A new method to determine the unknown constants on each horizontal layer in thermodynamic retrieval using multiple-Doppler-radar synthesized winds

Yu-Chieng Liou and Yung-Lin Teng

Department of Atmospheric Sciences

National Central University, Zhongli District

Taoyuan City, Taiwan

Corresponding author: Yu-Chieng Liou, tyliou@atm.ncu.edu.tw

ABSTRACT

It has been long recognized that when using multiple-Doppler-radar synthesized wind fields to retrieve the thermodynamic variables, the unique solutions are the deviations of the pressure and temperature perturbation fields from their horizontal averages. The latter are unknown, and vary with height, thus causing ambiguity in the retrieved vertical structure of the thermodynamic fields. In this research the Equation of State (EoS) is implemented as an additional constraint so that the horizontal average of the pressure and temperature perturbations on each layer can be explicitly estimated and removed from the retrieved three-dimensional thermodynamic fields. The only in-situ independent observations needed to perform the correction is the pressure and temperature measurements taken at a single station located at surface, mountain slope, or on board an aircraft. Experiments in this research were conducted under the Observation System Simulation Experiment (OSSE) framework to demonstrate the validity of the new approach. Problems and possible solutions associated with using real data sets and potential future extended applications of this new method are discussed.