

9.25 DEVELOPMENT OF TRAIN OPERATION CONTROL METHOD AGAINST GUST USING DOPPLER RADAR

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On Japan railroads, wind conditions affect operating efficiency, infrastructure, and safe passage of people and freight. Strong and gusty winds cause regional delays or shutdowns, and particularly hazardous crosswinds may lead to overturn of railcars. Therefore, cup anemometers densely cover along the railroads for operations through some thresholds of wind speed (e.g., winds in excess of 25 m s^{-1} or 30 m s^{-1}). However, small-scale localized but strong gusty winds such as tornadoes, downbursts, and gustfronts are difficult to detect with the present system.

In order to detect those hazardous wind phenomena, Doppler radars that observe wind movement in a large area can be used. The East Japan Railway Company installed a X-band Doppler radar on the rooftop of the building of the Amarume Station (Yamagata Pref., Japan), located in the regions along the side of the Sea of Japan where strong gusty wind associated with severe storms occur frequently in winter season. The observation has been conducted since March 2007 to develop a gust detection method using the radar data, and the applicability of that to train operation decisions has been assessed.

Based on the obtained data, we proposed a method suitable for detecting gust using Doppler radar and developed a train operation control method against gusts. By this method, Doppler radar automatically detects and tracks vortex. If the sum of tangential speed and the movement of the vortex exceed 33 ms^{-1} (lower limit of F1 by Fujita scale) and the predicted route of vortex approaches or passes through a railway within 10 minutes, the system issues a warning for the inter-station section to stop train.

This method was put to practical use on the Uetsu Line in the Shonai area from December 2017. Practical use of such train operation control method against gusts using Doppler radar is the first time in the world.
