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Medium range global flash flood predictions using probabilistic point rainfall forecasts (ecPoint-Rainfall)

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Forecasting flash floods represents a big challenge. Traditional regional flash flood forecasting systems may use rainfall observations or high-resolution rainfall forecasts as inputs, and flash flood prone areas may be identified using either simplified models (e.g. indexes based on rainfall thresholds) or semi-distributed/distributed hydrological models. These types of systems may not be easy to maintain due to the high quantity of data that needs to be managed and/or their high running costs. Therefore, there are several areas of the world with no access to flash flood forecasts, and, if they are available, warnings may be issued no more than 1-2 days in advance. This means either no warnings at all, or very short time for preparedness, producing high economic losses and thousands of deaths every year.

One solution to the above-mentioned issues could be the development of a flash flood forecasting system with a continuous global domain, which uses rainfall forecasts from global models. In this way, not only global coverage could be provided, but forecasts could be also given with lead times up to medium ranges, allowing earlier warnings. However, such a system would require as input high resolution (km scale) rainfall forecasts, and there is no global model that can currently provide them. Furthermore, there may be a large uncertainty embedded in km-scale model outputs.

Statistical post-processing techniques could fill this gap, and allow the use of rainfall forecasts from current global model outputs. In recent years, a novel statistical post-processing technique (ecPoint-Rainfall) has been developed at ECMWF to provide probabilistic global rainfall forecasts at point scale. It corrects for weather-dependent biases and weather-dependent sub-grid variability in ECMWF global ensemble rainfall forecasts. This novel technique has produced very promising results, obtaining post-processed forecasts at day 10 that have the same skill of the raw ECMWF ensemble rainfall forecasts at day 1 for events greater than 50 mm/12h. Therefore, we believe that these post-processed rainfall forecasts could be successfully used in flash flood forecasting.

Flash floods nevertheless are fast evolving events. Therefore, impacts depend not only on the magnitude of the natural hazard itself but also on exposure information, and how these two factors evolve and intersect in time and space. Therefore, flash flood forecasts should be enhanced not only by the understanding of the hazard itself but also by the understanding of vulnerability and exposure aspects. In this way, they can help to reduce losses by refining warning areas and help emergency responders to improve preparedness by targeting their efforts in a more efficient way. Therefore, event-base verification using media reports (e.g. from the European Severe Weather Database, the National Weather Service in USA, FloodList.com, and EMDAT) is currently under investigation to verify the capabilities of ecPoint-Rainfall to identify flash flood prone areas.

The presentation will focus on (1) a brief overview of ecPoint-Rainfall, (2) the setup of the global flash flood forecasting system using hazard/exposure information, (3) the verification challenges and results, and (3) the outlook of future flash flood forecast products.