



Long-term hydrological changes of the Seine river discharge, France

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The variability of Seine river discharge (France) was investigated using daily time series over the 1946-2006 period. The study focuses on the determination of the dominant modes which control the variability of discharge and precipitations in the Seine river watershed and of their possible link with the North Atlantic Oscillation.

Overall, the Seine river discharge is affected by a statistically significant increasing trend across the period. The hydrologic regime of the Seine river was found to be highly variable, especially during high-water periods (fall and winter), which seem to occur later in the year for approximately 15 years. The maximum annual discharge time series exhibited an obvious change around 1970, while the minimum annual discharge is affected by a change rather around 1990.

Continuous wavelet analysis of precipitations and discharge revealed similar spectral patterns in the form of energetic peaks highly localized in time, defining three time periods: before 1970, between 1970 and 1990, and after 1990. The discontinuities found in the extreme discharge values were then recovered. Overall, a 17-yr mode occurs around 1970 and a 5-9-yr shows up in the late 1980. The annual oscillation is always strongly represented in discharge, although it is affected by an increase in power throughout the period of study, much more powerful from 1990 until the end of the series.

Comparison was made between the annual NAO index calculated from winter months and minimum, maximum and mean annual discharge anomalies. A change around 1970 was detected, giving rise to positive NAO values and positive discharge anomalies, although no clear correspondance between their respective variabilities showed up. However, a wavelet analysis of the NAO index time series revealed similar modes of variability around 17 years and 5-9 years on both the local and global wavelet spectra, which tended to show that a link may exist between NAO and hydrometeorological processes in the region, even if it is not very obvious like in Southern or Northern Europe. Altogether, the spectral components expressing this potential link would explain around 10% of total variance in the Seine river discharge time series.