Flash Floods forecasts based on rainfall thresholds: application in an alpine region

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The paper describes the application of the Flash Flood Guidance methodology to a number of watersheds in the eastern italian alps. Flash flood guidance is tied to a given duration of rainfall and is defined as the volume of actual rainfall that generates bankfull discharge at the basin outlet, given the current soil moisture (obtained by using a hydrological continuous modelling approach). Flash flood guidance my be compared to observed or forecast rainfall volume of the same duration for the formulation and issuance of warnings and watches in an operational environment.

Five watersheds (with area ranging from 20 km^2 to 600 km^2) were simulated using two soil moisture accounting models: the Probability Distributed Model (PDM) and the Topmodel. For each of these basins, at least 10 years of quality-controlled hourly data (discharge, rainfall, temperature) were available. It is noted that the hydrology of most of the areas is dominated by complexities such as snow accumulation and melt and orographic precipitation. The same modelling system was used, in an inverse mode, for computation of the FFG. Soil moisture estimates at the FFG subbasin scale were obtained by disaggregating estimates obtained at broader scales considering two options: i)the model was run at the sub-basin scale, by using local rainfall and temperature data and regional model parameters; ii) FFG was obtained by disaggregating soil moisture at the sub-basin scale, by using broader scale rainfall and temperature data.

Accuracy of the FFG approach is statistically assessed by comparing current exceedances of threshold flow to occurrences of observed rainfall exceeding FFG. The analysis shows the difficulties related to this specific mountainous setting, where most of the uncertainty is due to errors in rainfall estimation.