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Sea Surface Trend over the Arabian Sea and Its Influence on the South West Monsoon Rainfall Variability over Sri Lanka

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Abstract : In recent decades, the inter-annual variability of summer precipitation over the India and Sri Lanka has intensified significantly with an increased frequency of both abnormally dry and wet summers. Therefore prediction of the inter-annual variability of summer precipitation is crucial and urgent for water management and local agriculture scheduling. However, none of the hypotheses put forward so far could understand the relationship to monsoon variability and related factors that affect to the South West Monsoon (SWM) variability in Sri Lanka. This study focused to identify the spatial and temporal variability of SWM rainfall events from June to September (JJAS) over Sri Lanka and associated trend. The monthly rainfall records covering 1980-2013 over the Sri Lanka are used for 19 stations to investigate long-term trends in SWM rainfall over Sri Lanka. The linear trends of atmospheric variables are calculated to understand the drivers behind the changers described based on the observed precipitation, sea surface temperature and atmospheric reanalysis products data for 34 years (1980–2013). Empirical orthogonal function (EOF) analysis was applied to understand the spatial and temporal behaviour of seasonal SWM rainfall variability and also investigate whether the trend pattern is the dominant mode that explains SWM rainfall variability. The spatial and stations based precipitation over the country showed statistically insignificant decreasing trends except few stations. The first two EOFs of seasonal (JJAS) mean of rainfall explained 52% and 23 % of the total variance and first PC showed positive loadings of the SWM rainfall for the whole landmass while strongest positive lording can be seen in western/ southwestern part of the Sri Lanka. There is a negative correlation ($r \leq -0.3$) between SMRI and SST in the Arabian Sea and Central Indian Ocean which indicate that lower temperature in the Arabian Sea and Central Indian Ocean are associated with greater rainfall over the country. This study also shows that consistently warming throughout the Indian Ocean. The result shows that the perceptible water over the county is decreasing with the time which the influence to the reduction of precipitation over the area by weakening drawn draft. In addition, evaporation is getting weaker over the Arabian Sea, Bay of Bengal and Sri Lankan landmass which leads to reduction of moisture availability required for the SWM rainfall over Sri Lanka. At the same time, weakening of the SST gradients between Arabian Sea and Bay of Bengal can deteriorate the monsoon circulation, untimely which diminish SWM over Sri Lanka. The decreasing trends of moisture, moisture transport, zonal wind, moisture divergence with weakening evaporation over Arabian Sea, during the past decade having an aggravating influence on decreasing trends of monsoon rainfall over the Sri Lanka.

Keywords : Arabian Sea, moisture flux convergence, South West Monsoon, Sri Lanka, sea surface temperature
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