中央氣象署115年第四十屆天氣分析與預報研討會
40th Conference on Weather Analysis and Forecasting

Analysis of MPD Lidar Data from Northern Taiwan and the Effects of Humidity and Radar Data Assimilation

王采琳[1] (T.-L. Wang) 鍾高陞[1] (K.-S. Chung)
[1]National Central University, Dept. of Atmospheric Sciences

Abstract

Micropulse Differential Absorption Lidar (MPD) provides continuous vertical water vapor profiles with high vertical and temporal resolution in the lower troposphere. During field campaign, Taiwan-Area Heavy rainfall Observation and Prediction Experiment (TAHOPE), the MPDs were deployed at three sites to investigate the water vapor characteristic over northern Taiwan in different weather system. It is found that water vapor at low levels in afternoon cases consistently ranks first or second at three sites. In addition, when calculating Layered Precipitable Water (LPW) using MPD data, the result showed that highest value of LPW exceeded 24mm in afternoon thunderstorm case at Yilan. Furthermore, diurnal analysis indicated water vapor in Mei-Yu, afternoon thunderstorm, and typhoon cases was higher during afternoon period (12 to 20 LST).

To examined the impact of assimilating water vapor, reflectivity and radial wind from radar data, water vapor and temperature from surface data, and water vapor profiles from MPDs were assimilated into the WRF-LETKF Radar Assimilation System for an afternoon thunderstorm case (SOP3) and a Mei-Yu case (IOP3). Assimilating MPD and surface observations improved the thermodynamic environment in both cases. For the afternoon thunderstorm case, using a 48 km localization for MPD water vapor better reproduced the observed rainfall distribution than a 100 km localization, whereas improvements in quantitative precipitation forecasts were limited for the Mei-Yu case. These results suggest that MPD humidity profiles effectively capture the localized thermodynamic environment, and a 48 km localization provides greater benefits for forecasting mesoscale systems.

Key words : Micropulse Differential Absorption Lidar (MPD)