Spatiotemporal dynamics of crop phenology and crop yield: The influence of climate variability in the Upper Blue Nile basin

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Abstract

Climate variability/change imposes significant challenge on crop production by altering crop growth dynamics, phenology and yield. Vegetation phenology is a multi-purpose indicator of environmental change as well as a proxy measure of productivity. At the same time crop yield is a direct indicator of the response to climate and anthropogenic changes as well as a mechanism to assess the state of food security. Understanding the spatial and temporal dynamics of vegetation growth and productivity is vital for crop management and decision-making. Conventional production monitoring based on field survey is costly, time consuming and prone to error. Moreover, fragmentation of farm plots, heterogeneous landscape and cropping system together with a high rate of climate variability becomes challenging to monitor crop growth and development processes. Lack of temporally frequent and spatially explicit data also constrains understanding of the inter-annual and seasonal dynamics of crop production. Remote sensing data on the other hand provide a valuable opportunity for spatially explicit understanding of vegetation phenology and crop yield monitoring. Yet, existing remote sensing sensors doe not provide temporally frequent and high spatial resolution data important for agricultural monitoring. In this regard, multi-sensor remote sensing data fusion is a valuable choice. It is therefore imperative that comprehensive assessment of the spatiotemporal dynamics of crop growth and production incorporating vegetation phenology and climate constraints using remote sensing method can provides a holistic understanding of the status of crop production. Thus, the main goal of this study is to investigate the spatiotemporal dynamics of vegetation phenology and the influence of climate variability on crop yield in Lake Tana basin, Northwestern Ethiopia. To achieve this objective a spatiotemporal data fusion models will be employed to determine vegetation growth dynamics and yield in heterogeneous landscapes. Furthermore, crop biomass productivity and yield estimation by coupling remote sensing data with light use efficiency based crop model is envisioned. Landsat and MODIS data fusion will be utilized to detect phenology and estimate crop yield together with ground data calibration and climate data. Thereby, this research is expected to contribute to the literature on the current trend and dynamics of vegetation phenology and crop productivity in heterogeneous topography and crop ecosystem.