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# Recent extreme hydro-meteorological events in North-Western Central Europe (Luxembourg): extreme hydrological features, meteorological factors and atmospheric conditions

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In a historical context, floods in Luxembourg (North-Western Central Europe) have typically been triggered by large advective precipitation events during the winter season. However, in recent years several severe convective rainfall events have caused flash floods in small meso-scale catchments in the eastern part of Luxembourg (2016 July 22th; 2018 June 1th; 2018 June 11th).
Eventually, these events have largely exceeded both the meteorological and hydrological records spanning several decades. Their extreme character poses unprecedented challenges in terms of flashflood monitoring and forecasting – all existing observational networks and hydrological modelling tools having been designed for (advective) large scale flood events. Subsequent challenges relate to the identification and characterization of potential links between these extreme events, climate change and/or land use change.
Here we contextualize the singular characteristics (i.e. intensity, size, location) of the three recent extreme storms via a statistical analysis of 60-year long rainfall data series and 50 years of discharge data in our area of interest. We provide a process-based description of the storm events, which highlights the driving factors triggering and developing convective precipitation. The singular properties of the events are finally related to the already assessed trends in historical climatic (i.e. large scale atmospheric circulation types), meteorological (i.e. wind speed, air temperature, precipitation, atmospheric pressure at local scale) and hydrological data (i.e. discharge time series in a nested catchment set-up covering a wide range of physiographic contexts). We leverage past studies in our area of interest that had identified strong links between atmospheric circulation types and winter floods – exploring potential links between specific atmospheric circulation types and flash flood events in a context of climate change.