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Influence of El Niño Southern Oscillation (Enso) Variation on Main Paddy Cultivation Seasons in Sri Lanka

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Abstract

The El Niño Southern Oscillation (ENSO) is a major climate driver that influences global weather patterns, with extensive effects on seasonal rainfall variability. Sri Lanka is a monsoon rainfall dependent country majorly for its paddy production as the staple food which is vulnerable to the influences of ENSO variation. The objective of this study was to understand the influences of ENSO events on the weather patterns in main paddy cultivation seasons ("Maha"- October to March and "Yala"- April to September) across major climatic zones of Sri Lanka which is Dry Zone (DZ), Wet Zone (WZ) and Intermediate Zone (IZ). This study analyzed the relationship between sea surface temperature-based ENSO Index (EI) at Niño 3.4 region, seasonal rainfall anomaly in the climatic zones and seasonal temperature anomaly over the period of 1980-2024. During the El Niño (ENSO positive) phase, first three-month (October to December) rainfall of Maha season (MS) exhibited a significant positive correlation with EI in DZ (r=0.58, p=0.001) and IZ (r=0.50, p=0.001), suggesting that El Niño conditions are associated with enhanced rainfall (DZ-18% and IZ-32%) in these regions during the 45-year period. However, during the La Niña years (negative phase), MS rainfall has decreased by 11%, 8%, and 24% in the DZ, WZ, and IZ respectively. Additionally, El Niño phases have reported a significant negative correlation (r=-0.33, p=0.02) with Yala season (YS) rainfall in the WZ, leading to a 10% decrease, while no significant relationship exists with rainfall in the other zones. Furthermore, the temperature exhibited a significant positive correlation between the EI and YS temperature (r=0.59, p=0.000), indicating that El Niño phases are associated with increased temperature during YS in Sri Lanka. Overall, these findings emphasize the strong influence of ENSO variability on seasonal climate associated with paddy cultivation, and its value for early agricultural planning and water resource management to strengthen climate resilience in Sri Lanka.

Keywords: *El Niño southern oscillation, Rainfall, Temperature, Paddy cultivation seasons, Climate resilience*