



Detection of tornadic vortex from Doppler velocity field using Convolutional Neural Networks

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Since December 2017 the practical system for an automatic strong gust detection and warning for railroads has been implemented and further development has been continued (Fujiwara 2018). The gust detection is performed by detecting a pair of extreme values found in the vortex pattern in the Doppler velocity field and fitting with the Rankin's vortex model. Then, the vortex is tracked, and if the vortex is continuously confirmed, we consider the vortex to be detected. Accurate vortex detection with rapid scanning radar is the most critical step in this system, however, the algorithm has some insufficiencies leading to a false detection (vortex does not exist when detection is issued) and miss (vortex exists without a detection). The collaborative study between the Meteorological Research Institute and the East Japan Railway company has developed a deep learning model to detect vortex pattern accurately from Doppler velocity. In this presentation, the Convolutional Neural Network (CNN) approach to extract vortex pattern from Doppler velocity field and to detect accurate objects (i.e. tornadoes) while reducing false pattern will be discussed. The CNN model in this study has been trained with 36,000 vortex data during December 2016 and February 2017, and the overall performances are 85% (Precision) and 89% (Recall) in the winter season in 2017/18. The experiments indicate significant improvement in vortex detection.