to accept the Kyoto Protocol which limited the ejections of greenhouse gases. However there are premises which show that the influence of solar variability on the climate should be taken into account in the first place.

The obtained results are analyzed from the point of view of well known effects of GCR influence on weather and climate with taken into account also a novel trigger mechanism in solar-terrestrial relations what allows revaluation of the role of solar flares and geomagnetic storms. The mechanism explains how agents of solar and geomagnetic activities affect atmospheric processes. This first agent under consideration is variation of fluxes of solar EUV and X-ray radiation. The second agent is fluxes of electrons and protons which precipitate from radiation belts as a result of geomagnetic disturbances. All these fluxes are completely absorbed in the ionosphere and hence do not reach lower atmosphere. Our novel radiooptical trigger mechanism of influence of solar and geomagnetic activity on the formation of weather and climate changes consists of three stages. The first stage is an increase in generation of the microwave radiation which penetrates from the ionosphere to the earth surface. The microwave radiation arises from the transitions between Rydberg states which are exited by the energetic ionospheric electrons. The second stage is a change in the proportion of water vapour to water clusters caused by increased microwave radiation. The third stage is a change of the atmosphere transparency in the absorption bands of water vapour and clusters. The atmosphere transparency determines the fluxes of solar irradiance coming down as well as flux of the thermal radiation coming out from the underlying surface. These fluxes form the basis of the thermal balance and affect the weather and climate characteristics of the lower troposphere.

The novel mechanism explains how factors of solar and geomagnetic activities affect atmospheric processes and why the changes observed in long-term trends might result in slowing down of global warming in the nearest future. According to the recent analysis of meteorological data (NASA Goddard Institute for Space Studies, 2008) the rate of global warming in 2008 appears to be slowing in comparison with the last eight years.