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Evolution of Indian land surface biases in the seasonal hindcasts from the Met Office Global Seasonal Forecasting System GloSea5

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In this study we investigate the development of biases over the Indian region in summer hindcasts of the UK Met Office coupled initialised global seasonal forecasting system, GloSea5-GC2. Previous work has demonstrated the rapid evolution of strong monsoon circulation biases over India from seasonal forecasts initialised in early May, together with coupled strong easterly wind biases on the equator. These mean state biases lead to strong precipitation errors during the monsoon over the subcontinent. We analyse a set of three springtime start dates for the 20-year hindcast period (1992-2011) and fifteen total ensemble members for each year.

We use comparisons with variety of observations to assess the evolution of the mean state biases over the Indian land surface. All biases within the model develop rapidly, particularly surface heat and radiation flux biases. Strong biases are present within the model climatology from pre-monsoon (May) in the surface heat fluxes over India (higher sensible / lower latent heat fluxes) when compared to observed estimates. The early evolution of such biases prior to onset rains suggests possible problems with the land surface scheme or soil moisture errors.

Further analysis of soil moisture over the Indian land surface shows a dry bias present from the beginning of the hindcasts during the pre-monsoon. This lasts until the after the monsoon develops (July) after which there is a wet bias over the region. Soil moisture used for initialization of the model also shows a dry bias when compared against the observed estimates, which may lead to the same in the model. The early dry bias in the model may reduce local moisture availability through surface evaporation and thus may possibly limit precipitation recycling.

On this premise, we identify and test the sensitivity of the monsoon in the model against higher soil moisture forcing. We run sensitivity experiments initiated using gridpoint-wise annual soil moisture maxima over the Indian land surface as input for experiments in the atmosphere-only version of the model. We plan to analyse the response of the sensitivity experiments on seasonal forecasting of surface heat fluxes and subsequently monsoon precipitation.