

LAMEPS activities at the Hungarian Meteorological Service

Edit Hágel

Presented by András Horányi



Hungarian Meteorological Service



Outline of the talk

- Motivation and background
- Sensitivity experiments
- Latest verification results
- Other ongoing LAMEPS activities at HMS
- Case study
- Conclusions
- Future plans

Motivation and background

- Success of global ensemble systems on large scales and medium-range
- A need for ensemble prediction on smaller scales and short range: LAMEPS
- Main goal: better prediction of local extreme events at short range (windstorms, heavy precipitation etc.)

- Additional probabilistic guidance to the forecasters complementing the categoric forecasts
- Step-by-step approach on a sound scientific basis
- Work started in autumn 2003 at HMS
- First step: downscaling of PEACE (Prevision d'Ensemble A Courte Echeance) forecasts

Sensitivity experiments

- Direct downscaling of PEACE forecasts (optimized for Western Europe)?
 - Are the PEACE provided initial and boundary conditions appropriate for the local EPS run, for a Central European application (in other words: can ALADIN EPS add extra value on the PEACE EPS forecasts) ?
 - What is the impact of different target domains and target times used in the global SV computations?

➤ ARPEGE EPS runs at HMS

- 10+1 ensemble members using ARPEGE
- SV technique, 16 SVs \Rightarrow 5 perturbations
- Total energy norm (initial and final time)
- SV target domain: ?
- SV optimization time: ?

➤ Target domains:

- Atlantic Ocean and Western Europe (old PEACE)
- Europe and Eastern basin of Atlantic Ocean
- ~ Central+South-East Europe
- ~ Hungary

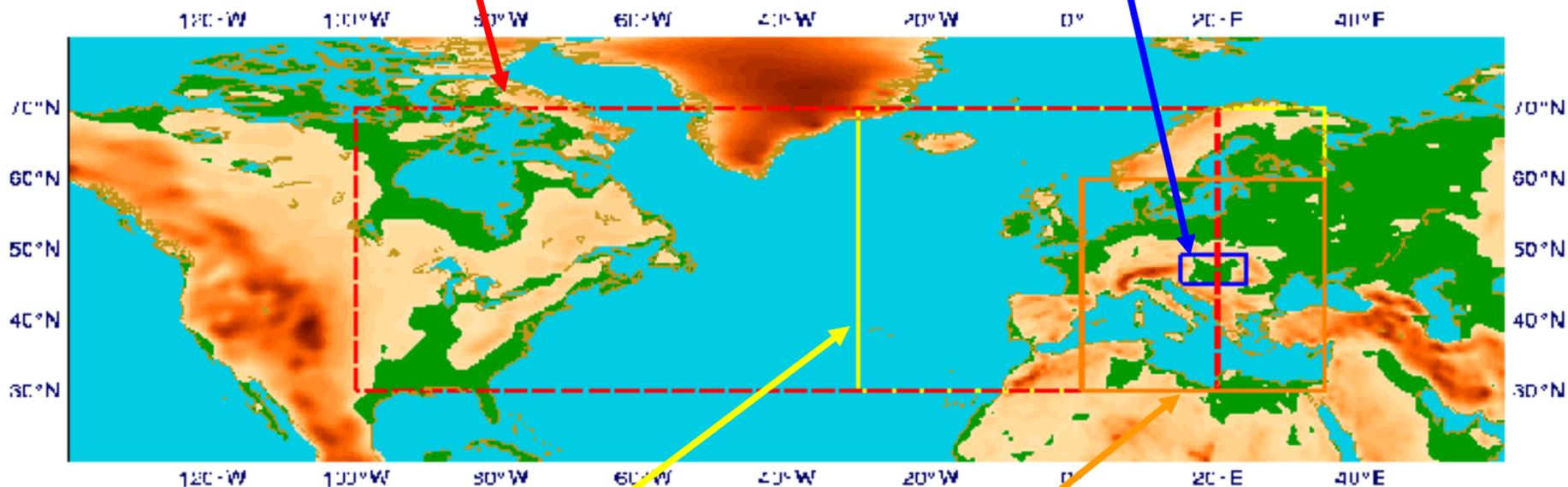
➤ Optimization times:

- 12 hours (PEACE)
- 24 hours

/ECMWF: 48 hours; caution for the linearity assumption/

Atlantic Ocean and Western Europe (target domain 1.)

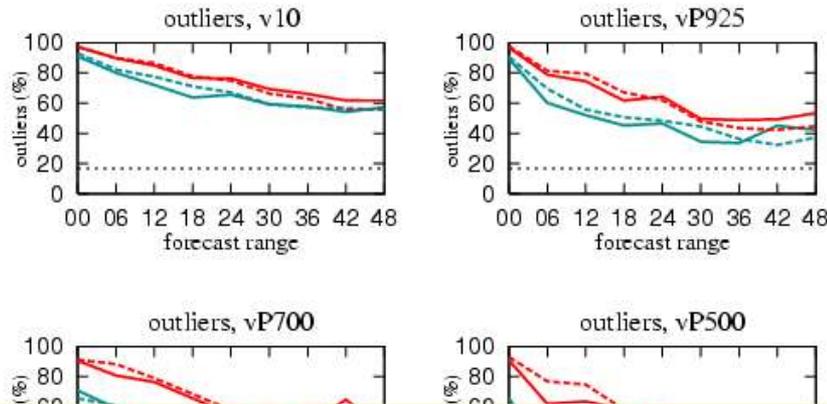
~ Hungary (target domain 4.)



~ Europe (target domain 2.)

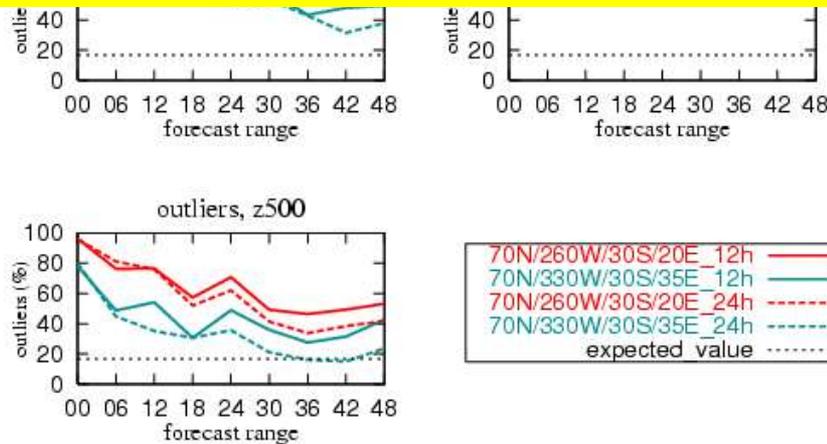
~ Central+South-East Europe (target domain 3.)

- To answer the question of domains and times:
 - case studies for different meteorological situations
 - target domain: 1.), 2.), 3.), 4.)
 - target time: 12h, 24h
 - experiments for longer period
 - target domain: 1.), 2.)
 - target time 12h, 24h

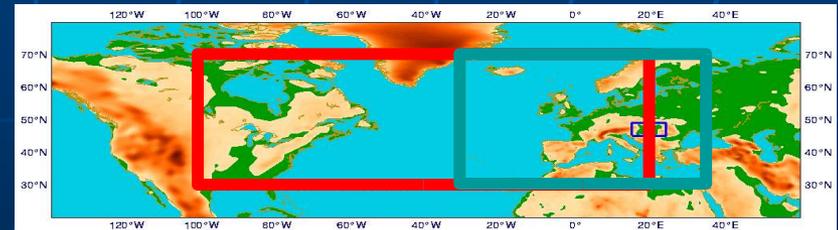


- **Target domain 1.)**
- **target time: 12h** ———

Target domain 2. and 24 hours optimization time is chosen for further experimentation



- **target time: 24h** - - -



- Important changes in PEACE system (e.g. increased resolution: $T_{199} \rightarrow T_{358}$, changes in target domain: shifted more to the East) \Rightarrow let's repeat the sensitivity experiments (for one month: 15/01/2005-15/02/2005)
 - downscaling of the operational PEACE forecasts
 - downscaling of ARPEGE EPS (different target domain and target time for SV computations, otherwise the same as PEACE)

Diagramme de Talagrand

T199 - Z500 - 24h

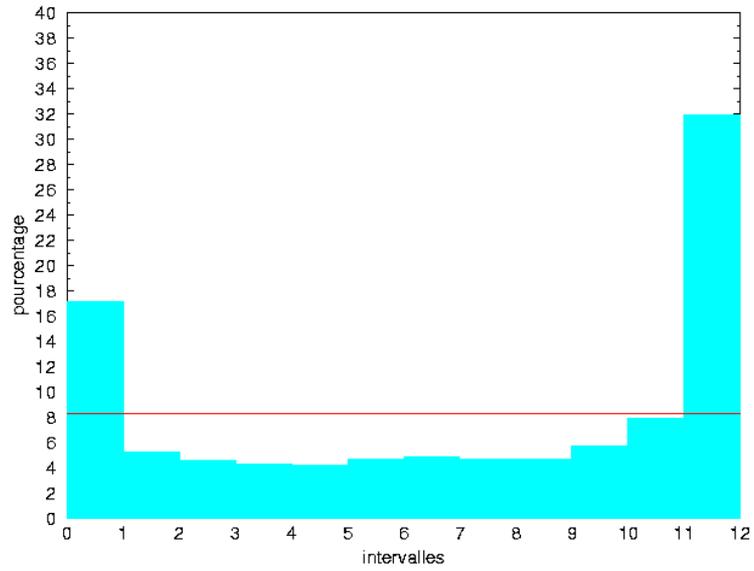


Diagramme de Talagrand

T358 - Z500 - 24h

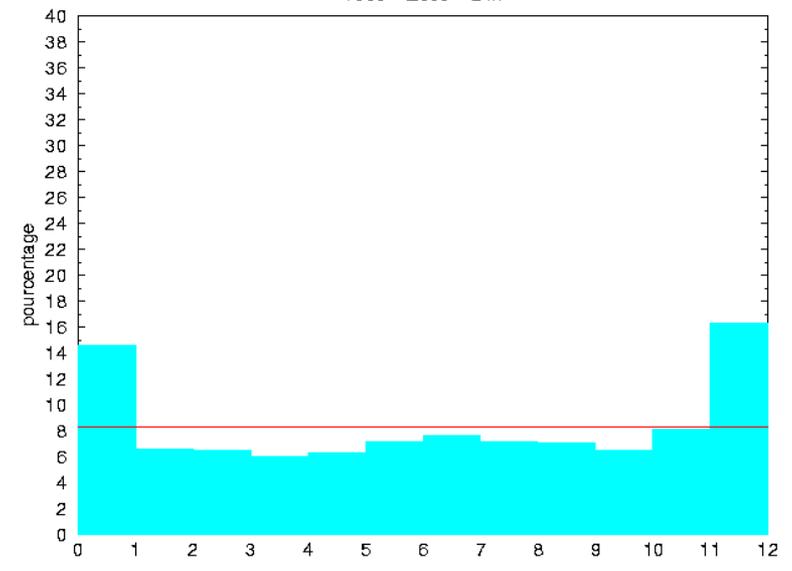


Diagramme de Talagrand

T199 - Z500 - 48h

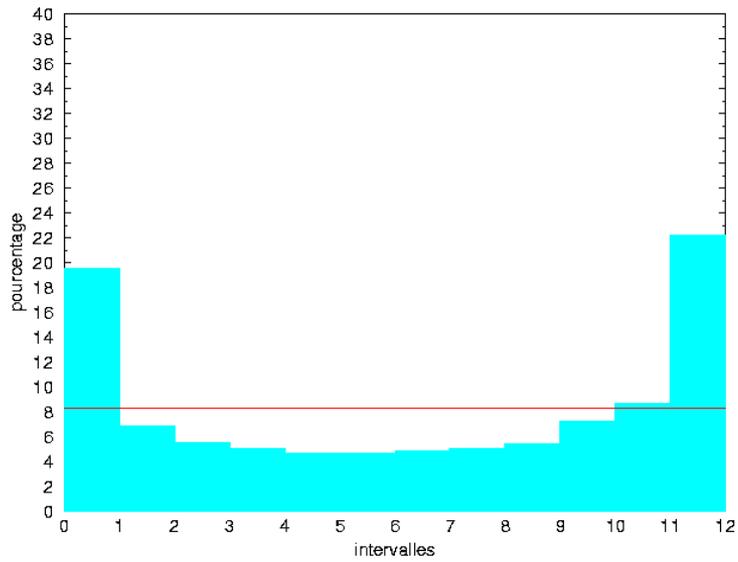
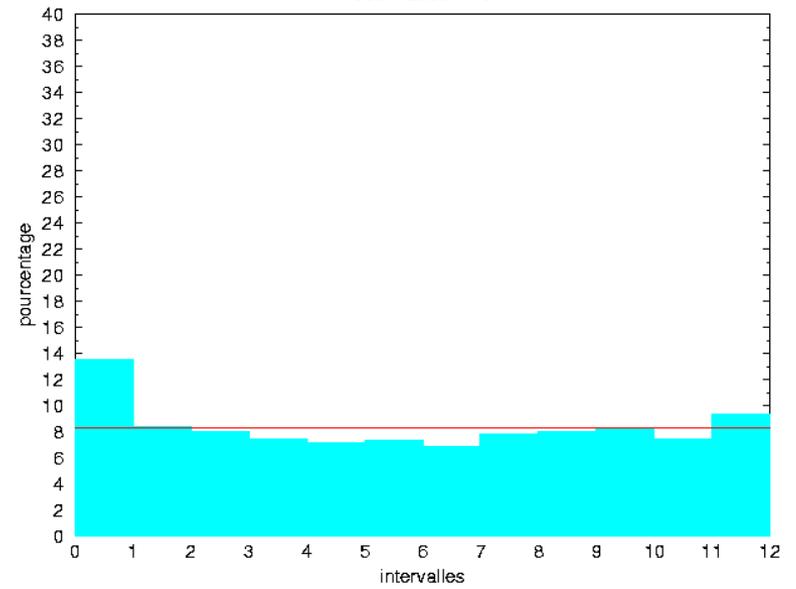


Diagramme de Talagrand

T358 - Z500 - 48h



Latest verification results

➤ How?

- Verification of ALADIN EPS forecasts against **ARPEGE long cut-off analysis** for MSLP, T2, v10, T850, z500

➤ What scores?

- RMSE and BIAS of the ensemble mean
- Standard deviation of ensemble members

➤ Verification area?

- Verification is performed on a domain covering Hungary

➤ How?

- Verification of ALADIN EPS forecasts against **observations** for MSLP, T2, v10, T850, z500, precipitation

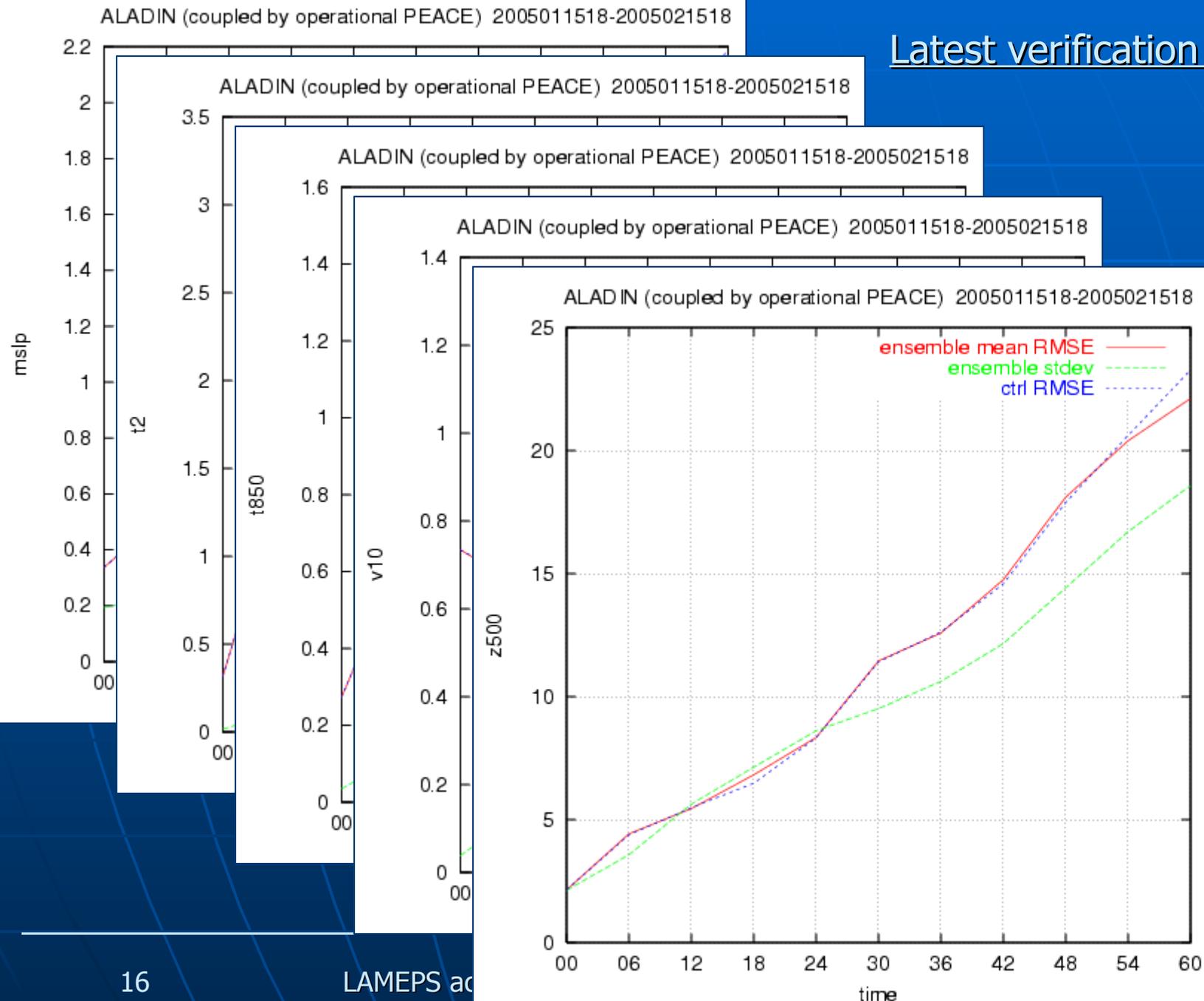
➤ What scores?

- ROC diagram, percentage of outliers
- Talagrand diagram
- Reliability diagram, BS, BSS

➤ Verification area?

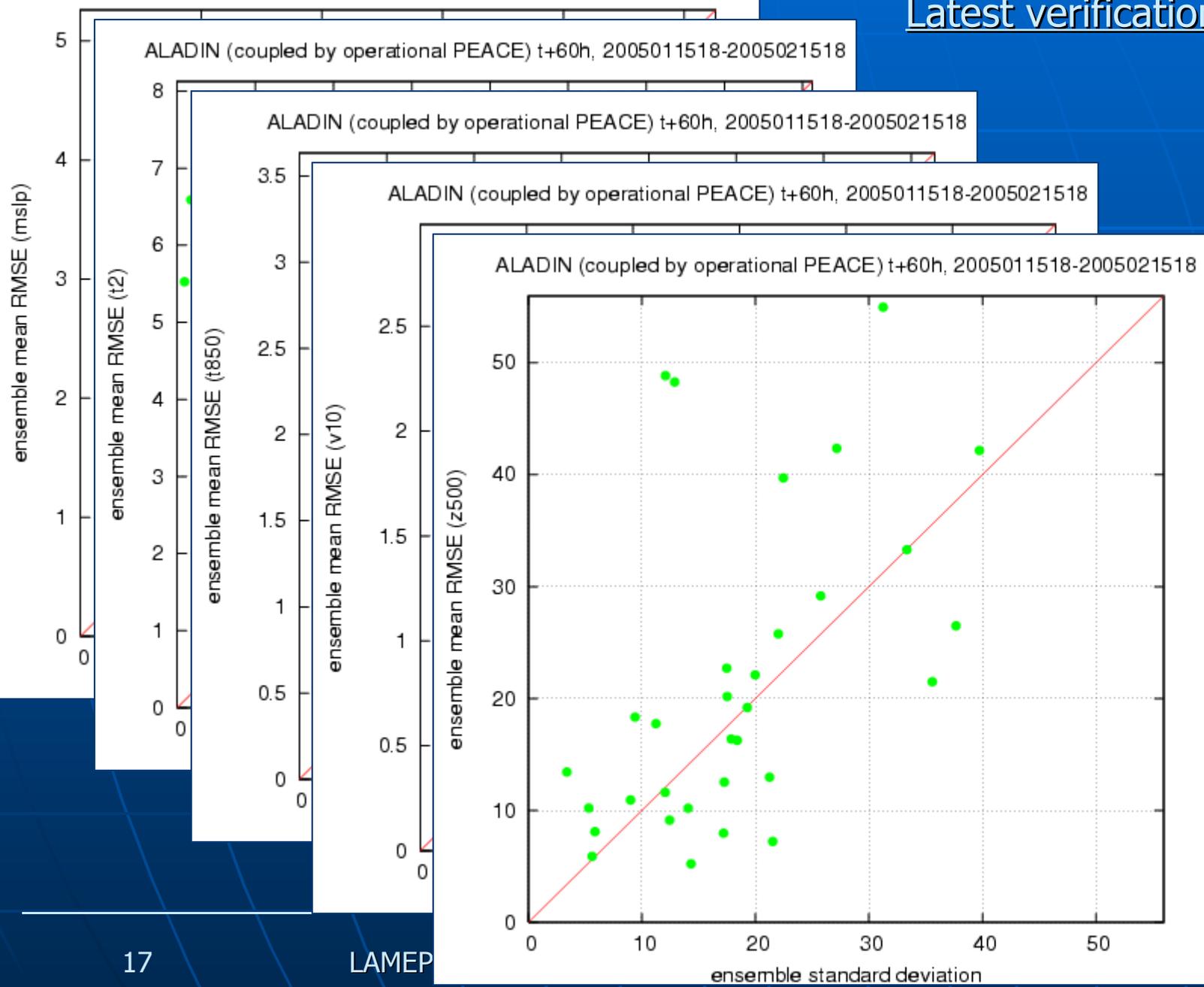
- Verification is performed on a domain covering Hungary

Latest verification results



upled





coupled

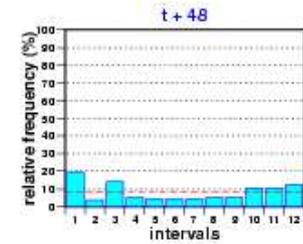
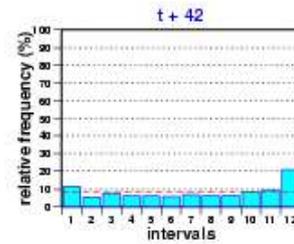
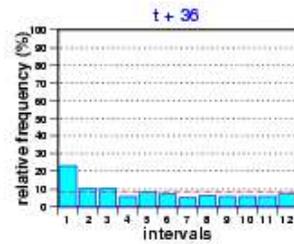
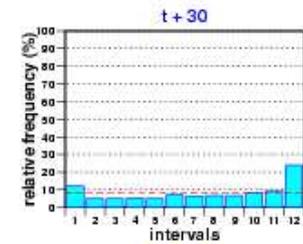
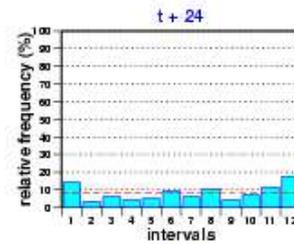
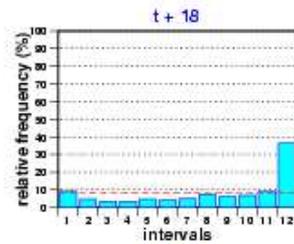
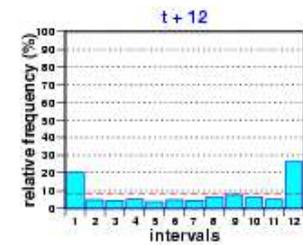
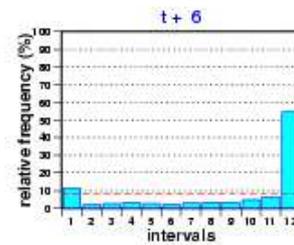
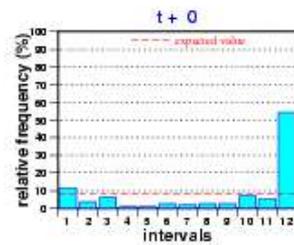


Talagrand-diagram - 2 m temperature
20050115 - 20050215 (ALADIN)

Talagrand-diagram - 850 hPa temperature
20050115 - 20050215 (ALADIN)

Talagrand-diagram - 10 m wind-speed
20050115 - 20050215 (ALADIN)

Talagrand-diagram - 500 hPa geopotential-height
20050115 - 20050215 (ALADIN)



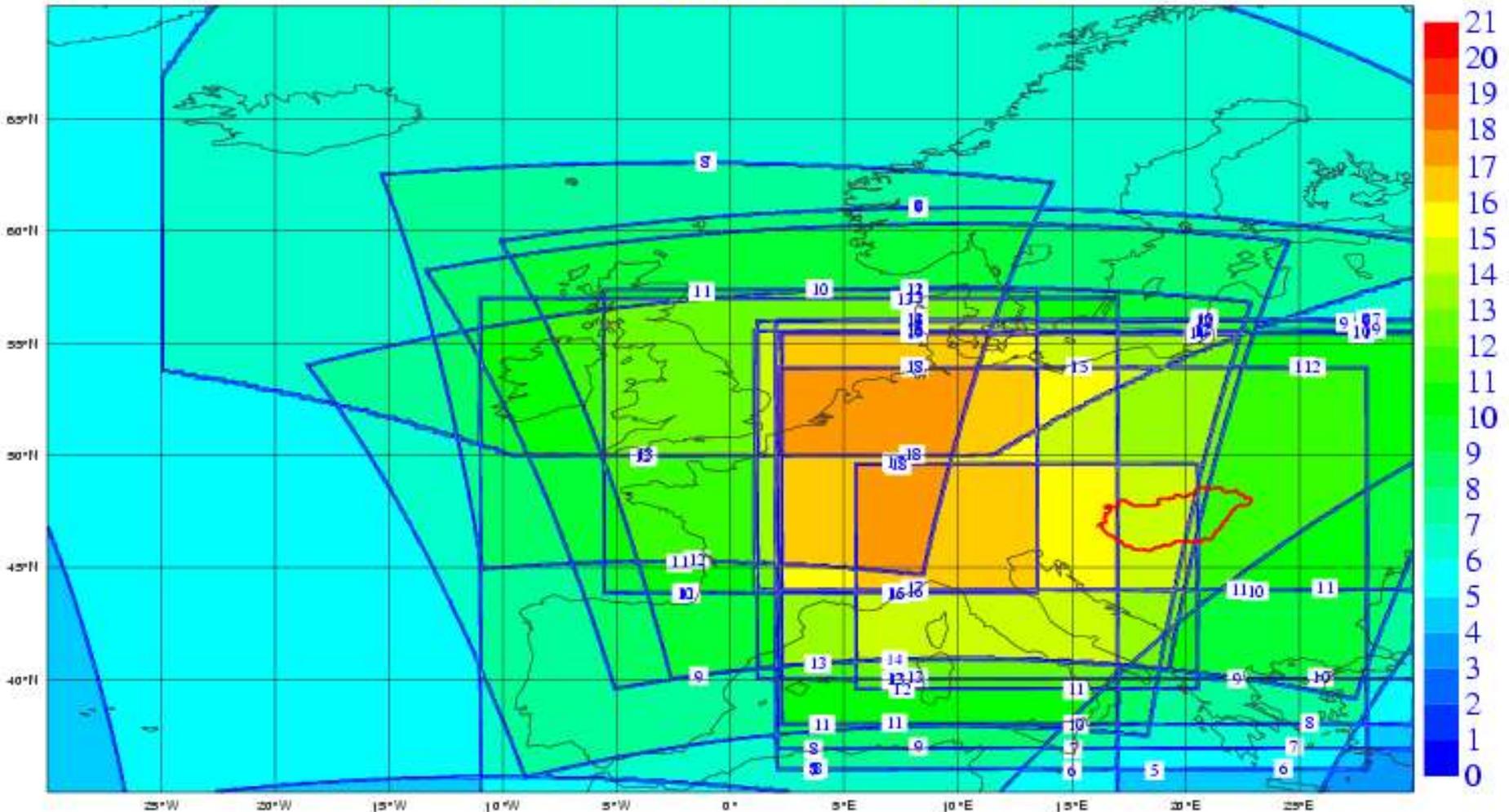
Other ongoing LAMEPS activities

- Participation in the SRNWP-PEPS project
- Downloading of COSMO-LEPS forecasts
- Downscaling of ECMWF forecast (similar to COSMO-LEPS)

➤ SRNWP-PEPS:

- 21 member Poor Man's Ensemble
- ALADIN, HIRLAM, COSMO, UKMO consortia
- Quasi-operational short-range multi-model ensemble forecasts on a 7 km grid
- Ensemble mean and probability forecasts
- Domain size: 35°S–70°N, 30°W–30°E
- 4 runs per day (00, 06, 12, 18 UTC)
- Running at German Weather Service (DWD)

SRNWP-PEPS elorejelzes, futtatas kiindulo idopontja: 2005 06 01, 00utc
ensemble merete, hany modell fedi le a teruletet
(legalabb ket tag minden racspontban)

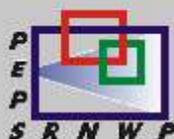


- What is done at HMS:
 - Grib files are sent two times and downloaded four times a day
 - Visualization (using Metview) for the whole PEPS domain and a zoom to Hungary
 - Products are available on our intraweb
 - Forecasters are asked to test the applicability of the products

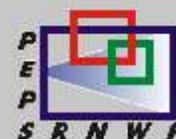


[Súgó][Előrejelzések]

[csapadék] [hó] [szélsebesség][széllökés][hőmérséklet] [ensemble mérete]



SRNWP-PEPS



2005-Máj-30 (hétfő), 00 UTC-s futtatás

Futtatás:

Év: 2005

Hónap: 05

Nap: 30

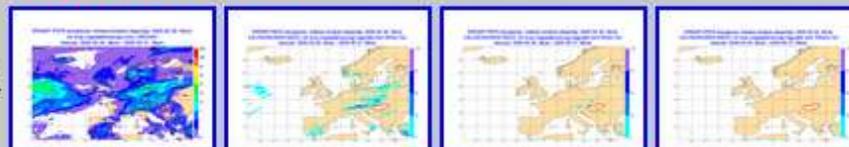
Óra (utc): 00

Mehet

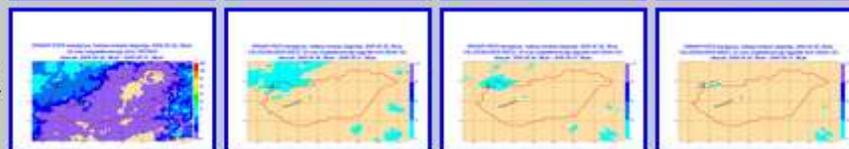
Csapadék, medián és valószínűségi mezők (>20mm, >50mm, >100mm):

24 óras időszakra vonatkozó adatok

+06h ... +30h



+06h ... +30h

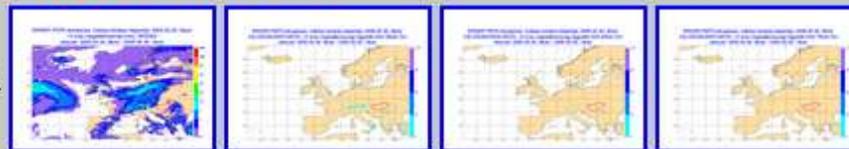


[Vissza a lap tetejére](#)

Csapadék, medián és valószínűségi mezők (>25mm, >40mm, >70mm):

12 óras időszakra vonatkozó adatok

+06h ... +18h



➤ COSMO-LEPS:

- Operational short-range ensemble forecasts on a 10 km grid with 10 ensemble members (until 120 hours)
- Downscaling of representative members from ECMWF ensemble with the non-hydrostatic Lokal Model
- Individual ensemble members and probability forecasts
- 1 run per day (12 UTC)
- Running at ECMWF

- What is done at HMS:
 - Grib files are downloaded once a day
 - Visualization (using Metview) for the whole COSMO-LEPS domain
 - Visualization of individual members, probabilities, „plume diagrams“ for some Hungarian cities
 - Products are available on our intraweb
 - Forecasters are asked to test the applicability of the products

[Súgó][Előrejelzések]

[csapadék] [hó] [szélsebesség] [Tmax] [Tmin] [T850] [z700] [faklya]



COSMO-LEPS



2005-Máj-29 (vasárnap), 12 UTC-s futtatás

Futtatás:

Év: 2005

Hónap: 05

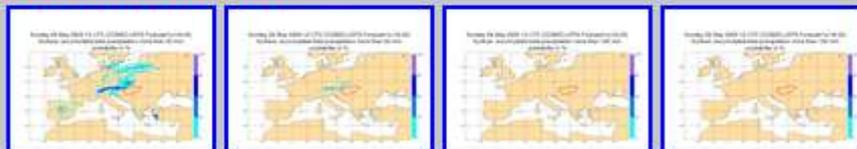
Nap: 29

Mehet

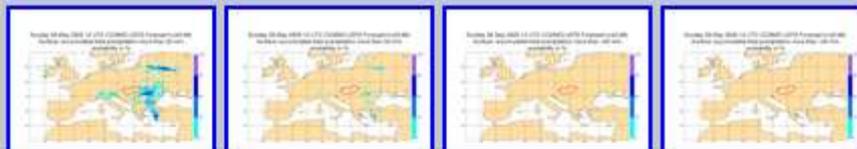
Csapadék, valószínűségi mezők (>20mm, >50mm, >100mm, >150mm):

24 órás időszakokra vonatkozó adatok

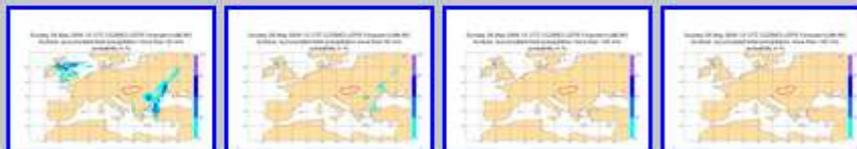
+18h ... +42h



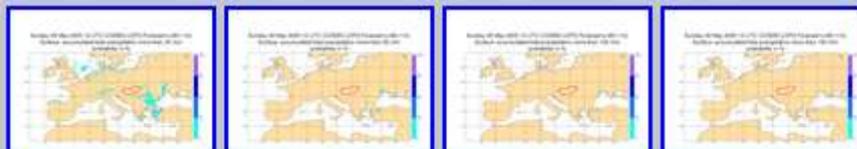
+42h ... +66h



+66h ... +90h



+90h ... +114h



[Vissza a lap tetejére](#)

- Clustering of ECMWF EPS
 - 10 clusters with representative members from 51 and then 102 EPS members
 - Clustering at +60h and +84h

- ALADIN integration
 - 84 hours forecasts
 - LACE domain

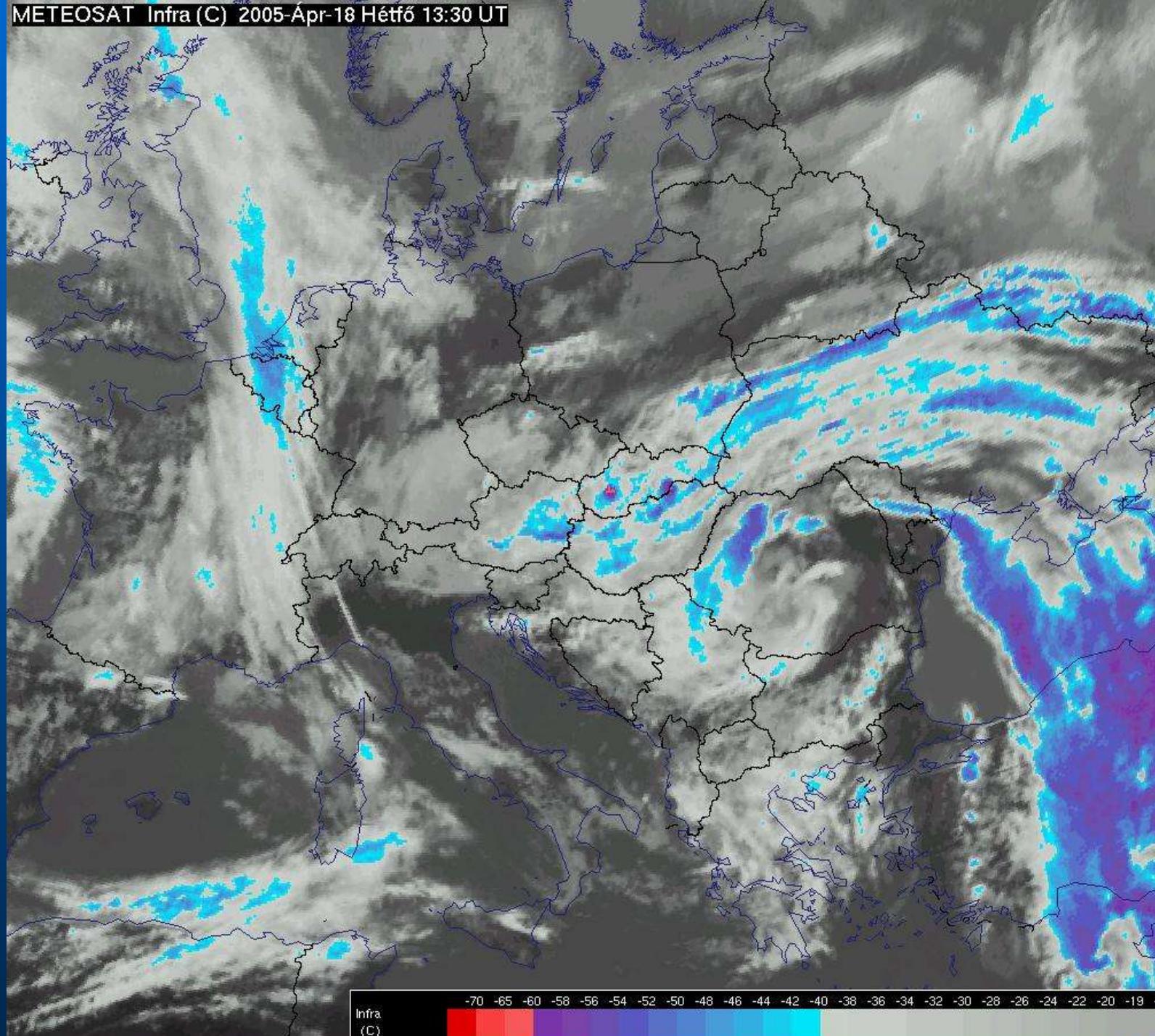
- Verification
 - Case studies

Case study (flash flood)

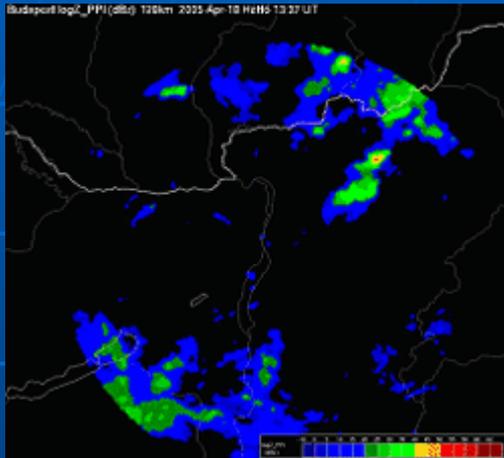
Mátrakeresztes, 18 April 2005



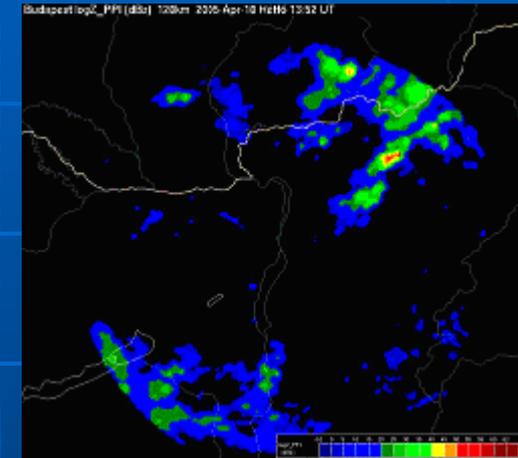
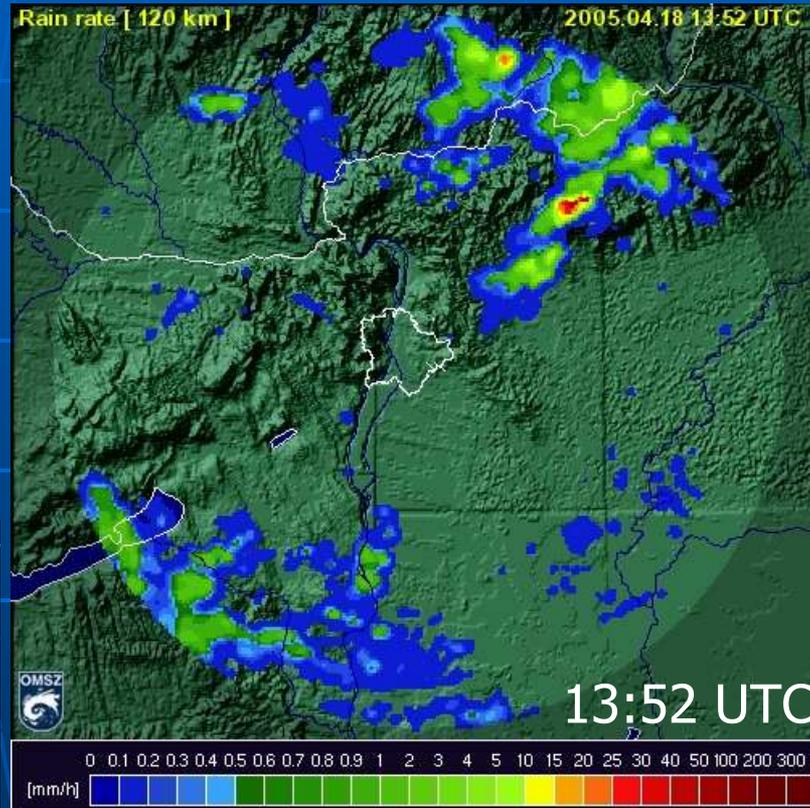
METEOSAT Infra (C) 2005-Apr-18 Hétfő 13:30 UT



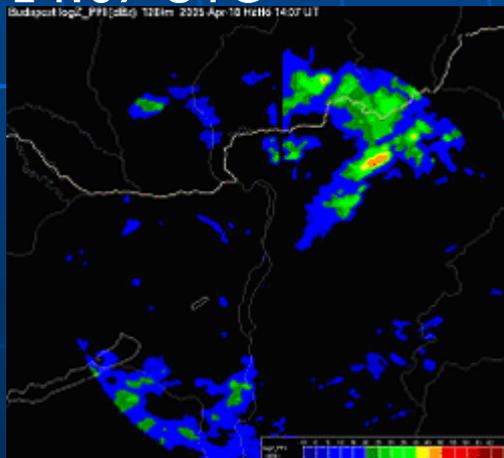
13:37 UTC



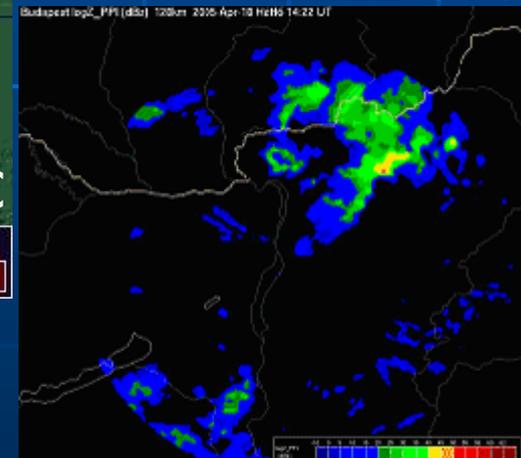
13:52 UTC



14:07 UTC



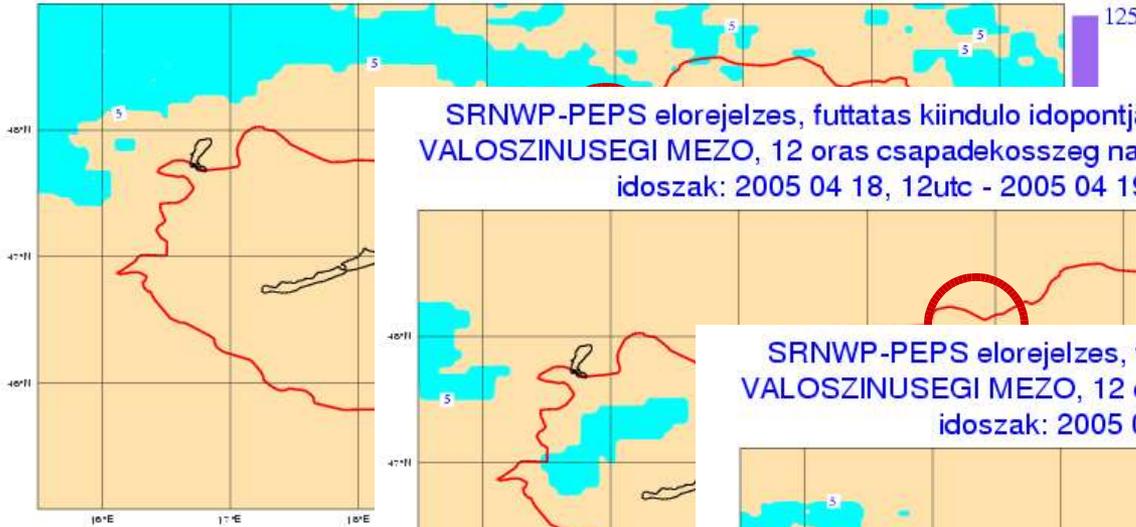
14:22 UTC



➤ SRNWP-PEPS forecasts:

- Ensemble mean is not showing high amounts (just 5-10mm)
- BUT probability of precipitation more than 25mm/12h is well predicted one day before (17/04/2005 12UTC forecast), though signal is not too intensive

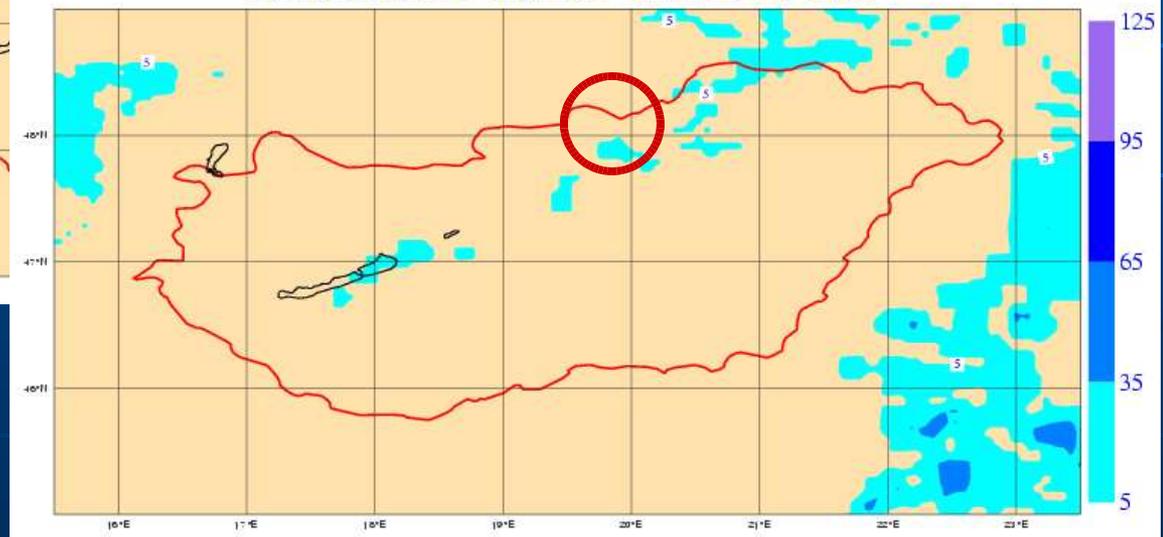
SRNWP-PEPS előrejelzés, futtatás kiinduló időpontja: 2005 04 17, 12utc
VALOSZINŰSEGI MEZO, 12 oras csapadekosszeg nagyobb mint 25mm (%)
idoszak: 2005 04 18, 06utc - 2005 04 18, 18utc



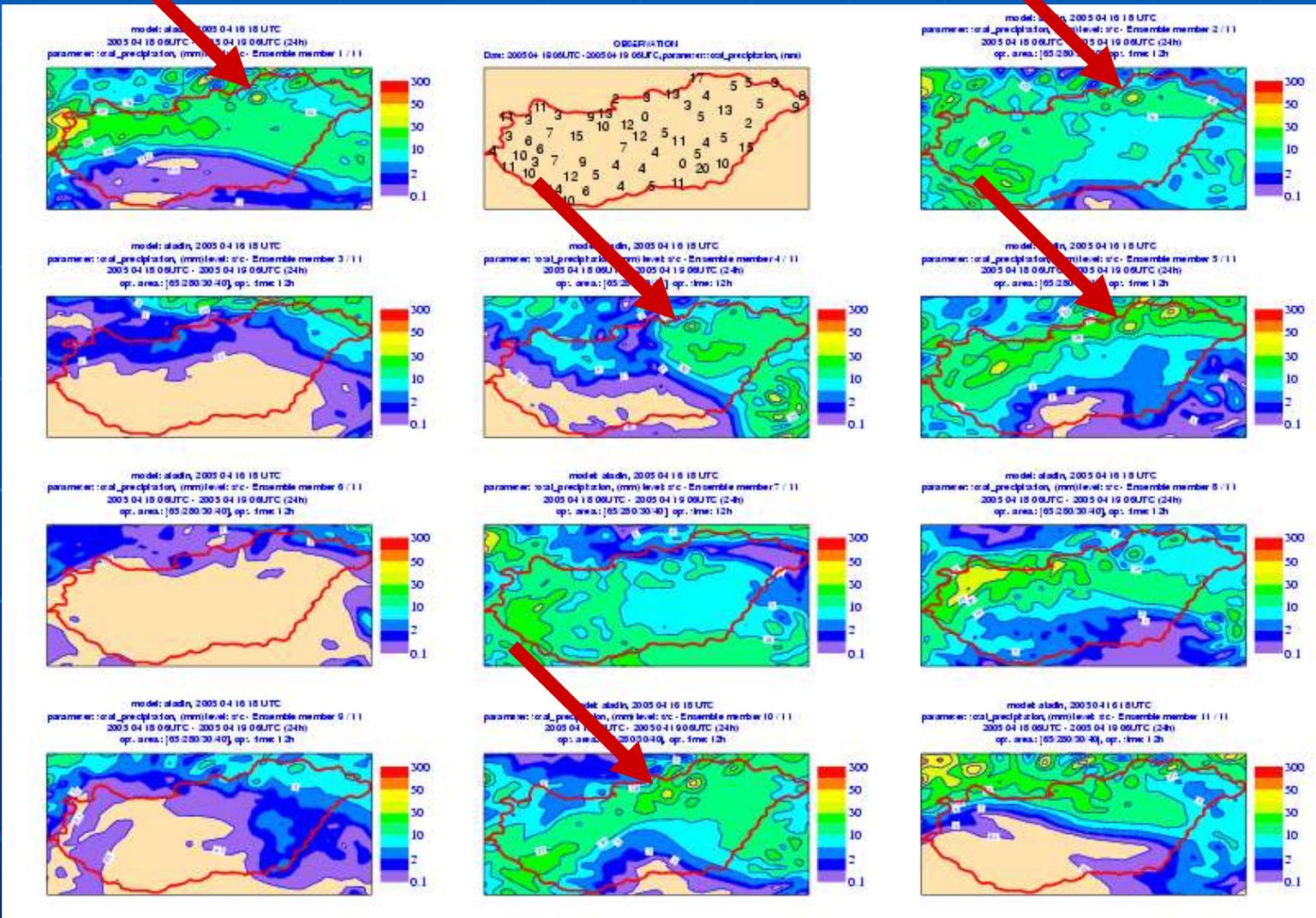
SRNWP-PEPS előrejelzés, futtatás kiinduló időpontja: 2005 04 17, 18utc
VALOSZINŰSEGI MEZO, 12 oras csapadekosszeg nagyobb mint 25mm (%)
idoszak: 2005 04 18, 12utc - 2005 04 19, 00utc



SRNWP-PEPS előrejelzés, futtatás kiinduló időpontja: 2005 04 18, 00utc
VALOSZINŰSEGI MEZO, 12 oras csapadekosszeg nagyobb mint 25mm (%)
idoszak: 2005 04 18, 06utc - 2005 04 18, 18utc

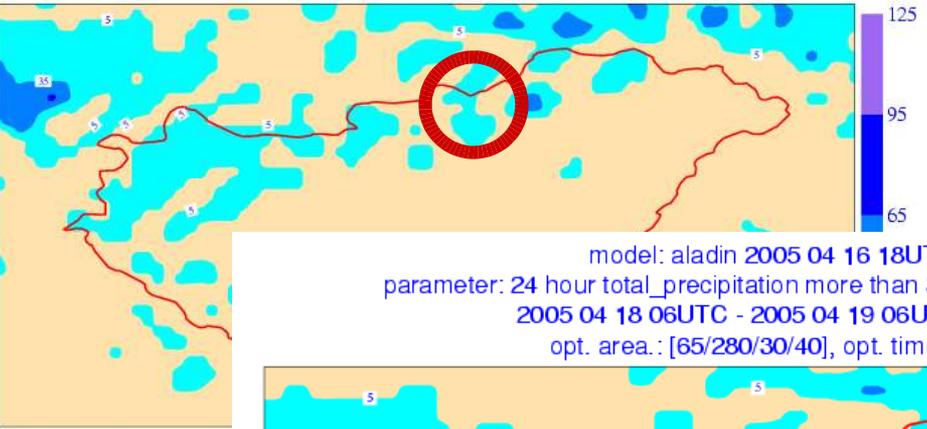


- ALADIN EPS coupled by PEACE forecasts:
 - Some members forecasting big amount of precipitation close to the correct location
 - ~10% probability of precipitation more than 35mm/24h at correct location

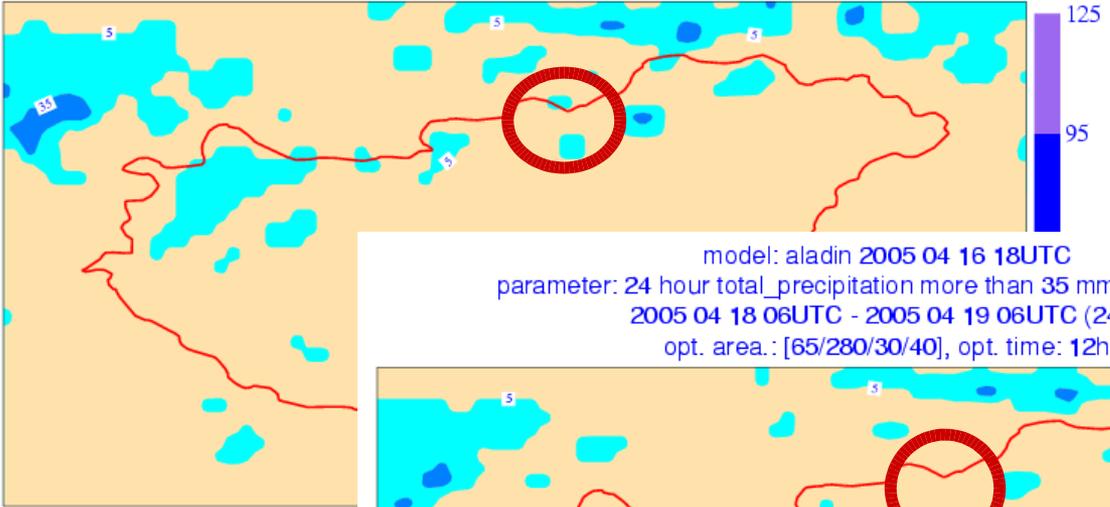


Case study PEACE

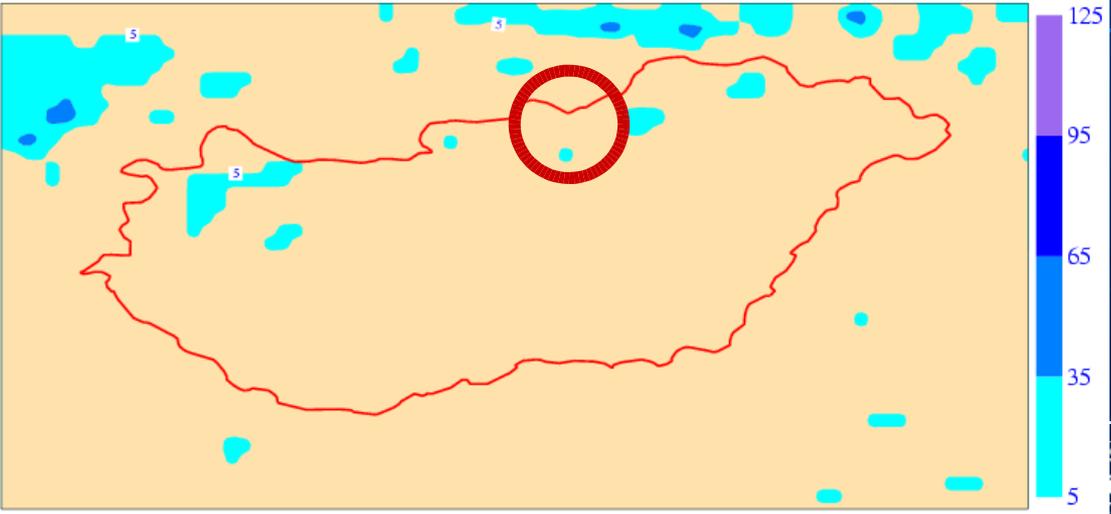
model: aladin 2005 04 16 18UTC
parameter: 24 hour total_precipitation more than 25 mm [%], level: sfc
2005 04 18 06UTC - 2005 04 19 06UTC (24h)
opt. area.: [65/280/30/40], opt. time: 12h



model: aladin 2005 04 16 18UTC
parameter: 24 hour total_precipitation more than 30 mm [%], level: sfc
2005 04 18 06UTC - 2005 04 19 06UTC (24h)
opt. area.: [65/280/30/40], opt. time: 12h



model: aladin 2005 04 16 18UTC
parameter: 24 hour total_precipitation more than 35 mm [%], level: sfc
2005 04 18 06UTC - 2005 04 19 06UTC (24h)
opt. area.: [65/280/30/40], opt. time: 12h



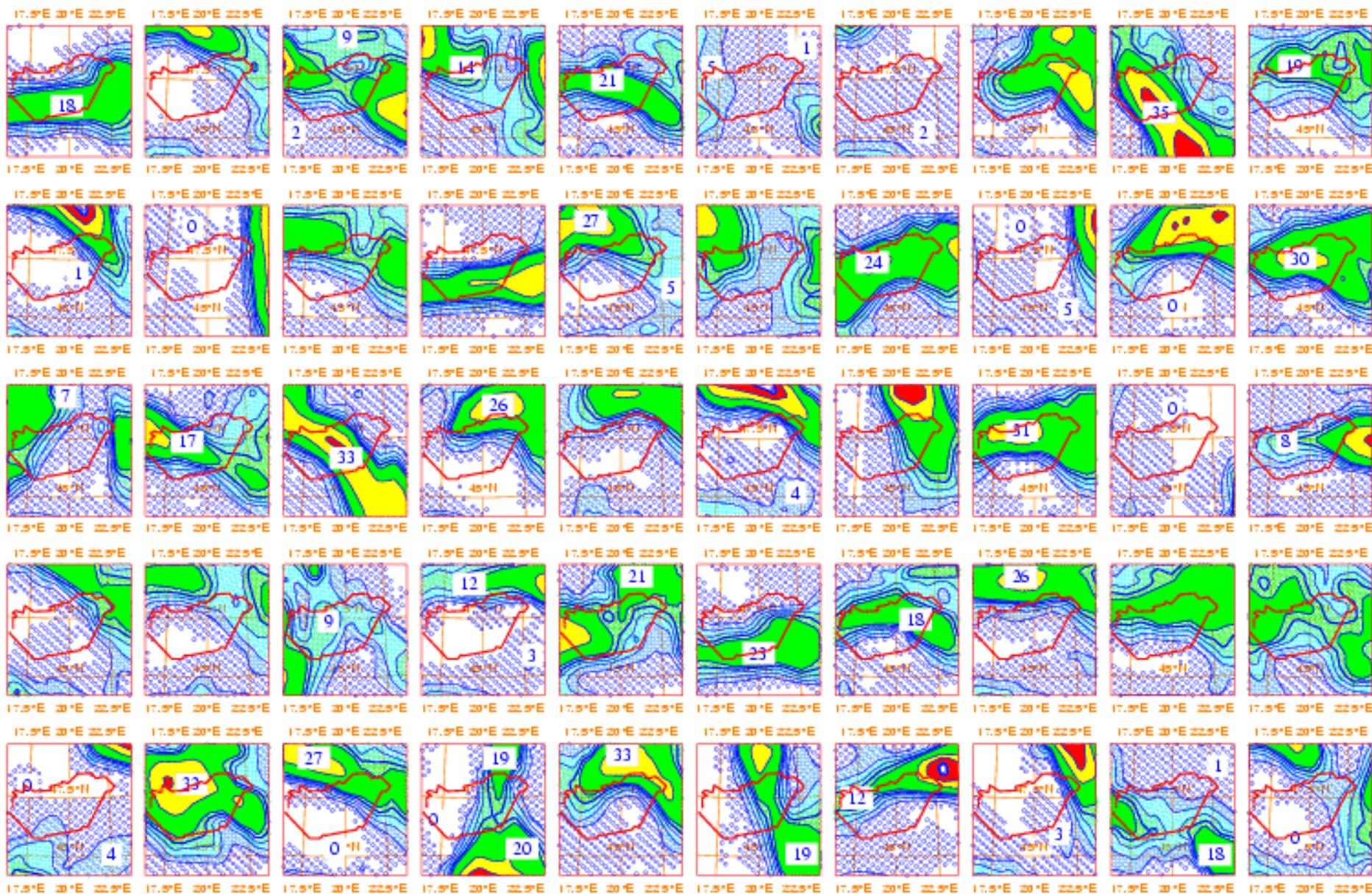
A

casts



➤ COSMO-LEPS forecasts:

- ~10% probability of precipitation more than 20mm/24h at nearly correct location 4 days before the event
- No sign at all 3, 2 and 1 day before the event



Case study ECMWF-EPS

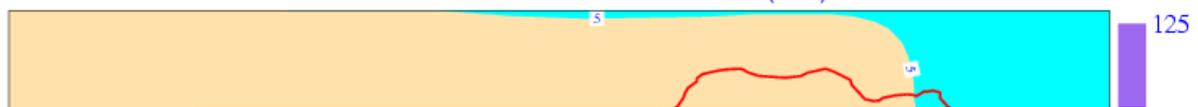
model: ECMWF EPS 2005 04 14 12UTC

parameter: 24 hour total precipitation more than 25 mm [%], level: sfc
2005 04 18 12UTC - 2005 04 19 12UTC (24h)



model: ECMWF EPS 2005 04 15 12UTC

parameter: 24 hour total precipitation more than 25 mm [%], level: sfc
2005 04 18 12UTC - 2005 04 19 12UTC (24h)



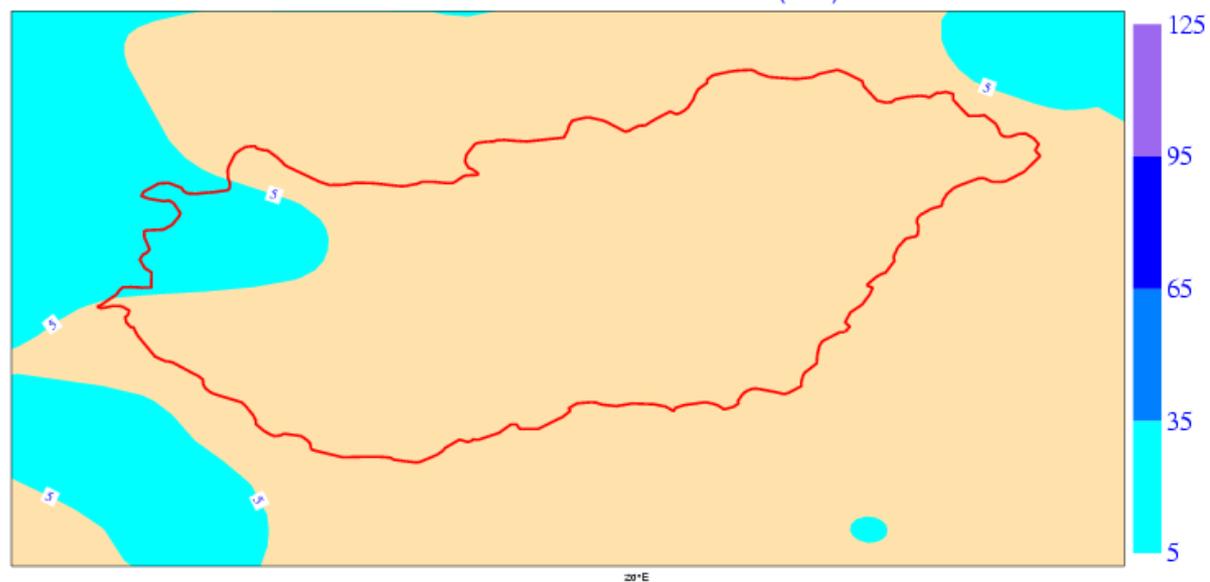
model: ECMWF EPS 2005 04 16 12UTC

parameter: 24 hour total precipitation more than 25 mm [%], level: sfc
2005 04 18 12UTC - 2005 04 19 12UTC (24h)

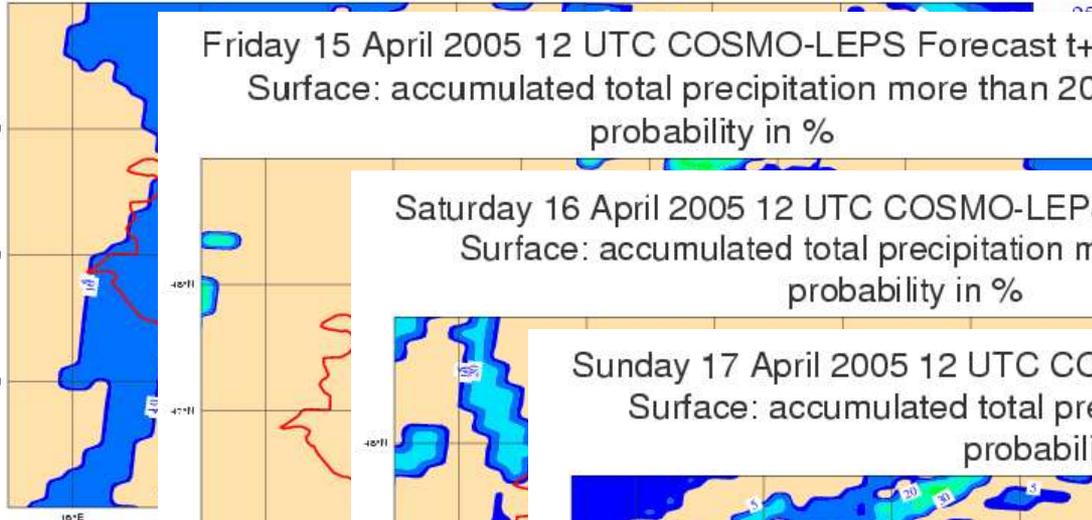


model: ECMWF EPS 2005 04 17 12UTC

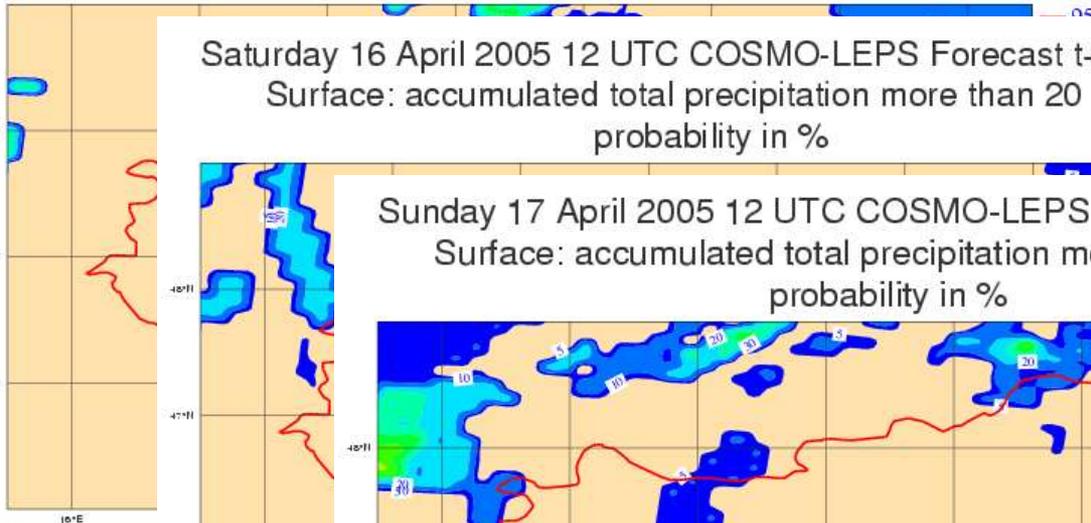
parameter: 24 hour total precipitation more than 25 mm [%], level: sfc
2005 04 18 12UTC - 2005 04 19 12UTC (24h)



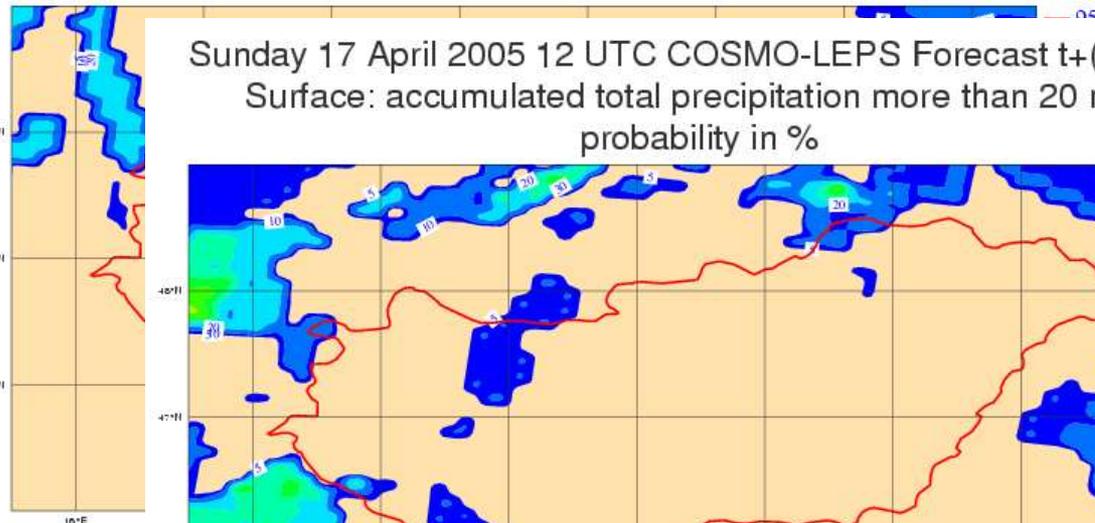
Thursday 14 April 2005 12 UTC COSMO-LEPS Forecast t+(96-120)
Surface: accumulated total precipitation more than 20 mm
probability in %



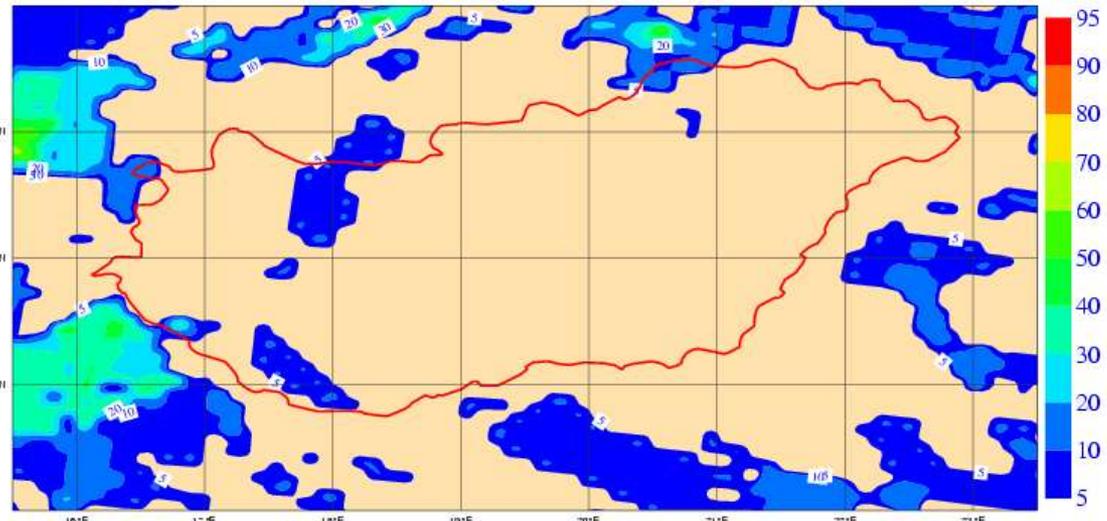
Friday 15 April 2005 12 UTC COSMO-LEPS Forecast t+(72-96)
Surface: accumulated total precipitation more than 20 mm
probability in %



Saturday 16 April 2005 12 UTC COSMO-LEPS Forecast t+(48-72)
Surface: accumulated total precipitation more than 20 mm
probability in %



Sunday 17 April 2005 12 UTC COSMO-LEPS Forecast t+(24-48)
Surface: accumulated total precipitation more than 20 mm
probability in %



Conclusions

- From the case studies and the experiments with downscaling the PEACE ensemble members:
 - spread is quite small for surface parameters
 - better situation for higher levels
 - by simply downscaling ARPEGE EPS forecasts with ALADIN it is very difficult to achieve significant improvements
- There is a strong need to compute local perturbations (e.g. breeding, SV)

Future plans

- Very-short term plans (within weeks):
 - finish sensitivity experiments on target domain and target time
- Longer term plans (within a year):
 - start computing local perturbations inside ALADIN using the breeding method
 - work on ALADIN SVs ?
- Coordination is needed to distribute the work (ALADIN, HIRLAM, SRNWP)

Thank you!