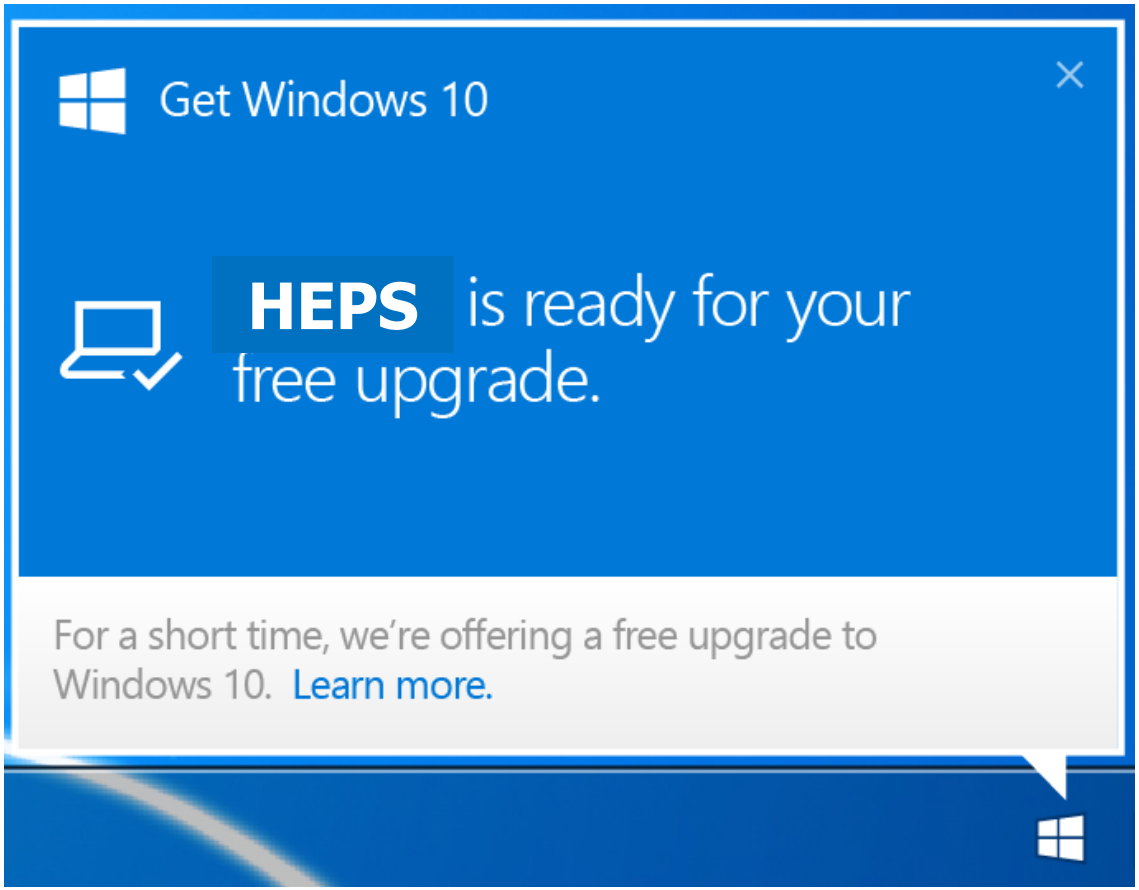
"UPGRADED" METEOROLOGICAL FORCING FOR OPERATIONAL HYDROLOGICAL ENSEMBLE PREDICTIONS: CHALLENGES, RISKS AND CHANCES



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The challenges of real-time HEPS operations

Challenges of Operational River Forecasting

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ABSTRACT

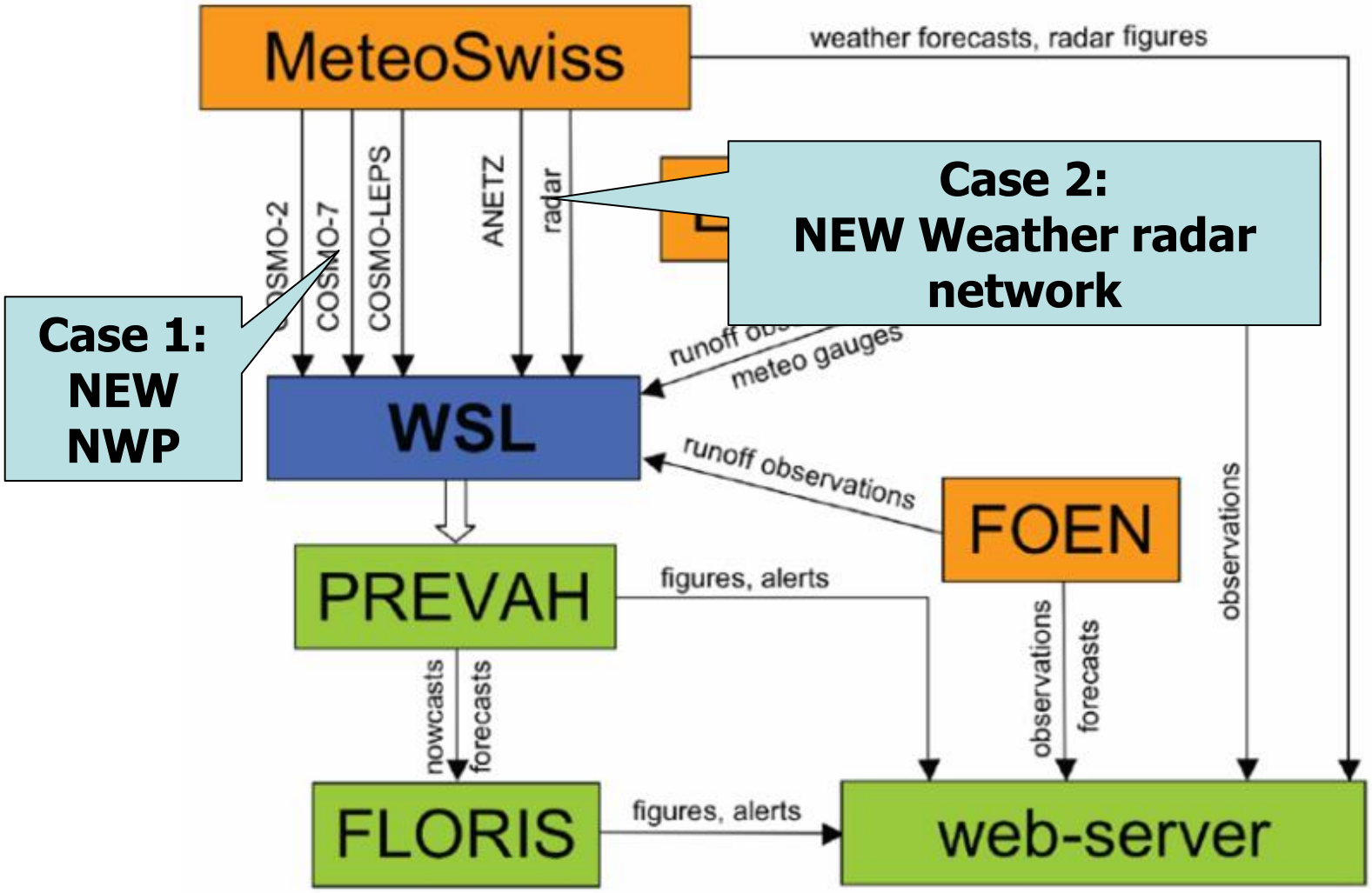
Skillful and timely streamflow forecasts are critically important to water managers and emergency protection services. To provide these forecasts, hydrologists must predict the behavior of complex coupled human–natural systems using incomplete and uncertain information and imperfect models. Moreover, operational predictions often integrate anecdotal information and unmodeled factors. Forecasting agencies face four key challenges: 1) making the most of available data, 2) mak[illegible] 3) turning hydrometeorological forecasts into effective warnings, service. Each challenge presents a variety of research opportunitie[illegible] mated quality-control algorithms for the myriad of data used in operational streamflow forecasts, data assimilation, and ensemble forecasting techniques that allow for forecaster input, methods for using human-generated weather forecasts quantitatively, and quantification of human interference in the hydrologic cycle. Furthermore, much can be done to improve the communication of probabilistic forecasts and to design a forecasting paradigm that effectively combines increasingly sophisticated forecasting technology with subjective forecaster expertise. These areas are described in detail to share a real-world perspective and focus for ongoing research endeavors.

Administering an operational service

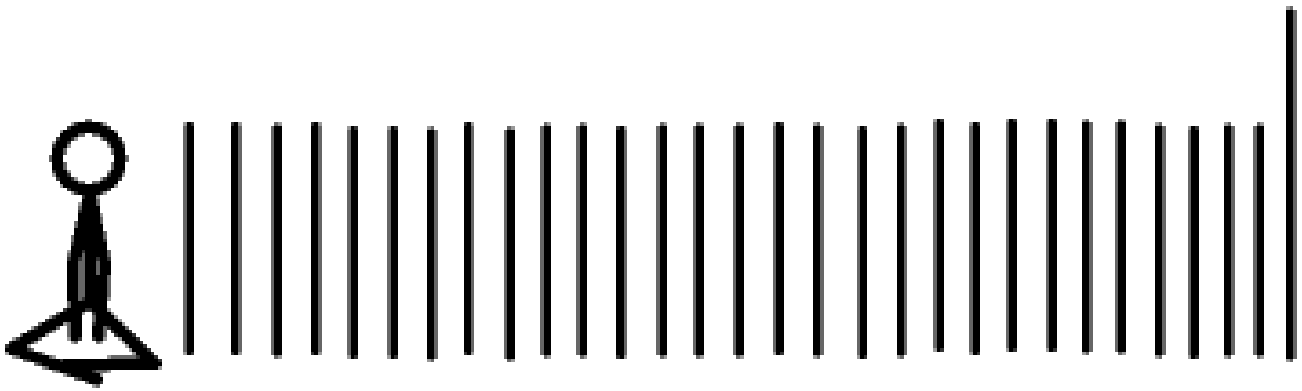
The challenges of real-time HEPS operations

- Get an hydrological model ?
- Calibrating it ?
- Feed it with numerical forecasts ?
- Get the data-flow-working ?
- Archiving the forecasts ?
- **Cope with changes of forcing data?**
- Communicate with Endusers?
- Get funding for all of the above ?

Our foecasting chain



What does it mean for us as small team operating HEPS?



NWP at MeteoSwiss: 2010-2016

ECMWF IFS-HRES (global)

- 16 km, 137 levels

COSMO-7 (regional)

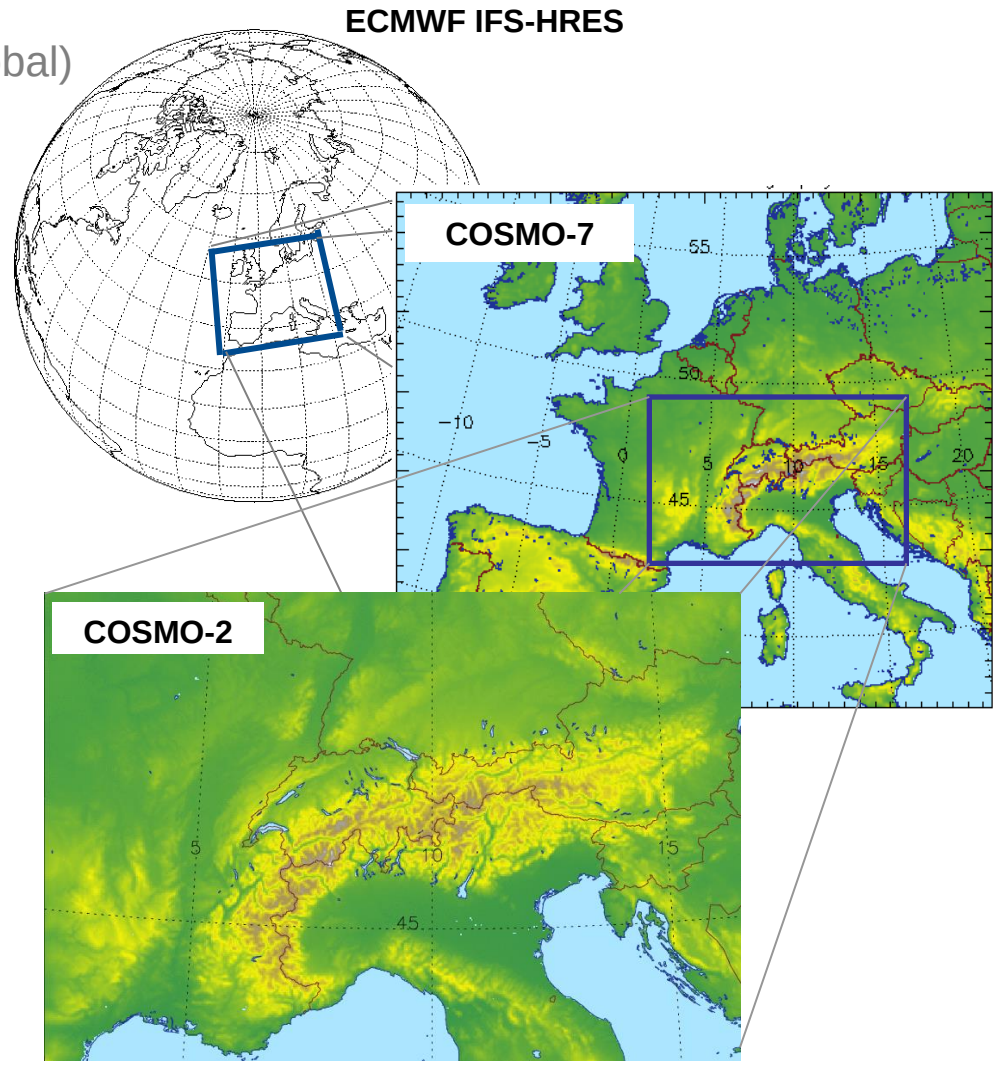
- 6.6 km, 60 levels
- +72h, 3x per day

COSMO-2 (local)

- 2.2 km, 60 levels
- +33h, 8x per day

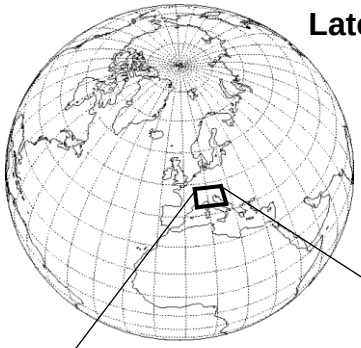
on-demand mode

- *+6h, hourly*

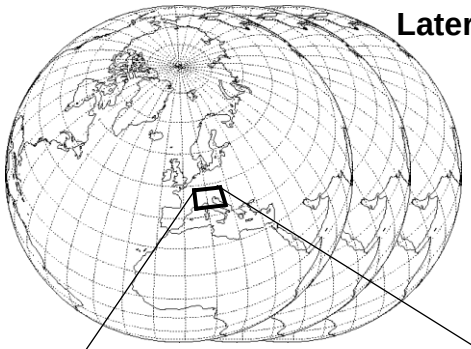


Slide from A. Walser, Meteoswiss

NWP at MeteoSwiss: 2015-20??

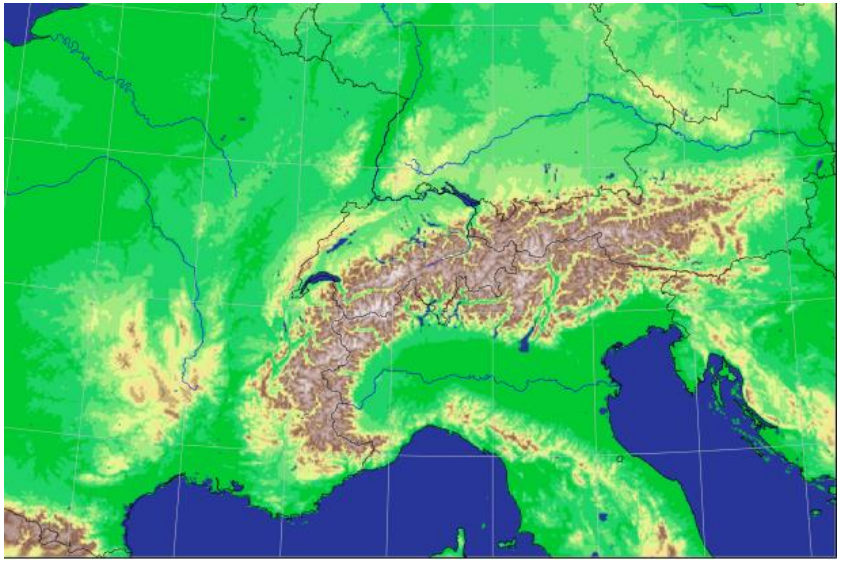


Lateral boundary conditions:
IFS-HRES
16km (10km)
4x per day

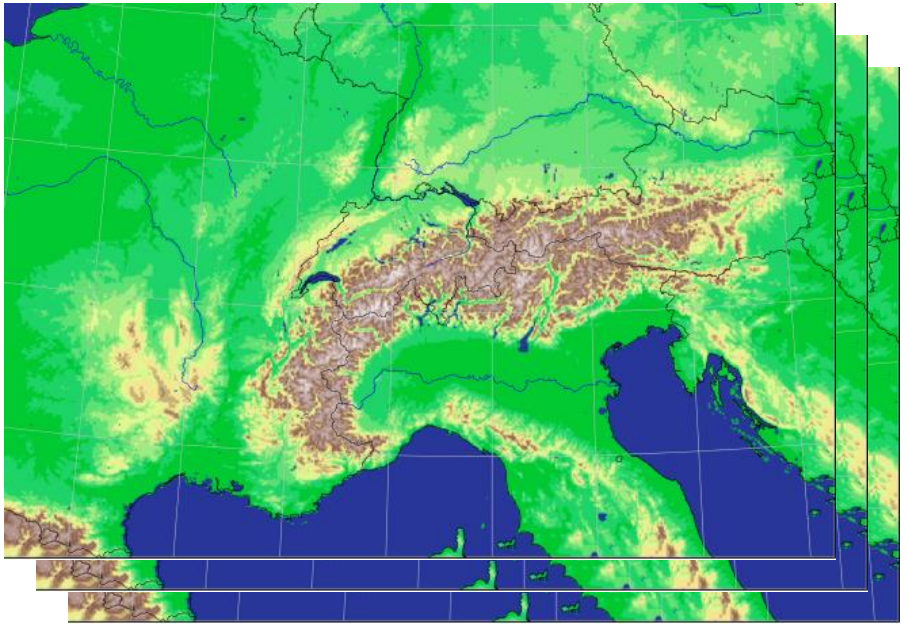


Lateral boundary conditions:
IFS-ENS
32km (20km)
2x per day

COSMO-1: 33/45 h forecasts, 8x per day
1.1km grid size (convection permitting)

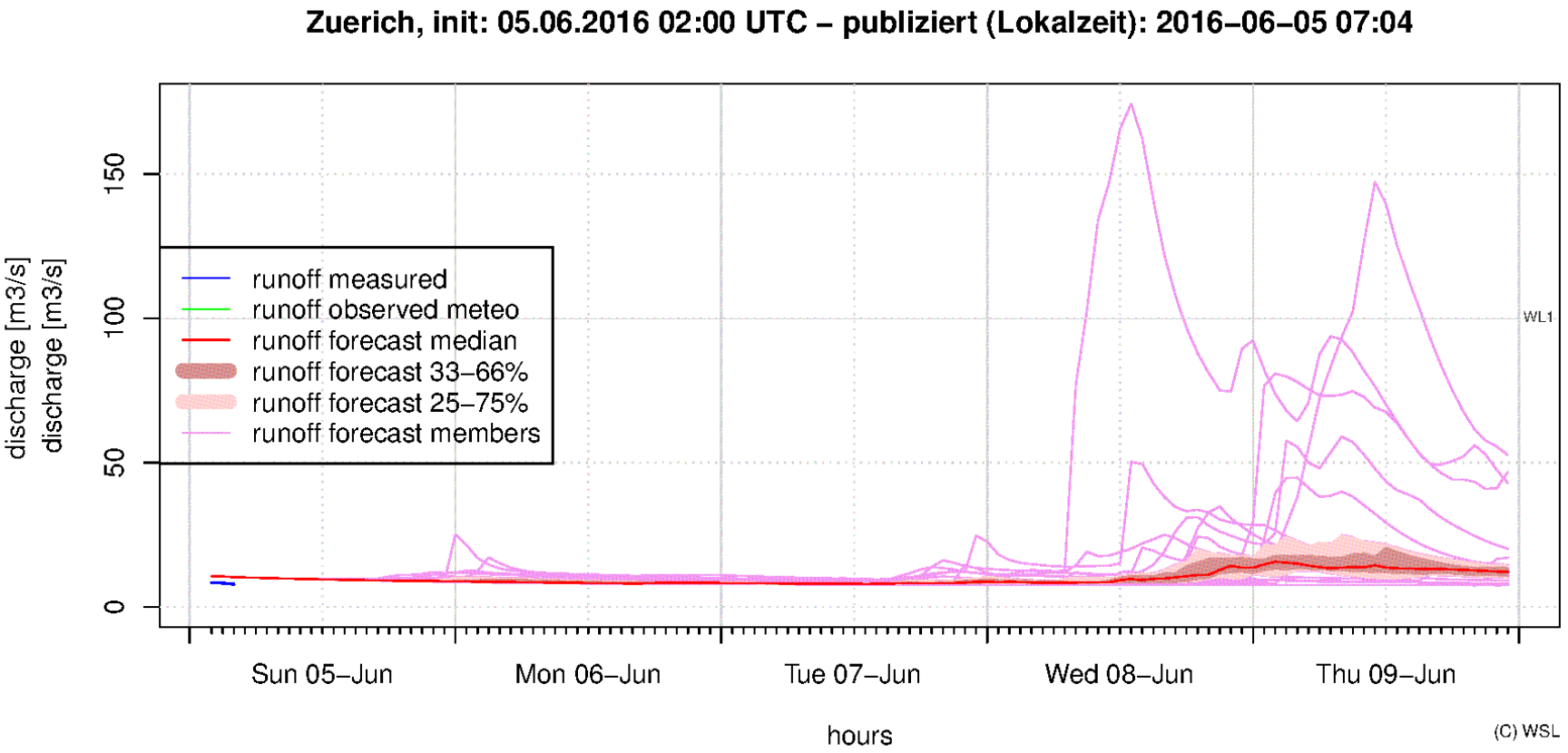


COSMO-E: 120 h forecasts 2x per day
2.2km grid size (convection permitting)
21 ensemble members



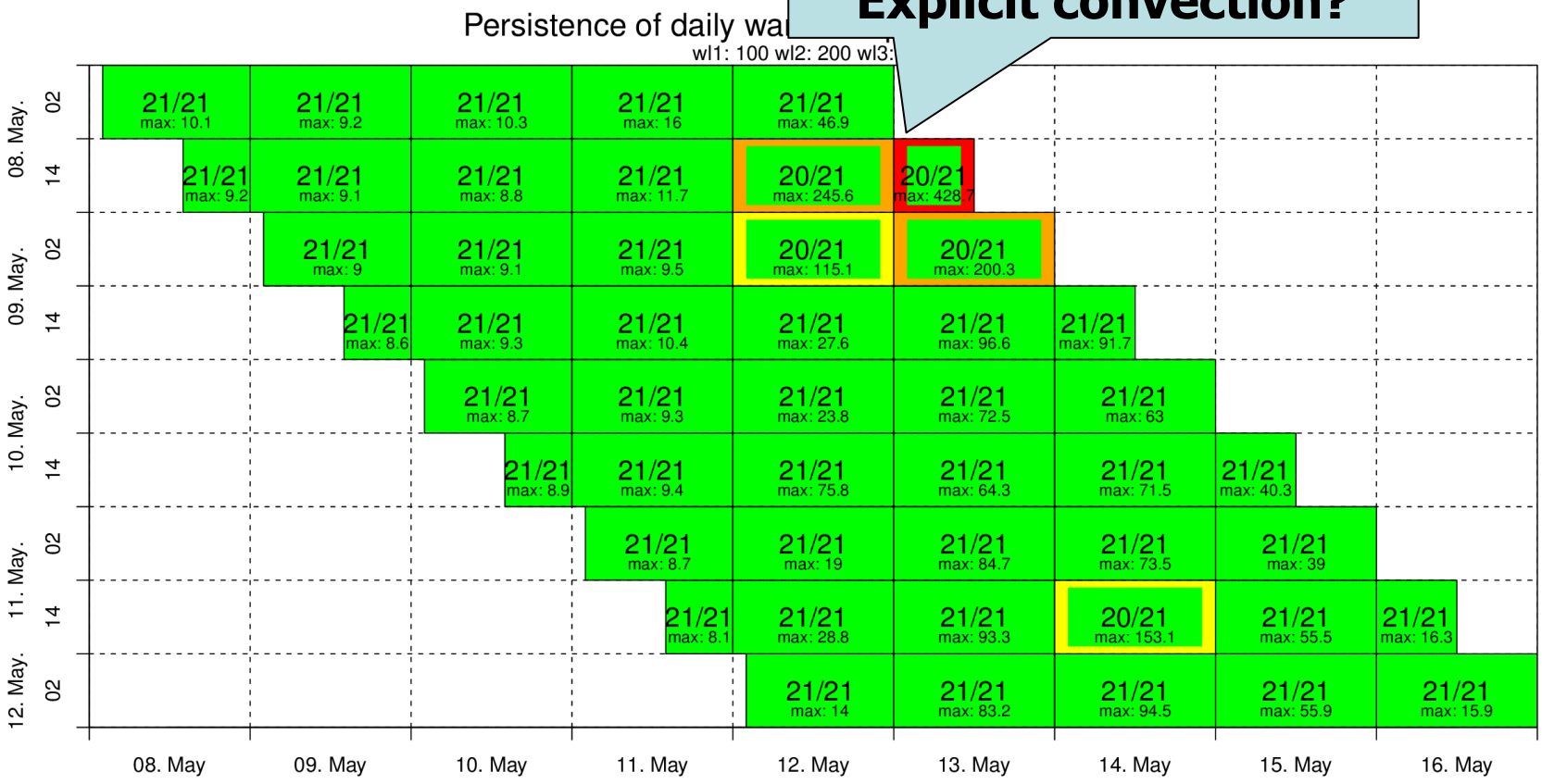
Slide from A. Walser, Meteoswiss

Recent forecast

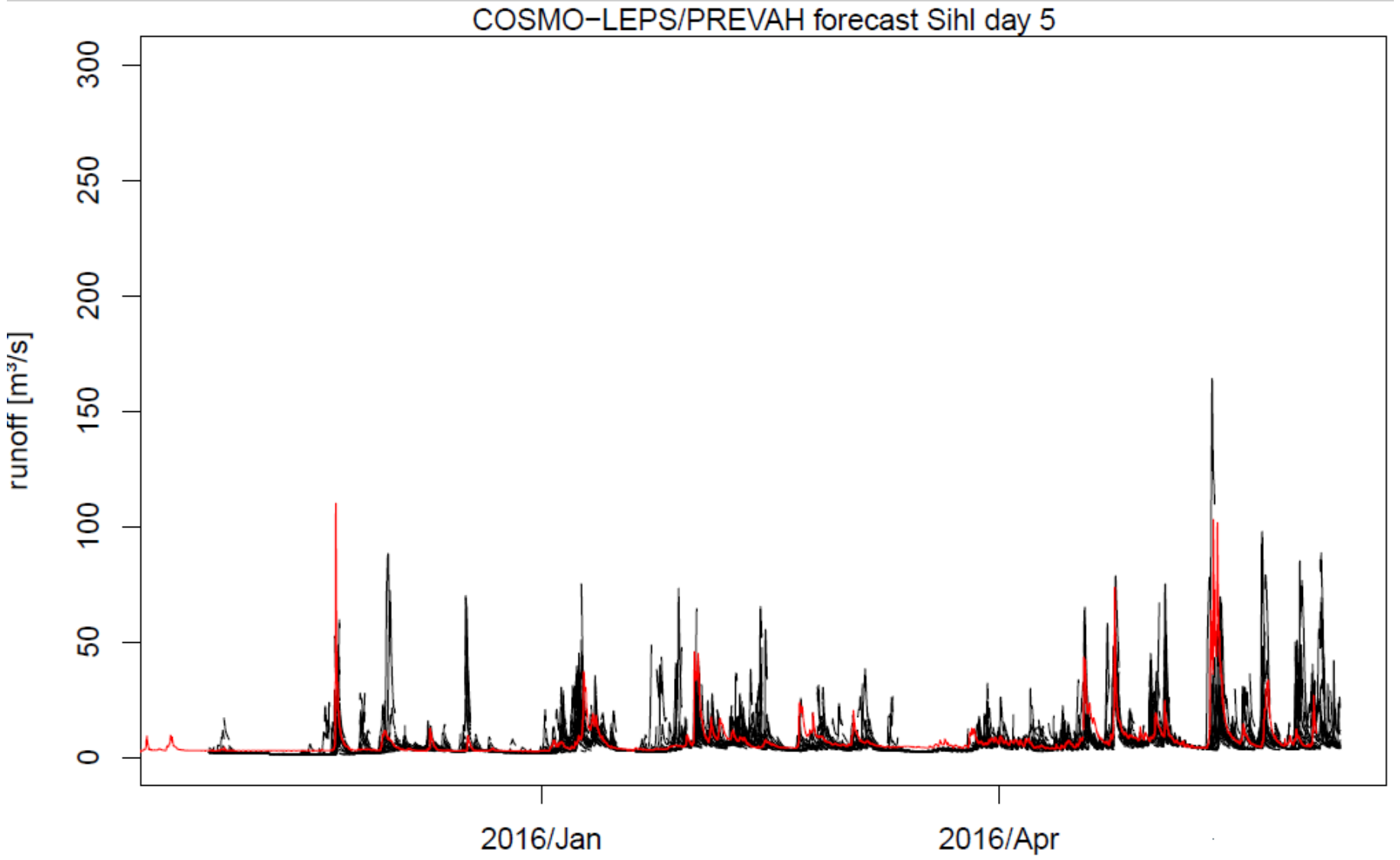


Recent persistence plots

21 members … more «crazy members» Explicit convection?



Day-5 Forecasts parallel operations

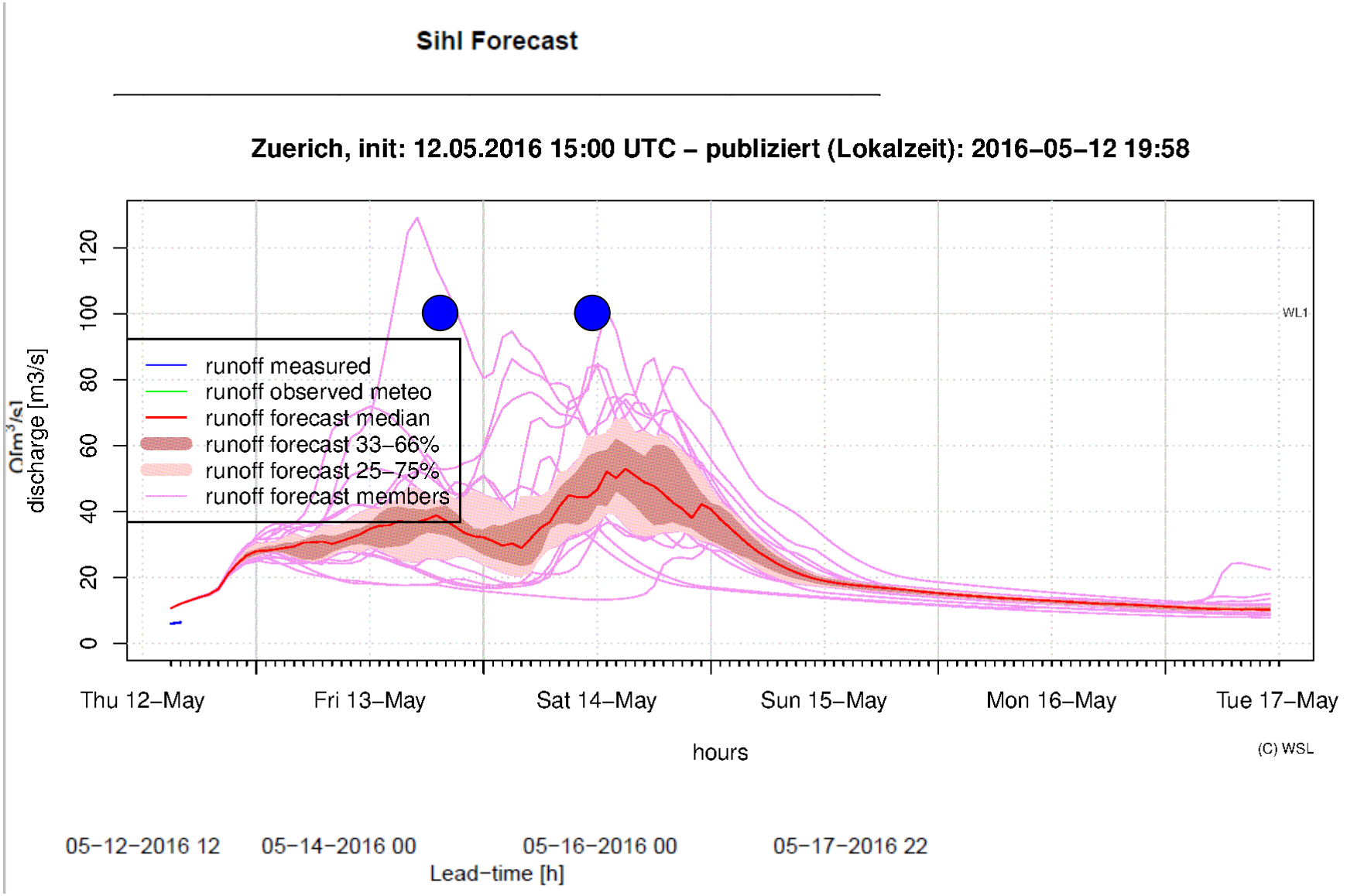


Verification: Correlation

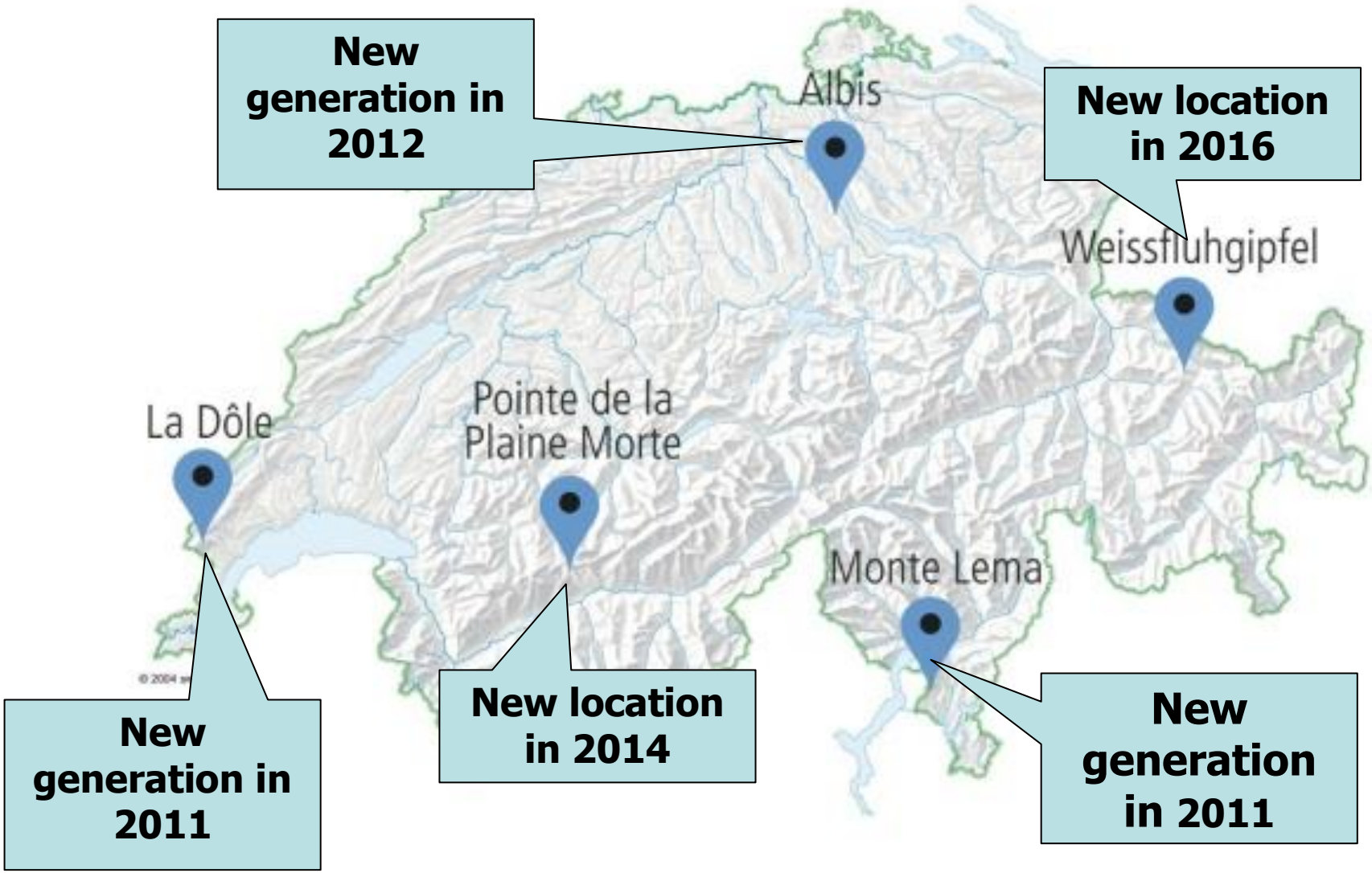
		2010-2014	22.10.15 / 3.6.2016
C-LEPS	Day 1	0.83	0.92
	Day 2	0.62	0.65
	Day 3	0.52	0.53
	Day 4	0.44	0.4
	Day 5	0.29	0.43
C -7	Day 1	0.86	0.89
	Day 2	0.58	0.78
	Day 3	0.42	0.59
C -2	Day 1	0.86	0.9

		22.10.15 / 3.6.2016
C-E	Day 1	0.89
	Day 2	0.68
	Day 3	0.61
	Day 4	0.47
	Day 5	0.39
C -1	Day 1	0.92

Post-processing: need of long training period!



Weather radar at MeteoSwiss:



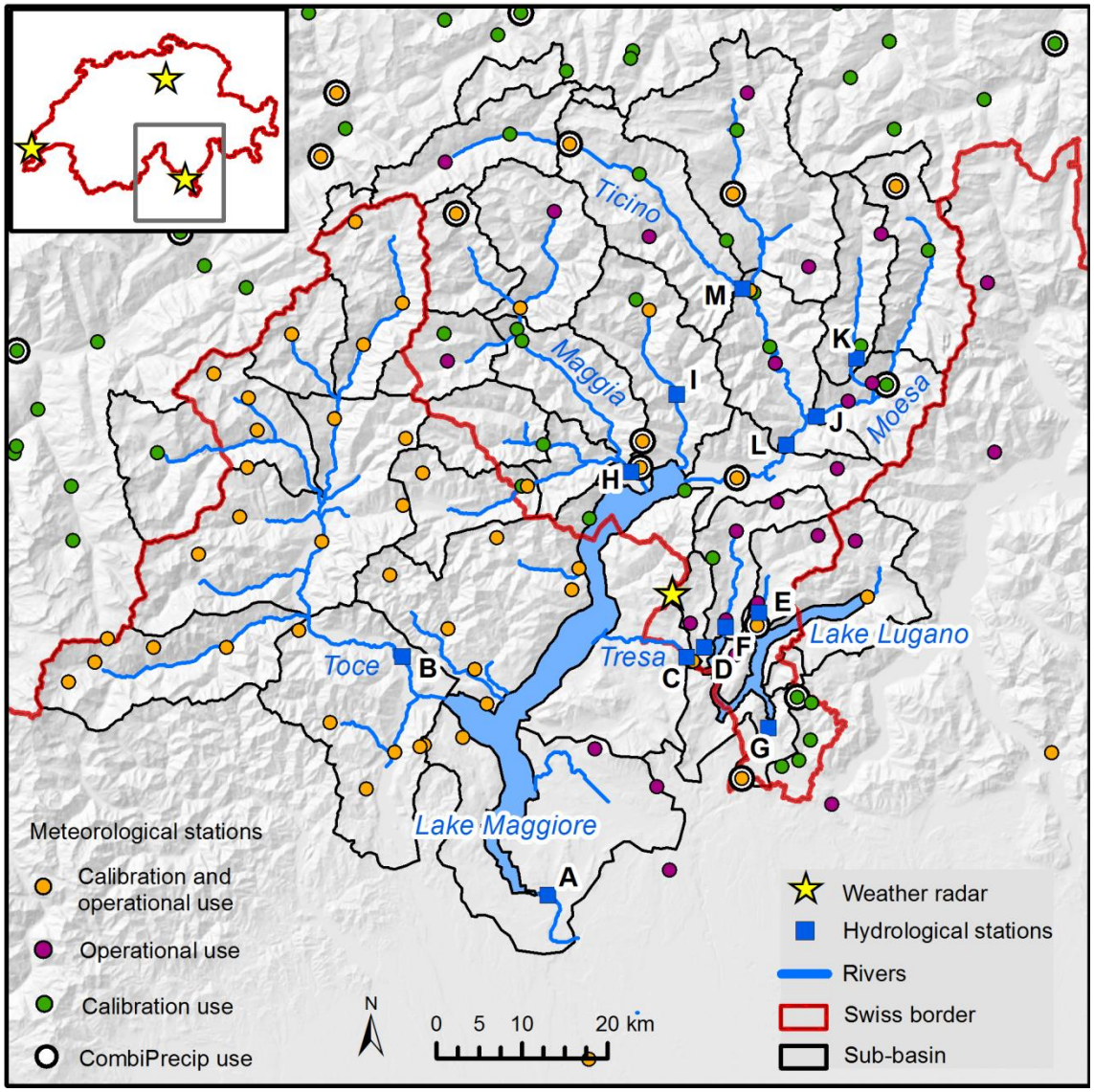
Precipitation Data

- Interpolated rain gauge data, full network
- CombiPrecip:
  - Combined radar – rain gauge data
  - developed by MeteoSwiss
  - using spatio-temporal co-kriging with external drift
- Calibration period: 01.01.2005 – 31.12.2009
- Validation period: 01.01.2010 – 31.12.2013
- Real-Time data experiment 2013

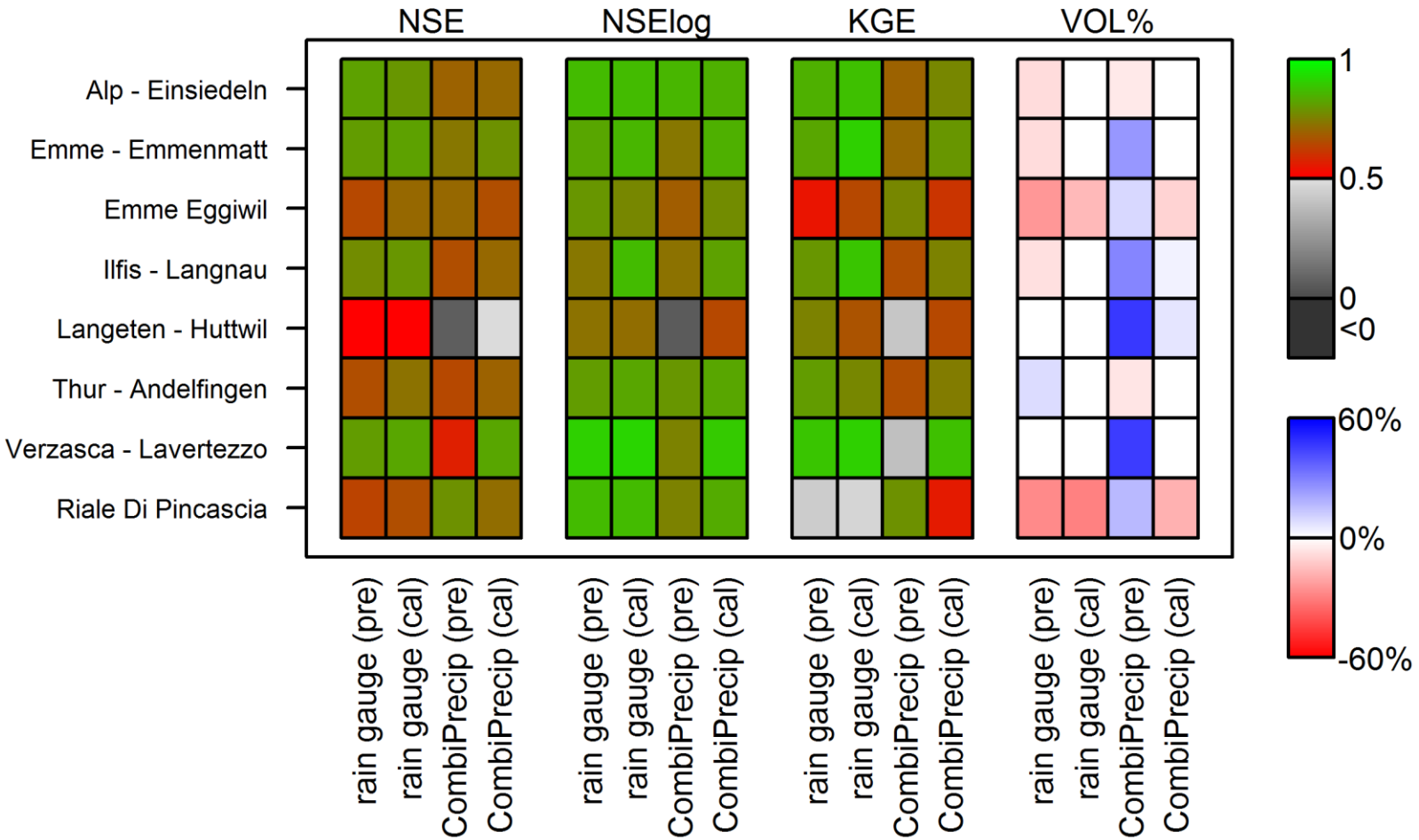
Andres et al., soon in press, MetApps

Situation raingauges

Andres et al., soon in press, MetApps

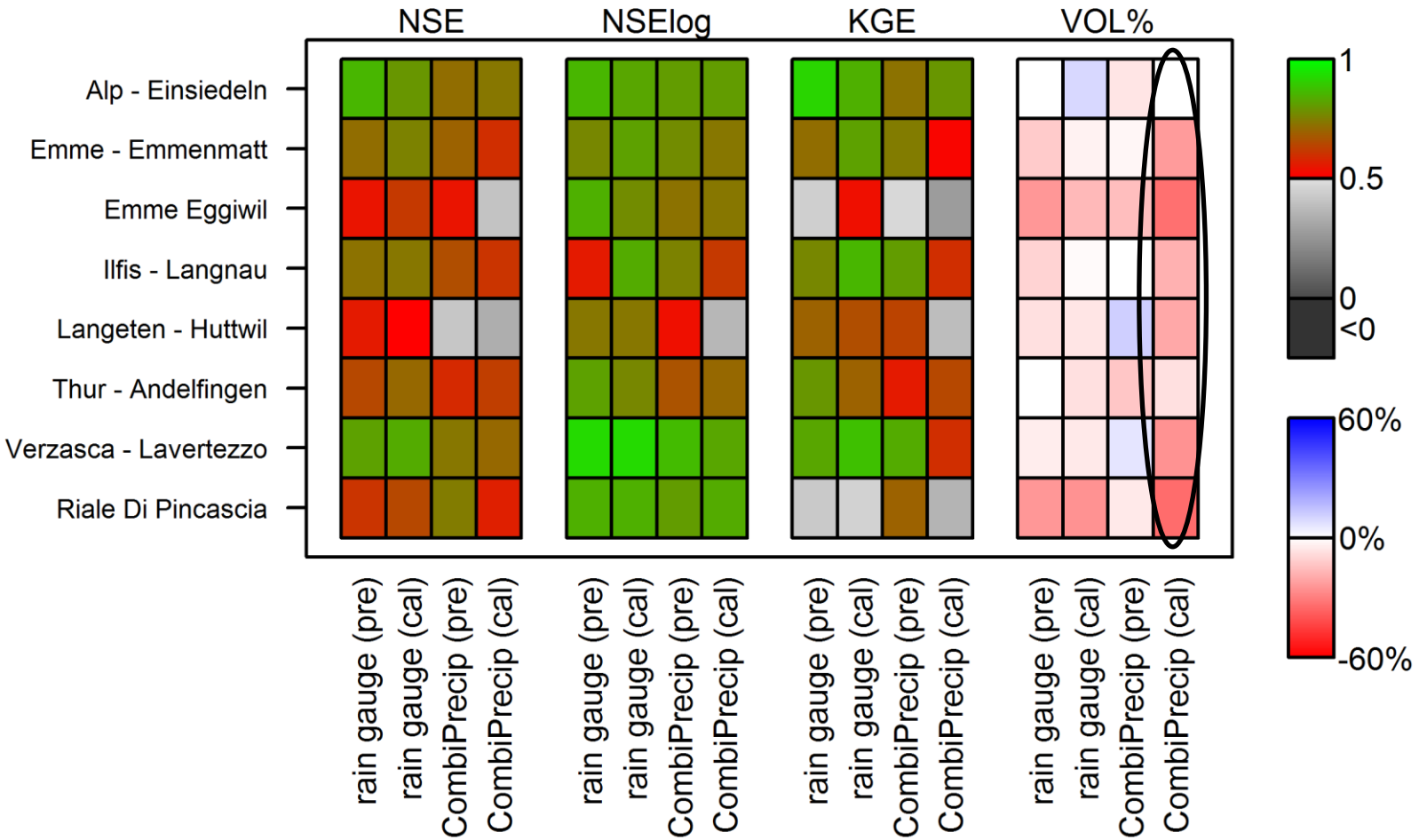


Reviewer: «Calibrate using radar data!»



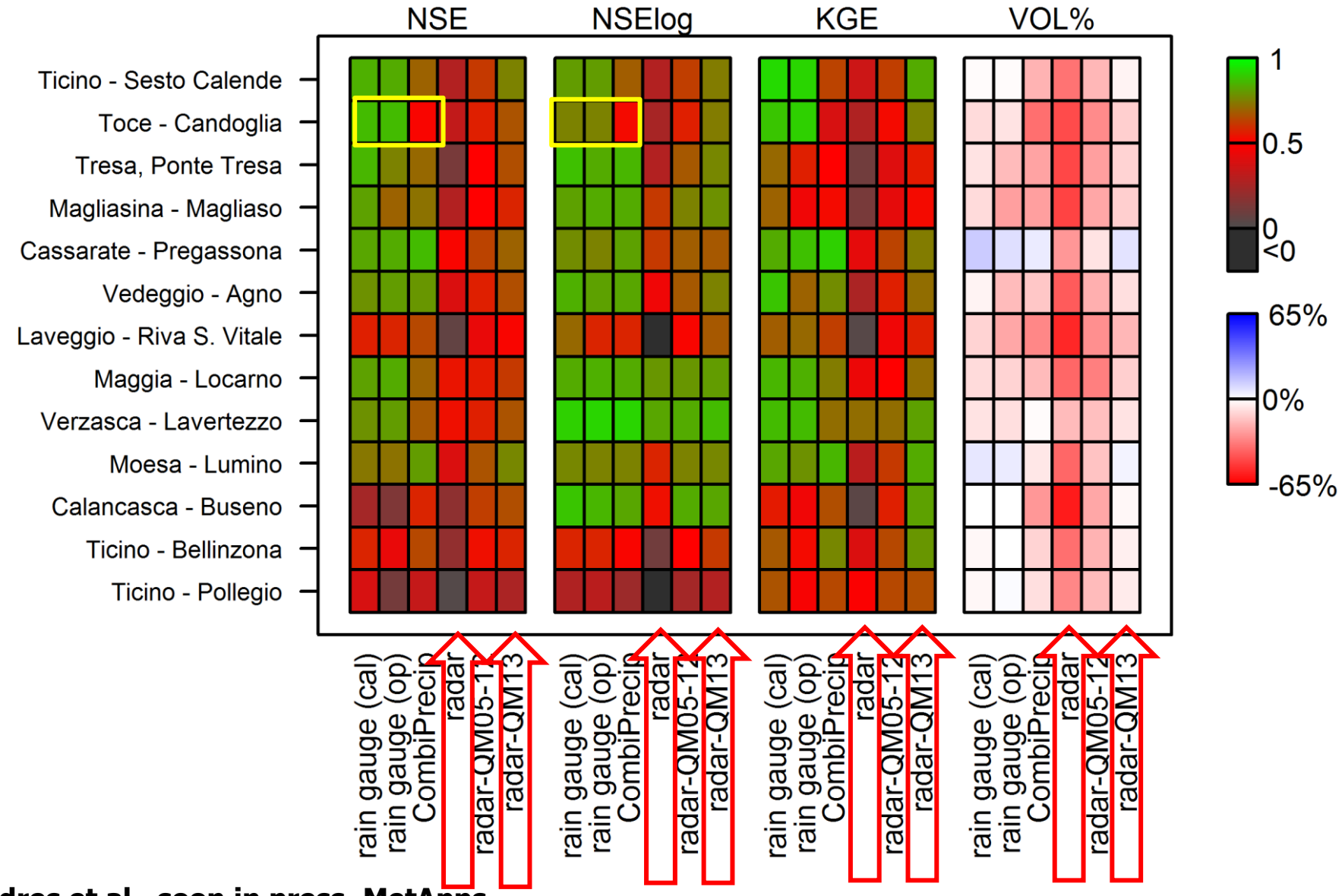
Calibration period

Reviewer: «Calibrate using radar data!»



Validation period

2013 experiment. Ticino area. Tried also preprocessing



Andres et al., soon in press, MetApps

Conclusions

- We know what we lose, we don't know what we get
- All archived forecasts are suddenly worthless (e.g. training of Post-processing procedures)
- Way back to past performance unknown
- Derived products biased by changes
- NWP -> Parallel phase possible -> maintenance?
- Radar -> Gradual change since 2011 -> terrible
- Lost of "gut feeling" by users and by ourselves

Over-the-loop
.. Andy?

Conclusions and opinions

- From a scientific point of view such changes in forcing data are only a marginal chance to improve an operational HEPS and represent a high risk. One should get reforecasts to cope with the change …
- Users might lose trust in the forecasts and even more dangerous, lose their "gut feeling" about taking decisions using ensembles.
- We are still very reluctant in trusting the QPE produced with the new weather radar.
- To me change bring more challenges than chances…