Geophysical Research Abstracts
Vol. 18, EGU2016-8307, 2016
EGU General Assembly 2016

Towards a global water scarcity risk assessment framework: using scenarios and risk distributions

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Over the past decades, changing hydro-climatic and socioeconomic conditions have led to increased water scarcity problems. A large number of studies have shown that these water scarcity conditions will worsen in the near future. Despite numerous calls for risk-based assessments of water scarcity, a framework that includes UNISDR's definition of risk does not yet exist at the global scale.

This study provides a first step towards such a risk-based assessment, applying a Gamma distribution to estimate water scarcity conditions at the global scale under historic and future conditions, using multiple climate change projections and socioeconomic scenarios. Our study highlights that water scarcity risk increases given all future scenarios, up to >56.2% of the global population in 2080. Looking at the drivers of risk, we find that population growth outweigh the impacts of climate change at global and regional scales. Using a risk-based method to assess water scarcity in terms of Expected Annual Exposed Population, we show the results to be less sensitive than traditional water scarcity assessments to the use of fixed threshold to represent different levels of water scarcity. This becomes especially important when moving from global to local scales, whereby deviations increase up to 50% of estimated risk levels.

Covering hazard, exposure, and vulnerability, risk-based methods are well-suited to assess water scarcity adaptation. Completing the presented risk framework therefore offers water managers a promising perspective to increase water security in a well-informed and adaptive manner.