Near-real time high-resolution Flash Flood Impact Forecasting

Josias Ritter, Marc Berenguer, Carles Corral, Shinju Park, and Daniel Sempere-Torres

Center of Applied Research in Hydrometeorology, Universitat Politècnica de Catalunya, BarcelonaTech, Jordi Girona 1-3 (C4), 08034 Barcelona, Spain

The third stage of the EU Floods Directive calls for improving preparedness for flood events, for instance by setting up hydrometeorological early warning systems. These systems are particularly useful to anticipate flash floods that typically occur in small to medium-sized catchments (< 1000 km2) with short response times, ranging from minutes to a few hours.

Existing flash flood early warning systems typically predict the mere hydrometeorological phenomena (e.g. discharge at a given river section). However, experience in emergency response management shows that pure hazard forecasts are difficult to interpret by emergency managers. To estimate the expected consequences and impacts of a predicted flash flood phenomenon, emergency managers first have to combine the hazard forecast with information about exposure and vulnerability of the area at risk. Given the already short lead time of flash floods, this further reduces the available time to coordinate flood response measures, and may lead to sub-optimal decisions.

We present a newly developed method of rapid flash flood impact forecasting, which combines hazard, exposure and vulnerability information at near-real time and high resolution. First, the flood extent is predicted by combining hazard forecasts with EU Floods Directive flood maps. Second, this flooded area is overlaid instantly with exposure and vulnerability layers, such as population density, land use and critical infrastructure. The resulting impact forecast is presented in quantitative (e.g. number of affected population) and qualitative terms (e.g. impact level), both spatially distributed and as lumped information at municipality level.

The method is applied in an operational setup in Catalonia, Spain. The Catalan Water Agency and Civil Protection operationally use the radar-based flash flood hazard forecast system FF-EWS. This hazard forecast is the input for testing the proposed methodology, and the product is a high-resolution (25x25m) impact forecast for Catalonia. Its forecasting skill is demonstrated using observed impacts of significant flash flood events in recent years.