Geophysical Research Abstracts
Vol. 17, EGU2015-5772-1, 2015
EGU General Assembly 2015

Uncertainty in projected impacts to water stress

Martina Floerke (1), Stephanie Eisner (1), Naota Hanasaki (2), and Yoshihide Wada (3)

(1) Center for Environmental Systems Research, University of Kassel, 34109 Kassel, Germany (floerke@usf.uni-kassel.de), (2) Center for Global Environmental Research, National Institute for Environmental Studies, Tsukuba 305-8506, Japan, (3) Department of Physical Geography, Utrecht University, Utrecht, Heidelberglaan 2, 3584 CS Utrecht, the Netherlands

The Inter-Sectoral Impact Model Intercomparison Project (ISI-MIP; Warszawski et al. 2014) offers a framework to systematically evaluate the effects of impact model uncertainty. Within the water sector, several studies have shown that global hydrological models (GHMs) are a significant source of uncertainty in projecting river discharge (Haddeland et al. 2014) and flood hazards (Dankers et al. 2014). Furthermore, their contribution to total impact uncertainty may be of similar or even higher magnitude than the uncertainty from different global climate models (GCMs) and scenarios (i.e. representative concentration pathways; RCPs) as described for water scarcity (Schewe et al. 2014) and irrigation water requirements (Wada et al. 2013).

Water stress, as defined by the withdrawals-to-availability ratio, is a simple impact indicator used to indicate the degree of imbalance between available freshwater resources and their abstractions for human activities. Vulnerability to water stress through the 21st century was shown to be mainly driven by socio-economic developments and differs across regions. Likewise, the number of people living under severe water stress conditions is expected to increase in the future. Nevertheless, the contribution of water use modeling to total impact uncertainty has not yet been identified, neither its spatial patterns been evaluated.

Hence, this multi-model ensemble study explores the uncertainty of water stress projections arising from three distinct sources: GCMs, GHMs, and water use models (WUMs). To address the overall objective we analyzed 45 possible trajectories (realizations) of global water stress according to all possible combinations of water use and water availability projections (3 GHMs * 3 WUMs * 5 GCMs) which built the basis of the global water stress assessment.

We show that the global water stress projections are mainly affected by uncertainties arising from GHMs and WUMs, which predominate the total impact uncertainty over the 21st century when projecting, e.g., the number of people under severe water stress. However, GHM uncertainty steadily declines over time at the cost of rising uncertainty from WUM.