Application of TOPMODEL in the Distributed Model Intercomparison Project (DMIP)

Christina Bandaragoda
Civil and Environmental Engineering Department, Utah State University, Logan, UT

David G. Tarboton
Civil and Environmental Engineering Department, Utah State University, Logan, UT

Ross Woods
National Institute of Water and Atmospheric Research, NIWA, Christchurch, New Zealand

Abstract. This paper describes the application of a networked version of TOPMODEL, TOPNET, as part of the Distributed Model Intercomparison Project, DMIP. The model implementation is based on a topographically derived river network with distributed model elements, subwatersheds, draining to each network reach. The river network is mapped from the U.S. National Elevation Dataset Digital Elevation Model (DEM) using procedures that objectively estimate drainage density from geomorphic principles. Rainfall inputs are derived from NEXRAD (radar) for each subwatershed. The initial model parameters for each subwatershed are estimated using look up tables based on soils (STATSGO) and vegetation (1-km AVHRR). For each subwatershed, the wetness index distribution is derived from the DEM. These initial model parameters provide the spatially distributed pattern of parameters at the scale of each subwatershed used as a basic model element. Our calibration was constrained to retain the relative spatial pattern of parameters inherited from the spatial data inputs through the use of multipliers that adjust the parameters in a spatially consistent manner. Parameter multipliers were calibrated using the shuffled complex evolution algorithm with the objective to minimize the mean square error between observed and modeled hourly streamflows. We describe the model and calibrated results submitted for all basins and entire length of time periods involved in the initial DMIP study. We were encouraged by the relatively good performance of the model, especially in comparison to streamflow from smaller interior watersheds not used in calibration, simulated as ungaged basins, and present analysis of model performance at different time and spatial scales.