Session: C34 Poster: W184A

C20C - Climate of the 20th century: On the combined role of ENSO and of the Indian Ocean dipole (IOD) for the simulated interannual and interdecadal variability of the Indian summer monsoon

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The Indian summer monsoon (ISM) is one of the main components of the broad-scale Asian summer monsoon that represents the largest source of moisture and precipitation of the tropical sector. ISM is influenced by many timescales variability (from intra-seasonal to interdecadal) and it is largely modulated by external factors, like the El Niño Southern Oscillation (ENSO). Toward the end of the 20th century changes have been documented in the strength of the ENSO-monsoon relationship. The Indian Ocean Dipole (IOD) has been identified as one of the phenomena able to trigger that connection. A coupled ocean-atmosphere general circulation model (GCM) is used to study the ISM with the aim to identify the role that ENSO, the IOD and, possibly their combination play on its variability. An ensemble of atmospheric GCM simulations forced with observed interannual SSTs is included in the analysis and compared with coupled model simulation and available reanalysis products. A lead-lag correlation analysis between circulation-based monsoon indices and ENSO and IOD SST indices reveal that the ISM connection with ENSO is larger in intensity and extend from the spring just before the summer monsoon peak to the next winter, while that with the IOD is weaker and mostly confined to the summer and the autumn following. According to the choice of the monsoon index the intensity and time-extension of the correlation may vary, in particular it tends to be stronger and to extend more in time when broad-scale monsoon indices are used. In the coupled model experiment the correlation is weaker than in the reanalysis and it is significant mostly during the summer monsoon peak season. The time evolution of the connection agrees more with the reanalysis for the IOD than for ENSO, and this is consistent with previous studies results that show how this model background state favors this IOD-like mode in the Indian basin. The comparison with amip-type experiments where the SSTs are prescribed evidence the importance of the remote and local temperature forcing in the connection. The analysis is extended considering also ENSO and IOD indices for the atmospheric component.