Geophysical Research Abstracts
Vol. 12, EGU2010-12670-1, 2010
EGU General Assembly 2010

Ensemble projections of future streamflow drought in Europe

Luc Feyen (1) and Rutger Dankers (2)

(1) Joint Research Centre, European Commission, Institute of Environment and Sustainability, Ispra, Italy (luc.feyen@jrc.it),
(2) Met Office, Hadley Centre, Exeter, UK

Global warming – with higher temperatures, hence higher evaporative demands, but also with changes in the seasonality of precipitation patterns and an increase in the frequency and intensity of extreme climatic events - is likely to favor conditions for the development of droughts in many regions of Europe. This study evaluates the impact of global warming on streamflow drought in Europe by examining changes in low-flow predictions of a hydrological model driven by a multi-model ensemble of climate projections. The ensemble consists of simulations from two regional climate models (HIRHAM and RCAO), both run with boundary conditions from two global models (HadAM3H and ECHAM4/OPYC3), and for two scenarios (SRES A2 and B2) of greenhouse gas emissions. We employed the methods of block maxima and partial duration series to obtain minimum flows and flow deficits and fitted extreme value distributions by the maximum likelihood method. In order not to mix drought events with different physical causes the analysis was performed separately for the frost and non-frost season. The ensemble analysis shows that in the frost-free season streamflow droughts will become more severe and persistent in most parts of Europe by the end of this century, except in the most northern and northeastern regions. In snow dominated regions winter droughts are projected to be less severe because a lower fraction of precipitation will fall as snow in warmer winters. Regions most prone to an increase in river flow drought are southern and south-eastern Europe. The decrease in summer precipitation over large parts of Europe, as well as the rise in winter temperature and precipitation over northern Europe is well established and fairly consistent between the various regional climate simulations. Therefore, the changes in streamflow drought are less sensitive to the decadal-scale internal variability that is usually present in climate simulations and that may partially or completely obscure the climate change signal in extreme events. After all, changes in low-flow conditions depend on changes in precipitation on longer (i.e., monthly to seasonal) timescales rather than on single events. Nevertheless, an ensemble approach based on multiple driving models and considering different emission scenarios as presented here provides a more robust estimate of future changes in streamflow drought hazard.