Geophysical Research Abstracts
Vol. 20, EGU2018-4413, 2018
EGU General Assembly 2018

Risks for the global freshwater system at 1.5 °C and 2 °C global warming

Tim Trautmann (1), Petra Döll (1,2), Dieter Gerten (3,4), Hannes Müller Schmied (1,2), Sebastian Ostberg (3,4), Fahad Saaed (5), and Carl-Friedrich Schleussner (5)

(1) Institute of Physical Geography, Goethe University Frankfurt, Frankfurt am Main, Germany , (2) Senckenberg Biodiversity and Climate Research Centre (BiK-F), Frankfurt am Main, Germany, (3) Research Domain of Earth System Analysis, Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany, (4) Geography Department, Humboldt-Universität zu Berlin, Berlin, Germany, (5) Climate Analytics, Berlin, Germany

The Paris Agreement aims for keeping the global warming level well below 2 °C but also trying to limit it to 1.5 °C compared to pre-industrial conditions. This study contributes to the scientific basis for assessing freshwater-related hazards and risk for those global warming levels by using the HAPPI (Half a degree Additional warming, Prognosis and Projected Impacts) ensemble. This ensemble consists of 20 bias-corrected simulations of four global circulation models to drive two global hydrological models, WaterGAP and LPJmL. Quasi-stationary HAPPI simulations are especially designed to quantify the relative risks associated with 1.5 °C and 2 °C of global warming. It has advantages compared to transient CMIP-like simulations due to the initial ensemble approach with a decade long prescribed sea surface temperatures. We analyzed eight hydrological indicators (HI) that characterize freshwater-related hazards for human water use, freshwater biota and terrestrial vegetation with respect to statistically significant differences between current conditions and the plus 1.5 °C as well as the plus 2 °C world. The results agree with previous studies on the overall pattern of wetting (higher northern latitudes and India) and drying (Mediterranean, Amazon basin and southern Africa) under global warming. While more land area and population are projected to be affected by increases than by decreases in case of mean annual and 1-in-10 dry year streamflow, 7-day high flow and groundwater recharge, the opposite is true for 7-day low flow, maximum snow storage, and soil moisture in the driest month of the growing period. Furthermore, we found for all but one HI bigger land areas with significant differences compared to recent conditions for the plus 2 °C warming level than for the plus 1.5 °C warming level. However, on 90% of the area differences between the hazards at the two warming levels are not significant. For further analysis of vulnerability and coping capacity we used a World Bank classification of countries into low income, lower middle income, upper middle income and high income countries for a grouped analysis. Low income countries are most, and high income countries least affected by decreased low flows. High income countries are also least affected by increased high flows, and lower middle income countries most. The impact of half a degree additional warming on high flows would be felt most by low income and low middle income countries, the effect on soil moisture and low flow most by high income countries.