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Global thermospheric disturbances induced by a solar flare: a modeling study

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This study focuses on the global thermosphere disturbances during a solar flare by a theoretical model of thermosphere and ionosphere. The simulated results show significant enhancements in thermospheric density and temperature in dayside hemisphere. The greatest thermospheric response occurs at sub-solar point, which shows the important effect of solar zenith angle. The results show that there are also significant enhancements in nightside hemisphere. The sudden heating due to the solar flare disturbs the global thermosphere circulation, which results in the significant change in horizontal wind. There is significant convergence process to the antisolar point and thus the strong disturbances in the nightside occurs at the antisolar point. The peak enhancements of neutral density around antisolar point occur at about 4 hours after solar flare onset. Simulated results show that thermospheric response to a solar flare mainly depends on the total integrated energy into the thermosphere, not the peak value of EUV flux. The simulated results are basically consistent with the observations derived from the CHAMP satellite, which verified the results of this modeling study.