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Understanding the physical link between ENSO and the Indian monsoon

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From data and coupled climate model simulations it is known that the strength of the monsoon rainfall over India is strongly connected to El Niño / Southern Oscillation (ENSO). The identification of the physical processes responsible for the influence of ENSO on the monsoon is of great importance for predicting the Indian summer monsoon rainfall (ISMR) to adapt to impacts of weak or strong monsoons. Nevertheless the coupling mechanism is not fully understood yet.

In our study we test three common hypotheses of how ENSO affects the monsoon rainfall. For our analysis we use a box model of the Indian monsoon circulation [1], that is highly suitable for understanding physical processes. From data we derive the impact of ENSO on specific variables that influence the ISMR and that are boundary conditions in our model. We then drive the model with ENSO as an external forcing via the determined mechanism. We show that the ENSO driven variability of the zonal winds is a main determinant for the interannual variability of the precipitation over India. Furthermore, the hypothesis of a coupling through the sea surface temperatures in the Indian Ocean or the influence on the snow depth/cover at the Tibetan Plateau can be rejected or are shown to have only a minor influence.

References

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