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Performance of Madden and Julian Oscillation in a multitude of ECHAM simulations

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The Madden and Julian Oscillation (MJO) is the dominant mode of intraseasonal variability (ISV) in the tropics with considerable convective precipitation systems propagating eastward from the Indian Ocean towards the West Pacific and decaying near the date line. GCMs evince considerable shortcomings in simulating the MJO, although relative to other GCMs ECHAM produces a relatively good simulation of the MJO. Several studies showed that the MJO performance of a GCM depends on the convection scheme, but also on model resolution, and whether or not the simulations are coupled to an ocean model. Recent studies further suggest that MJO skill is related to a larger mean state bias and vice versa.

Here, we show results of a multitude of simulations with various versions of ECHAM. We investigate, how the model skill in representing the MJO is associated with mean state biases and how both depend on model configuration, such as resolution and coupling with an ocean model.

We find that in boreal winter there is a strong improvement of the representation of the MJO with increasing resolution of the GCM, and (in contrast to what is seen in other models) that this is accompanied by a reduction of the mean precipitation bias. Obviously, the performance of the MJO is also subject to internal variability, although changes of the mean state are negligible. The group of experiments show a substantial different behaviour in summer and winter. While in winter, the MJO performance strongly depends on model features, there are no strong systematic differences in summer, although the observed ISV strength is higher than in winter.