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Climate: Present and near Future

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A novel radiooptical trigger mechanism is proposed in solar-terrestrial relations what allows revaluation of the role of the solar EUV/X-ray fluxes during flares and of the precipitating electron fluxes during geomagnetic storms. Our 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.

This mechanism is involved into analysis of climate changes going on during the several past decades. It is supposed that climate during past decades (in the period of global warming)was determined by secular (about one hundred years and two hundred years) maxima of solar activity which took place in the middle of eighties. Since 1985 the total solar irradiance flux started decreasing with simultaneous decreasing of ionizing EUV and X-ray radiation. However the geomagnetic activity according to the aa-index kept growing till 2003. This growth (+ 0.3 % / year) was replace activity also started decreasing (- 6.7 % / year) only after 2003. Summation of contributions to generation of ionospheric microwave emission both for solar and geomagnetic activities places the data of crisis in atmospheric trends to 2000-2001. Since then the role of radiooptical trigger mechanism in formation of clouds and aerosol layers is weakening that has to result in decrease in cirrus clouds which cause net warming at high altitudes. Evidently as delicate physical mechanism as governing the rated of association and dissociation of cluster ions is able to affect only newly born optically thin clouds, which are for away from the stable cyclonic and anticyclonic formations. Optically thick clouds that produce a net cooling need by far greater energy and longer time for evolution than comparatively short burst of fluxes during solar flares and geomagnetic storms.

Formation of thick low clouds to a considerable extent is determined by the magnitude of GCR fluxes. Weakening of the solar activity (which we have pointed out here) have led to the GCR increase. Moreover it is shown that there is a negative correlation between long-term GCR variations and surface air temperature changes. The GCR increase causes the growth of low cloudness and therefore produce mainly cooling effect on the mean surface air temperature. But it would be difficult to separate solar, geomagnetic and GCR effects which vary in a similar way and almost simultaneously.

Thus it is shown in the present paper that during last years the main factors of solar variability influence on the weather and climate changes sign of trends in the direction that leads to the decrease of global mean surface air temperature. According to the recent analysis of meteorological data (Japan Meteorological Agency, 2008) the rate of global warming in 2008 appears to be slowing in comparison with the last third of XX century.