

Signature of subionospheric LF wave perturbations associated by Hokuriku winter lightning observed at the Zao station.

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Intense electromagnetic pulses (EMP) radiated from lightning discharge could cause heating and ionization and alter the conductivity in the ionospheric D-region. Quasi-electrostatic fields (QE Fields) which are generated due to the removal of electric charge could also affect it. The purpose of this study is to reveal influence of the lightning on the lower ionosphere and its dependence on properties of lightning discharges. The VLF/LF signature of subionospheric perturbations associated with winter lightning in the Sea of Japan (around Hokuriku) has been observed during December 16-31, 2009. LF radio observation was made at Zao (Miyagi) for JJY transmitter (60 kHz) at Haganeyama (border between Saga and Fukuoka) whose great circle path (GCP) passes over the coast area of Hokuriku. The amplitude and phase of the JJY signal are recorded every 0.1 seconds. In addition to the subionospheric LF observation, lightning locations are determined by a lightning location network (WWLLN). The number of total lightning event identified in the area of 35-37 degrees N and 134-137 degrees E is 1002. Based on the LF observation, subionospheric perturbations which occur immediately after the causative lightning (early event) were detected. The total number of the early event detected in the selected area is 72. Early events identified are compared with peak current of the causative lightning which is derived from LF waveform observations to investigate the relation between early event properties and magnitude of EMP. As a result, it is found that both amplitude of the phase change and the recovery time to the undisturbed value are positively correlated with magnitude of EMP. This is interpreted that the influence of the lightning on the conductivity change in the lower ionosphere depends on the magnitude of EMP. We are further analyzing ELF waveform data observed at the Syowa station to investigate the effect of the QE fields on the conductivity in the lower ionosphere.