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Regime Transitions due to Icecloud-Radiation Interaction in an Aquaplanet GCM

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Recently an international project has been established with the aim to compare different general circulation models (GCM's) on the level of an aquaplanet. This allows one to focus on the interaction between the full model physics and its dynamical core without the complexities of a land surface, orography, or seasons. The present work uses an aquaplanet model derived from the operational global weather forecast model of the German Weather Service.

This presentation focusses on the interaction between cloud ice, radiation, and the global scale dynamics. In all runs the same sea surface temperature is specified with a maximum on the equator. The control run features the expected behaviour with one ITCZ right on the equator and two Hadley cells extending into the subtropics. In addition, a special run is analyzed in which the radiative properties of ice clouds are switched off. In this special run, one observes a drastic change of the circulation regime after about two model years: the ITCZ at the equator vanishes and two convergence zones at about +/- 15° latitude appear. At the same time the Hadley cell and the subtropical jetstream move poleward and weaken. A detailed analysis suggests possible explanations for this drastic regime transition and how it relates to the radiative properties of ice clouds.