The high-resolution boundary layer wind fields under clear sky revealed by multiple-lidar observations and WISSDOM

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Abstract

The WISSDOM (WInd Synthesis System using DOppler Measurements) is an algorithm originally designed for analyzing the three-dimensional wind fields within a severe weather system using radial velocity data measured by multiple Doppler radars. In this research, the application of WISSDOM is further extended to provide three-dimensional wind fields in the boundary layer under a clear sky scenario using observations collected by multiple scanning lidars.

The lidar data used for this study are obtained in two field experiments. The first one was conducted in Tianzhong Township, Changhua County in September 2023. The second experiment was conducted at Taoyuan International Airport (TIA) in April 2024. Our preliminary analyses show that the spatial resolution of the synthesized wind fields can reach 100 m or higher, while the temporal resolution is approximately 20 minutes. In the Tianzhong case, the signal of land-sea breeze circulation can be detected clearly. The temperature field is also retrieved based on the information of the winds. In the TIA case, the capability of WISSDOM to detect low-level wind shear is evaluated.

Key words : scanning LiDAR, boundary layer wind field