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CUBESAT DEVELOPMENT PROJECT FOR IONOSPHERIC EARTHQUAKE PREDICTION

Abstract

Satellite remote sensing technology, such as optical measurements and radar monitoring, has helped mitigate severe natural disasters. However, large earthquakes (EQs) occasionally accompanying tsunamis are still major risks, because their occurrences have been unpredictable, and conventional remote sensing and ground-based observations do not contribute to predictions so far. To overcome these problems, we focus on atmospheric and space electrical variations which might be a proxy of ionospheric earthquake precursors according to previous works. The investigation of atmospheric and space electricity is expected to promote practical short-term EQ predictions. For this purpose, we are developing a BBM of micro-satellite (6U Cube Sat) with international/global collaboration, a very tiny satellite dedicated to the EQ precursor detection and the elucidation of the physical mechanism. The results of one of plausible precursors were obtained using the French micro-satellite DEMETER. Our statistical analysis of the complete DEMETER data showed that a VLF electric field intensity of 1.7 kHz, corresponding to the cut-off frequency in the earth-ionosphere waveguide, decreased only near the epicenter within 4 hours of the 289 EQs with M ¿ 4.8. We found that the physical mechanism for this decrease was electron density enhancement in the D region (sub-ionosphere), which can be measured by investigating the whistler VLF electromagnetic waves generated in the ionosphere by tropospheric lightning. Thus, the in-situ satellite measurements of whistler waves (lightning-origin electromagnetic waves in the ionosphere) and ground-based lightning are expected to intercept D-region variations attributed to global EQs. The present proposed Cube Sat will observe high-sampling VLF waveforms in electrical field components within four hours of an EQ to further understand the physical mechanism of D-region variations.