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Trends in flood peaks' magnitude and seasonality in European transects

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In the last decade floods seems to have lashed more and more European population, so that more accurate studies concerning flood events tendencies are needed. We present a work in which trends in flood peaks' magnitude and seasonality (in time and space) are analyzed at the European scale: in total 2055 and 4340 stations respectively for magnitude and seasonality are considered along transect lines including entire nations, ranging typically from north to south of Europe. The work is part of the ERC Project "Deciphering River Flood Change".
Trend analysis of flood magnitudes is applied to time series longer than 40 years. We find that there is a cluster of stations with negative trends in flood magnitude around the alpine and perialpine area. Positive trends are more frequent in the valleys of the mid Europe. We also use quantile regressions to investigate the behaviour of the highest quantiles, corresponding to floods with the highest return period. The original database is further divided into four classes based on station elevation; the group of catchments between 500 and 1000 m a.s.l. has the most positive trends for the large quantiles.
The analysis is further developed by considering the coefficient of variation in 10-years time windows covering the data; the possible presence of trends in the CV is investigated. The obtained results show that there is a global prevalence of positive trend in the CVs, in particular for stations between 500 and 1000 m a.s.l., demonstrating a tendency toward the increase of very large (and possibly very small) annual maxima. To better discriminate the above results we used quantile regressions, able to highlight the trend behaviour of the highest quantiles computed on flood time series, Moreover, the database is divided into four classes based on station elevation. Results show that the group of catchments between 500 and 1000 m a.s.l. has definite and positive trends for the large quantiles.
A different branch of this study relates to the investigation of possible variations in the seasonality of floods (mean date of occurrence of the events). Possible shifts in the average date of maximum annual floods occurrence are considered over time. To this end, an original method for detecting temporal shifts is adopted: the "Barber's pole" regression model. This tool considers an angular regression of the date of occurrence (which describes the circumference of a cylinder) versus the year of occurrence (main axis of the cylinder). Trends in seasonality are found in the middle – high lands of Europe, including most of the stations between 200 and 1000 m a.s.l. close to the Alps, which show a tendency of anticipation of flood occurrence. Similar trends compete to Alpine basins and to the Norwegian Atlantic coast basins.
A link between flood seasonality and magnitude is finally examined using quantile regressions. The findings suggest that summer floods' magnitude are those affected by the strongest positive trend.