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On the identification of peak flow trends and river flow regime changes across European rivers

Dimosthenis Tsaknias, Anongnart Assteerawatt, Frédéric Azemar, Arno Hilberts, Ludovico Nicótina, Stephan Tillmanns, and Stefano Zanardo

Risk Management Solutions, London, United Kingdom (Dimosthenis.Tsaknias@rms.com)

During the last years there has been growing concern on the apparent increase of flood frequency and intensity. If this hypothesis is confirmed, flood risk models, along with flood protection projects should incorporate such a change. In this study we analyze the structure of extreme flows and we investigate the hypothesis of a change in flood regime for 13 European countries to identify significant trends.

To this end we selected approximately 300 streamflow gauges that satisfied the criteria of having at least 55 years of available data and few missing values. From this database we analyze extreme flows by evaluating both block maxima (annual and seasonal maxima) as well as peaks over threshold (POT) and we use the whole time series to investigate long range dependence in the flow regime. We perform non-parametric trend tests to discharge records where we test the null hypothesis of the stationarity of extremes flows. Furthermore, we investigate whether streamflow time series are characterized by long range dependence, which would imply clustering of wet and dry periods. Persistence can explain the long-term behavior of discharge and is expressed through the Hurst-Kolmogorov coefficient. We further examine whether there is any shift in the timing of the occurrence of extreme events.

Our analysis shows that, overall, there is not a consistent signal of change across Europe. Indeed, while for some stations increasing or decreasing trends on annual discharge maxima could be observed, no significant trend could be detected for the majority of the stations. These findings are in accordance with previous similar studies for various regions worldwide. Yet, in cases with low signal-to-noise ratio of hydro-climatic variables, longer detection times may be required.