A MODEL IN SPATIAL AND TEMPORAL DOMAIN TO PREDICT RADAR RAINFALL DATA

Nazario D. Ramirez-Beltran[1], Luz Torres Molina[2], Joan M. Castro[2], Sandra Cruz-Pol[3], José G. Colom-Ustáriz[3] and Nathan Hosanna[3]

[1]Department of Industrial Engineering, University of Puerto Rico
[2]Department of Civil Engineering, University of Puerto Rico
[3]Department of Electrical and Computer Engineering, University of Puerto Rico
Corresponding author: P.O. Box 9030, Mayagüez, PR 00681; nazario.ramirez@upr.edu

A short term rainfall prediction algorithm for an intense storm is introduced in this work. The algorithm uses high spatial and temporal resolution (0.06 km and 1 min) radar data to predict the evolving distribution of rainfall rate. It is assumed that for a short time period, (10 min) a rain cloud behaves as a rigid object, with all parts moving in the same direction at a constant speed. Thus, the most likely future rainfall areas are estimated by tracking rain cell centroid advection in consecutive radar images. To achieve this estimation, a nonlinear regression model varying in the time and space domain is proposed to predict the most likely rainfall patterns. This model is built under the assumption that the current radar reflectivity is a function of the previous reflectivity observed in surrounding areas with center on the location of a predicted pixel. The model is also based on the assumption that the ratio of reflectivity of a given pixel to reflectivity of convective core is a fundamental predictor for rainfall estimation. Rainfall forecasting algorithm was validated against five rainfall events occurred in the western part of Puerto Rico during March to October 2012 and in February 2014. The averages, probability of detection, false alarm rate, and Heike Skill Score were: 0.64, 0.27, and 0.61, respectively. The root mean squared error exhibits an average of 0.03 mm/hr. Results show that the forecasting algorithm works and is a potential tool to couple with a hydrological numerical model to predict the most likely inundations areas. The algorithm has been implemented for Puerto Rico western basin; however, it will work in other places where radar rainfall data are available.