



## The Teleconnection of Indian Summer Monsoon Clouds with Global Predictors: An Unexplored Measure for Coupled Model development

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The teleconnection studies regarding Indian summer monsoon (ISM) clouds are not focused on detail from both observational and modeling aspects. This is despite the fact that clouds play a seminal role in governing rainfall variability through the modulation of heating and induced circulation. Therefore, we find it essential to explore whether the inter-annual variability of ISM clouds is also remotely influenced by the slowly varying predictable component e.g. Sea Surface Temperature (SST).

The findings reveal the linkage of observed TCF (and rainfall) over the ISM region with slowly varying forcing (e.g., global SST). The observed/reanalysis teleconnection pattern of TCF-SST is almost similar to that of rainfall-SST. In the long-term period, TCF and SST show a strong and positive correlation with Extra-Tropics ( $R \sim 0.41$ ), NAO ( $R \sim 0.51$ ), and AMO ( $R \sim 0.41$ ) SST regions, in addition to canonical ENSO teleconnection ( $R \sim -0.39$ ). This is better captured in CMIP6-MME than in CMIP5-MME. The representation of the global teleconnection pattern has been significantly improved in participating models from CMIP5 to CMIP6. The teleconnection with extra-tropics and north Atlantic mode of variability is markedly enhanced in CMIP6-MME compared to CMIP5-MME. The present study has also shown the lag correlations in the teleconnection analysis, i.e., the correlation of June–September (JJAS) mean of rainfall/TCF with October–December (OND) SST from observation/reanalysis, CMIP5-MME, and CMIP6-MME. The CMIP6-MME performs better than CMIP5-MME as compared to observation/reanalysis.

Thus, the improved understanding of the teleconnection of cloud variables with ENSO and other predictors (ET, NAO, and AMO) will help researchers take up the challenges of improving the ISMR skill far ahead using the new generation coupled climate models. This may facilitate reliable seasonal ISM forecasting.

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