# MAP D-PHASE SEVERE CONVECTION FORECASTS

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## I. MAP D-PHASE

D-PHASE stands for *Demonstration of Probabilistic Hydrological and Atmospheric Simulation of flood Events in the Alpine region* and is a Forecast Demonstration Project (FDP) of the WWRP (World Weather Research Programme of WMO). It aims at demonstrating some of the many achievements of the Mesoscale Alpine Programme (MAP), in particular the ability of forecasting heavy precipitation and related flooding events in the Alpine region.

The MAP FDP will address the entire forecasting chain ranging from limited-area ensemble forecasting, high-resolution atmospheric modelling (km-scale), hydrological modelling, and nowcasting to decision making by the end users, i.e., it is foreseen to set up an end-to-end forecasting system.

Specifically, an end-to-end forecasting system for Alpine flood events will be set up to demonstrate state-of-the-art forecasting of precipitation- related high-impact weather. This system will include probabilistic forecasting based on ensemble prediction systems with a lead time of a few days, followed by short-range forecasts based on high-resolution deterministic atmospheric and hydrological models for selected regions or catchments, and completed with real-time nowcasting and high-resolution observational information. Throughout the forecasting chain, warnings will be issued and re-evaluated as the potential flooding event approaches, allowing forecasters and end users to alert and make decisions in due time.

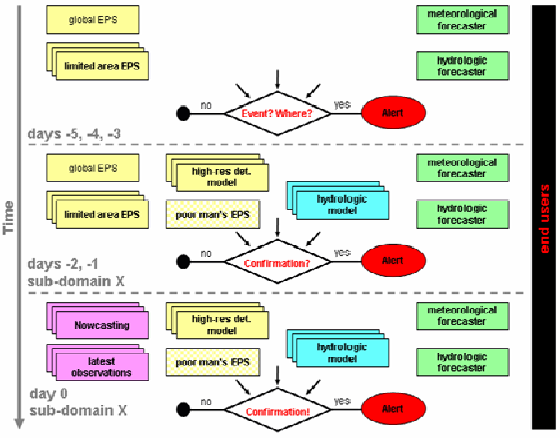


FIG. 1: Forecast chain and model cascade during MAP D-PHASE

The D-PHASE Operations Period (DOP) will be 1 June to 30 November 2007.

## II. THE ATMOSPHERIC FORECAST

Severe convection forecasts from numerical models are still inaccurate in time, location and intensity. The new high resolution models with explicit deep convection scheme showed improvements in this respect, particularly where an orographic forcing is present, like in the Alpine region.

The ensemble techniques allow a probabilistic approach, which showed significant results in the warning process of severe weather.

During D-PHASE Operations Period a large number of atmospheric models will be run over a mostly overlapping Alpine area, with emphasis on limited area ensemble and high resolution models (at the time of writing about 6 ensemble and 13 high resolution models).

## II. THE COUPLED HYDROLOGICAL MODELS

For the end user's point of view, like civil protection authorities, the effects of heavy precipitation are the most challenging problems. Many hydrological models (~ 17) will be run over mostly small or medium catchments areas coupled with high resolution atmospheric models or the different outputs of atmospheric ensemble models, computing the runoff of selected rivers.

## IV. NOWCASTING

Severe convection is probably the most challenging forecast and accurate results in time, space and intensity can be achieved only at nowcasting lead time and space resolution.

During D-PHASE Operations Period several mostly radar based nowcasting techniques will be available to locate severe convective cells (Hering, 2007; Hering et al., 2006) and to estimate in real time precipitation amounts (Germann etl al., 2006).

Particularly small catchments are very sensitive to the location of precipitation, and runoff forecasted by hydrological models can show large errors due to the input data coming from the atmospheric models.

In a complex terrain like the Alps radar precipitation estimation is a real challenge. In spite of significant improvements achieved by developing sophisticated correction schemes (Germann et al., 2006) residual errors in Alpine radar precipitation maps are still relatively large. Yet, in the absence of a nearby rain gauge, radar is the only instrument that provides in real-time estimates of precipitation amounts in convective situations. A novel promising solution to express the residual uncertainty in radar precipitation estimates is to generate an ensemble of fields: each ensemble member is a possible realisation given the four-dimensional radar reflectivity measurements and our detailed knowledge on the radar error structure (Germann et al., 2006a, 2007). In D-PHASE radar

ensembles are assimilated in the semi-distributed rainfall runoff model PREVAH for two steep flash-flood prone catchments of the size of 186 and 44 km$^2$ in the Southern Alps. For a description of PREVAH see Zappa (2003) and references therein. See Fig 2 below.

## V. FORECASTERS AND END USER INTERACTIONS

In MAP D-PHASE a large importance was set to the interactions with end users. Many institutions announced their interest in participating to the demonstration phase. They will have full access to all the data coming from atmospheric and hydrological models, as well from Nowcasting.

To access rapidly the significant information a Visualization Platform (VP) was set up. All models produce some alerts when the forecasted precipitation and runoff exceed regional defined thresholds. Three alert levels were defined corresponding to return periods of 7, 2, 0.1 event per year. The different outputs are showed side by side to allow easy comparison of the different models. Then all output field can be showed and compared on the VP.

The existing severe weather warning process works as usual, but in some weather centres forecasters are involved in the demonstration phase with following goals:

After the working shift forecasters have to fill a subjective evaluation questionnaire. Beside the objective verification of the models with the observations, this evaluation will show the true benefits in the warning process for the forecaster. Following questions have to be addressed:

- What benefit can be drawn from the high-resolution deterministic models.
- What benefit can be drawn from the limited-area ensemble prediction systems as compared to the deterministic models?
- Is there any advantage (or disadvantage) in having more than one model of the same type available?
- Are the forecasters able to effectively use the vast amount of data and extract the essential facts without loosing relevant information?
- Considering high-resolution deterministic models, limited-area ensemble prediction systems, which of these new products support the forecasters best in their decision making process?
- What is the relative importance between (new) model forecasts and nowcasting or observational information, for different lead times?

The results of the subjective evaluation will allow to plan and optimise the use of different modelling and nowcasting systems in the forecasting offices of the meteorological services, and will certainly be a valuable input to identify priorities for future developments.

We hope that our results will significantly improve the decision process in warning activities, like severe thunderstorm warning, and help better train the forecasters.

## VI. PRELIMINARY RESULTS

At the conference some preliminary results from the first 3 months DOP will be presented.

## VII. REFERENCES


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Home page of MAP D-PHASE:
http://www.map.meteoswiss.ch/d-phase

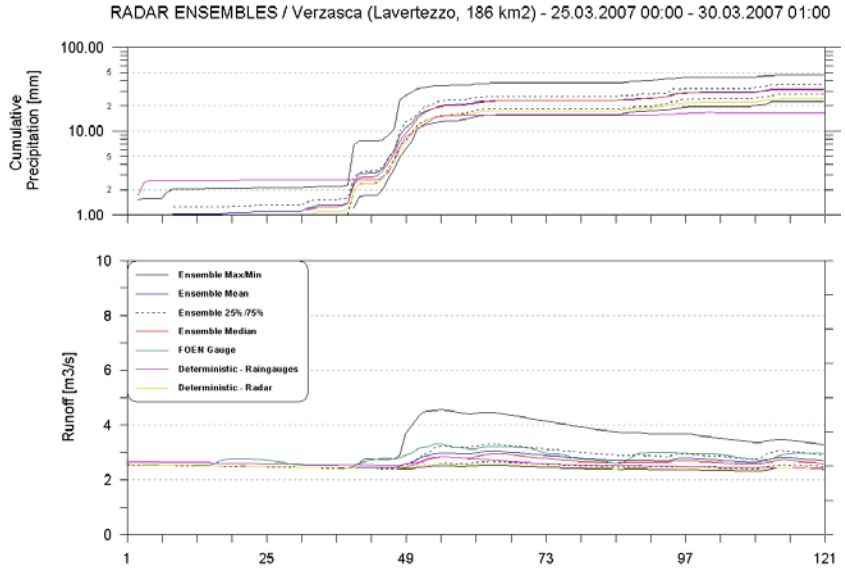


FIG. 2: Runoffs computed by hydrological model driven by radar ensemble. (see below), Courtesy M.Zappa (WSL)