AOGS 2005

Verification of a Mesoscale Simulation of Tropical Cyclone Vamei

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Following up on work presented last year on the case of tropical cyclone Vamei (27 Dec 2001, Singapore, cf. Chang et al. 2003), the atmospheric module of the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS™) was used to make a high-resolution simulation of the weather for the period 17 – 29 Dec 2001. Navy Operational Global Atmosphere Prediction System (NOGAPS) 1 degree x 1 degree analyses was used to initialize and to provide boundary conditions for the model run. Observational data were assimilated every 12 hours, without "bogusing" of the tropical cyclone. We used three nested grids at 54/18/6 km resolutions in Mercator projection: the outmost grid includes the whole Southeast Asia; the middle grid spans Sumatra, Malay Peninsula and Borneo; and the innermost grid covers Singapore's vicinity, including the southern reaches of the South China Sea east of Singapore where Vamei's genesis occurred. 60 vertical levels were employed, 50 of which lie in the tropical troposphere (0-16km) and 20 of which lie below 3km. Description of the COAMPS model can be found in Hodur (1997).

A tropical cyclone was spun up in the COAMPS model simulation, despite the relatively sparse observational data in the region. This is probably a testament to the fact that the conditions favouring tropical cyclone formation occur in the synoptic scale rather than in the mesoscale and/or mesoscale conditions are under synoptic control in the period under consideration. To verify the simulated track of the cyclone, we essentially followed the same methodology as Power and Davis (2002): from the region of maximum relative vorticity (which is a layer-average from the lower model levels), we look for the grid location where the magnitude of the mean wind vector normalized by the mean wind speed is minimized. Here, "mean" refers to a 9-point average over the grid location. Thus, we locate the centre of circulation of the simulated tropical cyclone. The track so derived is compared to published best-track data of Vamei. Results show that COAMPS captures the westward motion of the cyclone rather well, but the simulated motion is slower than observed motion by about 4km/h. The latitudinal location of the cyclone is well simulated, but there is of course an eastward displacement error in the longitudinal location.

* COAMPS is a trademark of US Naval Research Laboratory (Monterey).

References

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