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A modeling study of global ionospheric and thermospheric responses to extreme solar flare

Huijun Le, Libo Liu, Zhipeng Ren, Yiding Chen, Hui Zhang, and Weixing Wan

Key Laboratory of Earth and Planetary Physics, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China (lehj@mail.iggcas.ac.cn)

In this study, we employed a thermosphere and ionosphere coupling model to investigate ionospheric and thermspheric responses to an extreme solar flare of X40. The simulated results show that the peak enhancement of total electron content reaches about 35TECU and there are as long as more than 4 h ionospheric disturbances induced by the extreme solar flare. At the same time, the extreme solar flare causes significant disturbances in thermosphere. The peak enhancement of neutral density at 400km reaches more than 100% and the peak enhancement in neutral temperature at 400km is about 250K. Several numerical experiments for different class solar flares were further carried out to study the ionosphere and thermosphere variations with solar flare level. The results show the increasing amplitude of electron density at low altitude decreases with increasing flare level; however, the increasing amplitude of electron density at topside ionosphere increases with increasing flare level. The thermosphere density has the same variation trends with flare level. These results suggest that the extreme solar flare would cause the strong disturbances at high height.