

Effects of super solar flare on the Earth's atmosphere

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It is well known that solar flares are frequently observed. Observational and theoretical studies have revealed impacts of solar flares on the general circulation of the thermosphere/ ionosphere. On the other hand, there are only few studies concerning the effects of solar flares on the general circulation of the lower and middle atmosphere. Some theoretical studies suggest that super solar flare whose energy is larger than the energy of the normal solar flare by a factor of 10,000 is rare, but can occur. The solar constant during the super solar flare event is estimated to be 2-4 times larger than the present solar constant. This means that the super solar flare affects significantly the climate of the Earth. Using a general circulation model (GCM) we examine the response of the temperature to sudden increase of the solar constant due to the super solar flare. A GCM that contains the region from the ground surface to the exobase is used to estimate the effect of solar super flare on the general circulation of the Earth's atmosphere. The schemes for the boundary layer processes, the solar radiation and the infrared radiative transfer are included in the GCM. Our simulation results indicate that abrupt temperature increase of 10 K near the surface in low latitudes occurs when the solar constant is doubled. Moreover, the temperature near the surface increases abruptly up to 30-50 K when the solar constant is quadrupled. The solar super flare produces significant impacts on the temperature near the surface. Thus, the effect of the solar super flare on the Earth's atmosphere is one of the important problems in space weather.

Keywords: solar super flare, variation of the Earth's atmosphere, numerical simulation