ABSTRACT

The present study focuses on the selection of the best multi-model ensemble method for the discharge estimation in two catchments, namely Kesinga and Salebhata, of the Mahanadi river basin in India. For selecting the best multi-model ensemble method for developing the ensembles, eight different multi-model ensemble methods are compared using calibrated and validated discharge of eight popular hydrological models namely MIKE SHE, SWAT, HEC-HMS, AWBM, SIMHYD, SACRAMENTO, SMAR and TANK. Weighted mean method (based on calibration performance) and linear programming methods are found to be the most suitable for Kesinga and Salebhata, respectively. The selected methods are subsequently used to develop 189 possible multi-model ensembles each for Kesinga and Salebhata. These ensembles are evaluated for categorical and temporal performance, using a proposed SCORE that includes normalized relative operating characteristic (ROC) area and normalized number of skillful days. The results show that an ensemble of SWAT, TANK, SIMHYD, SACRAMENTO and SMAR, developed using weighted average method (based on calibration performance), is the best ensemble for Kesinga whereas; the ensemble of SWAT, HEC-HMS, TANK, SIMHYD and SACRAMENTO, developed using linear programming method, is the best ensemble for Salebhata. Uncertainty analysis of the selected ensemble and considered models is performed to assess the advantage of using ensemble rather than individual models. The selected ensembles are applied to predict river discharges for near future using the climatic data predicted by two regional climatic models for two future scenarios as per fifth assessment report of IPCC. The assessment results show that water availability, in general, is likely to decrease in case of Kesinga, whereas it is likely to increase in Salebhata. Furthermore, the intensity of flood events is likely to decrease in case of RCP 4.5 and increase in case of RCP 8.5 in Kesinga; whereas, it is likely to increase in both RCP scenarios in case of Salebhata.

Keywords: *Ensemble, ROC, temporal performance, categorical performance, quantile regression, uncertainty analysis, River discharge, Impact assessment.*