Geophysical Research Abstracts
Vol. 17, EGU2015-4083, 2015
EGU General Assembly 2015

Global hydrological droughts in the 21st century under a changing hydrological regime

Henny A.J. Van Lanen (1), Niko Wanders (2), and Yoshihide Wada (2)

(1) Hydrology and Quantitative Water Management Group, Wageningen University, Wageningen, the Netherlands (henny.vanlanen@wur.nl), (2) Department of Physical Geography, Faculty of Geosciences, Utrecht University, Utrecht, the Netherlands (n.wanders@uu.nl; y.wada@uu.nl))

Climate change very likely impacts future hydrological drought characteristics across the world. Here, we quantify the impact of climate change on future low flows and associated hydrological drought characteristics on a global scale using an alternative drought identification approach that considers adaptation to future changes in hydrological regime. The global hydrological model PCR-GLOBWB was used to simulate daily discharge at 0.5o globally for 1971–2099. The model was forced with CMIP5 climate projections taken from five global circulation models (GCMs) and four emission scenarios (representative concentration pathways, RCPs), from the Inter-Sectoral Impact Model Intercomparison Project (ISI-MIP).
Drought events occur when discharge is below a threshold. The conventional variable threshold (VTM) was calculated by deriving the threshold from the period 1971–2000. The transient variable threshold (VTMt) is a non-stationary approach, where the threshold is based on the discharge of the previous 30 years implying the threshold to vary every year during the 21st century. The VTMt adjusts to gradual changes in the hydrological regime as response to climate change.
Results show a significant negative trend in the low flow regime over the 21st century for large parts of South America, southern Africa, Australia and the Mediterranean. In 40–52% of the world reduced low flows are projected, while increased low flows are found in the snow-dominated climates. In 27% of the global area both the drought duration and the deficit volume are expected to increase when applying the VTMt. However, this area will significantly increase to 62% when the VTM is applied. The mean global area in drought, with the VTMt, remains rather constant (11.7 to 13.4 %), compared to the substantial increase when the VTM is applied (11.7 to 20 %).
The study illustrates that an alternative drought identification that considers adaptation to an altered hydrological regime has a substantial influence on future hydrological drought characteristics.