Characteristics of total lightning during thunderstorm activities associated with wind gust events in Japan

*Shintaro Kono¹, Yasuhide Hobara¹,²,³, S. Heckman⁴, M. Stock⁴, C. Liu⁴

1. Department of Computer and Network Engineering, The University of Electro-Communications, Tokyo, Japan, 2. Earth Environment Research Station, The University of Electro-Communications, Tokyo, Japan, 3. Center for Space Science and Radio Engineering, The University of Electro-Communications, Tokyo, Japan, 4. Earth Networks, USA

In recent years, numerous significant natural disasters have been reported. The local severe weather phenomena are difficult to predict by using conventional meteorological observations because of their small spatial and temporal scales. Total lightning, which is the sum of the cloud to ground (CG) and intra-cloud (IC) discharges, have been noted as one of the additional effective tools in forecasting severe weather. In Japan sharp increase of total lightning has been reported before some of the wind gusts based on the data from Japanese Total Lightning Network (JTLN) using Earth Networks Total lightning systems deployed by UEC group. In this study, we tracked the thunderstorm cells caused the wind gusts such as tornadoes and downbursts in Japan with information of the stroke rate of lightning, precipitation and vertical cut of cloud echo based on the data of JTLN and eXtended RAder Information Network (XRAIN). Moreover, comparison of thunderstorms with wind gust and without wind gust was made. As a result, lightening jumps were observed 10 to 40 minutes before the gust occurrence. In addition, thunderstorms accompanied by downbursts tend to have a higher total lightning stroke rate compared to thunderstorms without wind gust. These phenomena suggest the possibility of predicting wind gusts from the total lightning observation.

Keywords: lightning, total lightning, wind gust, severe weather, prediction