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Assessing Strategic Water Availability in the Upper Ing Watershed, Thailand

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Abstract

Availability of good quality irrigation water throughout a year is a key element for the economic development of the farming families. Even with high precipitation, most of agricultural lands in the northern Thailand are still suffering with unavailability of irrigation water. This paper assesses the strategic water availability and use under different development pathways at a watershed scale using the spatial water budget model (SWBM). First of all SWBM for the study area was developed as part of the methodology. Processes that are simulated are (a) land use water balance (b) water flow to stream (c) water storage in dams and small reservoirs, and (d) water use from reservoirs and streams.

We applied SWBM to the 25100 ha Upper Ing Watershed in northern Thailand and investigated the spatial and temporal variation in location of stream and water yields from different parts of the watershed. The base simulation was carried out for the year's 1998–2007 using a DEM and actual land use data at 100 m resolution. Simulated river flow rates at the watershed outlet corresponded well to measured flow rates. The ten year average simulated river flow rate was 1300 l s^{-1} , but it more than doubles during periods of heavy rainfall and decreased below 600 l s^{-1} in dry seasons. The differences in the total length of the streams (based on flow threshold 25 l s^{-1}) on a typical dry day in the dry season were approximately a factor 1.5.

Agricultural water need and possible extraction was assessed and presented by dividing the watershed into fifteen different zones based on the streams network. Monthly water yields for each zone were computed, results varied from less than 50 % to over 137 % of the per hectare water yield for the entire watershed. This variation was caused by differences in topography and land cover. Two methods of water extraction: directly from stream and harvesting rain water in reservoir and dam during monsoon and supplying in the dry season, were employed. Results show there are enough possibilities of harvesting small quantities of water in the different spatial gradients where currently there was no irrigation water supply.

Keywords: Thailand, spatial water availability, hydrological modeling, spatial water balance model