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Sensitivity of inland decay of North Atlantic tropical cyclones to soil parameters

Chandra M. Kishtawal · Dev Niyogi · Anil Kumar · Monica Laureano Bozeman · Olivia Kellner

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Abstract Using the HURDAT best track analysis of track and intensity of tropical cyclones that made landfall over the continental United States during the satellite era (1980–2005), we analyze the role of land surface variables on the cyclone decay process. The land surface variables considered in the present study included soil parameters (soil heat capacity and its surrogate soil bulk density), roughness, topography and local gradients of topography. The sensitivity analysis was carried out using a data-adaptive genetic algorithm approach that automatically selects the most suitable variables by fitting optimum empirical functions that estimates cyclone intensity decay in terms of given observed variables. Analysis indicates that soil bulk density (soil heat capacity) has a dominant influence on cyclone decay process. The decayed inland cyclone intensities were found to be positively correlated with the cube of the soil bulk density (heat capacity). The impact of the changes in soil bulk density (heat capacity) on the decayed cyclone intensity is higher for higher intensity cyclones. Since soil bulk density is closely related to the soil heat capacity and inversely proportional to the thermal diffusivity, the observed relationship can also be viewed as the influence of cooling rate of the land surface, as well as the transfer of heat and moisture underneath a land-falling storm. The optimized prediction function obtained by statistical model processes in the present study that predicts inland intensity changes during 6-h interval showed high fitness index and small errors. The performance of the prediction function was tested on inland tracks of eighteen hurricanes and tropical storms that made landfall over the United States between 2001 and 2010. The mean error of intensity prediction for these cyclones varied from 1.3 to

C. M. Kishtawal
SAC/ISRO, Ahmedabad 380015, India

C. M. Kishtawal · D. Niyogi (✉) · M. L. Bozeman · O. Kellner
Purdue University, West Lafayette, IN 47906, USA
e-mail: climate@purdue.edu
URL: http://landsurface.org

A. Kumar
ESSIC University of Maryland, College Park, MD, USA

A. Kumar
NASA/GSFC Hydrological Science Branch, Greenbelt, MD, USA

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