

Assessing the role of local air-sea interaction over the South Asia region in simulating the Indian Summer Monsoon (ISM) using the new earth system model RegCM-ES

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The South Asia climate is dominated by the monsoon precipitation that divides the climate in two different seasons, the wet and dry seasons, and it influences the lives of billions of peoples. The Indian Summer Monsoon (ISM) has different temporal and spatial scales of variability and it is mainly driven by strong air sea interactions. The monsoon interannual variability (IAV) and the intraseasonal variability (ISV) of daily rainfall are the two most important scale of analysis of this phenomenon.

In this work, the Regional Earth System Model (RegCM-ES) (Sitz et al, 2016) is used to simulate the South Asia climate. Several model settings are experimented to assess the sensitivity of the monsoon system like for example two different cumulus convection schemes (Tiedtke, 1989 and Emanuel, 1991), two different lateral boundary conditions in the regional ocean model (NOAA/Geophysical 5 Fluid Dynamics Laboratory MOM run, Danabasoglu et al 2014; and ORAP reanalysis, Zuo et al 2015) and two different hydrological models (Cetemps Hydrological Model, Coppola et al, 2007; Max-Planck's HD model, Hagemann and Dümenil, 1998) for a total of 5 coupled and uncoupled simulations all covering the period from 1979 to 2008.

One of the main results of the analysis of the mini RegCM-ES ensemble shows that a better representation of the IAV and of the ENSO-monsoon relationship is present in the coupled simulations. Moreover a source of monsoon predictability has been found in the one-year-lag correlation between JJAS India precipitation and ENSO, this is only evident in the coupled system where the one-year-lagged correlation coefficient between the Niño-3.4 and the ISM rainfall is much higher respect to the uncoupled one and similar to values observed between the observations and the Niño-3.4.

For the subseasonal time scale, RegCM-ES shows better performance compared to the standalone version of RegCM4 (Giorgi et al 2012), in reproducing "active" and "break" spells that characterize the ISV of the monsoon system. This is probably due to the air-sea interactions over the Bay of Bengal (BoB) that are mostly driven by large heat flux variations at the surface. To further assess this last hypothesis the northward migration of the boreal summer intraseasonal oscillation has been investigated. The coupled system shows a phase lag of about 10 days between SST and convection in agreement with the observations whereas no phase lag is observed in the standalone version of RegCM4.