Geophysical Research Abstracts
Vol. 15, EGU2013-3458, 2013
EGU General Assembly 2013

Future hydrological drought in the context of water scarcity

Henny A.J. van Lanen (1) and Niko Wanders (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)

Observations show that droughts and water scarcity have increased over the last decades in Europe. In particular summer low flows show downward trends in vast areas (only in Scandinavia wetting trends occur). The lower water availability and the enhanced water demands led to growing water scarcity and increasing challenges for water management to assess future water resources and to develop a pro-active approach. A key element in the assessment is how drought will develop, i.e. will drought become more severe (frequency, intensity, spatial scale, location). Hydrological drought (groundwater and streamflow) development is the most relevant among drought types for water resources assessment. This study presents the likely change of hydrological droughts characteristics in the 21st century as a result of climate change across the world. Magnitude and directionality of these changes and their dependency on climatology and catchment characteristics, is largely unknown. A conceptual hydrological model was forced with downscaled and bias-corrected outcome from three General Circulation Models (GCM forced models), A2 emission scenario The same hydrological model was also forced with the WATCH Forcing re-analysis dataset (reference model). The variable threshold level method was applied to identify hydrological drought occurrence, duration and severity in time series of simulated discharge. Results for the control period (1971-2000) show that the drought characteristics of the GCM forced models reasonably agree with the reference model implying that the climate models produce realistic outcome for global drought analyses. For the near future (2021-2050) and far future (2071-2100) the GCM forced models project a global average decrease in drought occurrence (67–74% end of 21st century), indicating that the number of drought days per year will become lower. However, all three GCM forced models project a substantial increase of both average drought duration (43–57%) and deficit volume (106-122%) of the remaining drought events by the end of the century. This also happens in the temperate climates (C-climates) that cover a large part of Europe. There the average drought duration is projected to increase by 15-33% in the near future and 50-62% in the far future. The relative change of the average deficit volume is even larger (34-64% and 117-147%, respectively). A very large decrease of 92-95% in hydrological drought occurrence is expected to occur in cold climates (D-climates), incl. northern parts of Scandinavia and Russia, where global warming results in a decreased length of the snow season, shift in snowmelt and increased water availability because of increased precipitation totals. In the dessert climates (B-climates) the smallest decrease in drought occurrence is expected to take place, which in combination with the substantially increased average drought duration and deficit volume of 179-210% will lead to intensifying water scarcity in these regions. Water managers are urged to consider in their river basin management plans the projected lower number, but more extreme hydrological droughts, which potentially lead to higher water scarcity in certain time periods.