Special Program in Applied Mathematics and Applied Mechanics

The Simulation and Forecast Application of Weather in Taiwan by the Cloud-Resolving Storm Simulator (CReSS)

2013 - 05 - 01 (Wed.)
15:00 - 18:00
308, Mathematics Research Center Building (ori. New Math. Bldg.)

In this presentation, the simulation of weather and forecast application in Taiwan by the Cloud-Resolving Storm Simulator (CReSS), which is a high-resolution cloud/mesoscale model developed and maintained by Prof. Tsuboki of Hydrosphere Atmosphere Research Center (HyARC) of Nagoya University, Japan, are reviewed. Studies of several heavy-rainfall events during the Mei-yu (May-June) and typhoon seasons in the past 2-3 years by the speaker, through the use of the CReSS model by simulation and often aided with sensitivity tests at cloud-resolving resolution (2-3 km grid size), are described and reviewed. These events include the South-West Monsoon Experiment (SoWMEX) Intense Observing Period (IOP) #8 case (14-17 June) in 2008 and the heavy-rainfall event in central Taiwan on 8 June 2007. In these two studies, roles of synoptic conditions versus local circulation and terrain effects, and remote trigger of convection by gravity waves are investigated. Also reviewed are studies on the effects of asymmetric rainfall/latent heating on two recent typhoons that caused serious damages: Typhoon Morakot (2009) and Fanapi (2010), and these two studies focus on the impact of asymmetric latent heating in slowing down the typhoons during their departing period (roughly by 5 and 8 km/h, respectively), which is a key factor for the extreme rainfall accumulation and resulted severe hazards. The use of the CReSS model for real-time weather forecasts in Taiwan since 2006 by the speaker is also presented. The high-quality quantitative precipitation forecasts (QPFs) produced by this model at real-time prior to Typhoon Moarkot in 2009 is first presented, and the forecast made at 0000 UTC 6 August (available no later than 1200 UTC 6 August) predicted a peak rainfall amount in the next 48 h in southern Central Mountain Range (CMR) of over

1900 mm, which is more than 1000 mm higher than the upper bound issued by the Central Weather Bureau (CWB) near the same time. Hindcast experiments further show that such a forecast can be improved to near 2300 mm in the next 3 days, accounting for 80% of actual amount observed. Other more recent examples of forecasts, such as those for Typhoon Fanapi (2010) and Megi (2010), and results from an experimental 8-day forecast for typhoons last year in 2012 are also shown briefly. Such high-resolution forecasts, when used effectively, have high potential in real-time applications and for emergency action and hazard reduction.