

Analyzing the Impact of Spatio-Temporal Climate Variations on the Rice Crop Calendar in Pakistan

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Abstract : The present study investigates the space-time impact of climate change on the rice crop calendar in tropical Gujranwala, Pakistan. The climate change impact was quantified through the climatic variables, whereas the existing calendar of the rice crop was compared with the phenological stages of the crop, depicted through the time series of the Normalized Difference Vegetation Index (NDVI) derived from Landsat data for the decade 2005-2015. Local maxima were applied on the time series of NDVI to compute the rice phenological stages. Panel models with fixed and cross-section fixed effects were used to establish the relation between the climatic parameters and the time-series of NDVI across villages and across rice growing periods. Results show that the climatic parameters have significant impact on the rice crop calendar. Moreover, the fixed effect model is a significant improvement over cross-sectional fixed effect models (R-squared equal to 0.673 vs. 0.0338). We conclude that high inter-annual variability of climatic variables cause high variability of NDVI, and thus, a shift in the rice crop calendar. Moreover, inter-annual (temporal) variability of the rice crop calendar is high compared to the inter-village (spatial) variability. We suggest the local rice farmers to adapt this change in the rice crop calendar.

Keywords : Landsat NDVI, panel models, temperature, rainfall

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