
Synopsis Seminar

Seminar Title	: Understanding the Indian Summer Monsoon variability in the past, present, and future climate using CMIP6 models
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Venue	: ER303 Class Room
Date and Time	: 23 Jul 2025 (04:00 PM)
Abstract	: The Indian Summer Monsoon (ISM) plays a very important role in Indian agriculture and India's socio-economic conditions. However, there is a large spread in the ISM projections of future climate by the end of 21st century. Evaluation of ISM rainfall (ISMR) changes during past warm periods could help us in a better understanding of ISMR variability in the future. Therefore, to study the ISMR variability, we have chosen one of the recent warm periods having similar global surface temperature and orbital forcing, such as solar luminosity as projected by the end of the 21st century, which is mid-Pliocene (~3.2 Ma). For investigation of ISMR conditions in mid-Pliocene, we have used the available models from Coupled Model Intercomparison Project phase 6 (CMIP6) CESM, EC, GISS, HadGEM, NorESM and IPSL. During the mid-Pliocene, we find an increase in the JJAS rainfall over most parts of India in comparison to the pre-industrial period, with an increase of 34% in seasonal precipitation. This higher precipitation conditions during the mid-Pliocene is accompanied by thermo dynamical (higher Carbon Dioxide (CO₂) forcing led to higher tropospheric temperature and higher precipitable water) and dynamical (larger tropospheric temperature gradient between Indian landmass and southern Indian Ocean corresponds to enhanced moisture transport, enhanced low-level cross-equatorial flow and intensified Monsoon Hadley Circulation) aspects. Further, interannual variations in ISMR are simulated to be less during the mid-Pliocene relative to the pre-industrial period from the statistical analysis of the coefficient of variation in precipitation anomaly and standard deviation in different monsoon indices from all model simulations. The interannual variations in sea surface temperature of different Oceans like Pacific, Indian and North Atlantic are also found to be less. However, the teleconnection of ISMR is found to be stronger with ENSO only during the mid-Pliocene as compared to pre-industrial period and insignificant with other oceans' forcing. The change in the ISM mean state in the future period (2071-2100 using SSP5-8.5 scenario with respect to the historical 1985-2014) in comparison with analogous past period (mid-Pliocene with respect to the pre-industrial) is found to be slightly less. By the end of the 21st century, the projected ISM rainfall increase is dominated by thermodynamic components driven by the extent of warming over the Indian region rather than the large scale monsoon circulation.