Special Program in Applied Mathematics and Applied Mechanics

The application of calculus of variations in Doppler radar parameter retrieval and weather forecast improvement

2013 - 03 - 06 (Wed.)
15:00 - 17:00
308, Mathematics Research Center Building (ori. New Math. Bldg.)

A Doppler weather radar is capable of providing wind information inside a precipitation system with high spatial and temporal resolution. However, the radar-observed radial velocity is merely the projected component of the complete wind fields (u, v, w) along the radar beam. In other words, the information about the flow structure is incomplete. This presentation introduces the application of calculus of variations in developing a synthesis method for the purpose of recovering three-dimensional wind field using multiple- Doppler radar observations. Advantages of the newly designed method over the traditional approach are discussed. This new method is applied to study the flow structures of several selected cases, including the squall lines in IOP #8 from 2008 SoWMEX/TiMREX, a slow-moving rainband producing heavy precipitation in Typhoon Morakot (2009), and the reorganized eyewall over land of Typhoon Fanapi (2010). Based on this method, we have also designed a radar data assimilation algorithm, which consists of wind synthesis, thermodynamic retrieval, and a water vapor adjustment scheme. It is found that this assimilation algorithm is able to effectively combine the observations with the numerical weather prediction model, so that the model's short-term rainfall forecast can be improved up to three hours.


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