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Intrinsic Role of Sea Surface Salinity on the development of Indian Summer Monsoon Onset

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The Indian Summer monsoon is a complex, nonlinear phenomenon involving atmospheric, oceanic, and land-based interactions. Air-sea interactions in the northern Indian Ocean play an important role in regulating the rainfall development of the monsoon. High sea surface temperatures, barrier layer formation due to the development of a freshwater pool, and the associated proclivity to increased convection determine the moisture flux and ultimately rainfall intensity over much of southern Asia. As prediction of rainfall directly determines water management for agriculture, industry, and daily life in countries of this region that rely on monsoon rainfall, it is critical to better understand related dynamical processes for accurate rainfall prediction that impacts over a billion people and is thus important with respect to economic stability and national security.
Present understanding of the dynamics pertinent to monsoonal rainfall and its prediction is insufficient. Due to new advances in sea surface salinity satellite technology, the ability to study air-sea interactions between salinity and the hydrologic cycle has never been better. This research provides an opportunity to pioneer an investigation of the role of salinity on monsoonal convection. Because salinity does not directly affect air-sea fluxes, salinity is often neglected in climate-related studies, though recent work has shown that regional salinity can indirectly play an integral role in ocean-atmosphere interactions in the South Eastern Arabian Sea (SEAS) region and monsoon onset. The scientific value of salinity data collected by the recently launched ESA's Soil Moisture Ocean Salinity (SMOS), NASA's Soil Moisture Active Passive (SMAP) and Aquarius (ended in 2015) missions will revolutionize both oceanographic and climate-related studies. It is important to use these new salinity products to validate the forecasting models and understand the different processes in the coupled models. Assimilation of satellite derived salinity in coupled models will also improve the monsoon forecasting. This research also applies the state-of-the-art NOAA/NCEP coupled atmosphere-ocean-land surface-sea ice system, Climate Forecast System (CFSv2.0), in coordination with the HYbrid Ocean Coordinate Model (HYCOM).