

Impact of Cartosat-1 orography on weather prediction in the high resolution NCMRWF Unified Model

A. Jayakumar, Jisesh Sethunadh, Saji Mohandas,
E. N. Rajagopal, and A. Subbu Nagulu

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Abstract: The current study reports for the first time an application of orography generated from Cartosat-1 satellite digital elevation model (DEM) generated with a source resolution 30 m in a convection-permitting numerical weather prediction model. The effects of improvements in the representation of orography have been examined in the high resolution regional National Centre for Medium Range Weather Forecasting Unified Model (NCUM-R) predictions for a heavy rainfall event over the city of Chennai. A time-lagged ensemble method is employed to account for the uncertainties associated with initial conditions, which can better forecast extreme weather events than single forecasts. The simulations reveal that the predictions based on Cartosat-1 DEM capture the local details of the rainfall distribution better than the NASA Shuttle Radar Topography Mission (SRTM) DEM based predictions, and better represent the orographic and thermal uplifting. The spatio-temporal patterns of the simulated rainfall over Chennai are superior in Cartosat-1 DEM based simulations mainly due to the enhanced wind convergence and moisture transport. The present study reveals the role of mountains in the enhancement of heavy rainfall event over the coastal cities and highlights the potential use of high resolution orography in the improvement of the operational weather forecasting skill of NCUM-R.

Keywords

orography; modelling; Cartosat-1; extreme rainfall; clouds; weather forecasting.