Assimilating radar data with retrieved thermodynamic fields: A case study of frontal system on June 11 2012

*Ching-Yin Ke[1], Kao-Shen Chung[1], Yu-Chieng Liou[1], Shu-Chih Yang[1]

1. National Central University, Taoyuan City, Taiwan

This study investigates the impacts of assimilating pseudo-observation of thermodynamic field(s) with radar data at the convective scale. The WRF-LETKF Radar Assimilation System (WLRAS) is used with 40-member ensemble, and radial wind and reflectivity are assimilated from two radars (RCWF and NCU-CPOL) in northern Taiwan. In addition, thermodynamic fields (temperature and relative humidity) retrieved by radar observations are assimilated to shorten the cycling process. A frontal system which brought extreme heavy rainfall in northern Taiwan on June 11 2012 is selected as a case study. Compared the final analysis of WLRAS to the Wind Synthesis System using Doppler Measurements (WISSDOM), it is found that when additional thermodynamic field is assimilated with radial wind and reflectivity, it further improves the wind (speed and direction) structure in the entire precipitation system: a zone of relatively weak flow behind the strong convection is captured, and the barrier jet and cold outflow are strengthened at the low level. All these features are very important factors in this event for causing the extremely heavy rainfall in a short period of time. In addition, different retrieved thermodynamic variables (dry-bulb temperature, potential equivalent temperature, virtual cloud potential temperature, and relative humidity) are assimilated in the WLRAS system to examine which one is the most effective information. The very short-term forecast is also launched afterward to evaluate the performance of QPF.

Keywords: Data assimilation, EnKF, Thermodynamic retrieval