



Decadal-scale river flow variability in Europe: evidence from long hydrometric records spanning 1900 – 2004

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Globally, there is growing concern that anthropogenic climate change is intensifying the hydrological cycle, causing more frequent and severe floods and droughts. There is a growing need, therefore, for observational data with which to discern any emerging trends in river flows, and to compare these with future projections from climate models. However, one of the problems with observed data is that most river flow records in Europe are comparatively short (from the 1960s or 1970s onwards). Recent studies have found significant trends over the last 30 - 40 years in runoff and for a range of indicators of high and low flows, but these records may not give a full picture of long-term change; in particular, trends in short records are heavily influenced by multi-decadal variability driven by atmospheric circulation patterns.

This study capitalises on a newly assembled dataset of near-natural daily streamflow records from around Europe (Stahl et al., 2010), consisting of around 400 stations. Whereas Stahl et al. (2010) focused on more recent trends, this study extends the analysis back to the turn of the twentieth century. Around 130 stations have records extending back to the early 1930s; an even longer perspective is provided by the few records which start before 1900. The requirement for long records means the geographical focus is restricted to parts of central and northern Europe. For each of these records, a number of indicators are derived, to enable the assessment of decadal changes in hydrological regimes as well as in extremes.

The primary aim of the study is to characterise decadal-scale changes in river flow in Europe, with a particular focus on assessing whether recent decades are representative of historical variability. In the current study, a multi-temporal approach is used to examine changes in river flow indices in moving windows, to assess trends and variability over a range of timescales. Preliminary results suggest that, in some parts of Europe (e.g. in some records from the Nordic countries), patterns of streamflow change have been comparatively stable throughout the twentieth century; in these areas, trends from the last 30 – 40 years are generally representative of changes over longer time periods. However, in other areas (e.g. southern France), there are distinct regime shifts, causing recent decades to contrast notably with other epochs of the last hundred years. There is clearly a need for caution in interpreting the outputs of trend analyses for recent periods, or fixed periods in general. This study provides a first assessment of historical flow variability over long timescales, which can be used as a context for interpreting other trend analyses, and outputs from historical runs of large scale Global Hydrological Models. The multi-temporal approach applied herein could be used in future to examine possible drivers (e.g. large-scale atmospheric circulation patterns) for the decadal patterns of variability presented in this paper.

Stahl, K., Hisdal, H., Hannaford, J., Tallaksen, L. M., van Lanen, H. A. J., Sauquet, E., Demuth, S., Fendekova, M., and Jódar, J. 2010. Streamflow trends in Europe: evidence from a dataset of near-natural catchments, *Hydrol. Earth Syst. Sci.* 14, 2367 – 2382.