Geophysical Research Abstracts
Vol. 19, EGU2017-18067, 2017
EGU General Assembly 2017

Long-term trends in field level irrigation water demand in Mahanadi delta districts - a hydrological modeling approach for coping with climate change

Venkat Raju Pokkuluri (1), Diwakar Parsi Guru Rao (1), Sugata Hazra (2), and Sunil Srikant Kulkarni (1)
(1) Indian Space Research Organisation, India (pokkulurivenkat@gmail.com), (2) Jadavpur University, India

India uses its 85 percent of available water resources for irrigation making it the country with largest net irrigated area in the world. With one of the largest delta plains, sustaining the needs of irrigation supplies is critical for food security and coping with challenges of climate change. The extensive development of upstream river basins/catchments is posing serious challenge and constrains to the water availability to delta regions, which depend on the controlled/regulated flows from the upstream catchments. The irrigation water demands vary due to changes in agricultural practices, cropping pattern and changing climate conditions. Estimation of realistic irrigation water demand and its trend over time is critical for meeting the supplementary water needs of productive agricultural lands in delta plains and there by coping the challenges of extensive upstream river basin development and climate change.

The present study carried out in delta districts of Mahanadi river in Odisha State of India, wherein the long-term trends in field level irrigation water requirements were estimated, both on spatial & temporal scales, using hydrological modeling framework. This study attempts to estimate field level irrigation water requirements through simulation of soil water balance during the crop growing season through process based hydrological modeling framework. The soil water balance computations were carried out using FAO-56 framework, by modifying the crop coefficient (Kc) proportional to the water stress coefficient (Ks), which is a function of root zone depletion of water. Daily meteorological data, spatial cropping pattern, terrain are incorporated in the soil water balance simulation in the model. The irrigation water demand is derived considering the exclusion of soil water stress for each model time step. The field level irrigation water requirement at 8 day interval had been estimated for the each Rabi season (post-monsoon) spanning over 1986 to 2015. The results indicate that irrigation water requirements show spatial and temporal changes and tend to deviate from notional/envisaged demands. Validation of estimated irrigation demand is attempted through correlation of gap in supply and demand with the trends in crop water stress and crop production during the study years. Crop water Stress Index (CWSI), which is the ratio of deficit of actual evapotranspiration (AET) from the potential evapotranspiration (PET) and is derived from MODIS Evapotranspiration data. Agricultural production data is used from State/Central government statistics. The attempted methodology provides opportunities to estimate future irrigation water demand under projected climate change scenarios and for planning for basin level water resources development sustaining the delta agriculture, which are projected to be more vulnerable to climate change.