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Using Population Exposure Information to Improve Global NWP Flash Flood Forecasts

Calum Baugh (1), Toni Jurlina (1,2), Christel Prudhomme (1,3), and Florian Pappenberger (1)

(1) ECMWF, Reading, United Kingdom, (2) Meteorological and Hydrological Service, Zagreb, Croatia , (3) Centre for Ecology and Hydrology, Wallingford, United Kingdom

A global flash flood forecasting system has been developed using data from the ECMWF [European Centre for Medium Range Weather Forecasts] ensemble prediction system. This system takes forecasts of precipitation and surface runoff and computes the respective Extreme Forecast Index [EFI] values, providing a guidance of flash flood hazard up to five days ahead. However during the verification of this system it was noticed that its accuracy suffered from a high incidence of false alarms, typically occurring in sparsely populated areas.

Therefore we investigated whether the accuracy of the flash flood forecasts could be improved by refining them with exposure information. We chose to use the populated fraction data from the Global Human Settlement Layer [GHSL] to provide the exposure information. This is because flash floods typically have a strong urban component and our verification dataset comprised of flash flood reports most often from populated areas.

A sensitivity analysis was performed for a range of populated fraction GHSL values which acted as thresholds. For a selected threshold, only the flash flood forecast data which overlapped GHSL pixels greater than or equal to the threshold were retained. Then the verification was calculated using the thresholded forecast data. The verification was performed by comparing flash flood forecasts against global flash flood reports from FloodList and EM-DAT between 10th March 2016 - 10th March 2017.

Results show a large reduction in the number of false alarms when thresholding the forecasts with GHSL populated fraction data, a greater reduction was achieved with larger threshold values. However for larger GHSL threshold values the number of successful forecast locations (hits) was also reduced. Therefore we find that flash flood forecasts are improved when using population exposure information to remove sparsely populated areas. Future work will investigate whether the addition of more exposure data, such as critical transport infrastructure, could provide even greater improvements.