



Lightning Charge Estimation over Eastern Part of Japan by ELF and LLS Observations

Y. Hobara⁽¹⁾, R Murai⁽¹⁾, R. Kitamura*⁽¹⁾, M. Kobayashi⁽¹⁾, T. Narita⁽²⁾, D. Ohta⁽³⁾, and T. Tsuya⁽³⁾

(1) Department of Computer and Network Engineering,
The University of Electro-Communications,

Chofu-city, Tokyo, Japan, e-mail:hobara@ee.uec.ac.jp

(2) Shonan Institute of Technology, Kanagawa, Japan

(3) TEPCO Power Grid, Tokyo, Japan

Remote estimation of electrical charges due to Cloud to Ground Strokes (CGs) over eastern area of mainland Japan were demonstrated. Peak current (I_p), polarity information and lightning geolocation were derived from the conventional lightning location system (LLS), while corresponding amount of lightning charge (Q) was calculated by using electromagnetic pulse in the Extremely Low Frequency (ELF) range recorded in Moshiri, Hokkaido, Japan together with the charge height (ds) assumed by the data from Meso Scale Model (MSM) provided by Japan Meteorological Agency (JMA). This is the first attempt to estimate the lightning charge lowered to the ground at few hundred \sim 1,000 km away from the lightning location. In this study, we analyzed the lightning data for about 900 days between the summer of 2011 to the end of 2014. Both regional and seasonal dependences in Q of CGs have been found. Statistical spatial distributions of CGs with Q were obtained for different seasons. In addition, three observation areas were classified and the cumulative frequency distribution of the respective areas were derived. As a result, Q for positive CGs in wintertime both over land and water were significantly larger than those for summertime. The Q in summertime were larger over Sea of Japan for positive CGs, while similar Q was expected both over land and water in negative CGs. These statistical distributions provide the basic information for lightning physics and also to prevent/mitigate potential damages to the power grid systems and renewable power generating systems.