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# Identification of Emerging Extreme Rainfall and Drought Events in Sri Lanka Using High-Resolution Downscaled Climate Projections and Precipitation Indices (1985–2100)

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## Abstract

Sri Lanka is highly vulnerable to climate change due to its complex topography, monsoon driven climate system, and strong dependence on climate sensitive sectors. The coarse resolution of global climate models (GCMs) limits their ability to represent the fine scale climatic processes and localized extreme events. To address this gap, a long term (1985-2100) high resolution (15 km) dynamically downscaled climate projections were collaboratively developed by the International Water Management Institute and the Department of Meteorology. The WRF-ARW regional climate model was driven by the bias corrected CMIP6 MPI-ESM1-2-HR GCM under SSP2-4.5 and SSP5-8.5, and validated with ERA 5. The model was selected as the best performing model among 37 tested models. The Simple Daily Intensity Index (SDII), which measures average rainfall intensity, and Maximum Consecutive Dry Days (MCDD), which captures the length of dry spells were estimated to identify future extreme weather events. Projected future indices (2015–2100) were compared with those of the baseline period (1985–2014) to identify emerging localized extremes. An increase in MCDD with a decrease in SDII signals extreme dry conditions. Conversely, a simultaneous increase in both indices indicates the possibility of longer dry spells interrupted by intense downpours. The results reveal distinct regional patterns across Sri Lanka: Jaffna is likely to experience extreme dry conditions whereas Kurunegala is likely to see high intensity rainfall events. This divergence illustrates a broader national trend of spatial microclimatic variation, exposing different regions to varying levels of climate risk. This analysis provides actionable insights to enable long-term preparedness in Sri Lanka's most climate-vulnerable areas.

**Keywords:** *climate indices; dynamical downscaling; extreme weather events; MCDD; SDII*