Geophysical Research Abstracts
Vol. 15, EGU2013-9717, 2013
EGU General Assembly 2013

Past and future hydrological drought in water-scarce European regions

Henny A.J. Van Lanen (1), Anne F. Van Loon (1), Marjolein H.J. Van Huijgevoort (1), Niko Wanders (2), Marcel A.A. Alderlieste (1), Kerstin Stahl (3), and Lena M. Tallaksen (4)

(1) Wageningen University, Hydrology and Quantitative Water Management Group, Wageningen University, PO box 47, 6700 AA Wageningen, The Netherlands (henny.vanlanen@wur.nl), (2) Department of Physical Geography, Faculty of Geosciences, Utrecht University, Utrecht, The Netherlands, (3) Institute of Hydrology, University of Freiburg, Freiburg, Germany, (4) Department of Geosciences, University of Oslo, Norway

In many Mediterranean regions water resources are heavily exploited leading to water scarcity. Global change likely will worsen water scarcity. This is particularly felt during drought. Therefore, drought should be explicitly addressed in water resources assessments. IPCC states that lack of hydrological data, multiple definitions, imperfect knowledge on drought-generating processes, and the imperfectness of models impede high confidence in drought assessments. This study addresses trends in past and future drought with focus on the Mediterranean region. We argue that, for water resources assessment, hydrological drought needs to be investigated instead of the more often used meteorological drought. This implies that drought propagation should be considered, incl. non-linearities due to temperature-related and storage-related processes resulting in different hydrological drought types, which have different impacts on water resources. Drought and water scarcity are closely linked and complex interrelationships exist. Trend studies on past drought, however, require that the two phenomena are separated. An innovative observational-modelling approach is presented that, through a combined flow naturalisation and analysis of anomalies, distinguishes between water scarcity and drought. We investigated trends in observed low flows (for near-natural catchments in southern Europe) and trends in hydrological drought characteristics (for other selected Mediterranean study areas), which were obtained from multi-model simulated runoff. Observed low flows showed drying trends and drought intensities increased. In the Jucar (Spain), Po (Italy), and Syros (Greece), the intensity increased by 20-25%, whereas the increase in Portugal was about 5% (1963-2001). Uncertainty in trends in drought characteristics is presented, on a pan-European scale and for selected Mediterranean study areas, through model intercomparison and through comparison against observed characteristics. Modeling was needed for gap infilling because of insufficiently long observed time series and not enough spatial coverage in the Mediterranean. A model experiment was also set up to explore future hydrological droughts for different time windows and emission scenarios. A single hydrological model forced with the downscaled and bias-corrected outcome of three GCMs (A2 scenario) showed that the number of days in drought is projected to decrease across the world, although the smallest change is in warm climates, like the Mediterranean. The average drought duration of future drought events, however, is expected to increase by tens of percents and the average drought deficit volume will be more than double (2071-2100). Multi-model analyses using the same GCMs (A2 and B1 scenarios) for selected study areas projected an equal number of drought events, but an increase of average drought duration by about 70% and deficit volume by 60-110%. The historical trends to more severe hydrological drought in most of the Mediterranean and the projected increase in duration and severity of hydrological droughts should urge policy makers to better fine-tune existing land and water policies, and water managers to take pro-active measures to combat water scarcity and to adapt to future drought, which would reduce society's vulnerability and increase resilience.