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Performance evaluation of WRF for extreme precipitation events by integrating WUDAPT

Pratiman Patel (1), Subhankar Karmakar (1,2), Subimal Ghosh (1,3), and Dev Niyogi (4)

(1) IDP in Climate Studies, Indian Institute of Technology Bombay, India (pratiman@iitb.ac.in), (2) Centre for Environmental Science & Engineering, Indian Institute of Technology Bombay, India (skarmakar@iitb.ac.in), (3) Department of Civil Engineering, Indian Institute of Technology Bombay, India (subimal@civil.iitb.ac.in), (4) Department of Earth and Atmospheric Science, Purdue University, USA (dniyogi@purdue.edu)

Increased occurrences of urban flash flood pose a major threat to the life and property of the residents, which urges for a reliable flood forecasting system. However, accurate precipitation forecast at high resolution has always been a challenge as they are substantially affected by land use/ land cover (LULC). Therefore, an attempt has been made to improve the forecast of extreme precipitation event by implementing detailed urban LULC map using Local Climate Zone (LCZ) classification system from World Urban Database and Access Portal Tools (WUDAPT). These LCZs represent specific land cover class based on urban morphology characteristics and can be used in Weather Research and Forecasting (WRF) model which also encapsulates Building Effect Parameterization (BEP) scheme. The BEP scheme considers the 3D structure of the buildings and allows complex land-atmosphere interaction for an urban area. The study is conducted for megacity Mumbai, the financial capital of India, which possesses significant heterogeneity in its building types. The LCZs are generated at 500 m grids using supervised classification and are ingested into WRF model. Two different LULC dataset i.e. Moderate Resolution Imaging Spectroradiometer (MODIS) and WUDAPT derived LCZs along with initial and boundary conditions from ERA-Interim (6 hourly) are used for two extreme events of 2014. The results show an improvement in spatial variability and reduction in overall bias when LCZ map is used instead of MODIS LULC. The LCZ map enhances high-resolution forecast from WRF by incorporating the details of building height, terrain roughness and urban fraction. In future, improved forecasts may assist in enhanced flood simulations by capturing the spatial variability.