Session: B5 Oral presentation

The dependence of Indian monsoon rainfall on moisture fluxes across the Arabian Sea and the influence of coupled model sea surface temperature biases

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The Arabian Sea is known to be an important moisture source for Indian monsoon rainfall. There is varying skill of climate models in simulating the monsoon and its variability, while Arabian Sea cold sea surface temperature (SST) biases are common in coupled models and may therefore influence the monsoon and its sensitivity to climate change. We examine relationships between monsoon rainfall, moisture fluxes and Arabian Sea SST in observations and HadGEM3 climate model simulations. Observational analysis shows that strong monsoons depend on moisture fluxes across the Arabian Sea, however detecting consistent signals with contemporaneous SST anomalies is complicated in the observed system by air/sea coupling and large-scale induced variability such as the El Niño-Southern Oscillation feeding back onto the monsoon through development of the Somali jet. Comparison of HadGEM3 coupled and atmosphere-only configurations suggests coupled model SST biases significantly reduce monsoon rainfall. Using a series of idealised atmosphere-only experiments we are able to attribute the monsoon rainfall reduction to systematic Arabian Sea cold SST biases and their impact on the monsoon-moisture relationship. The impact of large cold SST biases on moisture levels dominates over any enhancement in the land-sea temperature gradient, resulting in changes to the mean state. The effect of theses biases on interannual monsoon variability is also investigated. We hypothesize that the presence of a cold base state will result in underestimation of the impact of larger projected Arabian Sea SST changes in future climate, suggesting that Arabian Sea biases should be a clear target for model development.