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Evaluation of Simultaneous Influence of Warm Phase of ENSO with Indian Summer Monsoon using coupled GCMs available at APCC

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The 23-year (1983-2005) semi-operational hindcast datasets of seven coupled global climate models (CGCMs) for the June to September (JJAS) seasons (with May initial conditions), have been analyzed to evaluate the prediction skills of Indian summer monsoon(ISM) variability. The strength of ISM represented by the seasonal average rainfall over Indian region that includes only land grid points referred as all India summer monsoon rainfall (AISMR). The El Niño (warm phase of ENSO) and ISM relationship has been studied in details. The observational analysis shows, during aforementioned period, six El Niño events are identified through Niño 3.4 index and profound deficient precipitations over AISMR region. Thus, the amplitudes of El Niño events and their simultaneous influence with AISMR investigated thoroughly with seven CGCMs, available at APEC Climate Center (APCC).

The hindcast mean monsoon precipitation distribution of all the seven models (APCC, NCEP, PNU, POAMA, SINT, SUT1 and UHT1) over the ISM region appears to be reasonable. However, the spatial distribution of precipitation over ISM region from the CGCMs with respect to GPCP v2 observation shows a 50% departure over central part of India in the seven models. In addition, most of the models have shown negative (positive) bias over the land (ocean) region except POAMA and SUT1. The years 1994 and 1997 referred, as a strongest El Niño with co-occurrence of IOD does not have an adverse impact on AISMR, noticed in observations and this important aspects failed to capture by these seven CGCMs. However, the most of these models able to predict the deficient monsoon rainfall over AISMR region (during 1987, 1991, 2002 and 2004) which is associated with El Niño events.

In addition, the pattern correlation coefficients (PCC) of precipitation anomaly between GPCP v2 and aforementioned models over AISMR region (area averaged; 8oN-30oN; 70oE-90oE) have shown large fluctuation rather than ISM (averaged over 25So–40No; 40oE-120oE) region. This fluctuation arises because of all CGCMs fails to predict the heavy precipitation over northeast, west coast and equatorial Indian oceanic region. In brevity, among these models, APCC, NCEP, POAMA, SINT and SUT1 consistently predict the AISMR 70% to 90% significant level and the PCC varies in between 0.37 to 0.64, whereas PNU and UHT1 models shows 0.15 and 0.06 respectively. Therefore, the seasonal prediction skill of AISMR through multi-model ensemble (MME) represented by simple composites of five independent models such as APCC, NCEP, POAMA, SINT and SUT1 may be perform better than individual CGCMs.