Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Dipartimento federale dell'interno DFI
Ufficio federale di meteorologia e climatologia
MeteoSvizzera

P06.17

MAP D-PHASE: (flash) flood forecast

P.Ambrosetti[1], U.Germann[1], A.Hering[1], L.Fontannaz[2] , M.Stoll[3]
[1]MeteoSwiss, via ai Monti 146, CH-6605 Locarno, paolo.ambrosetti@meteoswiss.ch
[2] MeteoSwiss, 7 bis av. de la Paix, CH-1211 Genève 2, [3] MeteoSwiss, Krähbühlstrasse 58, CH-8044 Zürich

MAP D-PHASE Project

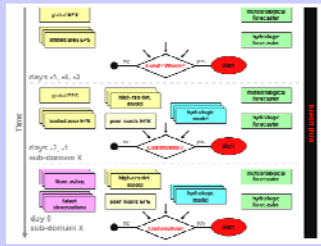
D-PHASE stands for *Demonstration of Probabilistic Hydrological and Atmospheric Simulation of flood Events in the Alpine region* and is a Forecast Demonstration Project (FDP) of the WWRP (World Weather Research Programme of WMO). It aims at demonstrating some of the many achievements of the Mesoscale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

The operational phase runs from 1st June to 30 November 2007.

The decision process
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. has been set up an end-to-end forecasting system.

This system includes:

1. Probabilistic forecasting based on ensemble prediction systems with a lead time of a few days.
2. Short-range forecasts based on high-resolution deterministic atmospheric models.
3. Hydrological models for selected regions or catchments.
4. Real-time nowcasting and high-resolution observational information.



Throughout the forecasting chain, warnings are issued and re-evaluated as the potential flooding event approaches, allowing forecasters and end users to alert and make decisions in due time.

Subjective Verification

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 are 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 model forecasts and nowcasting or observational information, for different lead times?*

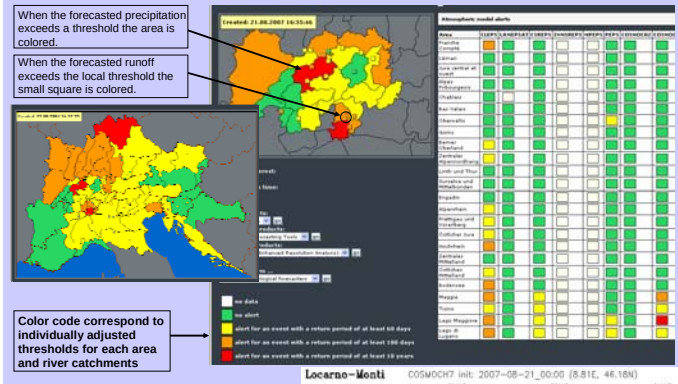
The results of the subjective evaluation will allow to plan and optimise the use of different modelling and nowcasting systems in the forecasting offices of the meteorological services, and will certainly be a valuable input to identify priorities for future developments.
We hope that our results will significantly improve the decision process in warning activities, like severe thunderstorm warning, and help better train the forecasters.

Homepage of MAP D-PHASE Project: http://www.map.meteoswiss.ch/d-phase

Visualization platform

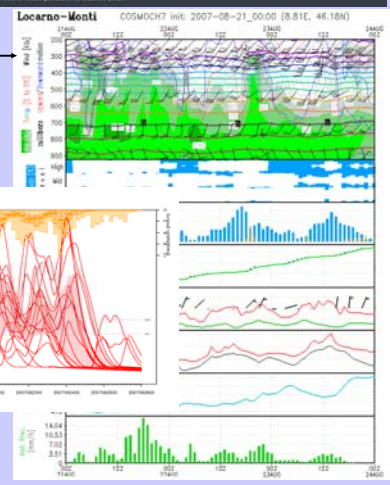
When the forecasted precipitation exceeds a threshold the area is colored.

When the forecasted runoff exceeds the local threshold the small square is colored.



Color code correspond to individually adjusted thresholds for each area and river catchments

For each model and several stations meteograms are computed at each run.



For each catchments runoff are computed by hydrological models using both deterministic and ensemble atmospheric models.

http://www.d-phase.info
(Registration requested)

Nowcasting flash floods

Preliminarily results of MAP D-PHASE

Deep convection forecast by atmospheric models
Severe convection is probably the most challenging forecast: several events during summer 2007 showed that even high resolution models with explicit convection scheme usually are not able to produce accurate results in time, space and intensity of severe convection. 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.

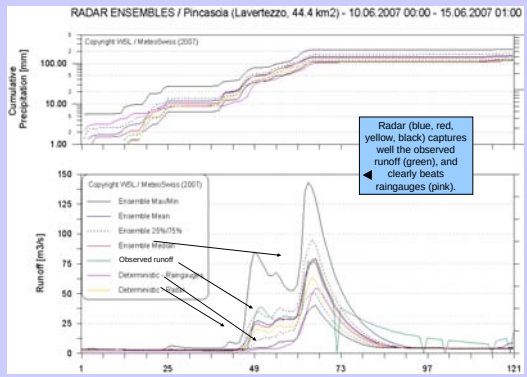
Precipitation Nowcasting
The operational experience shows that a fairly accurate precipitation forecast can be achieved only at nowcasting lead time and space resolution.During D-PHASE Operations Period a few mostly radar based nowcasting techniques are available to locate severe convective cells (e.g. Hering et al., 2007 at this conference, 06.08).

Radar precipitation estimation
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 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.

Runoff forecast based on Radar data
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 km2 in the Southern Alps.
An example is presented in this poster.

Lead time of flash flood
Small (and steep) catchments have short response time from precipitation to runoff surge. The first results showed that hydrological model forecast based on radar precipitation estimate can achieve a lead time > 60 minutes even over an area as small as10-100 km².

First real-time experiment worldwide using radar ensemble precipitation field for runoff modeling



First results obtained in real-time for Pincascia river, model run at 15 June 0000 UTC,

Runoff observed at river gauge is indicated in green. Runoff modeled using precipitation from rain gauge as input is shown in pink; other colors show runoff calculated with radar ensemble precipitation fields as input. No post-facto calibration or tuning. Model parameters were calibrated using rain gauge and river gauge data of past events. No radar data was used for calibration. There is space for improvements using also radar for model calibration.

Conclusions:

- MAP D-PHASE is an end to end demonstration project, showing the actual possibility of a complex chain of atmospheric and hydrological models, forecasters and end users like civil protection authorities.
- At each time step adequate data and information allow a suitable decision process from the early warning (based on ensemble global models), local deterministic and ensembles, high resolution models, to nowcasting techniques.
- The good collaboration between atmospheric forecaster and hydrologist permit to support the authorities in the estimation of the possible damages and risks due to heavy/intense precipitation.
- Radar precipitation estimates coupled with hydrological models showed some skill in flash flood forecasts. In this field additional research is still needed.