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Predictability of Indian summer monsoon onset and withdrawal using dynamical seasonal forecasts

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In this study we use ensemble dynamical forecasts to investigate the predictability of Indian Summer Monsoon (ISM) onset and withdrawal. The ensemble forecasts are performed by virtue of a Coupled General Circulation Model, which has been recently developed in order to initialize the atmospheric component from reanalysis data. We applied objective large-scale methods (both circulation and hydrological indexes) to detect monsoon onsets/withdrawals and we evaluated the capability of the probabilistic predictions to discriminate earlier than normal (i.e: before lower tercile of the sample distribution) and later than normal (i.e: after upper tercile of sample distribution) onset/demises. To this aim retrospective forecasts for the period 1989-2005 have been initialized 1 May and 1 August of each year to forecast onsets and withdrawals, respectively. The system shows considerable ability in forecasting early than normal ISM onsets while late onsets and both early and late monsoon withdrawals display very limited predictability. We showed that significant contribution to the skill in forecasting ISM onsets comes from the initialization of the atmospheric model component from reanalysis. On one hand, atmospheric initialization produces a better representation of the atmospheric mean state in the initial conditions, leading to a systematically better monsoon onset sequence. On the other hand, initialization of the atmosphere with reanalysis allows the coupled model to reproduce eastward propagating intraseasonal wind and precipitation anomalies over tropics that are in good agreement with observations. In turn, initialization of intra-seasonal variability (ISV) in the atmospheric model improves the forecasts of early than normal monsoons. In fact, northward propagating ISV modes over Indian Ocean appear to trigger ISM onset in several years displaying very early monsoon onset. Phase initialization of these modes, according to observations, enhances predictability of ISM onset.