

Rainfall-Runoff-Inundation (RRI) model for flood analysis in Attanagalu Oya basin, Sri Lanka

H. K.U.S. Dikkumbura and V.P.A. Weerasinghe*

Department of Zoology and Environmental Management, University of Kelaniya, Sri Lanka

*Corresponding author: primali@kln.ac.lk

Abstract

Floods are one of the most critical forms of natural hazard in global and local context. In the case of large scale flooding, it is important to identify the flood inundation areas and map the areas that undergo flooding for future flood management plans. This study analyzed rainfall-runoff and inundation in the Attanagalu Oya basin with the Rainfall-Runoff-Inundation (RRI) model that simulates the rainfall-runoff and inundation processes simultaneously based on two-dimensional diffusion wave equations. The applicability of RRI model to simulate flood inundation areas over the Attanagalu Oya basin was also investigated.

RRI model simulation was conducted with satellite-based topographical data and daily satellite-based rainfalls for the period of 15th to 18th May of 2010 which was the most recent destructive flood occurred in Sri Lanka. Water depths on slope, water depths on river and river discharges at a specific time step were obtained as output. The model performance was evaluated using satellite-based vector flood map in 2010 obtained from the Disaster Management Centre and river discharge data at Dunamale obtained from the Department of Irrigation, Sri Lanka. The simulation results showed 74.31 % accuracy in downstream flood inundation extent with vector flood map. The simulation under-predicted the flood inundation in upstream areas and tributaries due to the coarse resolution of digital elevation model. The relative error of river discharge data shows some underestimation of simulated flow discharges as it is - 20.17 %.

The model simulation was found to be capable of obtaining the peak flood inundation extent in downstream of basin due to its flat topography. RRI model can be used for the ungauged basins with no flow data available as its simplicity, requiring only rainfall input.

Keywords: Rainfall–Runoff-Inundation, two-dimensional model, Attanagalu Oya basin