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Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology MeteoSwiss

The D-PHASE Operations Period (*DOP*)

Mathias W Rotach, Marco Arpagaus
MeteoSwiss, Zürich, Switzerland

Manfred Doringner, University of Vienna

Christoph Hegg, WSL, Zurich Switzerland

Andrea Montani, ARPA-SIM, Bologna, Italy

Roberto Ranzi, University of Brescia, Italy

Francois Bouttier, Andrea Buzzi, Urs Germann, Simon Jaun, Ken Mylne,
Evelyne Richard, Andrea Rossa, Michael Staudinger, Reinhold
Steinacker, Hans Volkert, Volker Wulfmeyer, Massimiliano Zappa

3rd HEPEX Workshop, Stresa (I), 27-29 June 2007



Outline

- Quick review of D-PHASE
- The pieces that constitute D-PHASE
- Visualisation Platform & Data Archive
- Conclusions

**DOP = D-PHASE Operations Period
(June 1 to November 30 2007)**





MAP: Mesoscale Alpine Programme

- Mesoscale Alpine Programme: MAP SOP 1999
- WWRP R&D Programme - the first!
- Tons of exciting research results...
- WWRP: output for *operational forecast*?
--> *Forecast Demonstration Project (FDP)*
- D-PHASE endorsed as FDP: October 2005





D-PHASE

- Forecast Demonstration Project
- **Theme:** Heavy precipitation and flood forecast

D-PHASE:

***Demonstration of Probabilistic Hydrological
and Atmospheric Simulation of flood Events in
the Alpine region***





Heavy precipitation & related flooding



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The D-PHASE Operations Period | HEPEX Workshop, Stresa, June 27-29 2007
Mathias.Rotach [at] meteoswiss.ch

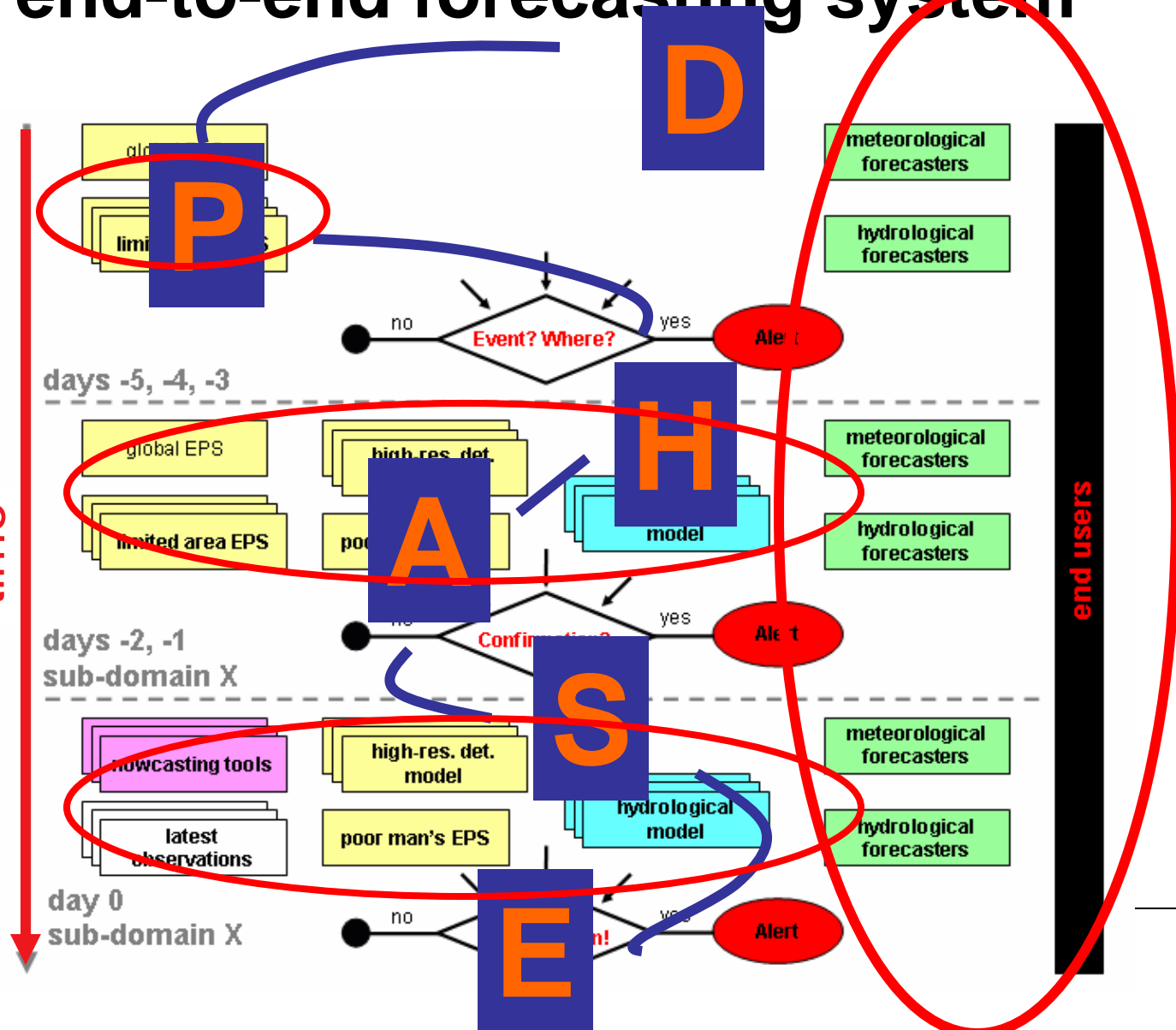


Distributed, Real-time end-to-end forecasting system

Probabilistic,

high-resolution,
hydrological,
atmospheric
simulations

time





The elements of D-PHASE

- Atmospheric Ensemble Models
- High resolution deterministic models
- Hydrological models
--> including ensemble hydrological forecasts
- Catchments
- Nowcasting instruments





Probabilistic atmospheric models

Model	Members	Resolution [km]	Institution
COSMO-LEPS	16	10	ARPA-SIM
MOGREPS	24	25	UK MetOffice
SREPS	20	27	INM
COSMO-SREPS	16	10	ARPA-SIM
ALADIN-LAEF	17	18	ZAMG
PEPS	variable	7	SRNWP
Micro-PEPS	variable	2	DWD





Atmospheric models: high resolution

Model	Resolution	Institution
COSMO	7 / 2.8 km	DWD
COSMO	7 / 2.8 km	CNMCA
COSMO	7 / 2.8 km	ARPA-SIM
COSMO	7 / 2.2 km	MeteoSwiss
MOLOCH	2.2 km	ISAC-CNR
BOLAM / MOLOCH	7 km	ARPA Liguria
QBOLAM	33 / 11 km	ARPAT
ALADIN / AROME	10 / 4 km	Météo France
MM5	9 / 3 / 1 km	Unv. Hohenheim
MM5	60 / 15 / 3.75 km	FZK, IMK, IFU
ALADIN	9.6 km	ZAMG
GEM-LAM	9 / 15 / 2.5 km	Env. Canada





Hydrological models

PREVAH (e-hm & d-hm)
FEWS / HBV (e-hm & d-hm)
RSYSTEM2 (e-hm & d-hm)
IST-SUPSI Model (e-hm & d-hm)
Ufficio dei corsi d'acqua - Model
TOPKAPI (e-hm)
MIKE11 (e-hm)
DRIFT
DIMOSOP (e-hm & d-hm)
GEOTOP
FEST
CDRIFT
GEOMADB
LARSIM
LUBW model
TU Wien model

--> some probabilistic
--> e.g., based on
COSMO-LEPS
--> one driven by a radar
ensemble
59 catchments...
--> End Users





Runoff Forecast



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Ensemble hydrological forecast

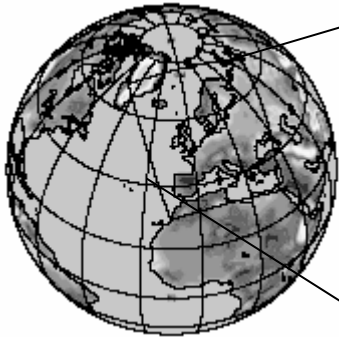
- Various experimental systems in D-PHASE
- Coupling local (atmospheric) ensemble system to runoff model
- Directly fed by radar ensemble





HEPS

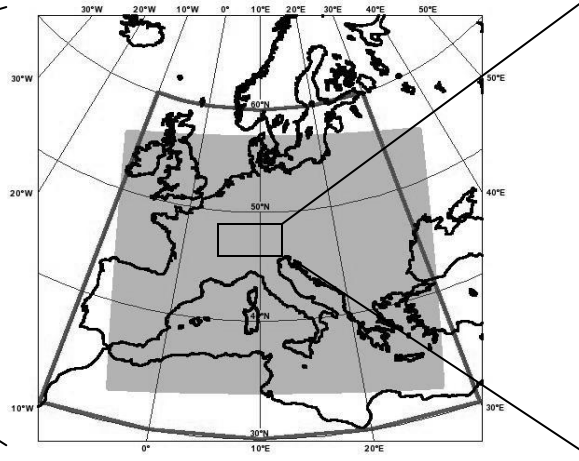
1. (ECMWF-EPS)



- global
- resolution: 50×50 km
- ensemble members: 51
- 40 vertical levels
- operational: 51 members

ECMWF

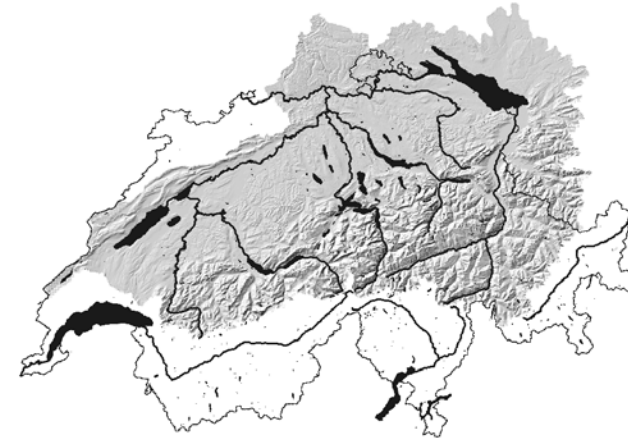
2. COSMO-LEPS



- central and southern Europe
- resolution: 10×10 km
- ensemble members: 51
- 32 vertical levels
- operational: 16 members

A. Montani, ARPA-SIM
A. Walser, MeteoSwiss

3. Hydrological-EPS



- PREVAH
- Rhine basin (Rheinfelden)
- resolution: 0.5×0.5 km
- ensemble members: 51
- operational: 1 member

M. Verbunt, ETH Zurich
S. Jaun, ETH Zurich
M. Zappa, WSL

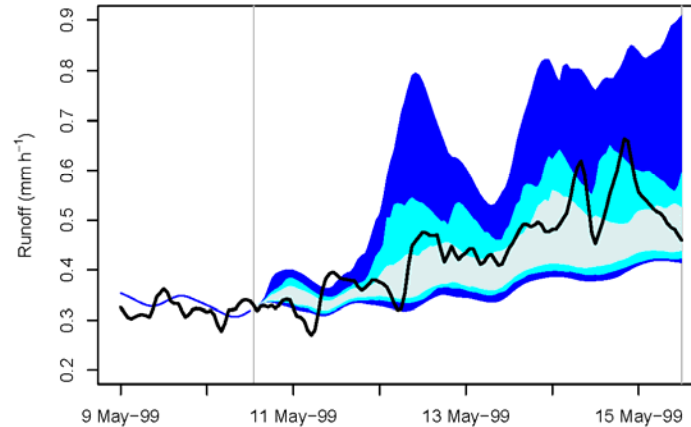




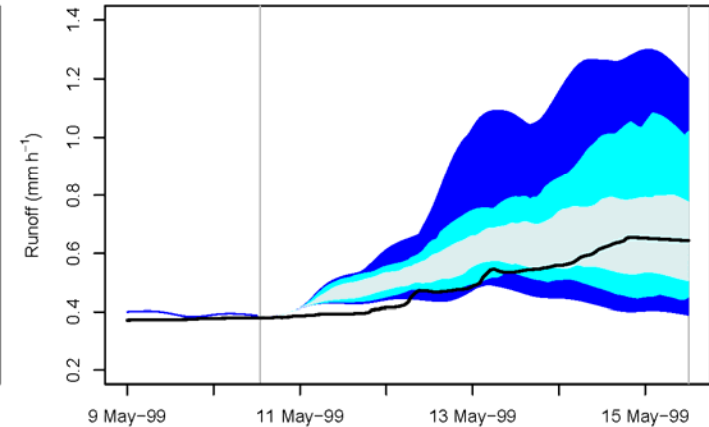
Examples probabilistic forecast



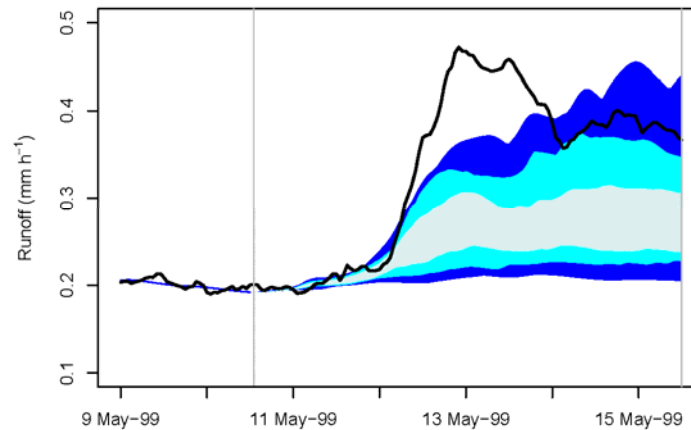
Aare - Hagneck (5127 km²)



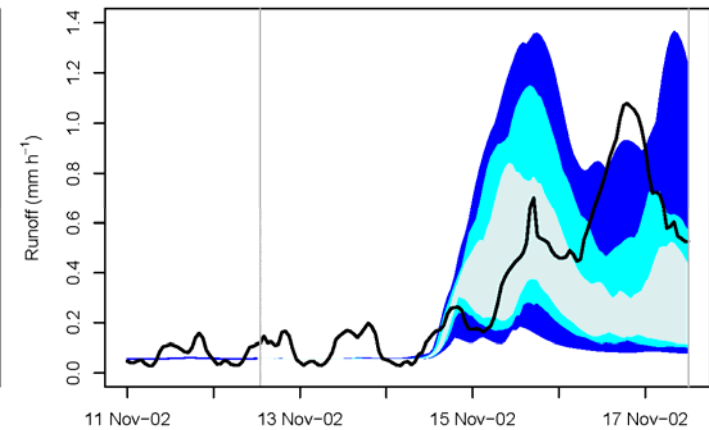
Reuss - Luzern (2251 km²)



Rhine - Rheinfelden (34,550 km²)



Rhine - Domat-Ems (3229 km²)



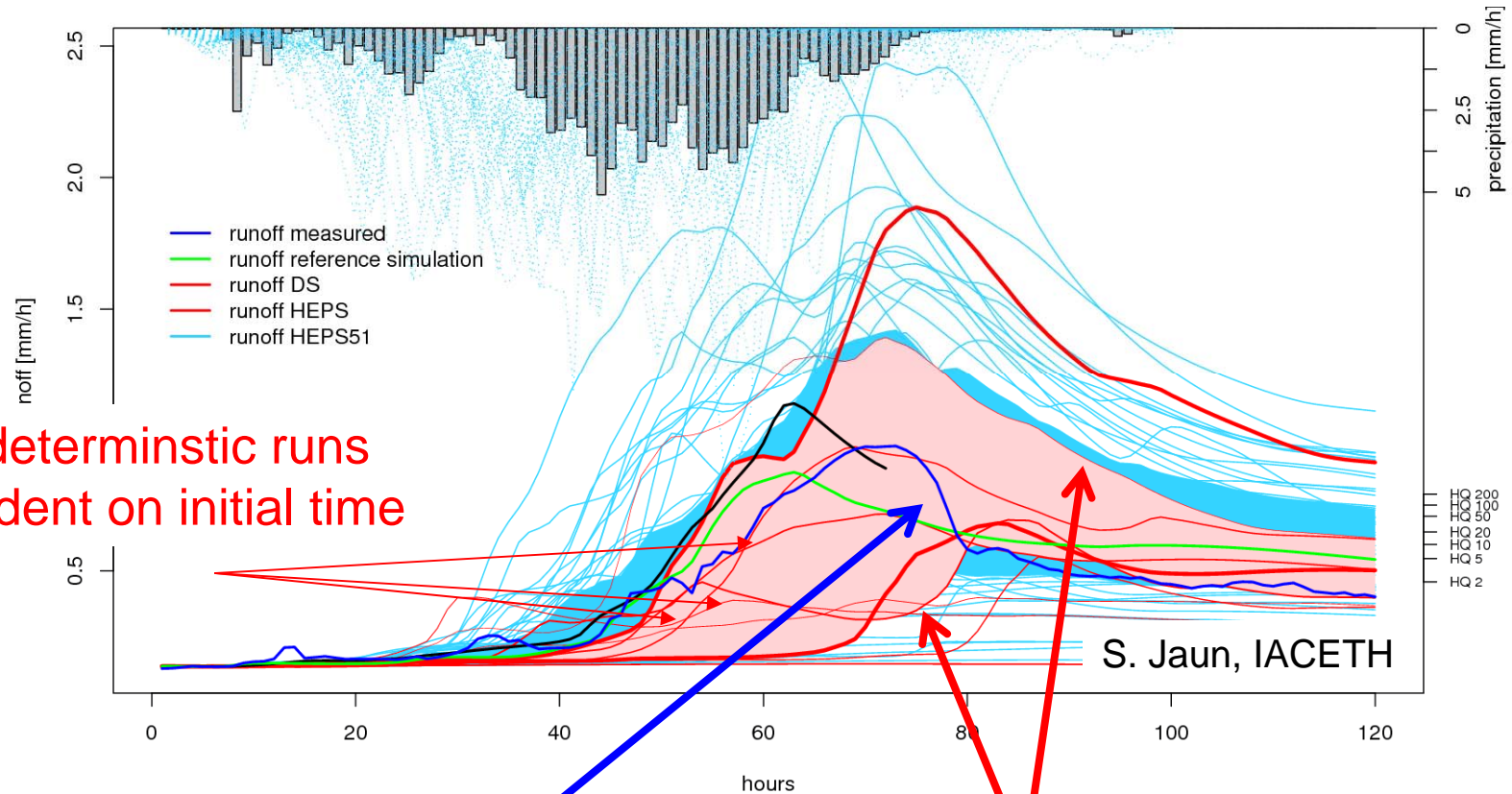
q25 – q75 interval
q10 – q90 interval
min - max interval
observed runoff





Deterministic vs. probabilistic forecast

Runoff at Hagneck (Aare, 5170 km²), IT: **20.8.2005**, 00 UTC



Different deterministic runs
--> dependent on initial time

Observed runoff
Inter-quartile range of the ensemble





Radar Ensemble for hydrological modeling

- Use estimation of radar uncertainty
 - > shading by topography
 - > clutter
- error covariance matrix
- construct an ensemble of radar precipitation estimates

Germann et al, ERAD, 2006 (keynote)

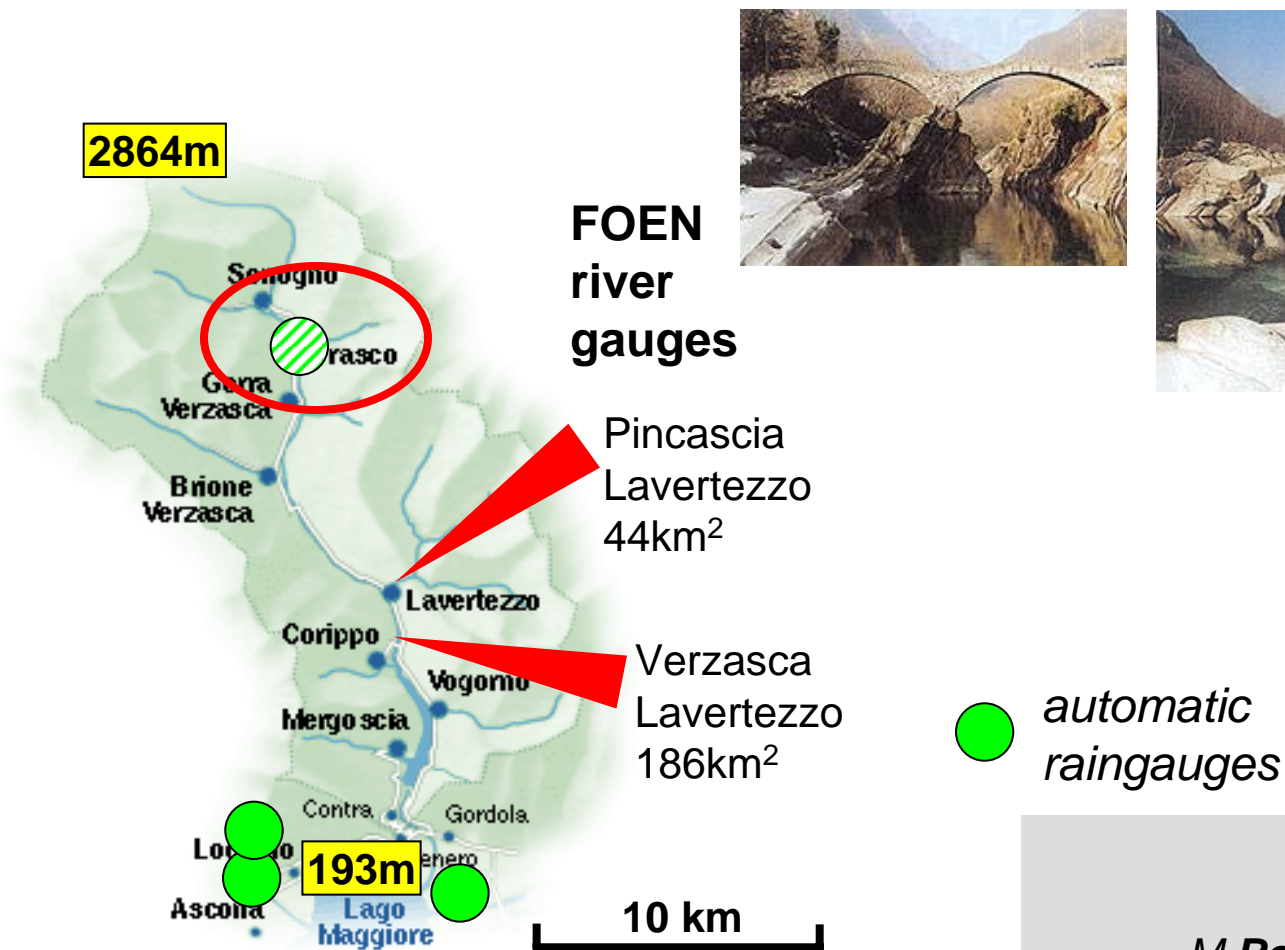
Germann et al, EGU, 2007

Germann et al, AMS Radar Conf, 2007





Radar Ensemble for hydrological modeling



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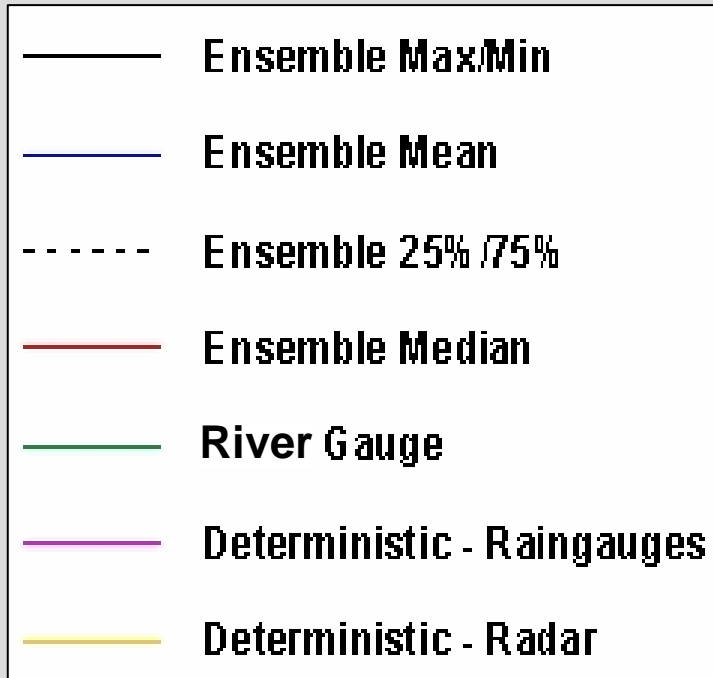
FOEN = Swiss Federal Office for the Environment

In collaboration with
M Zappa (WSL),
M Berenguer (Montreal),
I Zawadzki (Montreal),
D Sempere-Torres (Barcelona).

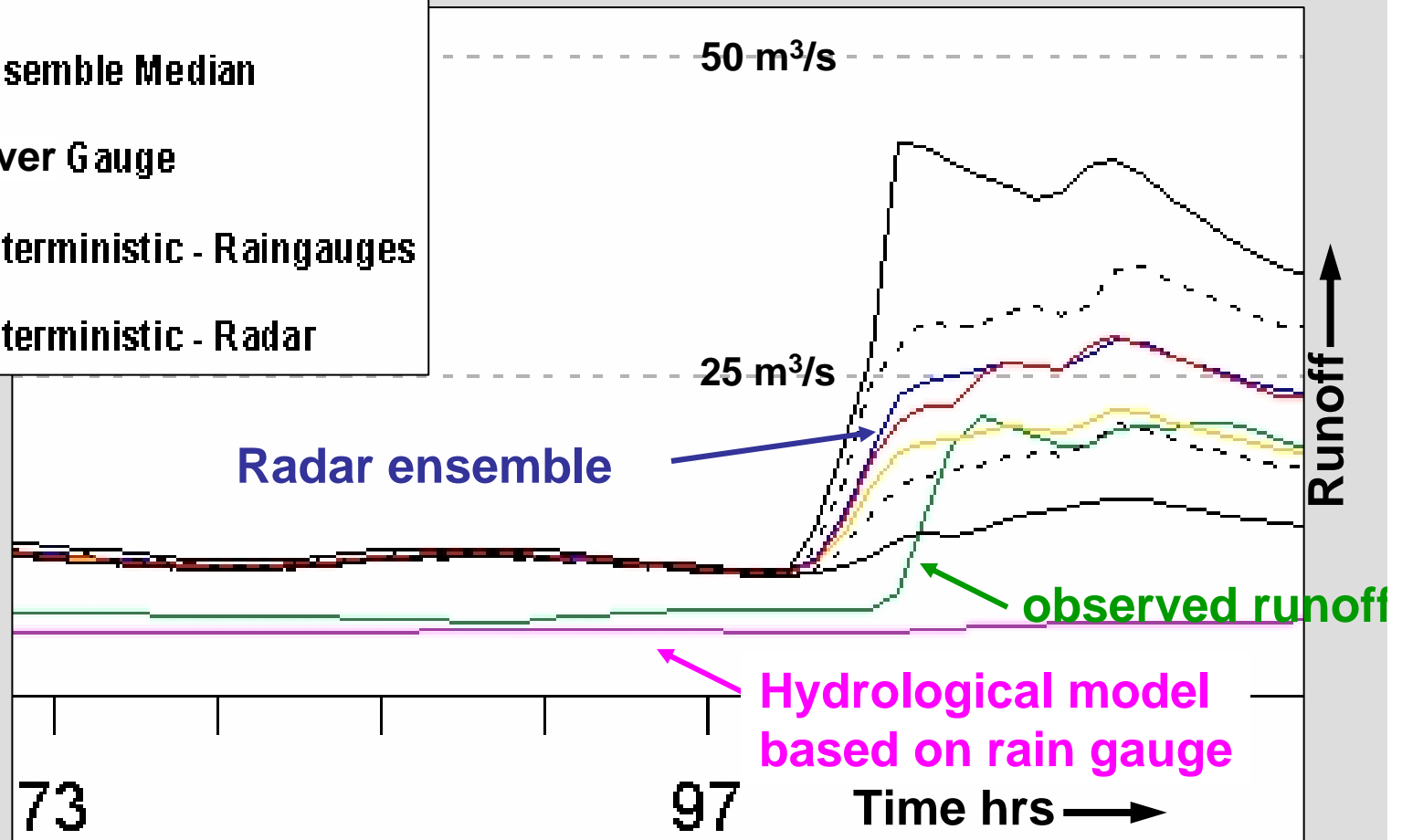


Nowcast run 14 May 2007 (without Frasco)

Radar Ensemble



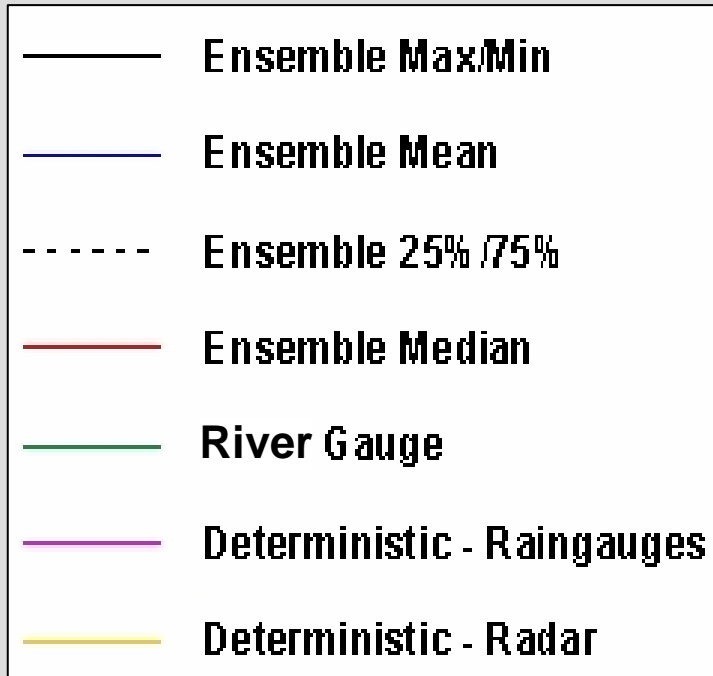
Germann et al, ERAD, 2006 (keynote)
Germann et al, EGU, 2007
Germann et al, AMS Radar Conf, 2007





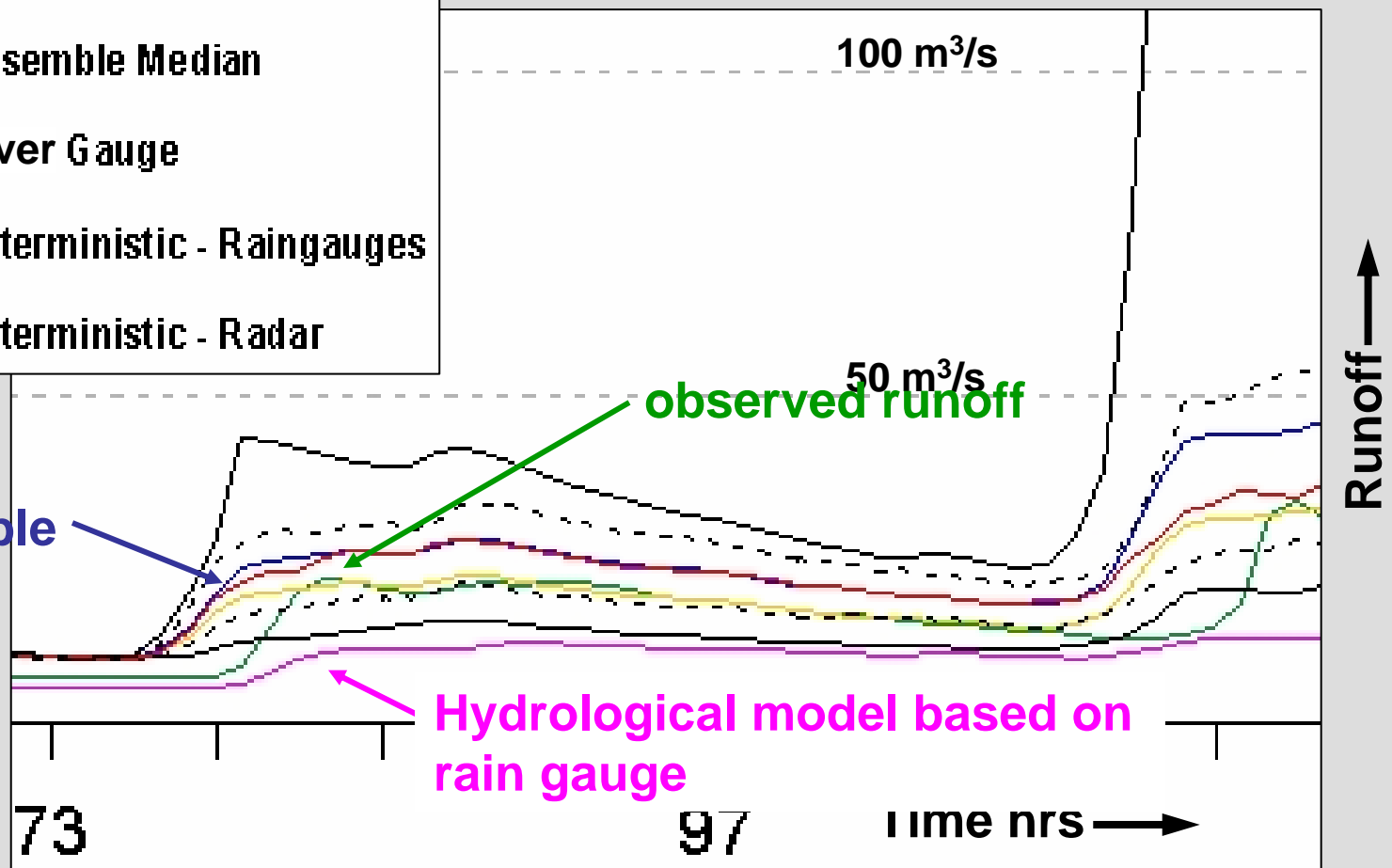
Nowcast run 15 May 2007 (with Frasco)

Radar Ensemble



Germann et al, ERAD, 2006 (keynote)
Germann et al, EGU, 2007
Germann et al, AMS Radar Conf, 2007

Radar ensemble





Nowcasting Instruments

Tool	Domain	Institution
VERA	D-PHASE / COPS Domain	University of Vienna
NWP minus VERA	D-PHASE / COPS Domain	University of Vienna
CLEPS minus Satellite	D-PHASE Domain	DLR





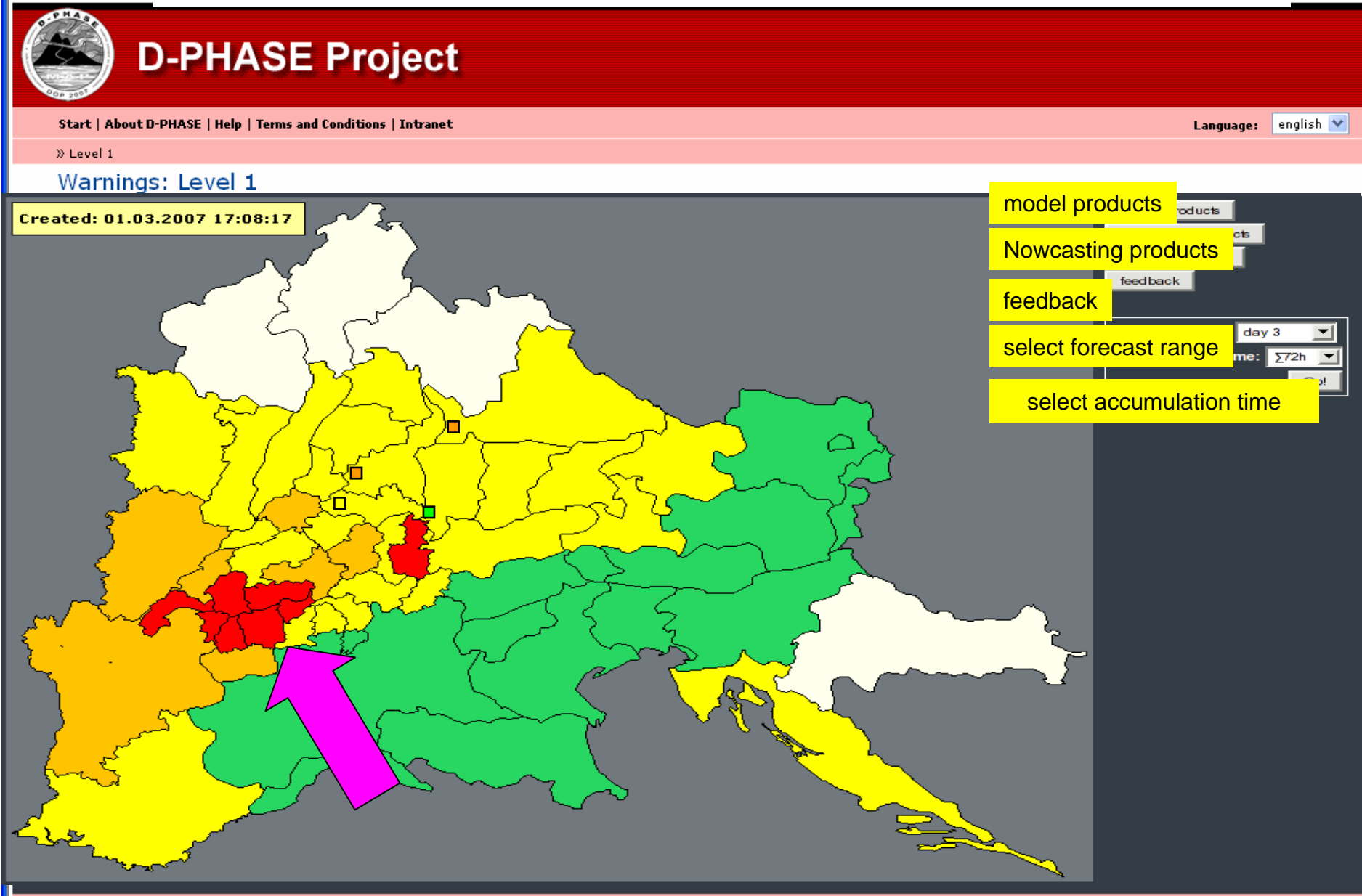
Common (centralised) Platforms

Visualisation Platform (VP):

- to **visualise (display)** all **products** and all **alerts**;
main source of information for forecasters and end users
- **interface** for (some of) the users **to submit** their **feedback** on the available products and alerts, respectively
- realised by Next Generation Software (Salzburg)
- www.d-phase.info
--> pw required



VP, Level 1: Alpine region





VP, Level 2: Alpine sub-region, country



D-PHASE

a WWRP Forecast Demonstration Project

[Start](#) | [About D-PHASE](#) | [D-PHASE alerts](#) | [Terms and Conditions](#) | [Trouble shooting](#) | [Intranet](#)

Language: english

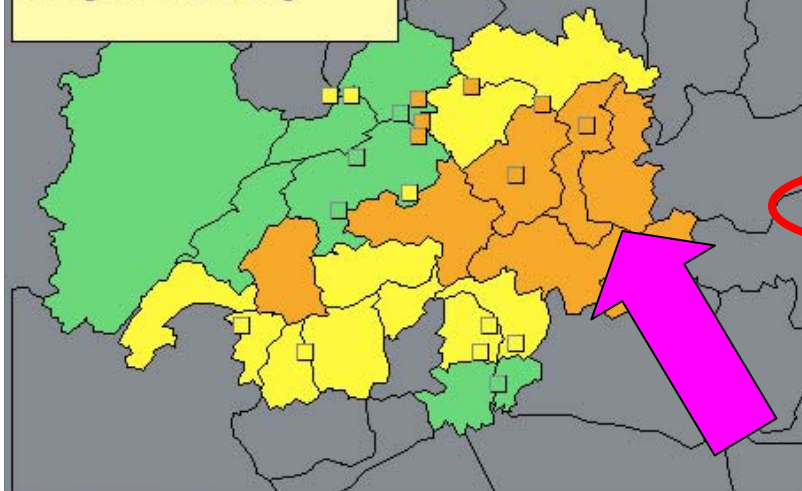
» [Level 1](#) | [Level 2](#)

Disclaimer: D-PHASE generates experimental alerts only. - For official warnings, please consult www.meteoalarm.eu.

Region: Central Alps



Prättigau und Vorarlberg



Day(s) of interest:

today

Accumulation time:

max

Model products:

model products

monitoring products

nowcasting products

feedback

Areaname	CLEPS	LAMEPSAT	CSREPS	MPEPS	PEPS	COSMOCH2	COSMOCH7	LAMI7	LMK	LME	AROME	ALAD
Hochrhein												
Franche Comté												
Leman												
Jura central et ouest												
Alpes Fribourgeois												
Chablais												
Bas Valais												
Oberwallis												
Goms												
Berner Oberland												
Zentraler Alpenordhang												
Linth und Thur												
Surselva und Mittelbünden												
Engadin												
Alpenrhein												
Prättigau und Vorarlberg												
Östlicher Jura												
Zentrales Mittelland												
Östliches Mittelland												

VP, Level 3-a: target area

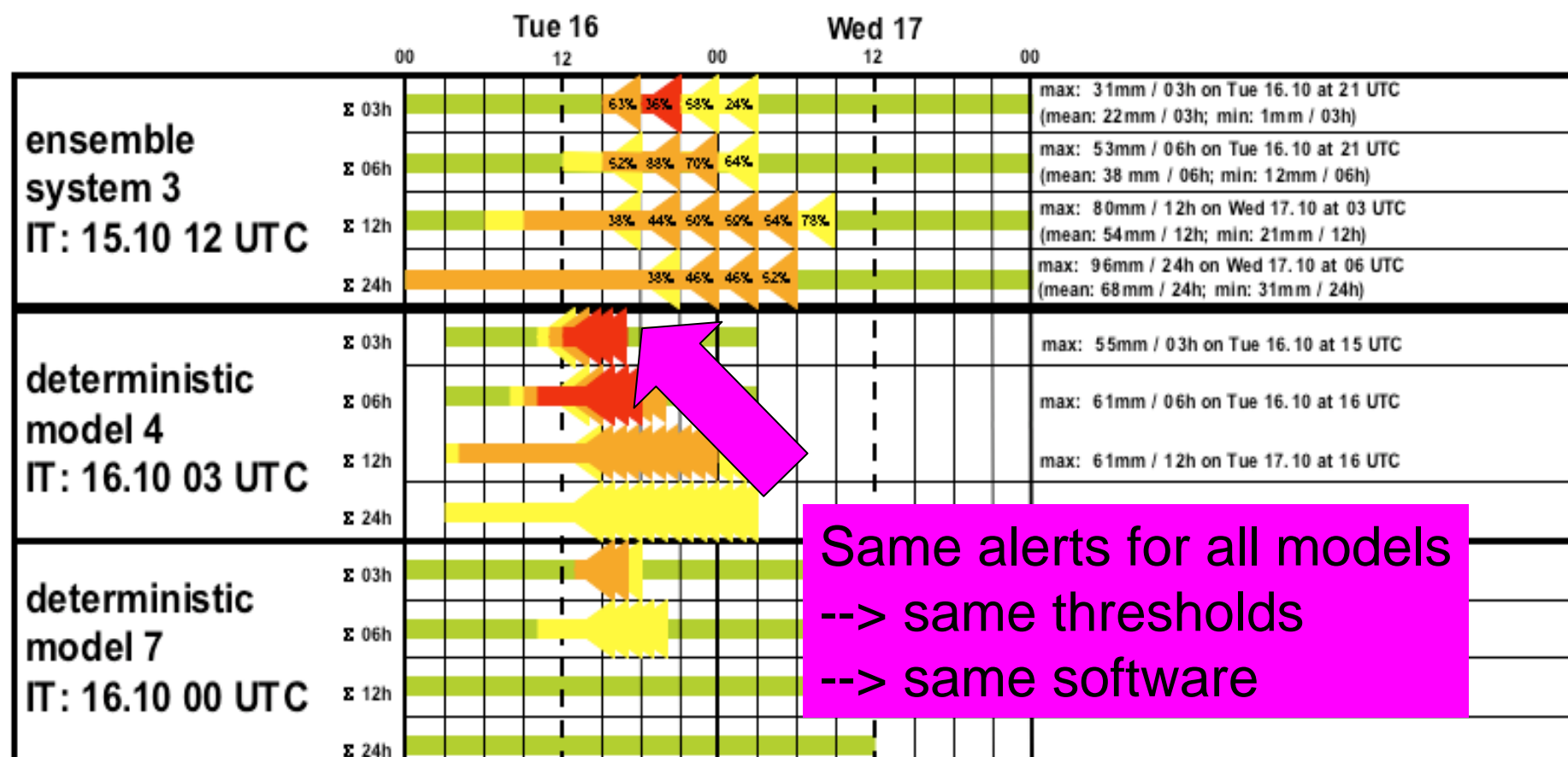


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Language: » [Level 1](#) | [Level 2](#) | [Level 3](#)

Warnings: Level 3a

Area: Alpes Fribourgeois



Same alerts for all models
 --> same thresholds
 --> same software


VP, Level 2: Alpine sub-region, country

The D-PHASE

File Edit View

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Address



today

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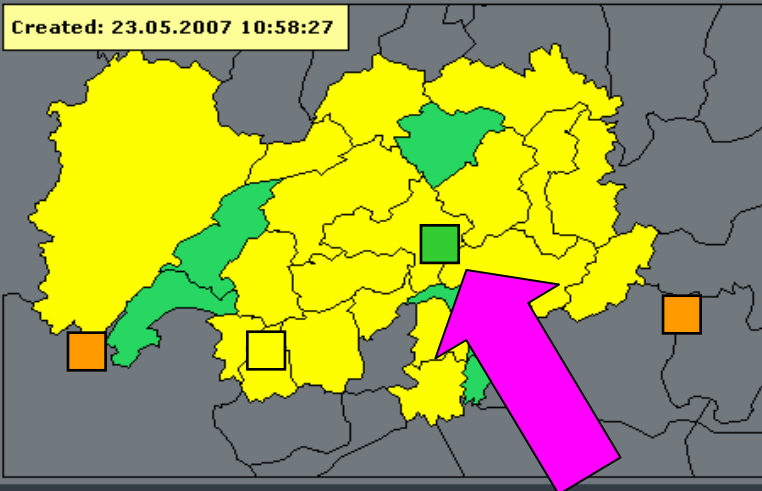
Language: english

» Level 1 | Level 2

Warnings: Level 2

Region: Central Alps

Created: 23.05.2007 10:58:27



model products

nowcasting products

forecast range: today

monitoring products

feedback

accumulation time: max

Areaname	ALADFR	AROME	CLEPS	CMCGEMH	CMCGEML	COSMOCH2	COSMOCH7	ISACMOL	LAMI7	LME	LM
Hochrhein											
Franche Compté											
Lac Lemman											
Jura central et ouest											
Alpes Fribourgeois											
Chablais											
Bas Valais											
Oberwallis											
Goms											
Berner Oberland											
Zentraler Alpennordhang											
Ob- und Nidwalden											
Ob- und Nidwalden											
Engadin											
Alpenrhein											
Prättigau und Vorarlberg											
Östlicher Jura											
Zentrales Mittelland											
Östliches Mittelland											

Internet

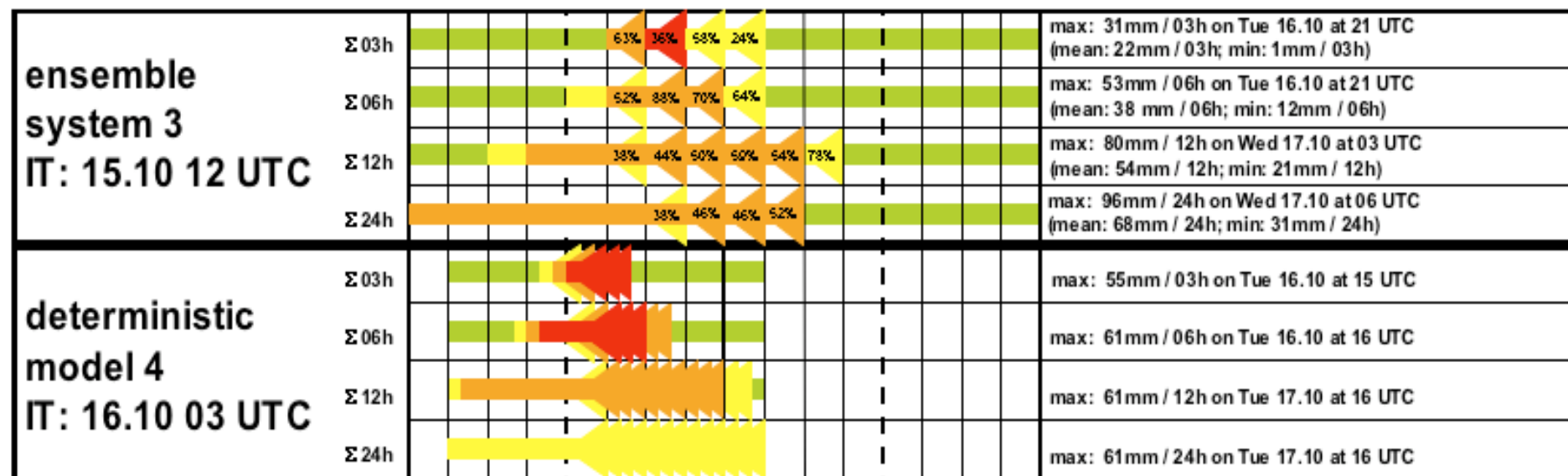
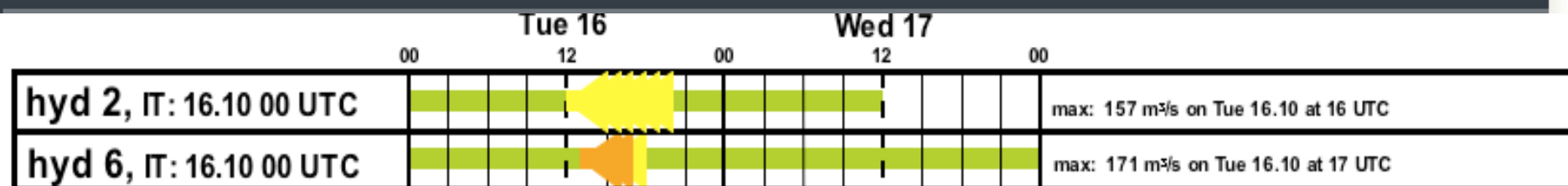


D-PHASE Project

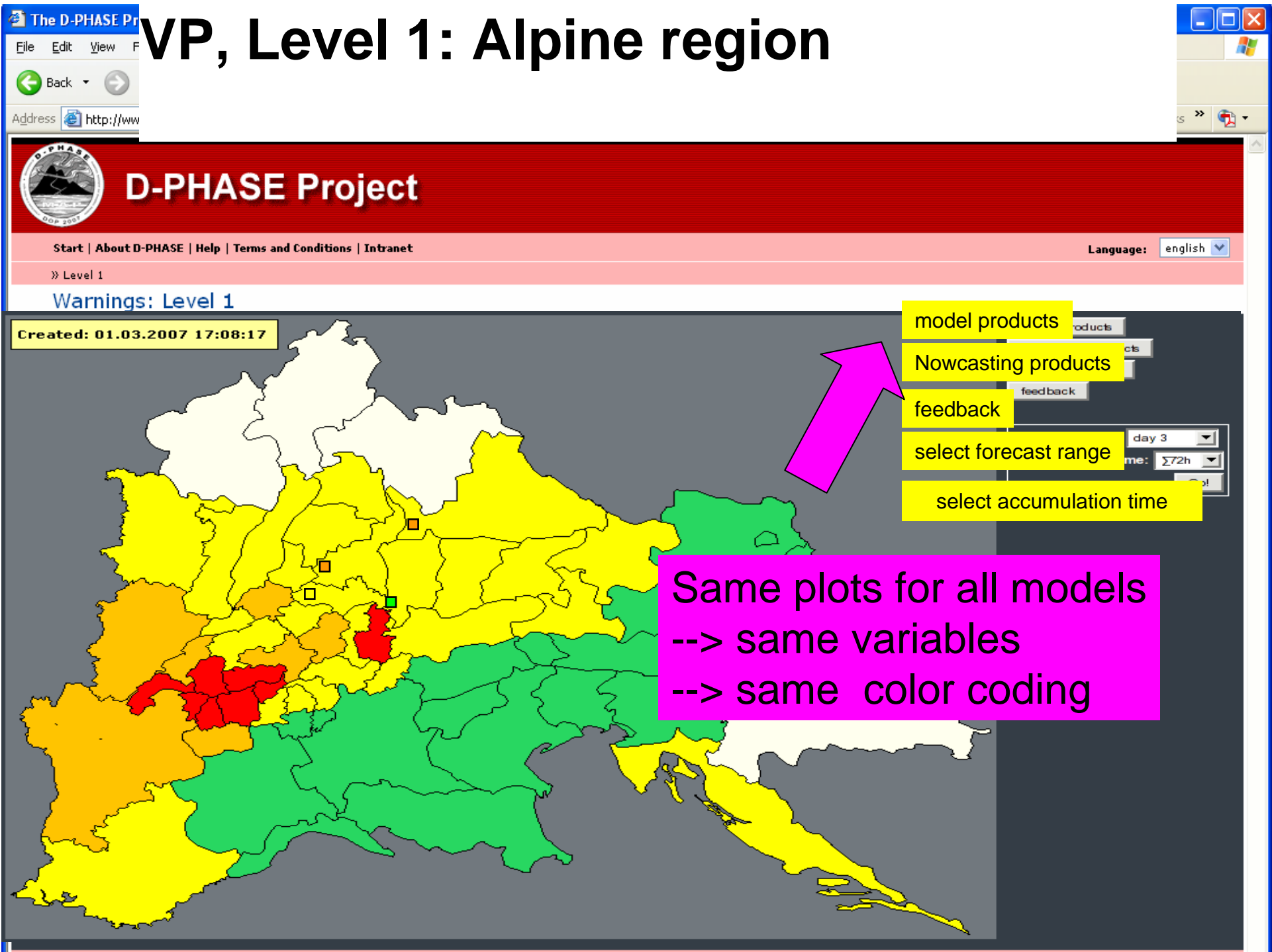
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Language: english» [Level 1](#) | [Level 2](#) | [Level 3](#)

Warnings: Level 3a

Area: Alpes Fribourgeois

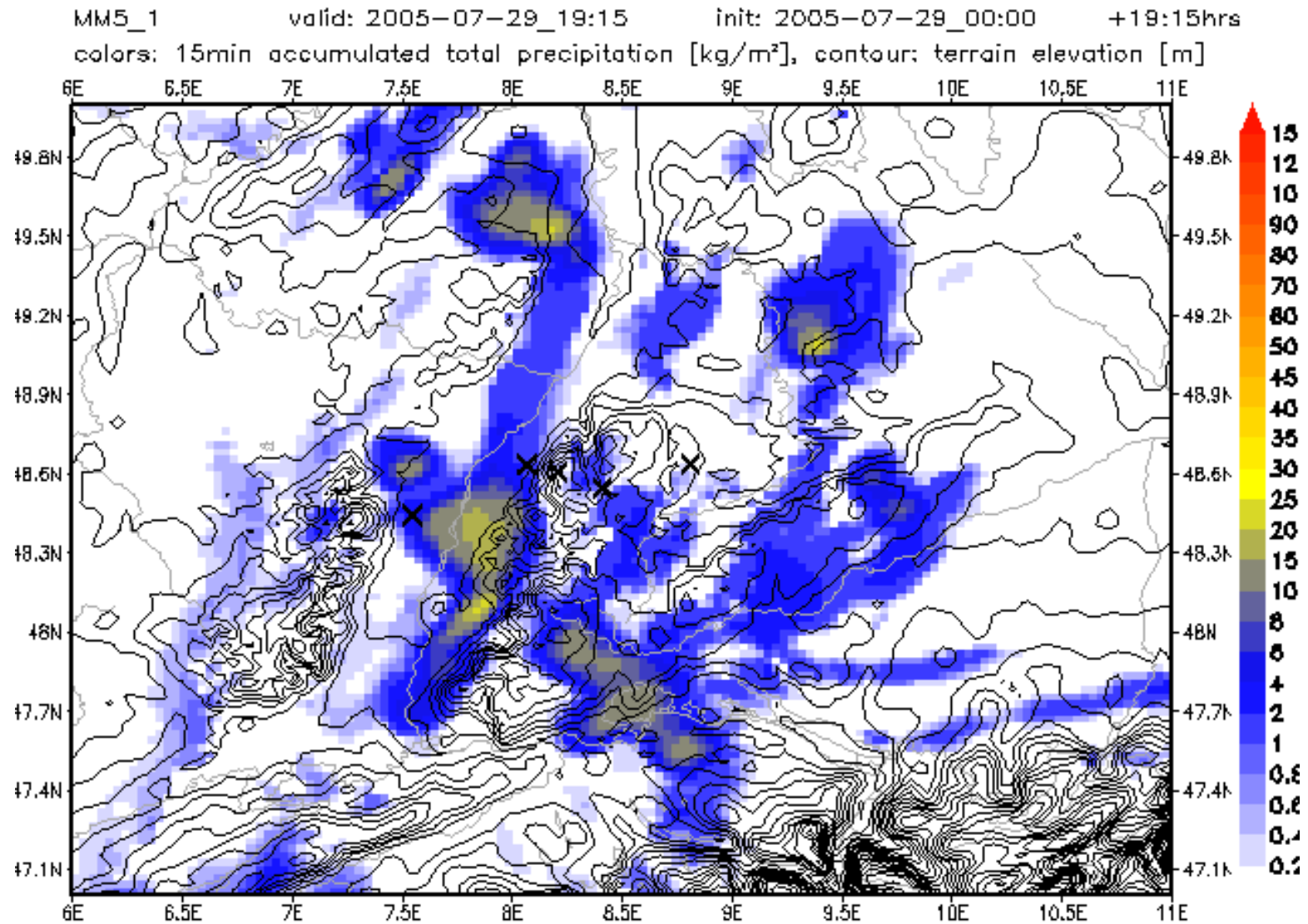


VP, Level 1: Alpine region





Joint visualisation - thanks to COPS

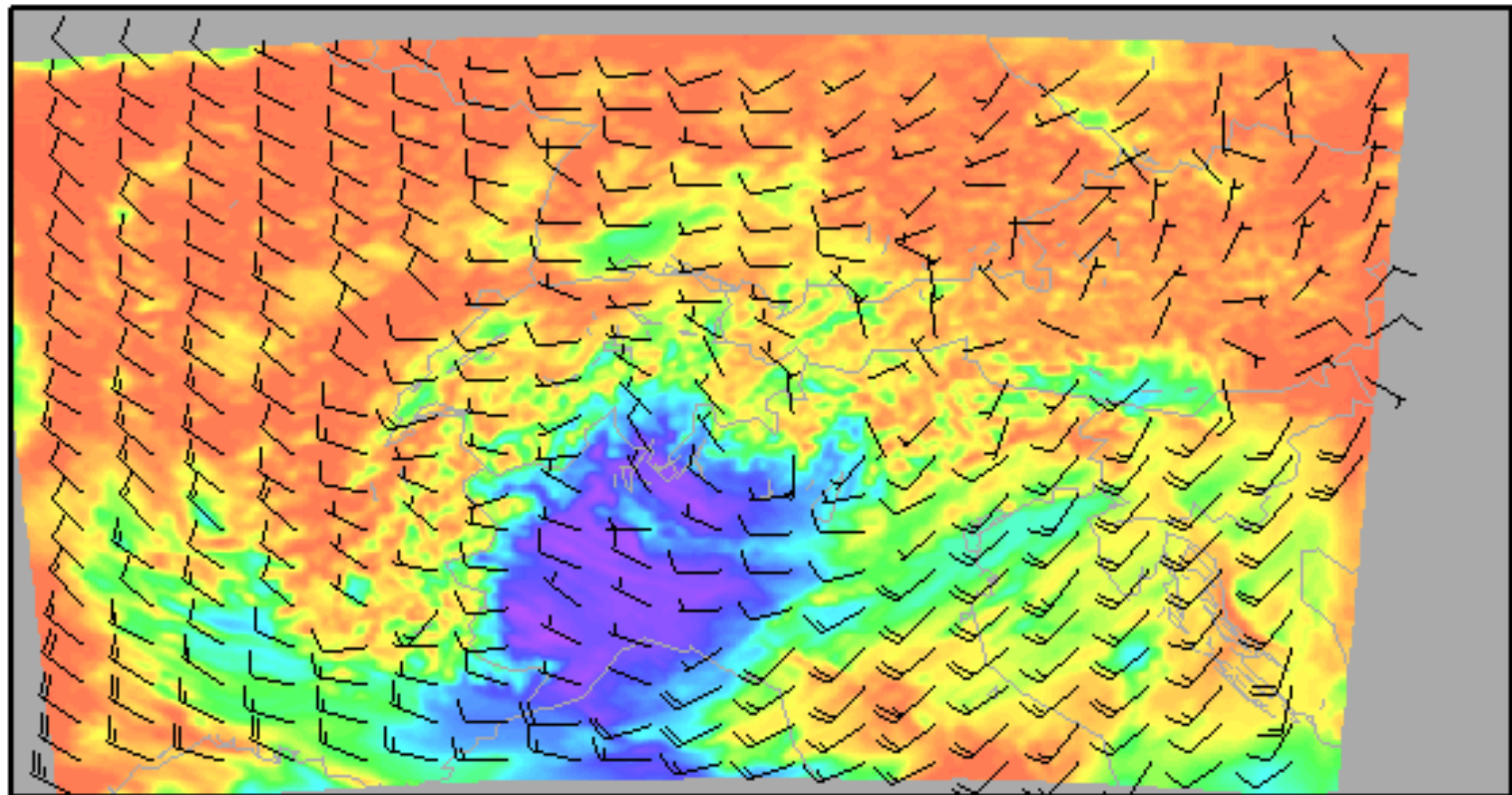


15 min accumulated precipitation



Joint visualisation - thanks to COPS

COSMOCH2 valid: 2007-03-19_12:00 init: 2007-03-19_00:00 +12:00hrs
colors: 850hPa relative humidity [%], vector: 850hPa horizontal wind vector



23-03-07
MAP D-PHASE Copyright

contact: Tmt

Relative humidity, 850 hPa wind



Common (centralised) platforms

Data Archive (DA)

- to **archive** all **data**, **alerts**, and **feedbacks**; **mainly for verification purposes**
- also stores all COPS and GOP data
- physically based at the MPI in Hamburg





Summary

- End-to-end modelling system
- ‘who’s who’ in the high-resolution / probabilistic modelling world
- Probabilistic modelling of hydrological processes
- Large number of end users
- Data set for model verification / feedback evaluation





Thank you for your attention!






Feedback by Forecasters

- Helped to design **Visualisation Platform**
- Evaluation by forecasters
 - > daily
 - > weather type, type of event,
 - > 'what did I use?'
 - > 'what did support me?'
- Analogue feedback by end users



Feedback by Forecasters

The D-PHASE
File Edit View
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Address


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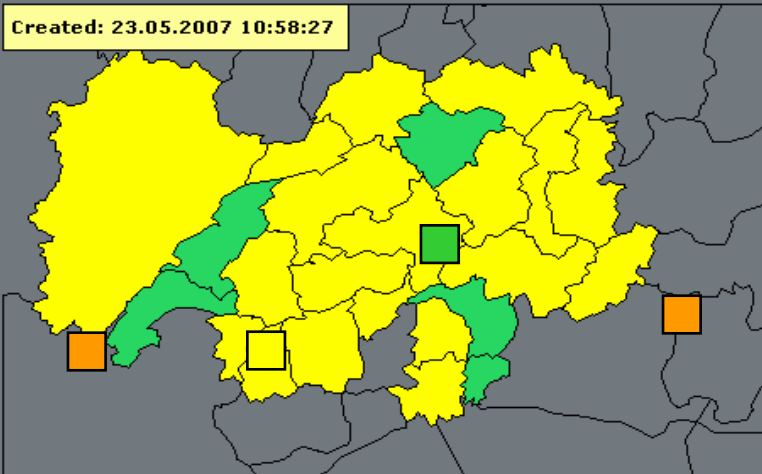
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Language: english

» Level 1 | Level 2

Warnings: Level 2

Region: Central Alps

Created: 23.05.2007 10:58:27


model products
nowcasting products

monitoring products
feedback

forecast range: today
accumulation time:


Areaname	ALADFR	AROME	CLEPS	CMCGEMH	CMCGEML	COSMOCH2	COSMOCH7	ISACMOL	LAMI7	LME	LM
Hochrhein											
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Prättigau und Vorarlberg											
Östlicher Jura											
Zentrales Mittelland											
Östliches Mittelland											



Feedback by Forecasters

http://www.d-phase.info - The D-PHASE Project - Microsoft Internet Explorer

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 **D-PHASE Project**

Evaluation Protocol

Part I. General Questions

Forecaster, Forecast Center

☒ Marco Stoll
☐ MeteoZürich
☐ MeteoLocarno
☐ MeteoGenève


Target Areas

☒ Alpenrhein
☐ Alpes Fribourgeoises
☐ Alpi Piemontesi
☐ Alsace
☐ Alto Adige - Südtirol
☐ Bas Valais
☒ Berner Oberland
☒ Bodensee
☐ Burgenland
☐ Central Slovenia
☐ Chablais
☐ Donau
☐ Donau BW
☐ Dummy 1
☐ Dummy 2
☐ East Slovenia
☐ Emilia Romagna
☐ Engadin
☐ Franche Compté

Done

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 **D-PHASE Project**

Evaluation Protocol

II. Questions addressing the weather situation

Synoptic weather situation

☐ N ☐ NE ☐ E ☐ SE ☐ S ☐ SW ☐ W ☐ NW
☐ Vb ☐ H ☐ L ☐ saddle ☐ through ☐ cut off
☐ cyclonic ☐ anticyclonic ☐ indifferent

remarks:

Weather System

☐ cold front ☐ warm front ☐ occlusion ☐ converg
☐ through line ☐ isolated thunderstorm ☐ station
☐ MCS ☐ Stau ☐ other

remarks:

Type of event

☐ light precipitation ☐ moderate precipitation ☐ h
☐ flooding ☐ snowfall ☐ other

remarks:

Phase of event

☐ pre-phase of event ☐ event in progress ☐ ever

Alarms issued

☐ precipitation ☐ thunderstorm ☐ wind ☐ heat
☐ frost ☐ road icing ☐ other

remarks:


Special remarks on precipitation

short description of spatial and/or temporal distribution

Done

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 **D-PHASE Project**

Evaluation Protocol

III. Questions addressing the model guidance

Questions with * aim at a direct comparison of different model systems used during the forecast process and chosen in part I of the questionnaire. These are single choice questions.

Questions with ** address the whole bundle of MAP D-PHASE model data available to the forecasters as well as its use in the forecast process. These are multiple choice questions.

Overall model guidance *

model:

☐ very good guidance, very useful
☐ good guidance, useful
☐ rather poor guidance, misleading
☐ very poor guidance, very misleading

remarks:

Additional benefit of the higher resolution models *

model:

☐ added value
☐ no added value
☐ poorer guidance as compared to global/coarse mesh

remarks:

Additional benefit of the ensemble prediction systems *

model:

☐ added value
☐ no added value
☐ poorer guidance as compared to global/coarse mesh

Done

Internet



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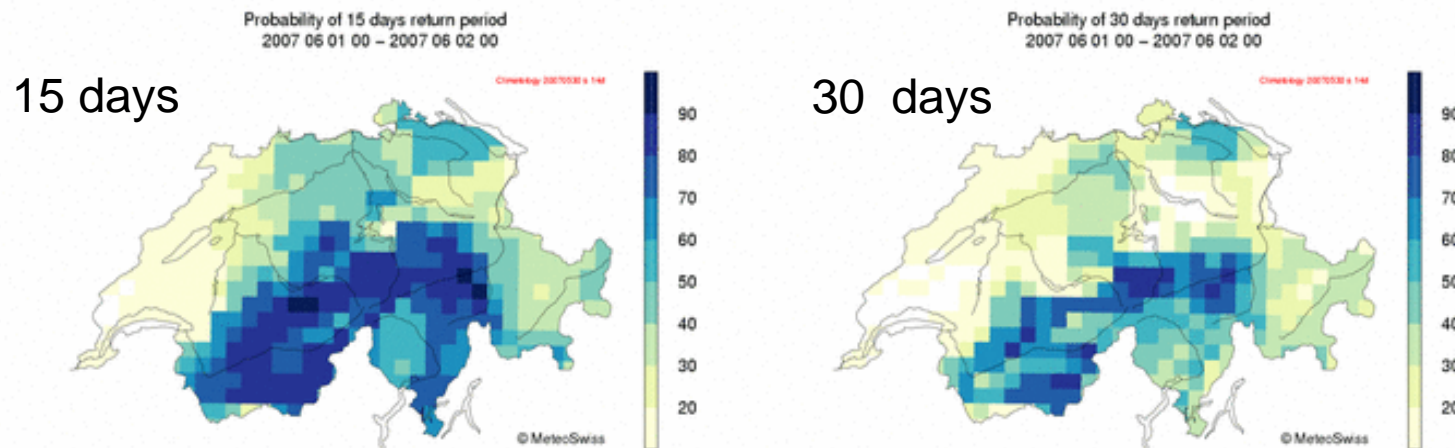
Additional guidance to Forecasters

- Alerts from COSMO-LEPS: probabilities
- Additionally: return periods
- If the model has ,extreme‘ precipitation
 - > 100mm/24h, say:
 - > is it an extreme *model event*?
 - > concept based on Extreme Forecast Index (EFI)
- **Model-climatology**
 - > for each day
 - > seasonality and location
 - > daily updated
 - > on the VP

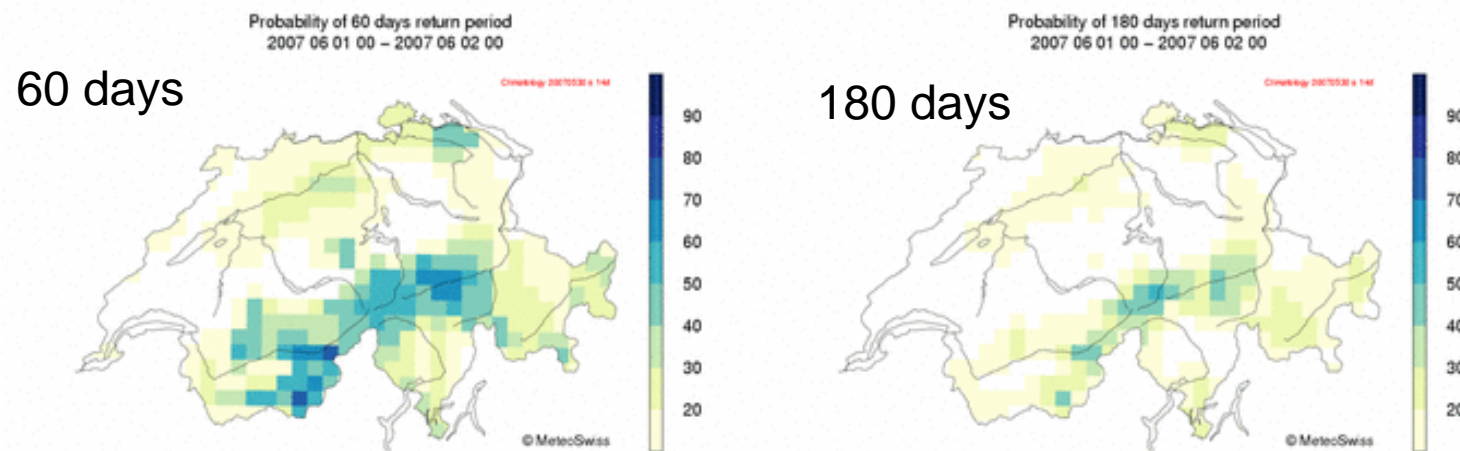




Return periods COSMO-LEPS



Probability for 24h precipitation sum to be larger than the n-day maximum in the model climatology





Analysis and verification

- Prior to D-PHASE
 - > model testing, sensitivity, etc.
 - > MAP cases (and others)
- Real time evaluation
 - > VERA (University of Vienna)
- Analysis of interesting cases
 - > all participants
 - > *post festum*
- Objective vs. subjective verification
 - > *post festum*





Summary

- End-to-end modelling system
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