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Historical and projected future hydroclimatic risk on seasonal yield in the irrigated rice paddies of Malaysia

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Food security is an increasing threat to rice-consuming nations in the face of a changing climate. In this study, we present a framework for analysing the historical and projecting the future relationship between climate variability and rice yield in the context of weather index insurance. The case study is the Muda rice granary, the largest rice paddy planting area in Malaysia producing approximately 40% of the national output. First, correlation and linear regression are used to explore the response of seasonal rice yield to various average and extreme precipitation, temperature and streamflow-based indices over a 16 year period between 2001 to 2016. The highest Pearson correlation (r) and coefficient of determination (R^2) values were obtained with June minimum temperature in the dry season, and December maximum 1 day precipitation and January mean streamflow in the wet season. The results suggest that rice yield is most at risk from the impact of hydroclimatic variability and change during the flowering and maturity stages of crop growth. Next, findings from the statistical analysis are integrated with hydro-crop simulation of the 4,515 km2 catchment area, using a calibrated Soil Water Assessment Tool (SWAT) and bias-corrected Regional Climate Model output from the Coordinated Regional Downscaling Experiment for South East Asia (CORDEX-SEA). The output is finally used to construct projected future risk profiles for rice production in the area.