Relation between charge amounts of lightning discharges derived from ELF waveform data and severe weather
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In order to measure the lightning currents and to estimate charge amounts, induction magnetic coils named as Rogowski coils installed at tall towers are generally used. However, such Rogowski coils can measure only the lightning discharges directly hitting the towers. Recently, it is shown that the ELF magnetic field waveforms measured at the 300 km distance from the lightning is comparable to the lightning current waveforms. Therefore, the charge amounts of any lightning discharges occurring within the area where the induction magnetic fields are measured can be easily estimated from ELF waveforms by quantitatively evaluating the relation between ELF waveforms and the current waveforms. Lightning discharges usually occur within active thunderclouds, and previous studies suggested that there are close relations between lightning activities and severe meteorological phenomena. However, in these studies, only the occurrence frequencies of lightning discharges are considered to estimate such relation. As lightning is a discharge phenomenon, it is more important to investigate the relation between electrical properties of lightning discharges, such as polarities, peak currents, and charge amounts, and the meteorological parameters of the severe weather.
In this study, the lightning current waveforms measured by a Rogowski coil installed at Mt. Ogami and ELF waveforms measured at Onagawa observatory are analyzed as a first step. To validate the similarity between current waveforms and ELF waveforms, we investigated the correlation of these two waveforms. Then, the average correlation coefficient and standard deviation are estimated to be $r=-0.84$ and $\sigma=0.14$, respectively. This result indicates that there are high similarities between these two waveforms. From these quantitative analyses, empirical equations that enable us to directly convert from the magnetic field intensities into the charge amounts were obtained.
As a next step, using ELF waveform data obtained at Kuju station in Kyushu and lightning data of the Japan Lightning Detection Network (JLDN), charge amounts for the lightning discharges occurring when down bursts were confirmed in the Kanto Plain are estimated by applying the empirical equations. Then, we newly found a clear characteristics showing that the time variation of charge amounts was drastically changed just before the downburst onset. At the presentation, we will show the results in one down burst event more in detail, and we will also show the statistical results for other downburst events.

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