Stratospheric aerosols injections influence to global climate stabilization

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Global warming climate changes are observed in recent decades. These changes largely associated with anthropogenic increases in greenhouse gases in the atmosphere (CO_2 – most important among them) [1]. The problem and opportunity of the global climate stabilization [2] at a current level are investigated. The study is based on a three-dimensional hydrodynamic global climate coupled model, including ocean model with real depths and continents configuration, sea ice evolution model and energy and moisture balance atmosphere model [3, 4]. The climate prediction calculations up to the year 2100, using CO_2 growth scenario A2, proposed by IPCC are carried out on the first stage [5]. They give an increase in global mean annual surface air temperature at 2.2 degrees in the year 2100. Next, a series of calculations were carried out to assess the possibility of climate stabilization at the level of the year 2010 by controlling emissions into the stratosphere of aerosol, reflecting part of the incoming solar radiation. Aerosol concentration from the year 2010 up to 2100 is calculated as a controlling parameter to stabilize mean year surface air temperature. It is shown that by this way it is impossible to achieve the space and seasonal uniform approximation to the existing climate, although it is possible significantly reduce the greenhouse warming effect. Assumption of a uniform stratospheric aerosol space distribution can stabilize the mean atmosphere global temperature, but climate will be colder at 0.1-0.2 degrees in the low and mid-latitudes and at high latitudes it will be warmer at 0.2-1.2 degrees (Fig. 1, 2).

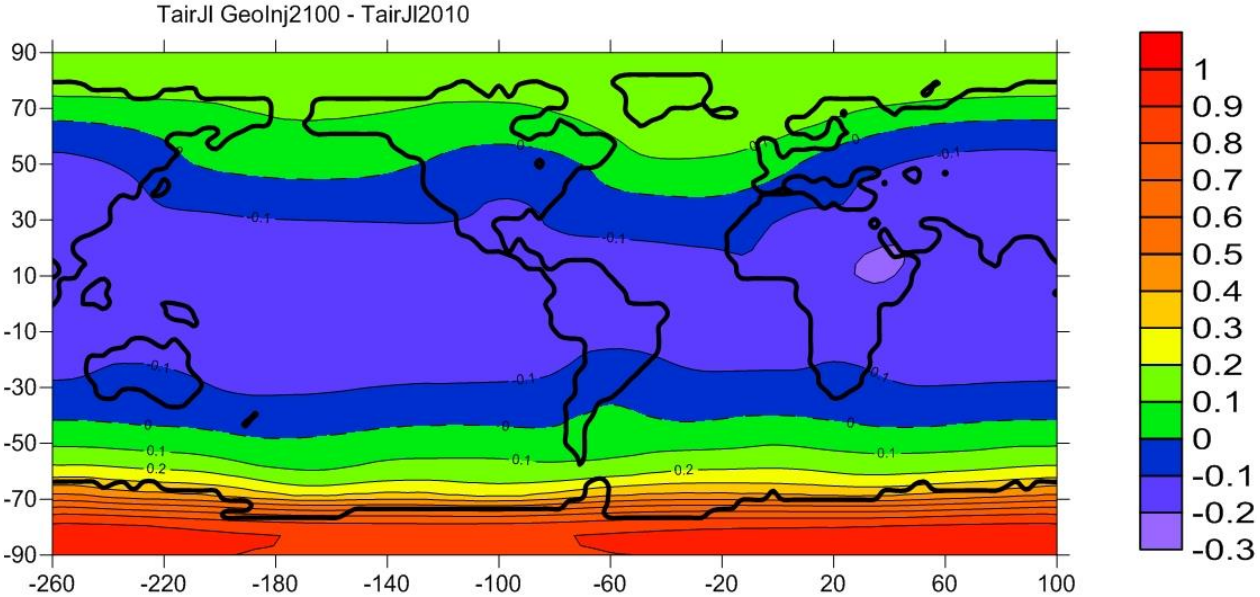

Fig.1. Difference between surface air temperature of stabilized climate (2100 year) and 2010 year climate. July

In addition, these differences have strong seasonal move – they increase in the winter season. The situation is slightly better when we allow latitude dependence of aerosol

concentrations. Compared to the previous case, the concentration is reduced in low and middle latitudes and is enlarged in high latitudes.

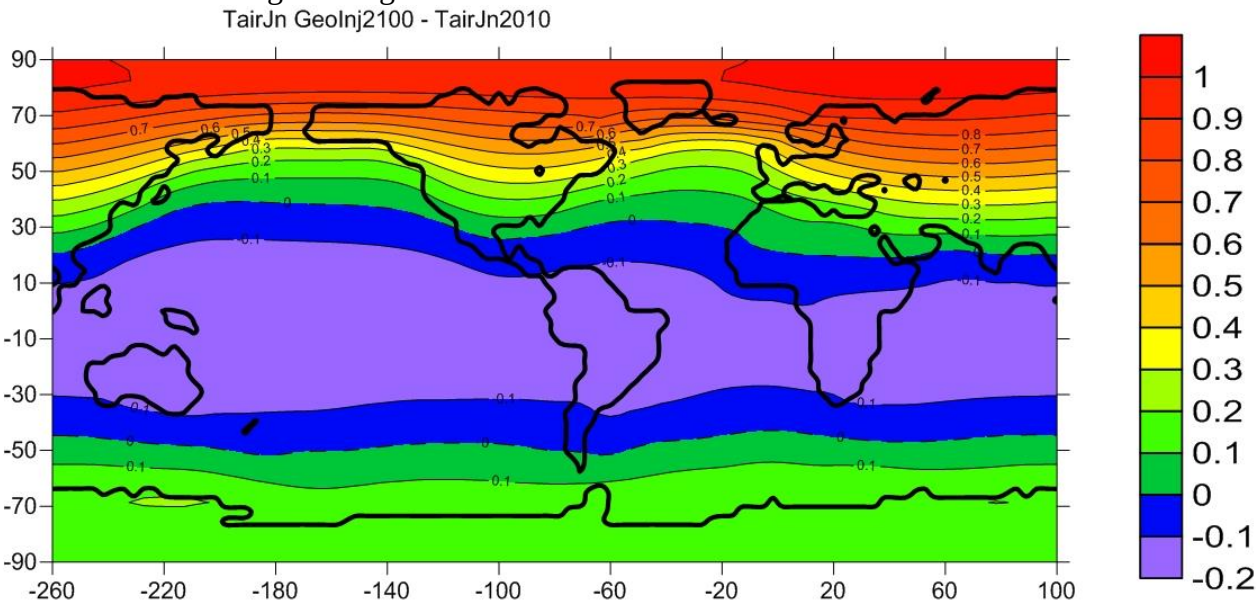

Fig.2. Difference between surface air temperature of stabilized climate (2100 year) and 2010 year climate. January

However, the increase in the aerosols concentration in the polar areas gives a weak effect, since there is little influence of solar radiation, while the greenhouse effect is stable. It is assumed in the following numerical experiments that aerosol emissions and concentration are zero from the year 2080. This leads to a rapid increase of the mean global atmospheric temperature, approaching the temperature without the aerosols to the year 2100.

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