

## The regional and seasonal variability of TLE global occurrence ratio using ISUAL and ELF network data

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Tohoku University operates worldwide ELF observation network, consisting of 4 observation sites located at Syowa in Antarctica, Onagawa in Japan, Kiruna in Sweden, and California in US. Each sensor records ELF waveforms in the wavelength range of 1-100 Hz continuously. We can estimate the lightning location and charge moments for intense lightning events, which are the important parameters to investigate the characteristics of parent lightning discharges of TLEs, such as sprites and jets. We improved lightning geo-location method with an estimation error of less than about 500 km, using precise arrival time and direction of lightning pulse. The data enable us to examine the global lightning activity and global lightning distributions.

ISUAL instrument onboard FORMOSAT-2 satellite launched on May 20, 2004 has observed about one thousand sprites and four thousand elves up to now. The ISUAL data provide information on global TLE distributions and characteristics of its shape and spectrum. The distributions of TLEs have obvious regional dependence and seasonal variations. In the center of Africa, sprite-streamers are observed more frequently than in any other area, while in Southeast Asia and in Caribbean elves are observed more frequently than in any other area. The regional and seasonal variations suggest some different characteristics of parent lightning discharges depending on season and/or location. For example, different conductivities between land and ocean could cause different time constant of lightning discharge, which, in turn, modulate the occurrence of TLEs.

Our lightning geo-location system detects ten times number of positive lightning as many as that of negatives on land, while ten times number of negative lightning as many as positives on ocean. Considering the detectability of geo-location system, it is considered that on land there are more positive lightning than on ocean relatively for big charge moment events. As a result of comparing the lightning distribution estimated from ELF data and that observed by the ISUAL, it is suggested that the ratio of cloud to ground discharge and inter-cloud discharge has a regional variety. We will compare the distributions of TLEs with those of lightning characteristics using the geo-location method, and will discuss regional variations of TLEs and lightning, and TLE occurrence and forms comparing with the characteristics of parent discharge, such as charge moment and time constant.