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Changes in the hydrological cycle predicted by IPCC scenario simulations of the coupled model ECHAM5/MPI-OM

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Recently, a new version of the coupled atmosphere/ocean general circulation model of the Max Planck Institute for Meteorology has become operational. The model comprises the atmospheric component ECHAM5, the ocean component MPI-OM and the OASIS coupler. For the 4th assessment report of the Intergovernmental Panel on Climate Change (IPCC), an ensemble of climate simulations was conducted for the period of 1860-2100. The coupled model was run without flux correction at T63 (about 1.9° or 200 km grid size) horizontal resolution and 31 vertical levels in the atmosphere, and about 1.5° horizontal resolution and 40 vertical layers in the ocean. For the past climate (1860-2000), observed concentrations of CO2, Methane, N2O, CFCs, Ozone (tropospheric and stratospheric), and sulphate aerosols (direct and first indirect effect) were prescribed. For the future climate (2001-2100) these concentrations were prescribed according to the IPCC scenario A1B. In our study we will focus on a control period representing current climate from 1961-1990, and on a future period representing a possible climate in the end of the 21st century from 2071-2100. In order to rate the predicted future changes, the simulated hydrological cycle of the control period has to be validated. Special attention is paid to the evaluation of precipitation on the regional scale by comparing the coupled model simulations with observational data in a number of catchments representing the major river systems on Earth in different climate zones. The validation yielded that the quality of the simulated hydrological cycle is comparable to an atmosphere only AMIP2 simulation of ECHAM5 forced with observed sea surface temperatures. For some catchments the coupled model simulation even leads to an improved simulation of the hydrological cycle. First results considering one A1B simulation show that generally (in the global average and over

most catchments) an enhancement of the hydrological cycle is predicted. But for some catchments, a strong weakening is predicted, such as for the Murray (Australia) and Danube (Central Europe).