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Assessment of the impact of climate change on the global water cycle using multiple climate and hydrological models

Cui Chen (1), Fulco Ludwig (2), and Stefan Hagemann (1)

(1) Max Planck Institute for Meteorology, Hamburg, Germany (cui.chen@zmaw.de), (2) Wageningen University and Research Centre, Wageningen, The Netherlands

21st century climate change is likely to have an intensified influence on the hydrological cycle and thus has the potential to impose additional water stress in some region. Here, the study focuses on the assessment of the implication of climate change for global hydrological regimes and related water resources states for the 21st century. Because different climate and hydrological models show quite different projected change with a large uncertainty for the future climate and water fluxes, multiple climate and hydrological models were used within the European project "Water and Global Change" (WATCH). Climate projections from three coupled atmosphere-ocean general circulation models (GCMs) (ECHAM5/MPIOM, CNRM-CM3, LMDZ-4) with A2 and B1 emission scenarios were used to assess the hydrological response to climate change to predict the future state of global and large scale water resources. Due to the systematic model errors of climate models, their output has been corrected by statistical bias correction method and then the corrected output was used directly as input for global hydrological models (GHMs) (MPI-HM, LPJmL, WaterGAP, VIC, MacPDM, H08, GWAVA, HTESSEL, JULES) to calculate the corresponding changes in hydrological fluxes (especially runoff, evapotranspiration and moisture storage). The analyses concentrate on the changes in the hydrological characteristics for twelve large, continental river basins (Amazon, Amur, six largest arctic rivers, Baltic sea, Congo, Danube, Ganges, Mississippi, Murray, Nile, Parana and Yangzi) without taking into account anthropogenic influences in the hydrological simulations. The hydrological cycle was evaluated and multiple-model based projections were produced for the terrestrial components of the hydrological cycle for the near and far future decades centered on 2035 (2020-2050) and 2085 (2071-2100). Global maps are constructed to identify regions where the water cycle and associated water resources (discharge, soil moisture and snow water storage) are significantly impacted by climate change, and which regions are vulnerable to these changes in terms of e.g. water availability. The uncertainties caused by both GCMs and GHMs are also assessed respectively.