Identification of crop type distribution using remote sensed data and its application for crop water requirement

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Water security is a major concern in the Kathmandu, capital city of Nepal and its surrounding valley area, due to increased water demand caused by rapid growth of population and urbanization. The situation of water scarcity become more serious in recent years through overuse of water resources and aggravated by water pollution. For the sustainable use of water resources, it is necessary to clarify the balance of water demand, supply and availability in the valley based on scientific data analysis. However, data for the water balance analysis is not well organized and provided for water managers. For example, the spatial and temporal variation of agricultural water use is not well understood even though agriculture is one of the major water sectors and larger amount of water is used in the cropland for maintain agricultural production.
The objective of this study is to estimate the spatial and temporal distribution of crop water requirements (CWR) in Kathmandu valley. Due to the limitation of data for calculating agricultural water use (crop type, crop calendar, etc.), integrated analysis of satellite observations and field observed data, agricultural census data and numerical model is carried for mapping of CWR.
Crop map is produced using time-series of satellite derived vegetation index (Normalized Vegetation Index : NDVI derived from Moderate Resolution Imaging Spectroradiometer : MODIS) and field survey of cropping pattern at some reference sites in the valley. This crop map provides spatial pattern of crop type, duration of growing season, and the time of planting/harvesting in the valley. The census data of cropland area provided by Central Bureau of Statistics, Nepal is used for correction of satellite-derived map of cropland extent.
CWR for each crop types are estimated using CROPWAT model developed by the Land and Water Development Division of FAO. CROPWAT is tool for calculation of crop water requirements and irrigation requirements using soil, climate and crop data.
Then, spatial distribution of CWR and its seasonal variation in Kathmandu valley are provided based on combined use of crop map with CROPWAT model. In addition, balance of precipitation and CWR is also investigated using estimated CWR and gauge-corrected high resolution satellite precipitation product (PERSIANN-CCS). The hotspots of agricultural water stress, the area of higher CWR compared with precipitation, are identified through this water balance analysis. Furthermore, the seasonal change of water balance in whole Kathmandu valley is also investigate, and it is found that irrigation water supply is necessary to fulfil CWR for these hotspots, especially in the late fall season.

Keywords: Normalized Difference Vegetation Index(NDVI), CROPWAT, crop water requirement(CWR)

