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Operational Testing of Satellite based Hydrological Model (SHM)

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Incorporation of the concept of transposability in model testing is one of the prominent ways to check the credibility of a hydrological model. Successful testing ensures ability of hydrological models to deal with changing conditions, along with its extrapolation capacity. For a newly developed model, a number of contradictions arises regarding its applicability, therefore testing of credibility of model is essential to proficiently assess its strength and limitations. This concept emphasizes to perform 'Hierarchical Operational Testing' of Satellite based Hydrological Model (SHM), a newly developed surface water-groundwater coupled model, under PRACRITI-2 program initiated by Space Application Centre (SAC), Ahmedabad. SHM aims at sustainable water resources management using remote sensing data from Indian satellites. It consists of grid cells of 5km x 5km resolution and comprises of five modules namely: Surface Water (SW), Forest (F), Snow (S), Groundwater (GW) and Routing (ROU). SW module (functions in the grid cells with land cover other than forest and snow) deals with estimation of surface runoff, soil moisture and evapotranspiration by using NRCS-CN method, water balance and Hragreaves method, respectively. The hydrology of F module is dependent entirely on sub-surface processes and water balance is calculated based on it. GW module generates baseflow (depending on water table variation with the level of water in streams) using Boussinesq equation. ROU module is grounded on a cell-to-cell routing technique based on the principle of Time Variant Spatially Distributed Direct Runoff Hydrograph (SDDH) to route the generated runoff and baseflow by different modules up to the outlet. For this study Subarnarekha river basin, flood prone zone of eastern India, has been chosen for hierarchical operational testing scheme which includes tests under stationary as well as transitory conditions. For this the basin has been divided into three sub-basins using three flow gauging sites as reference, viz., Muri, Jamshedpur and Ghatshila. Individual model set-up has been prepared for these sub-basins and calibration and validation using Split-sample test, first level of operational testing scheme is in progress. Subsequently for geographic transposability, Proxy-basin test will be done using Muri and Jamshedpur as proxy basins. Climatic transposability will be tested for dry and wet years using Differential split-sample test. For incorporating both geographic and climatic transposability Proxy-basin differential split sample test will be used. For quantitative evaluation of SHM, during Split-sample test Nash-Sutcliffe efficiency (NSE), Coefficient of Determination (R^2) and Percent BIAS (PBIAS) are being used. However, for transposability, a productive approach involving these performance measures, i.e. NSE*R^2*PBIAS will be used to decide the best value of parameters.

Keywords: SHM, credibility, operational testing, transposability.