

Dependences of Global Lightning and Sprite Activities on Solar and Geomagnetic Activities

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In order to investigate the dependences of global lightning and sprite activities on solar and geomagnetic activities, we developed a new ELF observation system and have carried out continuous monitoring of 1-100 Hz waveform at Syowa station (69.0S, 39.6E) in Antarctica and Onagawa observatory (38.4N, 141.5E) in Japan. Using ELF data obtained at Syowa for the period from February 2000 to January 2003, we calculated a variation of SR spectral power (SR_spv) and found that an average power spectrum of SR_spv has a distinct spectral peak at 27.9 day. We estimated the ionospheric reflection height using the two-scale-height conductivity model of the Earth-ionosphere cavity and found that the 27.9 day periodicity of SR_spv is caused not by the modulation of the ionospheric reflection height but by the 27 day modulation of global lightning activity itself. It is also found that there is a clear anti-phase relation between SR_spv and tropical cloud coverage. We performed cross-spectral analyses among SR_spv, cloud coverage, and solar and geomagnetic activity parameters. Though we found a clear in-phase relation in SR_spv-(Kp, Dst) and an anti-phase relation in cloud-(Kp, Dst), we need further investigation to understand the mechanisms of the 27 day modulation and the link among these variations.