Solar flare effects of the D-region ionosphere using daytime tweek atmospherics

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It has been known that intensity and phase of very low frequency (VLF, 3-30 kHz)/low frequency (LF, 30-300 kHz) transmitter signals significantly change due to intense ionization by solar flares [e.g., Mitra, 1974; Thomson et al., 2005]. Santolik and Kolmasova [2017] showed daytime tweek atmospherics (1.5-10.0 kHz) did not become observal for two hours just after a solar flare of M2.2 class, which suggests large absorption due to the solar flare. However, there are little studies for tweeks during solar flares. In this study, we investigate solar flare effects of the D-region ionosphere using tweek atmospherics. We analyzed the daytime tweek atmospherics observed at Kagoshima (31.48N, 130.72E) and Moshiri (44.37N, 142.27E), Japan, during January-July, 2013. The sampling frequency is 20 kHz, and the VLF data were recorded for each two minuteat 20-22 and 50-52 minutes every hour. For two M1.4-class flares, the daytime tweeks were received about 30-40 minutes after the solar flares. For a M5.6-class flare, the daytime tweeks were not observed for about 4 hours after the solar flare. The tweek reflection height had a weak negative correlation (-0.38) with X-ray flux observed by the GOES-13/15 satellites, suggesting that electron density in the D-region ionosphere increased with increasing the X-ray flux.In the presentation, we will discuss the D-region ionization and propagation mechanism of the tweeks during solar flares in more detail.

