



Long-term changes in Rhine river discharge: impact of changing snow cover, river regulations and an intensified hydrological cycle

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Recent climatic changes alter the hydrological cycle in many ways. Particularly regions dominated by snow and ice undergo substantial changes reshaping the character of their entire hydrological regime. This study aims at a better understanding of long-term impacts of changes in snow cover on river discharge and implications for water availability, hydropower and the seasonality of riverine floods in catchments characterized by nival and mixed pluvio-nival flow regimes. Furthermore, we investigate interactions between changes in snow melt contributions, anthropogenic river regulations and reservoir constructions and changes in precipitation. Focus is on hydro-climatological observational data in daily resolution recorded in Central Europe and the Alpine region (primarily Rhine river basin) starting in the 19th century. Highly resolved non-linear trends are determined combining quantile sampling with moving average trend statistics and empirical mode decomposition. Preliminary results indicate that changes in alpine snow covers and anthropogenic river regulations strongly affect the seasonality of river runoff in snowmelt dominated catchments and hint at a recent intensification of the hydrological cycle due to rising temperatures and changes in the concentration of anthropogenic aerosols.