Regional Cooperation for Limited Area Modeling in Central Europe

LACE
nwp central europe

LAM-EPS in LACE: Strategies for research and application

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DHMZ SHMU OMSZ ZAMG ROMANIA ANM

Research and Application

Sep 29-Oct 2, 2014

Research:

- News on stochastic surface/soil physics in ALADIN-LAEF

- Ideas and plans for R & D of physics perturbations

From research to application:

- What is the benefit of using a convection-permitting EPS?
(AROME-EPS vs. ALADIN-LAEF)

- The benefit of frequent updates of LBCs -> Chiara‘s talk on Monday

Application:

- LACE-LAMEPS for civil protection: Experiences from the project PROFORCE

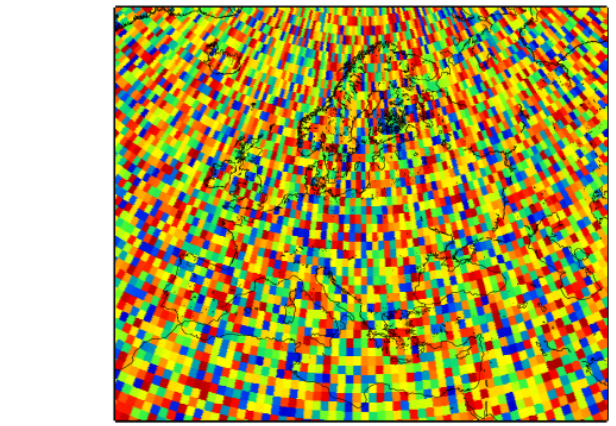
ALADIN-LAEF surface-SPPT (M. Bellus)

Sep 29-Oct 2, 2014

Stochastic physics schemes:

BMP: (Buizza, Miller, Palmer, 1999) – used in earlier experiments with LAEF

Random number: Uniformly sampled, constant for grid boxes with size D and for time T, multivariate

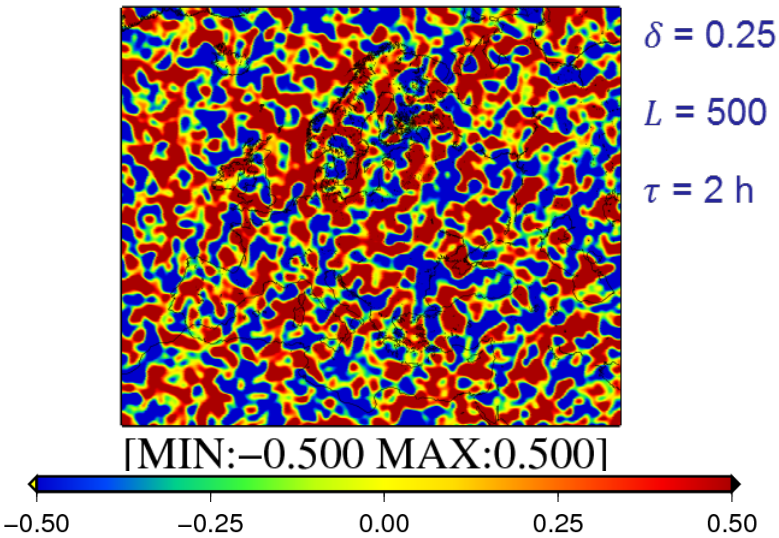


D = 1 deg

T ~ 20 time steps

SPPT (Palmer et al., 2009; Bouttier et al., 2012):

Random number: Gaussian distribution + spectral pattern generator (parameters δ, L, τ), univariate



δ = 0.25

L = 500 km

τ = 2 h

Perturbations smoothly reduced near surface and near model top.

ALADIN-LAEF surface-SPPT (M. Bellus)

Sep 29-Oct 2, 2014

SPPT for ISBA fields:

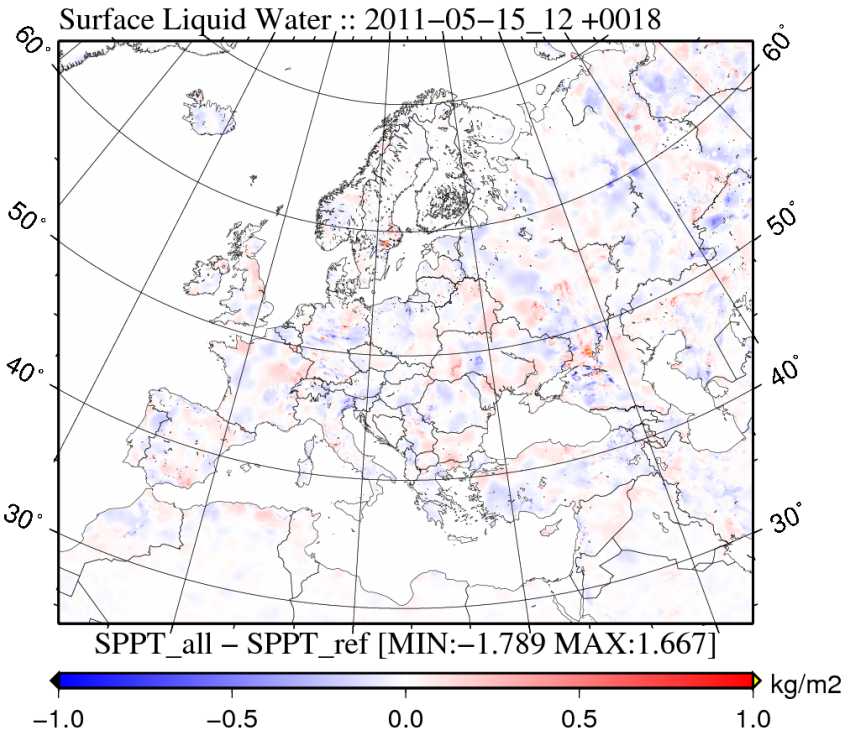
- Gaussian distribution of random numbers, univariate

Perturbed fields:

- surface temperature
- liquid soil water content
- frozen soil water content
- snow albedo
- snow reservoir water content
- snow density
- water intercepted by vegetation

No perturbation of deep soil prognostic fields, because of their slow response.

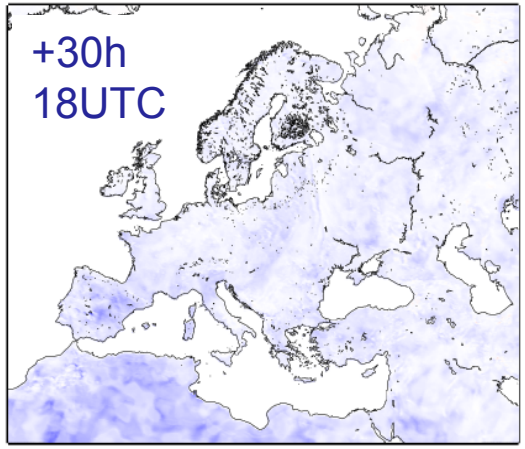
No perturbation of upper air fields.



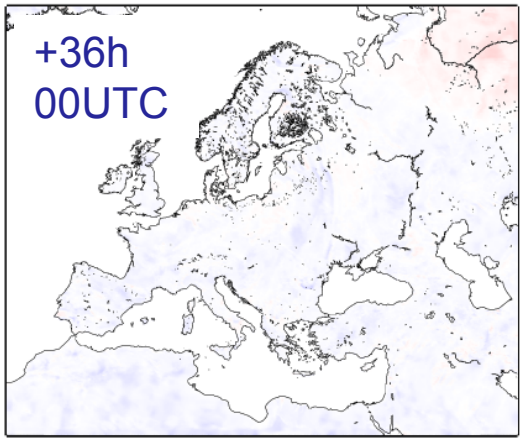
Difference between perturbed and unperturbed surface liquid water content for a single ensemble member

ALADIN-LAEF surface-SPPT (M. Bellus)

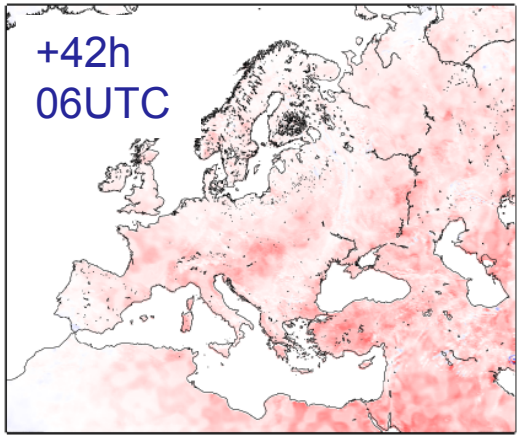
Sep 29-Oct 2, 2014



[MIN:–1.704 MAX:0.668]

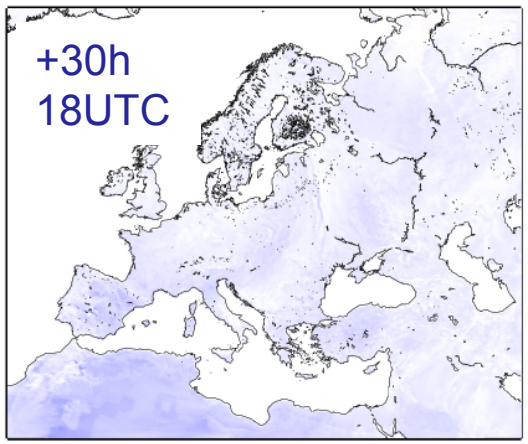


[MIN:–0.396 MAX:0.341]

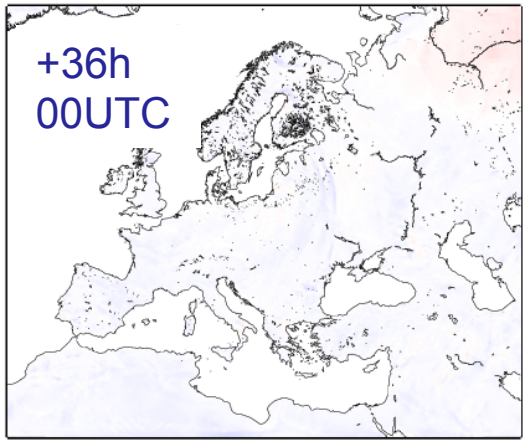


[MIN:–2.255 MAX:1.563]

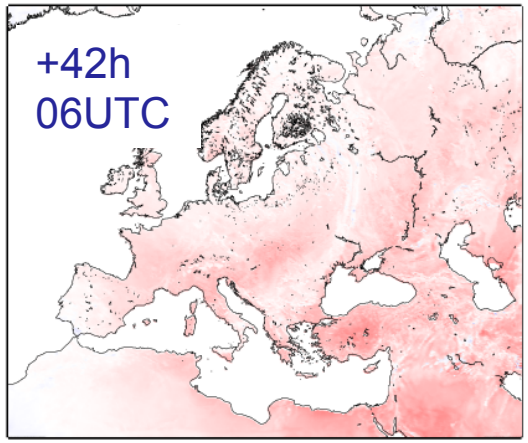
Perturbed
$\delta = 0.25$



[MIN:–1.443 MAX:0.532]



[MIN:–0.327 MAX:0.648]



[MIN:–0.869 MAX:1.290]

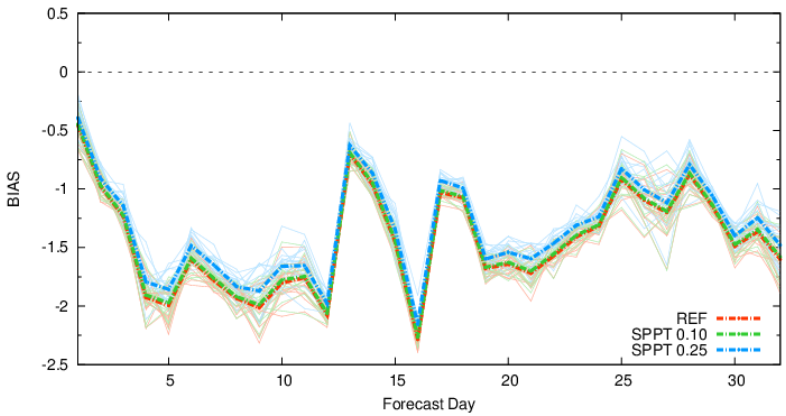
Unperturbed

ALADIN-LAEF surface-SPPT (M. Bellus)

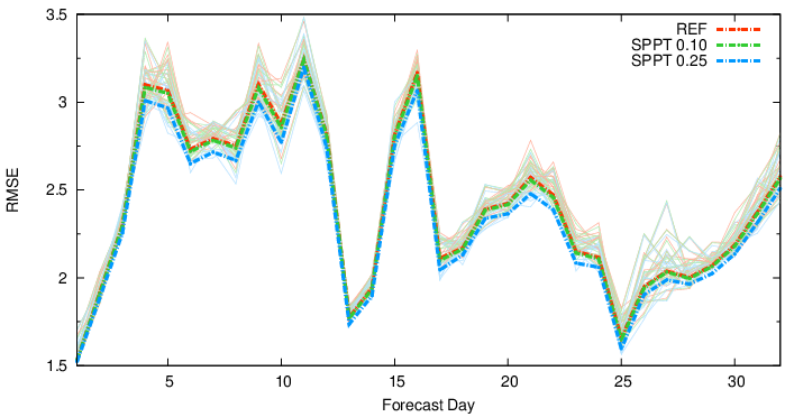
Sep 29-Oct 2, 2014

Verification for 2m temperature, Unperturbed, SPPT δ = 0.10, SPPT δ = 0.25

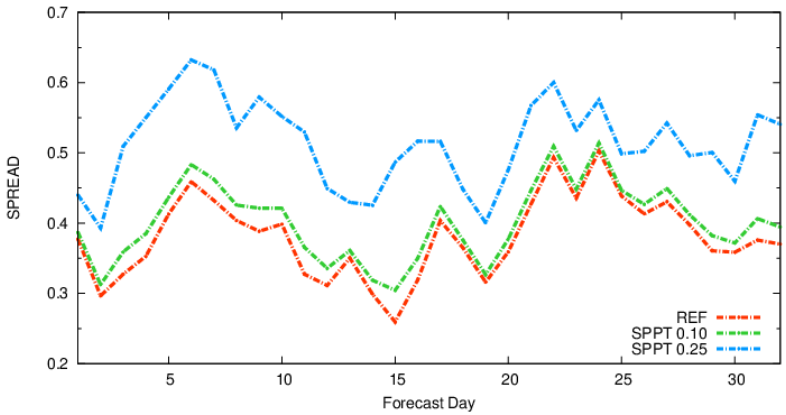
BIAS



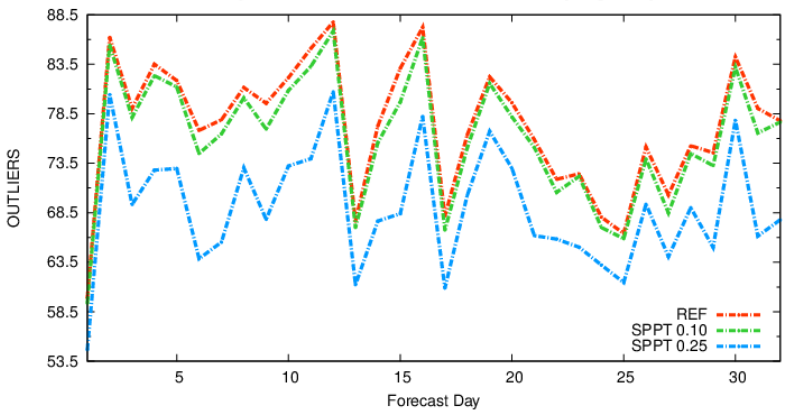
RMSE



SPREAD



OUTLIERS



SPPT – further steps

Status:

- good experience with perturbations of surface tendencies in LAEF (M. Bellus)
- good experience with AROME-EPS and classical SPPT (M. Szucs, shown 2013)

Open questions:

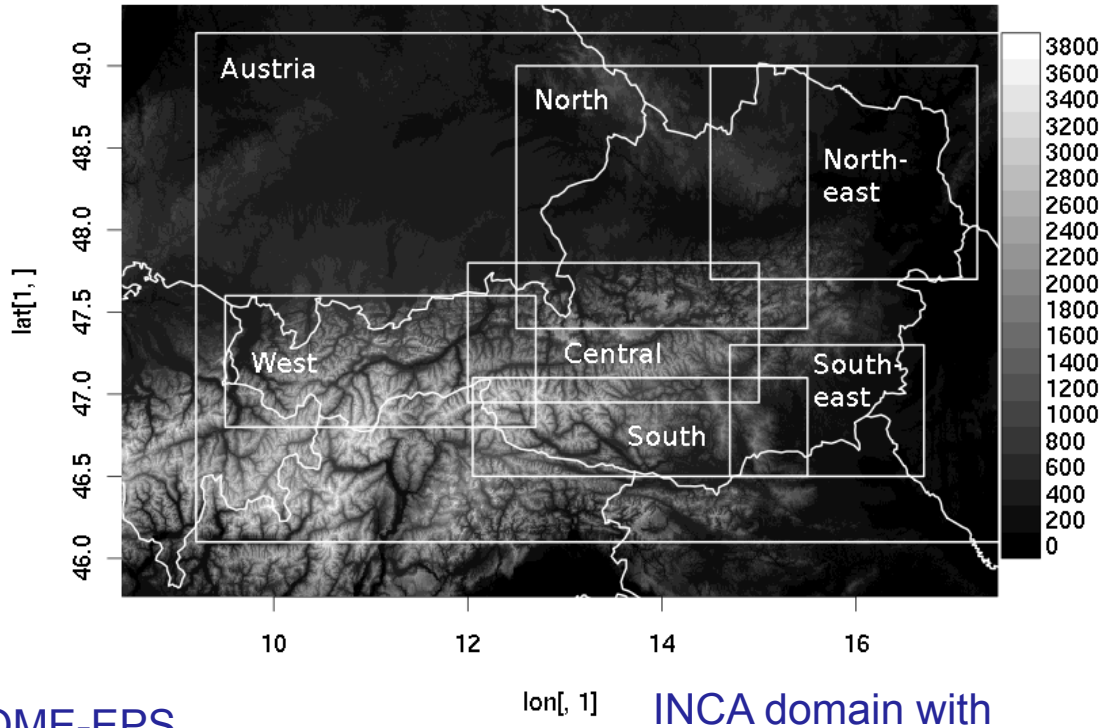
- Vertical structure: Is it possible to combine stochastic surface/soil perturbations with perturbations in upper levels?
- Better perturb all parameters' tendencies or just selected ones?
- Perturb all tendencies in the same manner or differently (regarding consistency or according to their predictability)
- Are the impacts different for convection-permitting EPS (AROME-EPS) and regional EPS (e.g. LAEF)?
- How can we combine multi-physics and stochastic physics perturbations in an efficient way?

AROME-EPS vers. ALADIN-LAEF

Sep 29-Oct 2, 2014

3-months downscaling experiment with ALADIN-LAEF coupling files.

- Period: 15.5.2011-15.8.2011
- 3-hourly coupling
- +30h lead time



INCA domain with selected subdomains.

- Verify what is the benefit of AROME-EPS downscaling of LAEF compared to LAEF
- Focus on precipitation in mountainous terrain
- Observations: INCA-analyses, surface observations, ECMWF-analyses (upper levels)

AROME-EPS vers. ALADIN-LAEF

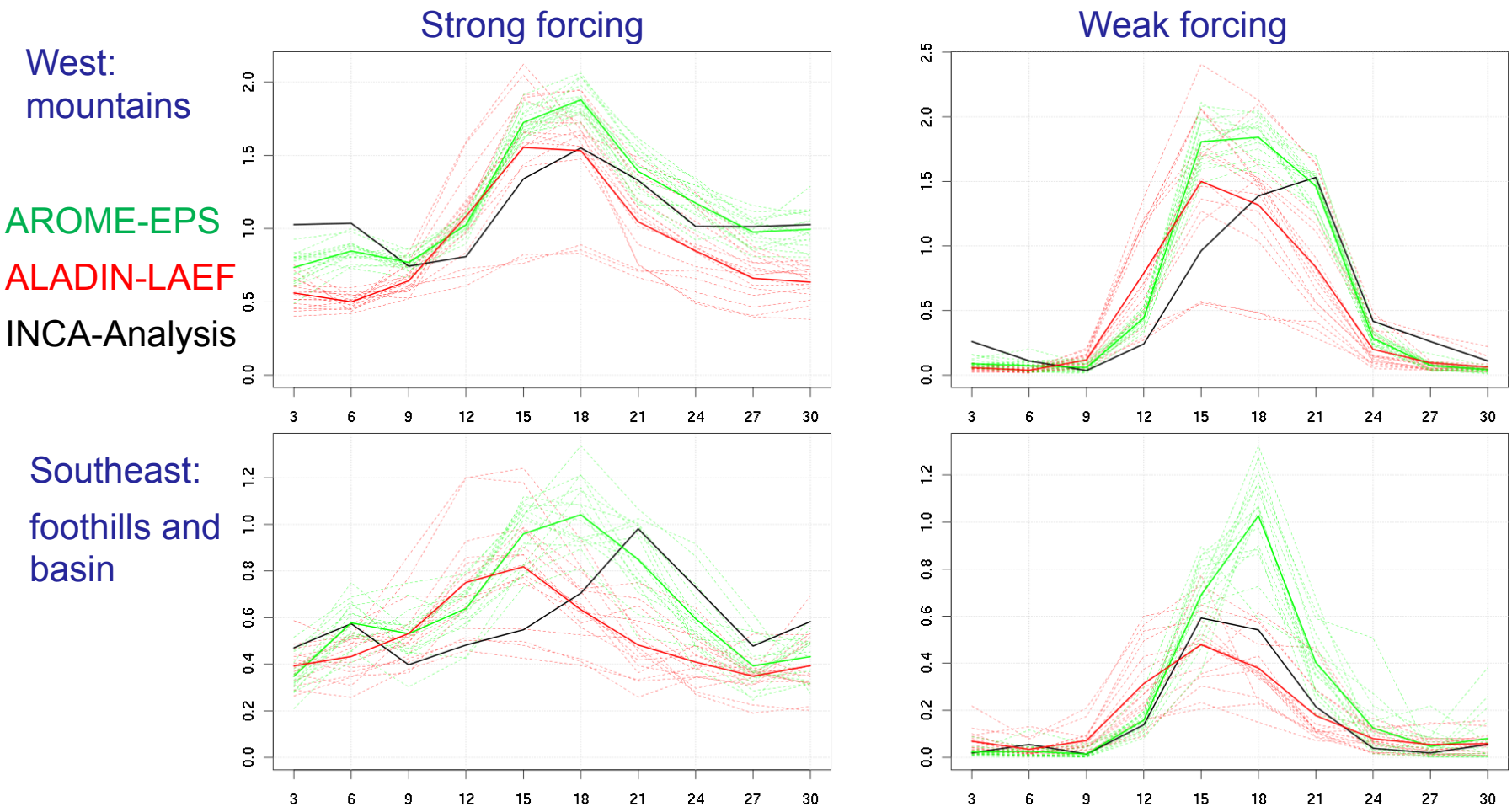
Sep 29-Oct 2, 2014

Mean areal precip. sums: Strong vs. weak forcing days, mountain region vs. lowlands

AROME-EPS

ALADIN-LAEF

INCA-Analysis



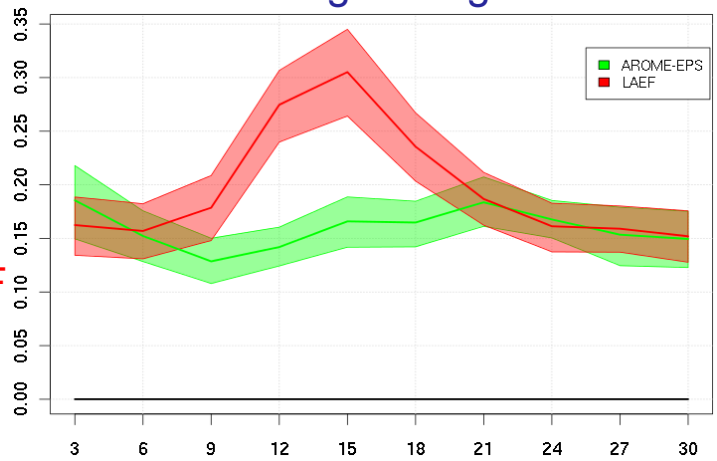
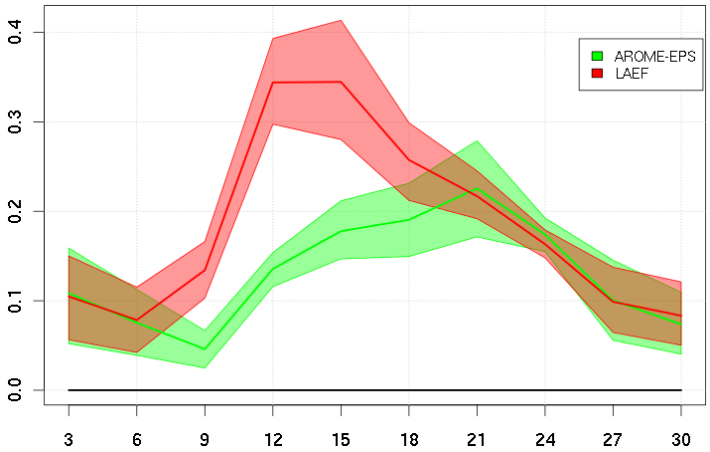
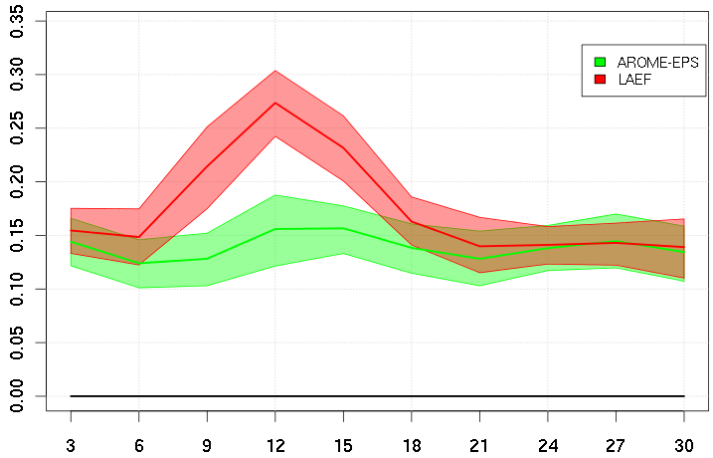
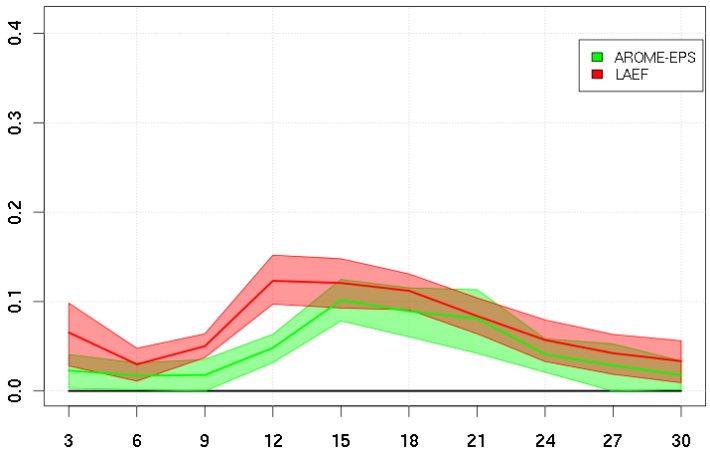
AROME-EPS vers. ALADIN-LAEF

Sep 29-Oct 2, 2014

Brier Score: Strong vs. weak forcing days, mountain region vs. lowlands, threshold 0.1 mm

AROME-EPS

ALADIN-LAEF

	Strong forcing	Weak forcing
West: mountains		
Northeast: flat terrain		

AROME-EPS vers. ALADIN-LAEF

Sep 29-Oct 2, 2014

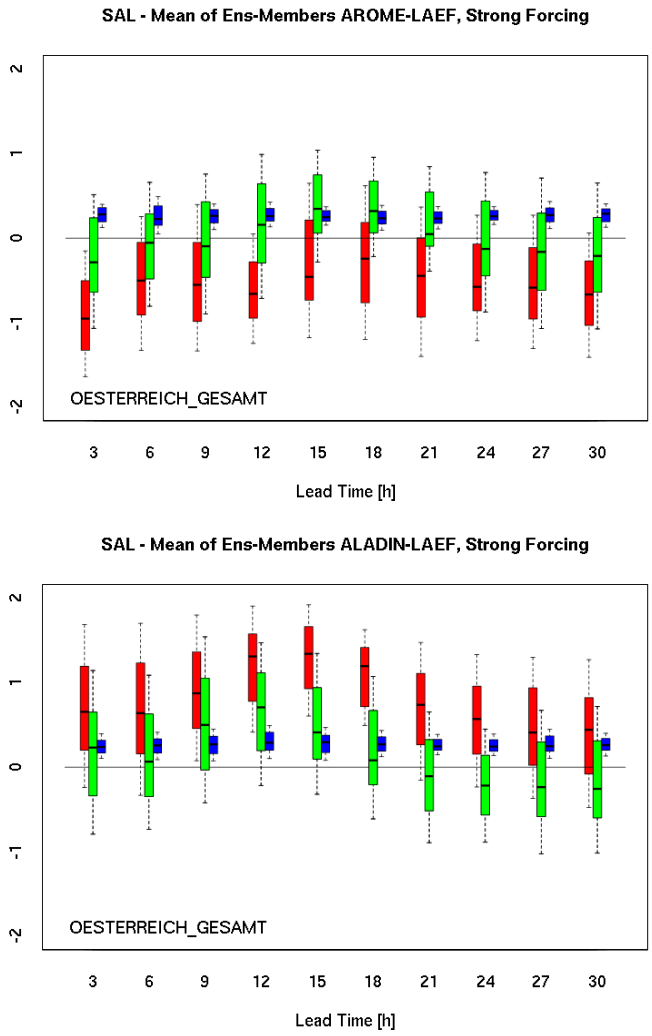
S-A-L: for AROME-EPS mean

S

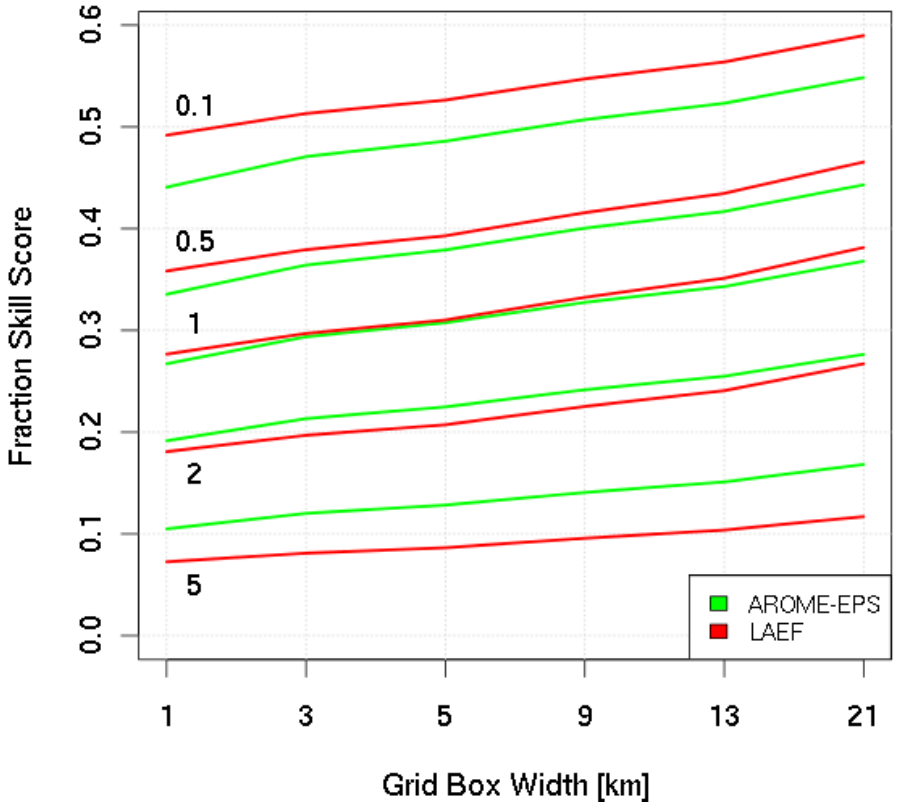
A

L

S-A-L: for ALADIN-LAEF mean



Fractions Skill Score for the convective scale



- EPS & Civil Protection

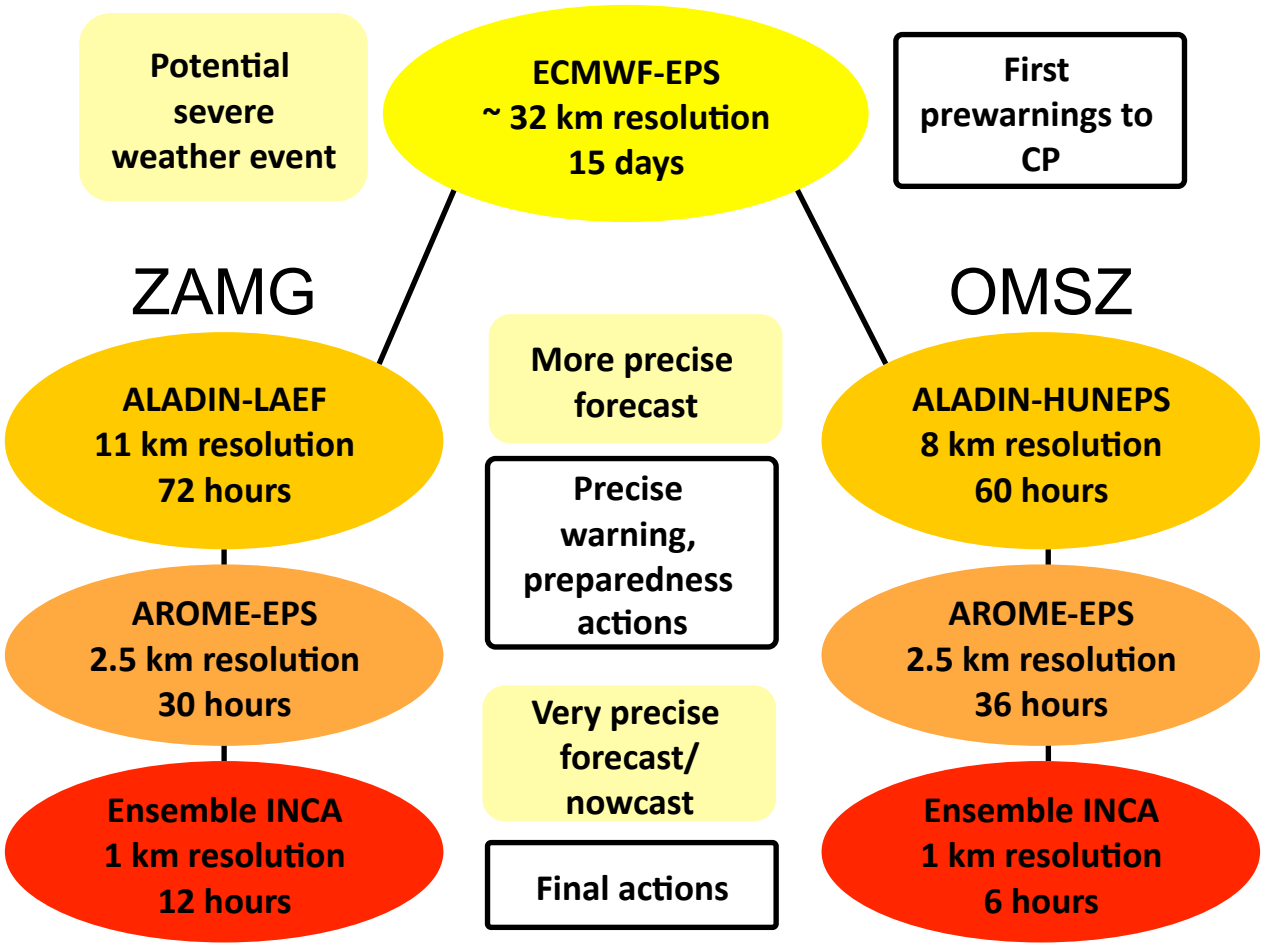
Partners:

ZAMG, OMSZ,
civil protection organizations
from Somogy County (HU)
and Lower Austria

Aims of PROFORCE:

- Build-up a 'seemless' probabilistic forecast system
- Adapt for forecasting extreme weather events
- Requirements for the use of prob. Forecasts in civil protection

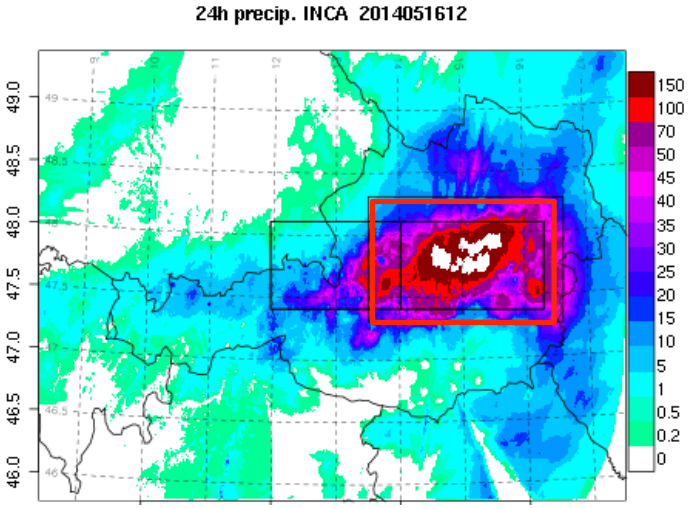
Model chains used in PROFORCE



EPS & Civil Protection - PROFORCE

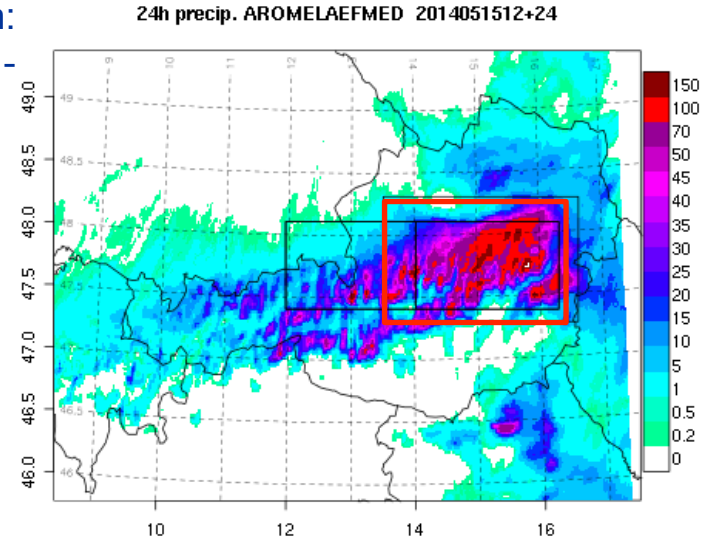
Sep 29-Oct 2, 2014

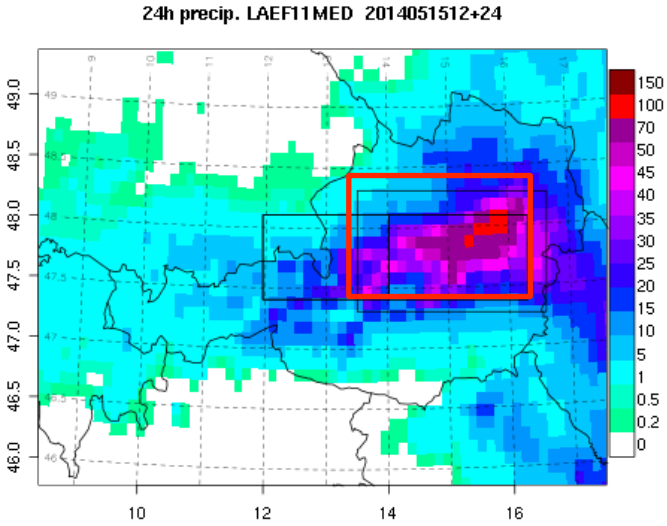
Storm 'Yvette' (May 14-17, 2014)



Model	Mean precipitation
INCA	65 mm
AROME-LAEF-Median	38 mm
ALADIN-LAEF-Median	32 mm
ECMWF-Median	27 mm
AROME-LAEF-Mean	39 mm
ALADIN-LAEF-Mean	38 mm
ECMWF-Mean	27 mm

Mean areal precipitation 24h: May 15,12 UTC - May 16,12 UTC

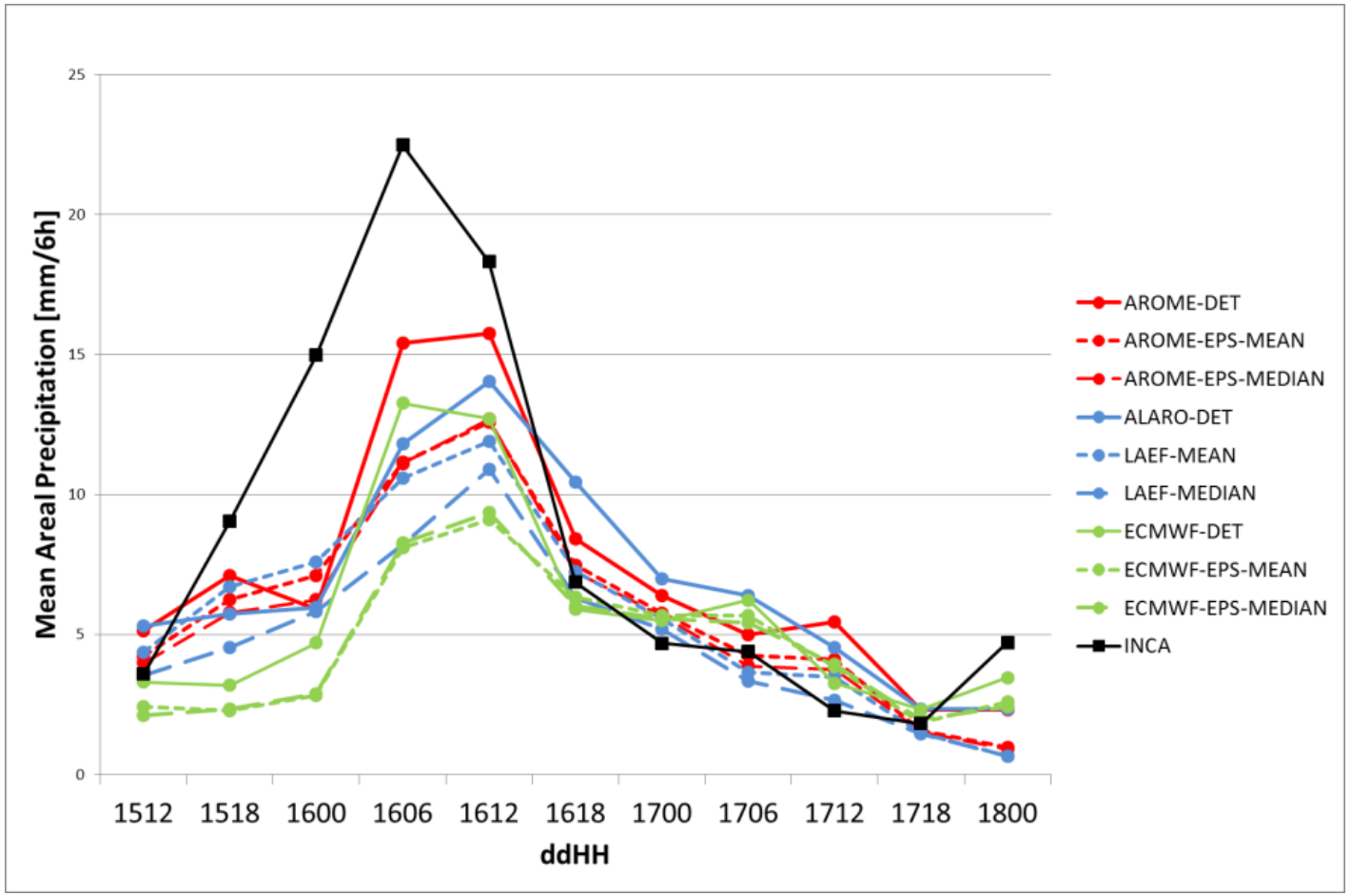




EPS & Civil Protection - PROFORCE

Sep 29-Oct 2, 2014

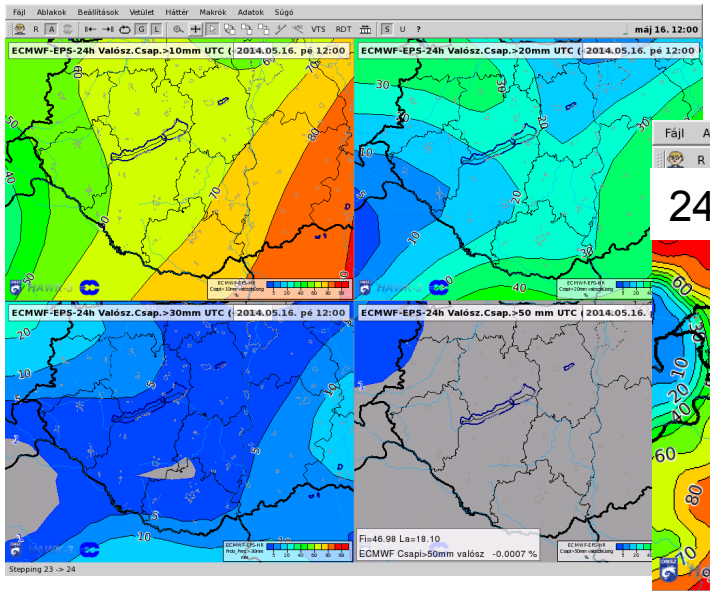
Case of storm 'Yvette' (May 14-17, 2014)

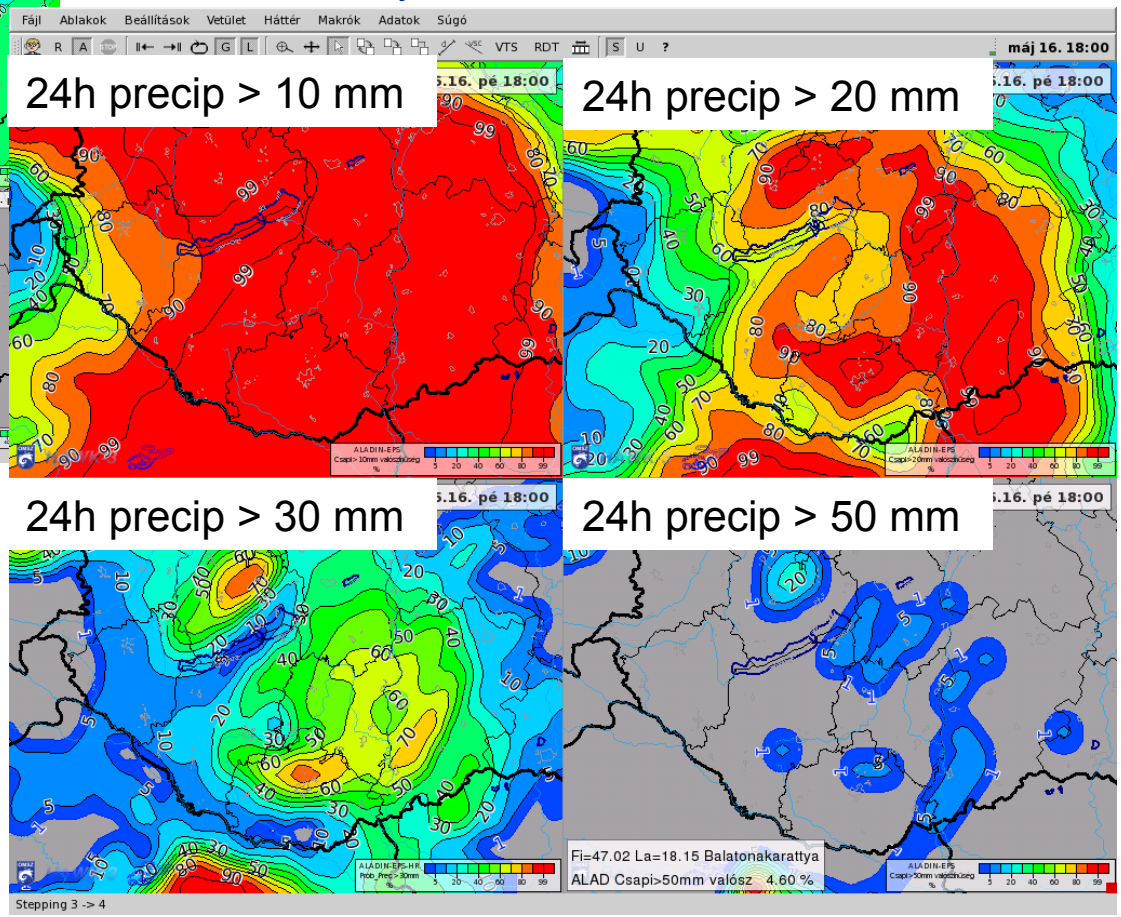


EPS & Civil Protection - PROFORCE

Sep 29-Oct 2, 2014

Probabilistic forecasts for 24h precipitation of ECMWF-EPS (left) and ALADIN-EPS (bottom) for 18 UTC on May 16





Good performance and enhanced structures compared to ECMWF-EPS

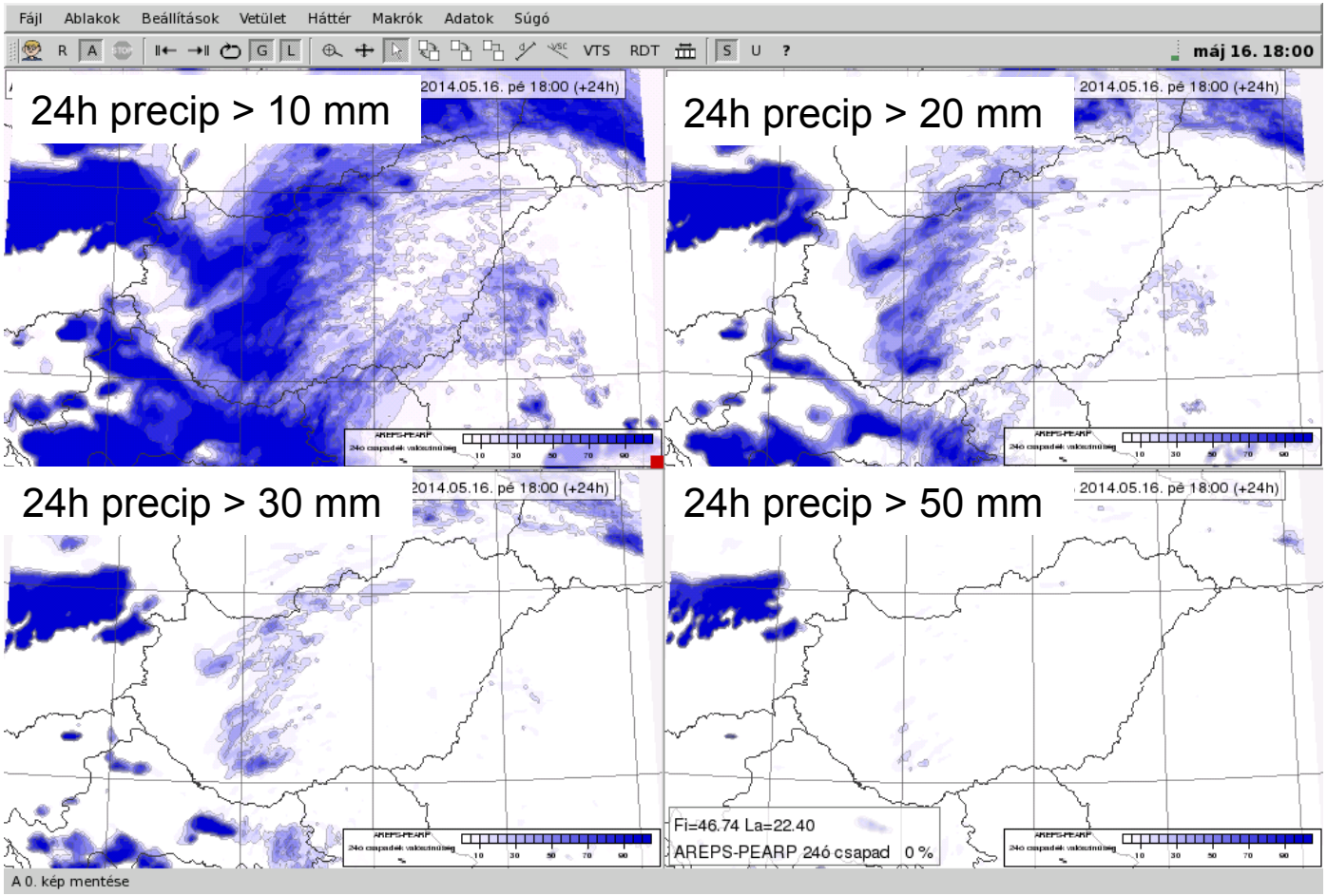
EPS & Civil Protection - PROFORCE

Sep 29-Oct 2, 2014

AROME-EPS:

High probabilities also for the higher thresholds in Somogy county.

High precipitation amounts also occurred in the afternoon.



EPS & Civil Protection - PROFORCE

Impressions by EPS-users of the civil protection organizations

- the simpler the better
- harder to grasp than deterministic forecasts
- use for longer time needed to find out if probabilistic products are helpful
- training is important: especially information on use of weather forecasts, basics of probabilistic forecasts
- Problem: in the end public wants decisions in “black and white”

Requirements

- Forecasts for specific thresholds related to severity of event depending on expected impact
- Use of equal colours and equal kinds of plots for long-range, short-range, nowcasting

Further ideas

- Use of warning index

Thank you for your attention!