



# Impact of Doppler weather radar data on numerical forecast of Indian monsoon depressions

A. Routray,<sup>a</sup> U. C. Mohanty,<sup>a\*</sup> S. R. H. Rizvi,<sup>b</sup> Dev Niyogi,<sup>c</sup> Krishna K. Osuri<sup>a</sup>  
and D. Pradhan<sup>d</sup>

<sup>a</sup>Centre for Atmospheric Sciences, Indian Institute of Technology Delhi, India

<sup>b</sup>National Centre for Atmospheric Research, MMM Division, Boulder, Colorado, USA

<sup>c</sup>Purdue University, West Lafayette, Indiana, USA

<sup>d</sup>Regional Meteorological Centre, IMD, Kolkata, India

\*Correspondence to: U. C. Mohanty, Centre for Atmospheric Sciences, Indian Institute of Technology Delhi, Hauz Khas, New Delhi-110016, India. E-mail: ucmohanty@gmail.com

This work is a first assessment of utilizing Doppler Weather Radar (DWR) radial velocity and reflectivity in a mesoscale model for prediction of Bay of Bengal monsoon depressions (MDs). The Weather Research Forecasting (WRF) modelling system – Advanced Research version (ARW) is customized and evaluated for the Indian monsoon region by generating domain-specific Background Error (BE) statistics and experiments involving two assimilation strategies (cold start and cycling). The monthly averaged 24 h forecast errors for wind, temperature and moisture profiles were analysed. From the statistical skill scores, it is concluded that the cycling mode assimilation enhanced the performance of the WRF three-dimensional variational data assimilation (3DVAR) system over the Indian region using conventional and non-conventional observations. DWR data from a coastal site were assimilated for simulation of two different summer MDs over India using the WRF-3DVAR analysis system. Three numerical experiments (control without any Global Telecommunication System (GTS) data, with GTS, and GTS as well as DWR) were performed for simulating these extreme weather events to study the impact of DWR data.

The results show that even though MDs are large synoptic systems, assimilation of DWR data has a positive impact on the prediction of the location, propagation and development of rain bands associated with the MDs. All aspects of the MD simulations such as mean-sea-level pressure, winds, vertical structure and the track are significantly improved due to the DWR assimilation. Study results provide a positive proof of concept that the assimilation of the Indian DWR data within WRF can help improve the simulation of intense convective systems influencing the large-scale monsoonal flow. Copyright © 2010 Royal Meteorological Society

*Key Words:* variational data assimilation; cycling mode; background error

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## 1. Introduction

Monsoon depressions (MDs) are some of the most important synoptic-scale disturbances occurring over the

Indian region during the summer monsoon season. The number of MDs which occur over India, their strength and their longevity are the primary contributors to the quantity of Indian summer monsoon rainfall and to the