國立中央大學大氣物理研究所書報討論

Date : 2025/06/06

Location : S1-713

Speaker : Yu-Wei Tseng

Advisor : Prof. Shu-Chih Yang

Enhancing Afternoon Thunderstorm Forecasts over Northern Taiwan: The Role of Radar Superobbing and MPD Water Vapor Assimilation

ABSTRACT

A convective-scale ensemble data assimilation (EDA) system based on the framework of the WRF-LETKF radar assimilation system has been widely applied to study short-range precipitation prediction in Taiwan. This study investigates two recent advancements in the convective-scale EDA system. First, in the standard operation, the radar observations, including radial velocity and reflectivity, are resampled with the data within a fan-shaped area using a distant-dependent weighting function. However, this will sacrifice the data density and affect the ability to capture the intensity of the convection. We replace the superobservations generated in the polar coordinate with the ones arranged in the Cartesian coordinate. Second, observation from a Micropulse Differential Absorption Lidar (MPD) is assimilated in the convective-scale EDA system to compensate for the limitation of radar observation lacking the direct moisture-related measurement. The MPD is an innovative instrument that can provide water vapor profiles at high frequency.

The impact of these recent advancements is investigated with an afternoon thunderstorm case in the Taipei Basin on 31 May 2022, a heavy rainfall event during the intensive observation period #2 of the joint Taiwan-Area Heavy Rain Observation and Prediction Experiment (TAHOPE)/Prediction of Rainfall Extremes Campaign in the Pacific (PRECIP) field campaign. The results indicate that compared to polar coordinates, the Cartesian radar data effectively enhance data coverage over the ocean while maintaining convection intensity in high-data-density regions. This data distribution is beneficial for representing the precipitation intensity. Even though the convective cells were initiated and burst into an extensive convective system in the Taipei Basin, the additional assimilation of the MPD data 60 km upstream increases moisture availability, leading to improved representation of model radar reflectivity. More results from DA and prediction experiments will be presented.

Keyword

Micropulse Differential Absorption Lidar(MPD)

Superobservation(SO)