

Evaluating the characteristics of tropical precipitation in the new MPI global climate modelling system

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In this study the simulation of various aspects of tropical precipitation by the new global climate modelling system from the Max-Planck-Institute for Meteorology in Hamburg is evaluated. In particular, a variety of different model configurations are considered in order to analyse the role these differences have for the simulation of tropical precipitation. These are AMIP-type simulations with the new atmospheric GCM, ECHAM6.0, at different horizontal and vertical resolutions, i.e., T63L47 and T127L95. Furthermore, coupled simulations with the two versions of ECHAM6.0 to two different ocean GCMs, i.e., the T63L47 version to GR15L40 and the T127L95 version to TP04L40. Finally, coupled simulations to the JSBACH module, defining the new MPI earth system model. As compared to its predecessor, ECHAM6.0 has a new radiation scheme, undergone small changes in the convection scheme, an updated ozone and sulphate aerosol climatology, an improved sea-water albedo as well as improved representations of some processes related to snow and sea-ice. The new TP04L40 ocean GCM has a finer and more uniformly distributed horizontal grid as compared to GR15L40. As observations precipitation estimates from different sources are considered, i.e., GPCP, GPCC and HOAPS. For some of the analyses, re-analyses such as ERA-40 and ERA-Interim are used as observations for the state of the atmosphere. One aspect to be considered is the mean spatial distribution of tropical precipitation with focus on the locations of the tropical convergence zones and the partition between land and ocean areas, another one is the annual cycle with one or two rainy seasons. Also sub-seasonal variations of precipitation associated with the Madden-Julian-Oscillation are analyzed. Special focus is put on the tropical Atlantic region, where in particular coupled climate models have difficulties in simulating the spatial distribution and the annual cycle of precipitation correctly.