Attempt of energy estimation by multipoint observation of thundering infrastructure sound

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We performed multipoint observations of thunder using six infrasound sensors installed around Kochi University of Technology(kami,Kochi Prefo), and estimated the location of the source of thunder and the total energy of each event.

It is known that there is a correlation between the distribution of lightning activity and the area where heavy rain occurs, and this is considered to be effective for elucidating regional meteorological mechanisms and predicting heavy rain disasters. Based on previous research, the propagation distance of thunder was considered to be about 15 km. Owing to this, six infrasound sensors were successively installed around Kochi University of Technology in November 2019. Separation between the sensors were set within approximately 15 km, so that simultaneous observations at three or more points required for estimating the source location were possible. The TOA (Time of Arrival) method was used as the method of estimating the wave source position.

Simultaneous observations were made at three locations for audible sound and infrasound of thunder corresponding to a 311 kA positive lightning strike that occurred at 1:49 on December 2, 2019. In the estimation of the source location, the error was about 700 m with the best result from the JLDN (Japanese Lightning Detection Network) lightning report obtained from Franklin Japan Inc. In the energy estimation, the observation result obtained at the sensor 7.0 km away from the lightning strike point was 90 kJ, and that of the sensor 8.5 km away was 724 kJ, which was a large difference possibly depending on the installation location and environment. This is considered to be due to the fact that the observation data picks up a group of thunder events, and the integrated value largely changes depending on which time range is determined as one thunder.

During the two months from late of November 2019 to the end of January 2020, based on the JLDN Lightning report, 13 thunderstorms in total were observed at three or more locations around the sensor installation area from 13 lightning events for two days. The results of the observation on December 2, 2019 revealed that multiple shock wave events were mixed in the infrasound observation data, which made the interpretation of source position and energy estimations difficult. In the observation on January 27, the average wind speed was 14 m/s and the strong wind increased the sound noise level in the observation data, making it difficult to analyze the data. In the future, a program to apply a low-pass filter to data will be created and reported in this presentation.

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