Geophysical Research Abstracts
Vol. 20, EGU2018-17445, 2018
EGU General Assembly 2018

Irrigated area estimation using Landsat satellite images in the Berambadi watershed

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Groundwater has rapidly evolved as a primary source for irrigation in 90's with tremendous impacts on the environment. The overexploitation of groundwater has a substantial impact on the water resource in the form of quality and availability. Estimation of the irrigated area for various cropping seasons is required to evaluate the anthropogenic activities of water resources.
In peninsular India, main crop growing seasons are Summer (dry season, from February to April), Kharif (South-West monsoon season, May to September) and Rabi (North-East monsoon season, from October to January). As climate is semi-arid, irrigation is commonly used in kharif (to complement insufficient monsoon rains), very frequently in rabi and always in summer. This farmers practice of irrigating 2 to 3 crops a year is having a tremendous impact on groundwater resource. In the Berambadi catchment, intensive groundwater irrigated agricultural watershed in Karnataka, groundwater levels have declined up to 50 meters from topology, especially in the valleys of the watershed (Sekhar et al., 2016). This groundwater depletion in the downstream is interrupting and disconnecting the base flow, which can impact on the ecology of adjacent reserve forest (Bandipur national park).
In the present study, we compare the total irrigated cropland and mean groundwater level at 1 km^2 grid scale in the Berambadi watershed (84km^2). The irrigated cropland areas were estimated for post-monsoon (Rabi) 2015 and summer 2016, using a combination of three optical indices (Normalized Differential Vegetation Index, Normalized Differential Moisture Index, and Enhanced Vegetation Index) derived from Landsat 8 OLI (Optical Land Imager) sensor. Groundwater was collected from 150 borewells in the watershed and mean value for each grid was generated by kriging.
Results show a large spatial variability of irrigated area in the watershed with larger percentage of each grid being irrigated in regions where groundwater level is shallow. This suggests that in areas where groundwater is already depleted by past intensive irrigation, farmers had to reduce the size of their irrigated plot or abandon double and triple crop. This demonstrate the importance of accounting for groundwater feedback for managing farming practices in a sustainable manner.

Keywords: Landsat satellite images, Data analysis, Irrigated cropland, Groundwater irrigation, Vegetation indices, Support vector machines.