Simulation of water cycle components in the Narmada River basin by forcing SWAT model with CFSR data

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Abstract: In the present study, an attempt has been made through a hydrological model (SWAT – Soil and Water Assessment Tool) to simulate water cycle components over the Narmada river basin, one of the largest rivers in the Indian peninsula. The model was forced with observed as well as CFSR rainfall data to calibrate surface runoff simulated by the model. The spatial and temporal variability of the water cycle components were examined by running the SWAT model for 30 years (1984-2013) at a daily time-scale using CFSR precipitation, temperature, humidity, winds and solar radiation. It was found that there are large variations in hydrological parameters simulated by the model from sub-basin to sub-basin and year to year. During the monsoon seasons, surface runoff is maximum but during other seasons, almost no surface runoff is seen as there is almost no rain. Groundwater increase is seen after about 1 month of rainfall peaks in the basin. Evapotranspiration has two peaks, one in March-April and the other in August. Much less evaporation takes place in the basin in the month of May. These components (other than surface runoff) are also sensitive to climatic forcing (winds, relative humidity and solar radiation in addition to temperature and rainfall) applied. Evapotranspiration increases when all the climatic parameters are used, which then reduces the water availability on the surface for percolation and groundwater recharge. However, rainfall is the key parameter which decides the hydrology in the Narmada basin. The SWAT model has been able to compute water balance at basin and sub-basin scales.