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Multi-scale changes in the Indian Summer Monsoon rainfall: insights from mid- to late Holocene transient simulations

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The Indian Summer Monsoon Rainfall (ISMR) varies on a wide range of timescales, from interannual to multi-centennial. Slight variations of seasonal rainfall amounts strongly affect livelihood, which mostly relies on rain-fed agriculture. Improving our understanding of multi-scale variations of ISMR is thus critical to advance its potential predictability and reduce society vulnerability to climate change.
Here, we explore such multi-scale variations by analyzing a multi-complexity ensemble of transient simulations ran with the IPSL Earth system model from mid- to late Holocene (6000 years BP to 1950). First, we show that orbital forcing induces low-frequency changes in the ISMR mean state, with near-linear drying from mid- to late Holocene. The relative long term response between land and ocean is compared to available observations from pollen and lakes over land and ocean sediments to assess the realism of the simulation over the broad Indian sector. Second, we show that interannual-to-decadal variability increases along the period despite the drying trend of the ISMR mean state. We isolated a relationship with a concomitant increase in SST variance in the tropical Pacific, especially in its eastern equatorial part. Is the increased variability in precipitation and SST part of the same large-scale response of local variability to long term insolation? Or is the increased variability in precipitation induced by the strengthening of ENSO variability? In addition, we'll use high resolution paleo records from coral and shell over the Indo-Pacific sector and from speleothems and tree rings over land to assess the realism of the simulated changes in long term teleconnections.