Geophysical Research Abstracts
Vol. 15, EGU2013-2397, 2013
EGU General Assembly 2013

Ionospheric response to the X-class solar flare on 7 September 2005

Bo Xiong and Weixing Wan
Institute of Geology and Geophysics, Chinese Academy of Sciences, China (xiongbo@mail.iggcas.ac.cn)

We investigate the extreme ionospheric effect during the intense solar flare (X17.0/3B) that occurred on 7 September 2005. A strong E region electron density enhancement is observed by the incoherent scatter radars at Millstone Hill, Sondrestrom, and Tromsø, as well as by the radio occultation experiment on board the CHAMP satellite. The observations from both Millstone Hill and Sondrestrom stations show the average percentage enhancements of electron density during 17:40–18:10 UT are more than 200% near the E region peak height but only about 10% near the F region peak height; as a result, it leads to an unusual phenomenon where the E region electron density exceeds the F region electron density. We ascribe the unusual response to weak enhancement in EUV flux and strong enhancement in X-ray flux during this flare. To further understand this unusual feature, we analyze in detail the E region response by comparing the electron production rates derived from the measurements with those fitted by the Chapman production function. Our results demonstrate that the Chapman production theory fits the observations better in the flare time than in the nonflare time, which is attributed to the obvious difference in the solar radiation spectra at flare and nonflare times. Owing to the strong enhancement in X-ray flux during this flare, the E region electron production is more dominated by the X-ray, and the Chapman ionization theory is more applicable in the flare time than in the nonflare time. In addition, we propose a method to estimate the effective solar radiation flux from the ionospheric observations of electron density profiles. The radiation flux derived with our method agrees well with the X-ray flux at 0.1–0.8 nm observed by GOES 12.