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What controls the very quick runoff response in the Meuse basin?

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Currently, the hydrological model used in the operational forecasting system of the river Meuse is lumped and does not account for the heterogeneity of the landscape, topography and vegetation. Previous studies have shown the importance of model structure distribution in different hydrological response units (HRUs) to improve model simulations. These HRUs take into account the different dominant runoff generation processes that occur in different parts of the landscape. The conceptualization of a runoff response with a very rapid time scale is essential to model the rapid runoff generated by very high intensity rainfall events. The parameterization of this rapid runoff response in the different sub-catchments of the Meuse is very sensitive due to the non-linearity of this threshold process and to the spatio-temporal variability of high-intensity rain events.

In this study, we formulate several hypotheses on what controls the very quick runoff response in the Meuse basin and we try to use additional sources of data to test the a-priori assumptions that we made in the conceptualization of the HRUs in our hydrological model and to facilitate model parameterization.

We hypothesize that by using appropriate runoff signatures, we may be able to assess the importance of the threshold response in the different catchments. The selection of specific storm events is useful to split the runoff in different time scales to improve the a-priori estimation of the very rapid runoff parameterization. Linking these differences to topographic and physiographic properties of the catchment like soil texture and land use may help us to explain the difference in observed spatial patterns. Especially the assessment of the fraction of roads and paved areas that cross the different hydrological response units may help to explain the observed spatial patterns. Additionally, we believe that deriving permanent and temporary wet areas using the Modified Normalized Difference Water Index (MNDWI) may guide us in strengthening or adapting the assumptions we made concerning the HRU classes.