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Development of a Multi-physics Multi-ensemble Subseasonal Prediction System and its Real-time Performance during Contrasting Indian monsoons

Susmitha Joseph, Avijit Dey, Raju Mandal, Mahesh Kalshetti, Ravuri Phani, Shubham Waje, and Atul Sahai

Indian Institute of Tropical Meteorology, Pune, India (susmitha@tropmet.res.in)

Subseasonal predictions with a time scale of 2-4 weeks, which fills the gap between the weather and seasonal forecasts, are limited by the uncertainties arising from the initial conditions as well as the model physics. Therefore, to develop an efficient subseasonal prediction system, both these uncertainties need to be addressed. With this background, a multi-physics multi-ensemble approach has been adopted to develop a competent second-generation subseasonal prediction system at the Indian Institute of Tropical Meteorology (IITM), Pune, India. The first-generation prediction system developed at IITM is run operationally at the India Meteorological Department and has useful skills for up to two weeks.

A combination of physics perturbations and initial condition perturbations with a total of 18 ensemble members is present in the system. This system has been experimentally run since May 2022. The hindcast runs during 2003-2018 are also made on-the-fly. The initial results indicate a considerable improvement in the forecast skill compared to its predecessor and have reasonable deterministic prediction skill for up to three weeks. The system could provide skilful prediction of the subseasonal variations during the two contrasting monsoon seasons 2022 (above normal) and 2023 (below normal) 2-3 weeks in advance.