

## **Abstract**

Understanding the relation between cloud rainfall and aerosols is important especially in India, since the Indian economy is determined by and dependent upon climate. This study emphasises the strong role of the global climate indices and aerosols on rainfall at different space-time scales. The study establishes the relation between climate indices and cloud occurrence at different altitudinal levels. A robust selection of the spatial extent based on earlier research is done and the relation between climate indices and cloud occurrences is described here. Nino 3.4 emerged as the most dominant index influencing cloud occurrences over the Indian subcontinent.

The study also focuses on the patterns of trend in rainfall over the arid North Western and the coastal South Eastern Indian regions. Non-parametric statistical tests show some significant positive and negative trends in rainfall at 10% level of significance. Spatial heterogeneity in rainfall pattern along temporal scales is also observed. The Pettit Mann Whitney test (PMW) shows a definitive change in rainfall pattern for the arid North Western region and the coastal South Eastern region post the 1970s conforming to the established global climate shift theory. Further, the Principle Component Analysis (PCA) used in this study explores the most dominating indices affecting rainfall over the North Western region.

This study also assesses the spatial and temporal variability of Aerosol Optical Depth (AOD) for the arid North Western and the coastal South Eastern Indian region based on the observations from Moderate Resolution Imaging Spectroradiometer (MODIS). The Aerosol Indirect Effect (AIE) computed for the South Eastern Indian region shows a strong warming scenario. Further, a strong relation between rainfall and AOD is also observed and is interpreted in detail in this study.

In this study the relation between the cloud, rainfall, and aerosol interactions for the global-to-local scales and vice-versa have been explained in detail.