

ABSTRACT

The present study explored the effect of assimilation of satellite and conventional meteorological data using the Three-Dimensional Variational (3DVAR) data assimilation technique on the simulation of monsoon disturbances including low pressure and monsoon depressions that form over the Indian region using Weather Research and Forecast (WRF) model. The first objective is to examine the impact of assimilation of temperature, humidity and total precipitable water from three different satellites separately, namely Moderate Resolution Imaging Spectroradiometer (MODIS), Advanced Television and Infrared Operational Vertical Sounder (ATOVS), and Spectral Sensor Microwave Imager (SSM/I) for monsoon depressions that formed over the Indian region. The second objective is the diagnostic evaluation of the simulated monsoon depressions using dynamic and thermodynamic variables that govern the structure, intensity and track of the depression. The third objective is to study the impact of assimilation of the direct radiance in simulating the monsoon disturbances. The fourth objective includes the investigation of sensitivity of individual satellite observations, conventional surface observations and upper air observations separately as well as together for the monsoon disturbances that formed over the Bay of Bengal and Arabian Sea. The result from the assimilation of satellite temperature, humidity and total precipitable water shows a modest, but significant improvement in the overall results for the experiment which assimilated observations using 3DVAR by simulating values of the meteorological fields which in general are in good agreement with the *in situ* observations and analysis. The results from the diagnostic analysis of the model simulated three monsoon depression indicate that the results obtained in the present study for all the monsoon depressions are consistent with the previous studies conducted. The direct assimilation of satellite radiance did show improvements in the precipitation forecast. Significant reduction in the root mean square error is seen due to assimilation of observations of dew point temperature. The sensitivity study performed using various observations confirmed the following finding: the inclusion of multiple satellite observations did result in improved forecast fields in the model simulations. The present study highlighted the strength and weakness of assimilation of different satellite data sources. The current operational regional models in India do not ingest most of these satellite observations

and hence the present study is particularly relevant to the operational forecasting community in India in their ongoing efforts to improve weather forecasting over India

Keywords: Data assimilation, 3DVAR, Satellite data, WRF