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Statistical features of near-ground tornadic vortices in comparison with radar-observed vortices aloft

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Tornadoes have been observed by Doppler radars in the past decades. It is expected that the information from the radar-observed tornadic vortices can be utilized to estimate the associated near-ground vortices and forecast the possible disaster. However, since there is little observation of near-ground tornadic vortices, the relationship between the radar-observed vortices and near-ground vortices is not clear yet.

To increase our understanding of near-ground tornadic vortices in relation to the radar-observed vortices, winter tornadic vortices and misocyclones in the Japan Sea coastal region have been observed by situ observational Linear Array of Wind and Pressure Sensors (LAWPS) in conjunction with two X band Doppler radars since 2011. These measurements have been conducted as part of the Shonai area railroad weather project. The LAWPS system consists of 12 ultrasonic anemometers deployed 5 m AGL at 100 m horizontal interval and 25 barometers 0.5 m AGL at 50 m interval along the shoreline. The sampling frequency of the sensors is 10 Hz. Tornadic vortices above the LAWPS are observed by one of radars located 1.5 km from the LAWPS with very fine spatial resolution ($\sim$50 m for azimuth and $\sim$20 m for range resolution) in the plan position indicator mode of 2° elevation. The radar measurement height over the LAWPS is about 100 m AGL. To compare the horizontal structure of vortices observed by the LAWPS with those by the Doppler radar, time to space conversion was applied using the vortex translational speed and direction to the LAWPS data under the assumption of a steady state of vortices for a certain time interval.

With the long-term observation, the dataset contains many vortices passing over the LAWPS system, which have a large variety of characteristics such as strength and size. Based on the data analysis, this presentation will be about the statistical features of the near-ground vortices compared to those observed by the Doppler radar aloft.