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庄内突風観測プロジェクトにおける冬季雷観測－初期観測結果－

Winter lightning observation in the Shonai area railroad weather project: preliminary results

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Strong and gusty winds often affect safety operation of the train. In order to prevent rail road accident, many propeller-vane / cup anemometers have been distributed on the railroad. However, it is difficult to detect strong and gusty winds with high accuracy and high resolution with the present system. Therefore, the multilateral monitoring system using the other meteorological observation data has been required.

The Shonai area railroad weather project has investigated fine-scale structure of wind gust using two X-band Doppler radars and the network of 26 surface weather stations since 2007. In 2009, the project was expanded and started lightning observation to investigate mechanism of lightning activity, particularly winter lightning in the Shonai area. Lightning activity is known to be related to microphysical and dynamical processes within storms. Hence, integration of continuous 3-D lightning monitoring (intracloud and cloud-to-ground lightning) and comprehensive high-density meteorological observation can provide useful index for predicting strong gust.

We developed a lightning monitoring system which consists of three VHF sensors and one LF sensor. Observed signals are digitized with two digital oscilloscopes and stored in a personal computer. Precise GPS time data are also recorded simultaneously. After operation test at Meteorological Research Institute, this system was installed in the north of Shonai area in October 2009. Now, we are monitoring winter lightning over the Shonai area. We will build a few monitoring station in the Shonai area and map lightning activity in three dimensions in 2010. Furthermore, in order to estimate the electrification of thunder cloud, we installed an electric field mill near Shonai Airport in October 2009. An array of the sensors will be constructed in 2010.

The lightning monitoring system has detected some lightning activities since October 2009. Using obtained data set, we have computed the azimuth and elevation of VHF radiation sources originated from lightning flashes. These data are compared with the radar echo, the electric field data, and the other observation data.

In this presentation, we will introduce an overview of the project and show some preliminary results.