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Indian Ocean SST, evaporation, and precipitation during the South Asian summer monsoon in IPCC-AR4 coupled simulations

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The veracity of modeled air - sea interactions in the Indian Ocean during the South Asian summer monsoon is examined. Representative simulations of the twentieth century climate, produced by coupled general circulation models as part of the Intergovernmental Panel on Climate Change Fourth Assessment Report, are the analysis targets along with observational data. The analysis shows the presence of large systematic biases in coupled simulations of boreal summer precipitation, evaporation, and sea surface temperature (SST) in the Indian Ocean, often exceeding 50% of the climatological values. Many of the biases are pervasive, being common to most simulations. The representation of air - sea interactions is also compromised. Coupled models tend to emphasize local forcing in the Indian Ocean as reflected by their large precipitation - SST correlations, at odds with the weak links in observations which suggest the importance of non-local controls. The evaporation - SST correlations are also differently represented, indicating atmospheric control on SST in some models and SST control on evaporation in others. The Indian monsoon rainfall - SST links are also misrepresented: the former is essentially uncorrelated with antecedent and contemporaneous Indian Ocean SSTs in nature, but not so in most of the simulations. Overall, coupled models are found deficient in portraying local and non-local air - sea interactions in the Indian Ocean during boreal summer. In our opinion, current models cannot provide durable insights on regional climate feedbacks nor credible projections of regional hydroclimate variability and change, should these involve ocean - atmosphere interactions in the Indian basin. © Springer-Verlag 2008.

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