

Study on early detection of thunderstorm based on electromagnetic measurement in ELF-VLF band

*Kozo Yamashita¹, Yuki Kubono², Yukihiro Takahashi³, Jun-ichi Hamada⁴, Jun Matsumoto⁴

1.Salesian Polytechnic., 2.Kyushu Institute of Technology, 3.Hokkaido Univ., 4.Tokyo Metropolitan University

Recently, heavy rain, tornado and lightning discharge associated with thunderstorm become a representative of severe weather in urban region. Well-established methodology for early detection and nowcast of thunderstorm activity is essential to protect and sustain urban function. Main objective in this study is to verify practical effectiveness of early detection of thunderstorm generation based on lightning observation. Receiver for lightning observation is designed to measure electromagnetic wave radiated from lightning discharge in ELF (Extremely Low Frequency, less than 3 kHz) and VLF (Very Low Frequency, 3-30kHz) band and installed around the Tokyo metropolitan region. Radio wave in ELF-VLF bands can propagate long distance (more than several hundreds kilometers) and makes it possible to detect lightning discharge with high sensitivity with few observation sites.

In this presentation, lightning observation for thundercloud generated above Ebina city, Kanagawa at September 6th, 2014 is summarized as an initial result. First detection of lightning signal in ELF-VLF observation is 30 minutes earlier than that in existing network for observation of cloud-to-ground (CG) lightning discharge. This result indicates the possibility that not only CG lightning discharge but also intracloud (IC) lightning discharge whose electromagnetic radiation is weaker than that from CG could be detected by our network. The IC lightning dominated over CG lightning in the early stages of thunderstorm. Detection of IC in ELF-VLF observation enables us to monitor thunderstorm generation without high-spatial density observation.