

ELF帯電波観測により推定した雷放電の放電電荷量を用いたダウンバースト現象の予測可能性

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Predictability of the downburst phenomena using the charge amounts of lightning discharges derived from ELF observation

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Lightning discharges usually occur within active thunderclouds, and previous studies suggested that there are close relations between lightning activities and severe meteorological phenomena. Therefore, lightning discharges can be potentially used as a good proxy to predict the occurrence of the severe weather. Especially, as lightning is a discharge phenomenon, it is more important to investigate the relation between electrical properties of lightning discharges, such as the polarity, the peak current, and the charge amount and the meteorological parameters of the severe weather.

Since it is reported that there are comparable relation between lightning current waveforms and ELF magnetic field waveforms measured at the 300 km distance from the lightning, we evaluated the similarity of the lightning current waveforms measured by a Rogowski coil installed at Mt. Ogami and ELF waveforms measured at Onagawa observatory. Then, the average correlation coefficient and standard deviation between these two waveforms 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.

Furthermore, to investigate the relation between severe weather and lightning activities, we picked up 8 downburst events in 2015 according to Japan Meteorological Agency (JMA). Using ELF waveform data obtained at Kuju station in Kyushu and lightning data of the Japan Lightning Detection Network (JLDN), charge amounts of the lightning discharges that occurred around the downburst onset were estimated by applying the empirical equations. In addition, precipitation amounts observed by the JMA C-band radar were also analyzed. At the presentation, we will show the results and discuss the relation between the time variation of the lightning charge amount and the onset of the downburst.