

Decrease in hydroclimatic conditions generating floods in the southeast of Belgium over the last 50 years resulting from changes in seasonal snow cover and extreme precipitation events

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As a consequence of climate change, several studies concluded that winter flood occurrence could increase in the future in many rivers of northern and western Europe in response to an increase in extreme precipitation events. This study aims to determine if trends in extreme hydroclimatic events generating floods can already be detected over the last century. In particular, we focus on the Ourthe River (southeast of Belgium) which is one of the main tributaries of the Meuse River with a catchment area of 3500 km². In this river, most of the floods occur during winter and about 50% of them are due to rainfall events associated with the melting of the snow which covers the Ardennes during winter.

In this study, hydroclimatic conditions favorable to flooding were reconstructed over the 20th century using the regional climate model MAR ("Modèle Atmosphérique Régional") forced by the following reanalyses: the ERA-20C, the ERA-Interim and the NCEP/NCAR-v1. The use of the MAR model allows to compute precipitation, snow depth and run-off resulting from precipitation events and snow melting in any part of the Ourthe river catchment area. Therefore, extreme hydroclimatic events, namely extreme run-off events, which could potentially generate floods, can be reconstructed using the MAR model. As validation, the MAR results were compared to weather station-based data. A trend analysis was then performed in order to study the evolution of conditions favorable to flooding in the Ourthe River catchment.

The results show that the MAR model allows the detection of more than 95% of the hydroclimatic conditions which effectively generated observed floods in the Ourthe River over the 1974-2014 period. Conditions favorable to flooding present a negative trend over the last 50 years as a result of a decrease in snow accumulation and in extreme precipitation events. However, significance of these trends depends on the reanalysis used to force the regional climate model as well as the length of the time series.