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Importance of land-cover data-set spatio-temporal resolution on water budget modeling in highly irrigated areas, Telangana, India

Abhilash Kumar Paswan[1,2], Sylvain Ferrant[3], Adrien Selles[4], Virendra Mani Tiwari[1,2], and Shakeel Ahmed[2]

[1]Academy of Scientific & Innovative Research (AcSIR), Ghaziabad – 201002 , India (abhilashpaswan@gmail.com)
[2]CSIR – National Geophysical Research Institute (NGRI), Hyderabad – 500007, India
[3]Centre d'Etudes Spatiales de la Biosphère/OMP, Université de Toulouse, CNES, CNRS, INRAE, IRD, UPS, UMR5126, Toulouse, France
[4]Bureau de Recherches Géologiques et Minières (BRGM), Université de Montpellier, Montpellier, France

Falling water tables in several parts of India, especially in the southern part, experiencing semi-arid climatic conditions with hard rock aquifer systems, possess a threat to food, water and economic security to millions of citizens. Understanding of the water budget in such an area is paramount to take necessary steps towards planning of water usage and its management. Land use information at 1km is recognized as sufficient in hydrological modeling. But what is the best resolution of land use forcing variables for agro-hydrological modeling to simulate the water budget by taking agricultural water withdrawal into account. This study focuses on the use of medium (500m) and high resolution (10m) land cover maps derived from satellite products to map the seasonal rice inundated area extent in the Telangana state to estimate the Irrigation Water Demand (IWD) and withdrawal. We employed Soil and Water Assessment Tool (SWAT), a process based ecohydrological river basin or watershed model, to assess how resolution of land use maps may affect the water budget representation of Telangana. The model is calibrated and validated for a period from 2015 to 2020 (6 years) using monthly river runoff data, groundwater and terrestrial water fluctuation derived from respectively governmental piezometric observations (TSGWD) and GRACE. An uncertainty analysis was performed using the Sequential Uncertainty Fitting (SUFI-2) algorithm. Preliminary results suggest that though trends in runoff are influenced by climate drivers, as southwest monsoon contributes appx. 80% of annual rainfall. However, the farmers seasonal land cover adaptation to surface and groundwater availability have a strong impact on water balance over the study area. Precise land cover information of such temporal variations based on appropriate spatial resolution satellite observations contributes to accurate estimate of IWD especially in groundwater fed areas where rice areas are spread in small aggregates. This study also highlights the adaptation and importance of temporal and spatial resolution of datasets in strategic planning and water management practices in water stressed regions.