Hydrological response of two adjoining subtropical catchments – Iril and Thoubal of the Manipur river basin in the Indian Himalayan Region

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The Thoubal river catchment (TRB) and Iril river catchment (IRB), which are two major adjoining sub-basins of the Manipur river basin in India, were selected for this study. A GIS-based semi-distributed hydrological model soil and water assessment tool (SWAT) was used to derive the hydroclimatic parameters such as surface run-off, evapotranspiration. The present study aims to calibrate and validate the SWAT model using streamflow and satellite soil moisture data, as well as to examine the hydroclimatological responses in the two adjacent basins, and compare the relative changes in treating the Iril–Thoubal river basin jointly and as two separate entities. The model was calibrated and validated using the SUFI-2 tool. During calibration and validation, both IRB and TRB showed good model performance. This study shows that in a poorly gauged river basin with scarce data, remotely sensed soil moisture data may be effectively applied for the calibration and validation of hydrological models. The novel aspect of this study is the efficient calibration and validation of a hydroclimatic model for subtropical river sub-basins with limited hydrological ground data reinforced with open-source satellite-derived soil moisture datasets.

Keywords: Calibration, hydroclimatic model, hydrological response, river catchments, validation.

analysing the consequences of land–water management practices at the basin scale[4–8]. Climate change alters the hydrological response of a river catchment indiscriminately, which complicates hydrological studies using conventional approaches. In recent years, hydrological models have been used to provide a visual representation of hydrological processes as well as accurate flow simulations, particularly when evaluating the effects of land-use change and climate variability on hydrological cycles and water balance components[9–11]. The present study focused on two adjoining river catchments in the Manipur river basin (MRB): the Iril and Thoubal rivers which serve as principal sources of potable water and irrigation in the valley region of Manipur Indian Himalayan Region (IHR). In the last decade, the hydrological regime and productivity in terms of water supply have deteriorated drastically in the MRB due to unplanned urbanization, upstream catchment degradation, unregulated sand–gravel mining practices, etc. The present study evaluates the asymptotes of hydrological responses of two adjoining MRB catchments – Iril river basin (IRB) and Thoubal river region (TRB), whether the hydroclimatic factors vary with a statistical nonlinear relation across the climate gradient along with co-variation of climate (precipitation, temperature, evapotranspiration), and land-use land-cover (LULC) temporal changes. This study examines