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Comparative estimation and assessment of initial soil moisture conditions for Flash Flood warning in Saxony

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Flash Floods are known as highly destructive natural hazards due to their sudden appearance and severe consequences. In Saxony/Germany flash floods occur in small and medium catchments of low mountain ranges which are typically ungauged. Besides rainfall and orography, pre-event moisture is decisive, as it determines the available natural retention in the catchment. The Flash Flood Guidance concept according to WMO and Prof. Marco Borga (University of Padua) will be adapted to incorporate pre-event moisture in real-time flood forecast within the ESF EXTRUSO project (SAB-Nr. 100270097).

To arrive at pre-event moisture for the complete area of the low mountain range with flash flood potential, a widely applicable, accurate but yet simple approach is needed. Here, we use radar precipitation as input time series, detailed orographic, land-use and soil information and a lumped parameter model to estimate the overall catchment soil moisture and potential retention. When combined with rainfall forecast and its intrinsic uncertainty, the approach allows to find the point in time when precipitation exceeds the retention potential of the catchment. Then, spatially distributed and complex hydrological modeling and additional measurements can be initiated. Assuming reasonable rainfall forecasts of 24 to 48hrs, this part can start up to two days in advance of the actual event.

The lumped-parameter model BROOK90 is used and tested for well observed catchments. First, physical meaningful parameters (like albedo or soil porosity) a set according to standards and second, “free” parameters (like percentage of lateral flow) were calibrated objectively by PEST (Model-Independent Parameter Estimation and Uncertainty Analysis) with the target on evapotranspiration and soil moisture which both have been measured at the study site Anchor Station Tharandt in Saxony/Germany. Finally, first results are presented for the Wernersbach catchment in Tharandt forest for main flood events in the 50-year gauging period since 1968.