Optimisation of Rainfall-Runoff Modelling for Urban Flood Management with Ensemble Radar Nowcasts

Optimiser la modélisation de l'écoulement des eaux pluviales pour la gestion des inondations en milieu urbain avec des ensembles de prévisions de radar à court terme (Nowcasts)

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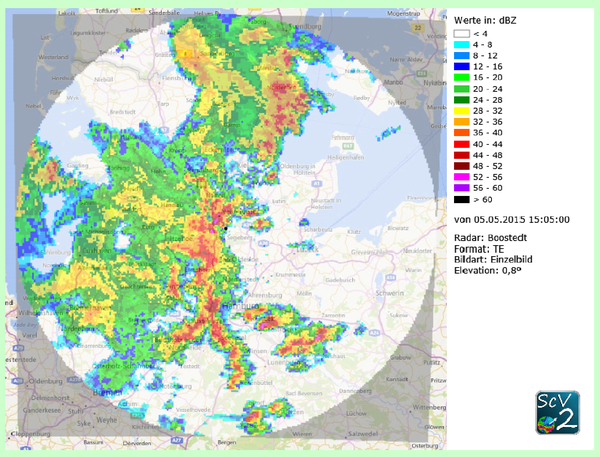
(1): SCOUT: Rainfall Processing System

Ensemble nowcasts are generated by variation of several forecast parameters (e.g. extrapolation of velocity vectors and growth rates of observed precipitation cells) intended to represent the uncertainty of the observed parameters. For the case study 10 Ensemble Members (EM) are generated (see Fig. 1).

(2) KalypsoHydrology: Rainfall-Runoff Model

The ensemble radar nowcasts are processed to each spatial element of the hydrological model by an analysis of proximity and neighbourhood. KalypsoHydrology is part of the Kalypso product used for flood management in several regions (e.g. Hamburg, Saxony and Schleswig-Holstein).



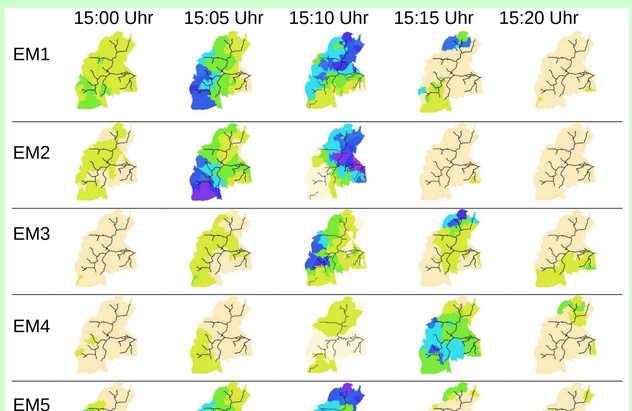


Fig. 1: Radar image (top) and processed nowcast ensemble member results for an urban case study area in Hamburg (Kollau, 5th of May 2015).

StucK → Long term drainage management of tide-influenced coastal urban areas with consideration of climate change

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(3): Flood Warning Service Hamburg

The results of the Ensemble Radar Nowcasts (Fig. 1) and the Ensemble Flood Forecasts (Fig. 3) are used to optimise the Flood Warning Service Hamburg (WaBiHa: http://www.wabiha.de) (Fig. 5).

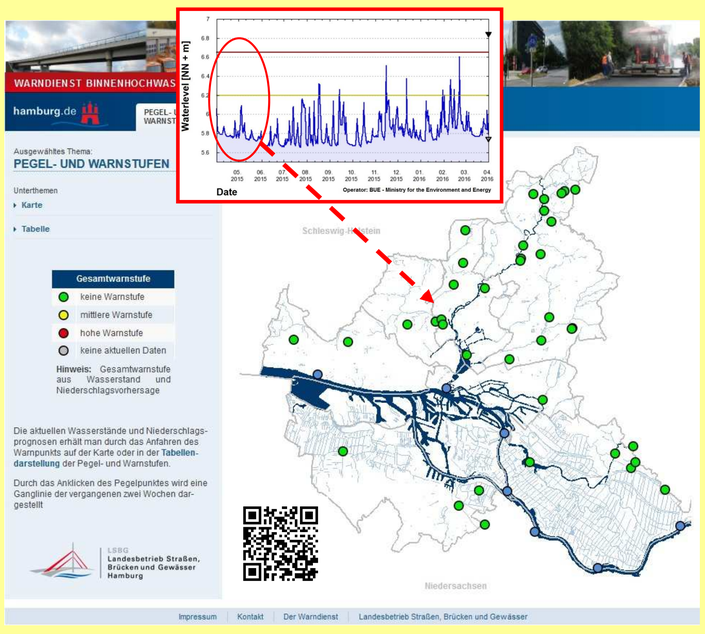

Fig. 5: Flood Warning Service Hamburg (WaBiHa).

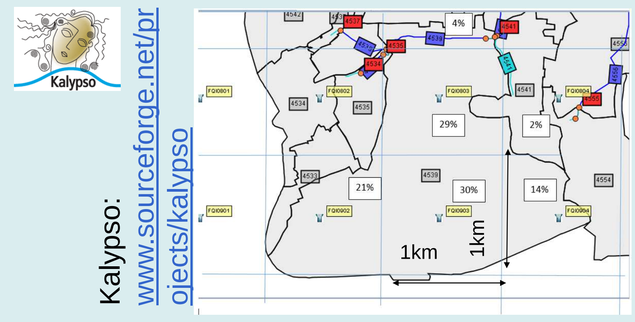

Fig. 2: Detailed spatial integration of the precipitation data. Area weighted mean of radar grid elements and intersection with the hydrological areal units.

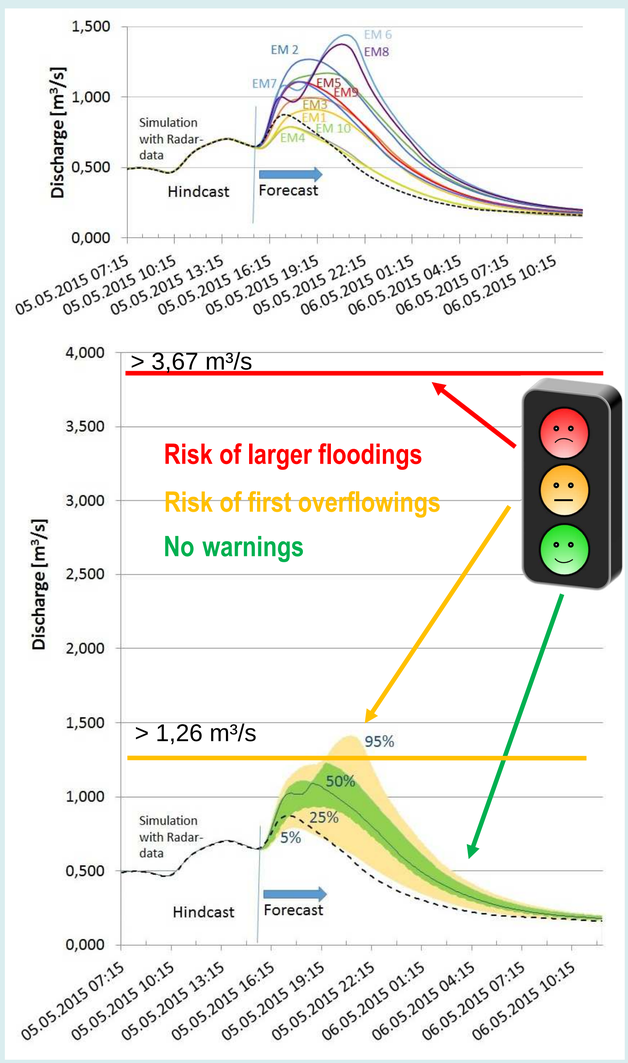

Fig. 3: Discharge hydrographs of the 10 nowcast ensemble member results (top) and evaluation of the flood risk on the basis of the defined warning levels for the regarded gauging station using state discharge relationships (cp. Fig.5).

Summary: Especially in urban areas, improved strategies are required to assess the influence of small scale precipitation patterns of local heavy rainfall events in a flood warning context. The results of the case study show a wide range of possible precipitation scenarios given by the radar nowcast ensemble members for a local rainfall event. This reflects the large uncertainty in predicting discharge curves. The first steps of the project StucK (2015 till 2018) are presented here: (1) developing a methodology to compute ensemble nowcasts of local heavy rainfall events, (2) integration of small scale radar rainfall nowcasts in a Rainfall-Runoff Model and (3) first approach with percentiles to optimize the Flood Warning Service Hamburg. Within the project different statistical approaches will be analysed to improve the online forecast system.

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