Geophysical Research Abstracts
Vol. 20, EGU2018-12777, 2018
EGU General Assembly 2018

Mechanistic and statistical analysis of the summer 2016 flash-flood event in Luxembourg: lessons learned and new perspectives in monitoring

Jean François Iffly (1), Christine Bastian (2), Audrey Douinot (1,3), Daniel Göhlhausen (2), Renaud Hostache (1), Patrick Matgen (1), Franck Minette (1), Noemie Patz (2), Ivonne Trebs (1), and Laurent Pfister (1)

(1) Luxembourg Institute of Science and Technology, ERIN, Belvaux, Luxembourg (jeanfrancois.iffly@list.lu), (2) Administration de la Gestion de l'Eau, Belval, Luxembourg, (3) IGB, Berlin, Germany

Three major issues related to flash-floods are that [1] forecasting the exact location, spatial extent and intensity of most convective events remains very uncertain, [2] the density of conventional (static) hydro-meteorological monitoring networks is usually too coarse for catching the very limited spatial extension of extreme precipitation events) and [3] most flood forecasting systems are designed for large-scale riverine floods (triggered mostly by precipitation over large areas during advective storms) and are therefore not suited for the specific spatial and temporal scales that are characterizing flash-floods.
The Sûre River basin in Luxembourg (north-western Europe, 4240 km^2) stands as an example in this respect. Flood events are typically triggered by long-lasting precipitation events, caused by westerly atmospheric circulation types, and leading to saturation excess overland flow. Since the mid-1990s this basin has been equipped with a dense hydro-meteorological observation.
Here, we show data from a recent flash-flood event that occurred in Luxembourg on 22nd July 2016 in three neighbouring catchments, located on the eastern boarder of the Sûre basin. A truly exceptional rainfall event generated flash-floods and subsequent destruction of multiple infrastructures on that occasion in the Ernz Blanche, Ernz Noire and Hallerbach catchments.
Recorded maximum rainfall intensities locally reached 20 mm per 10 minutes, 50 mm in one hour and up to 70 mm in six hours. The statistical analysis of the observed data suggests that the observed maximum 10-minute rainfall intensity had a return period of 8 years, while the hourly rainfall volume had a return period of approximately 185 years. In response to this exceptional convective meteorological event, the local river system responded almost instantly by triggering very large flood waves. Observed time to peak was particularly rapid – reaching 90 minutes on two rivers (Ernz Blanche & Hallerbach). Even though uncertainties related to the rating curves remain considerable, we have been able to estimate runoff coefficients between 4 and 15%. While being truly exceptional in a local context, the specific discharge estimated for our area of interest (up to 1.13 m3.s-1.km-2) remains moderate in comparison to values observed in basins located in Germany or France during flash-flood events (up to 20 m3.s-1.km-2). The statistical analysis of the 22nd July 2016 event suggests a return period of approximately 50 years.
The uncertainties inherent to the mechanistic and statistical assessment of the July 22nd 2016 flash-flood event in Luxembourg are mostly due to the inappropriate design of the hydro-meteorological monitoring network for this type of very short and highly intense events, as well as the still rather short observation series (rarely extending over more than two decades). In a context of non-stationarity characterising hydro-systems subject to global change, there is an urgent need for a new design of hydro-meteorological monitoring and forecasting systems – operating at unprecedented spatial and temporal scales. New telecommunication technologies, such as microwave links or LPWAN (Low-Power Wide-Area Networks) offer new complementarities to conventional systems that will be explored in the Sûre River basin in the coming years.