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Evaluation of Modis for Mapping of Major Crops in Semi-arid Punjab of Pakistan

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Abstract

The present study was performed in Punjab, the major food-producing province of Pakistan, for evaluating the performance of the Moderate Resolution Imaging Spectroradiometer (MODIS), Normalized Difference Vegetation Index (NDVI) of 250 m spatial resolution for major crops mapping. Cost-free MODIS data at 8 days temporal resolution were downloaded both from Aqua and Terra sensors from 2005 to 2015. The data were pre-processed followed by unsupervised classification using K-means algorithm. All major crops including wheat, rice, cotton, sugarcane, and fodder were identified from the temporal profiles of NDVI over the years for each Kharif (i.e. summer) and rabi (i.e. winter) cropping seasons. The classification results were cross-checked with state-owned crop census data of major crops at different districts of Punjab. The results were also verified with the information gathered at the ground-truth points, mainly located in the mix cropping districts.

The results show that wheat is the major crop during rabi seasons followed by rabi fodder, and during Kharif cotton is the largest crop followed by Kharif fodder and rice. The results for wheat shows that its overall accuracy at Punjab level as well as in different cropping zones is good because of its major covering during rabi seasons. The results for cotton were also found quite good as NSE, R^2 and %BIAS are 0.90, 0.91 and 1.30, respectively. The evaluation of rice shows that its overall performance is even better as NSE, R^2 and %BIAS is 0.95, 0.96 and $^{-2}$.9, respectively. However, the evaluation results in different cropping zones show that cotton results in rice zone and vice verse are poor. The error matrix further confirm our results as overall classification accuracy and kappa coefficient during rabi seasons are 57 % and 0.30, respectively and during Kharif seasons, it is 46 % and 0.25, respectively. The difference for both cropping seasons is associated with greater heterogeneity in cropping during Kharif seasons. It is concluded that MODIS performed overall good in a particular crop dominant zone but its performance is found unsatisfactory in other zones.

Keywords: Crop mapping, K-means, MODIS, multi-temporal, NDVI, Punjab

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