First LAMEPS experiments at the Hungarian Meteorological Service

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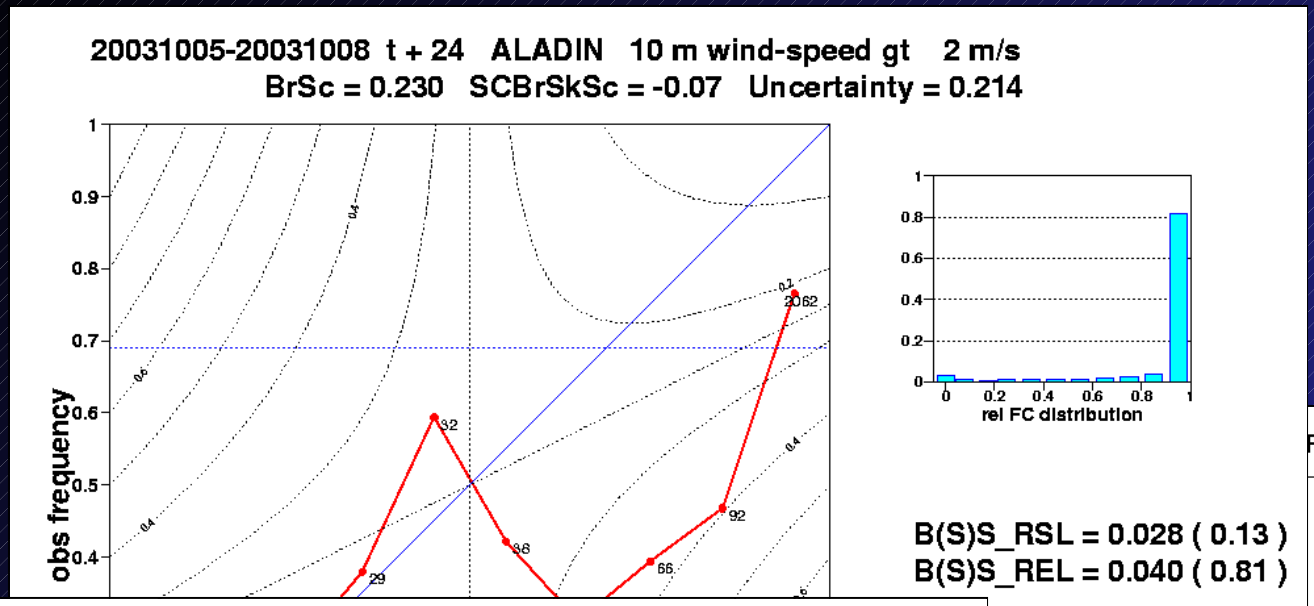
Motivation

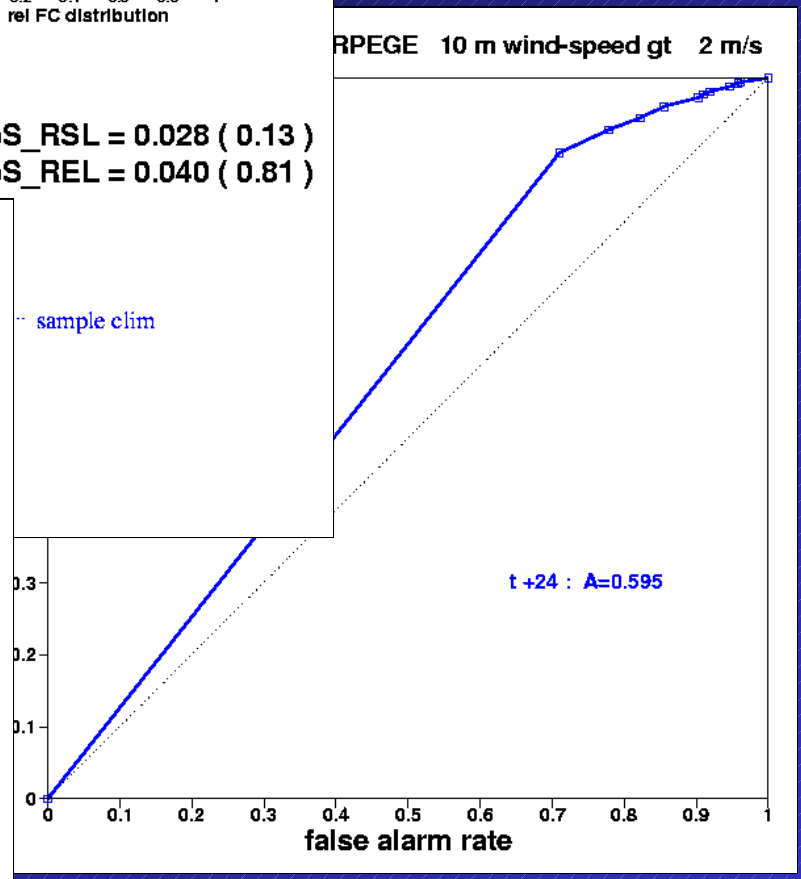
- Success of global ensemble systems on large scales and medium-range
- A need for ensemble prediction on smaller scales and short range, too: LAMEPS
- Main goal: better prediction of local extreme events at short range (windstorms, heavy precipitation etc.)
- Experiments started in 2003 at HMS

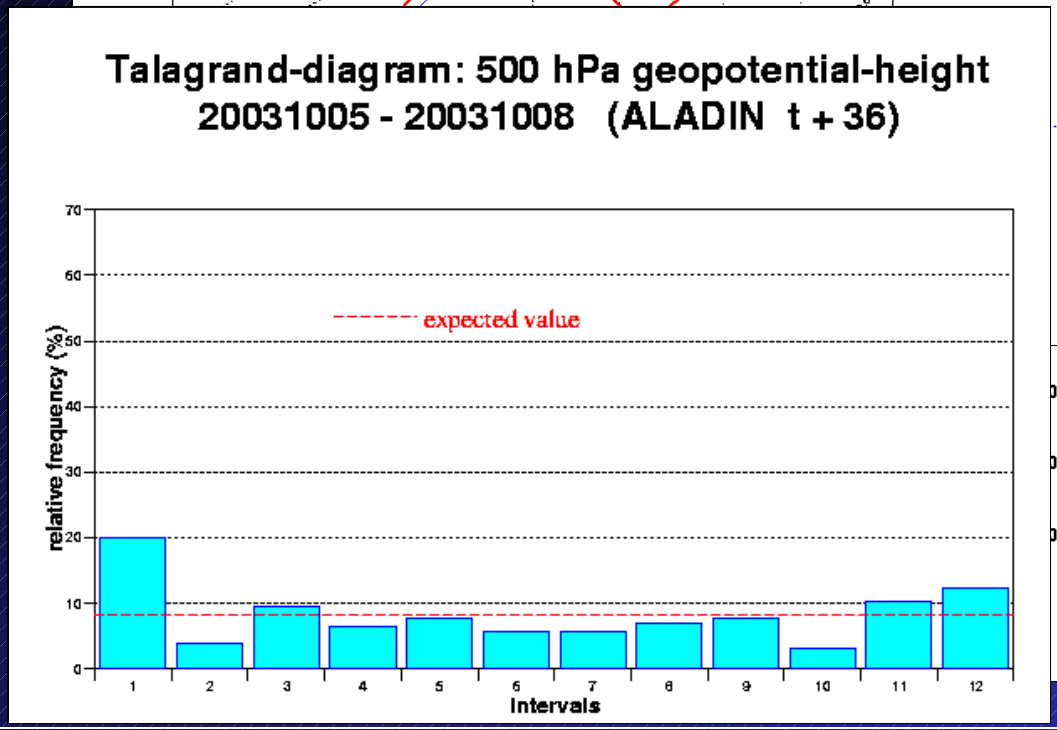
Verification tools

- ROC (Relative Operating Characteristics) diagram
- Talagrand diagram
- Brier score, Reliability diagram

- Special verification method for precipitation
  - verification against „super-observations”

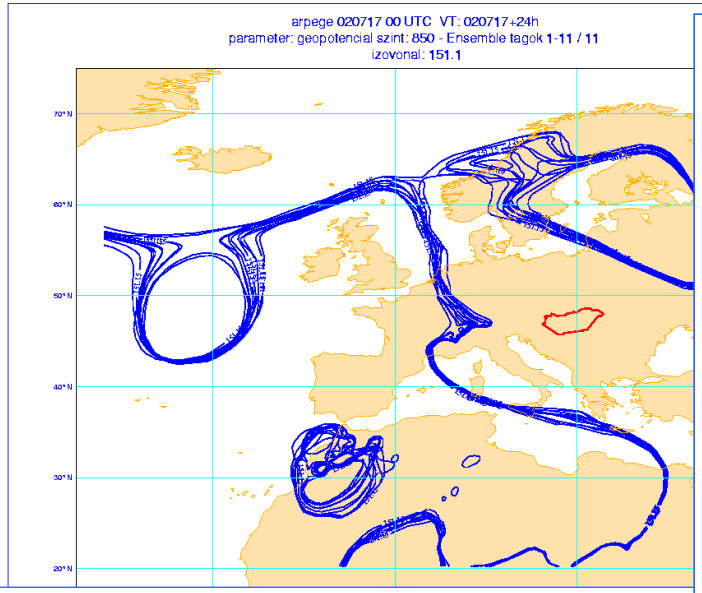

20031005-20031008 t + 24 ALADIN 10 m wind-speed gt 2 m/s
BrSc = 0.230 SCBrSkSc = -0.07 Uncertainty = 0.214
obs frequency
2062
32
29
36
66
92
rel FC distribution
B(S)S_RSL = 0.028 (0.13)
B(S)S_REL = 0.040 (0.81)
sample clim

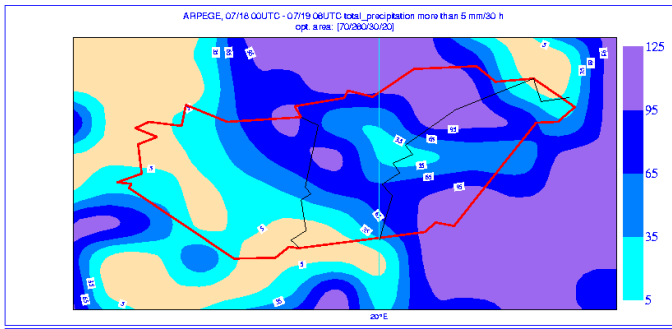

RPEGE 10 m wind-speed gt 2 m/s
t +24 : A=0.595
false alarm rate

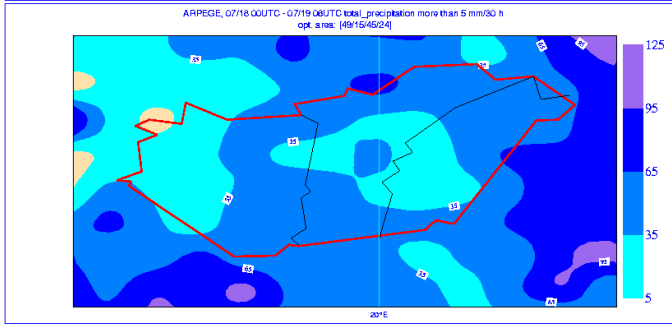

Talagrand-diagram: 500 hPa geopotential-height
20031005 - 20031008 (ALADIN t + 36)
expected value
relative frequency (%)
Intervals

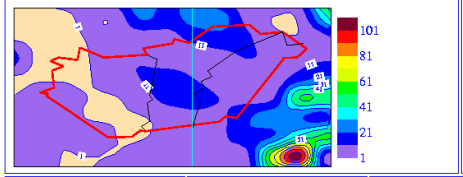
Visualization tools

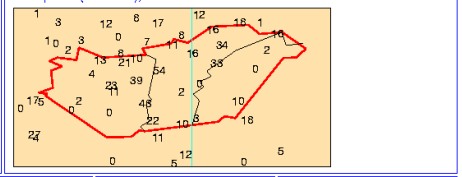
- Ensemble mean
- Plumes
- Probabilities
- Members (together/only one member)
- Spaghetti diagram

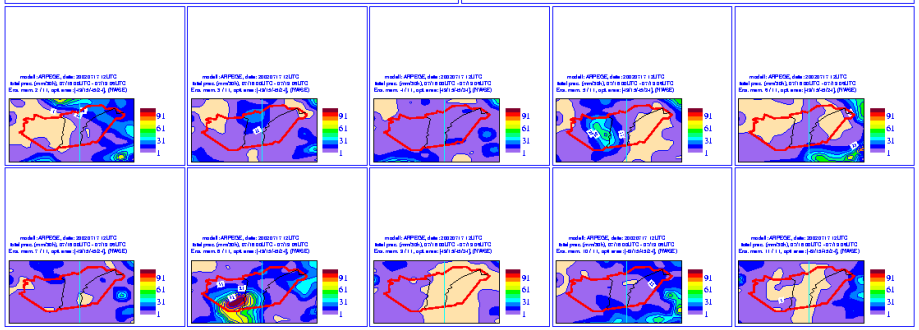

arpege 020717 00 UTC VT: 020717+24h
parameter: geopotencial szint: 850 - Ensemble tagok 1-11 / 11
izovonal: 151.1

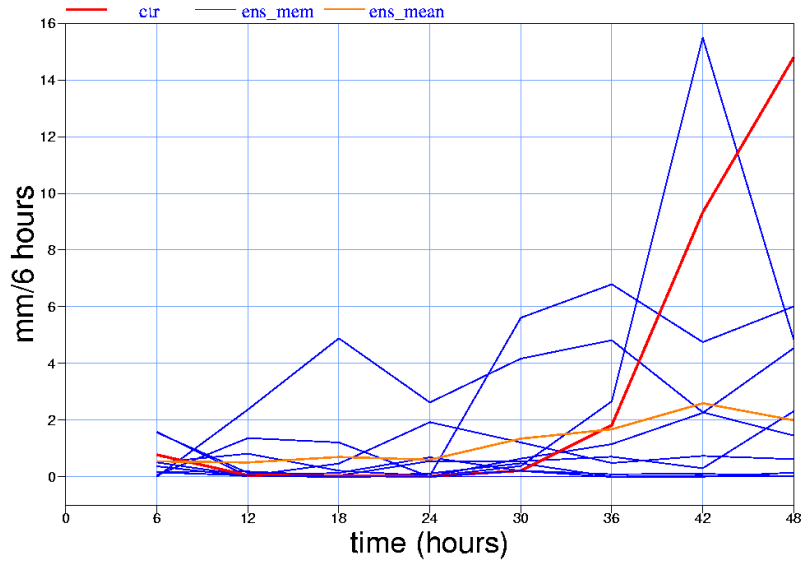

ARPEGE, 07/18 00UTC - 07/19 06UTC total_precipitation more than 5 mm/30 h
opt. area: [70/280/30/20]
125
95
65
35
5


ARPEGE, 07/18 00UTC - 07/19 06UTC total_precipitation more than 5 mm/30 h
opt. area: [49/15/45/24]
125
95
65
35
5


model: ARPEGE, date: 20020717 12UTC
total prec. (mm/30h), 07/18 00UTC - 07/19 06UTC
Ens. memb. 1 / 11
101
81
61
41
21
1


OBSERVATION
total prec. (mm/30h), 07/18 00UTC - 07/19 06UTC




ctr
ens_mem
ens_mean
mm/6 hours
time (hours)
0
2
4
6
8
10
12
14
16
0
6
12
18
24
30
36
42
48

LAMEPS experiments at HMS

- Methods we want to try:
  - ALADIN EPS coupled with global (ARPEGE based) ensemble members
  - ALADIN EPS coupled with representative members of clusters of ARPEGE based super ensemble
  - ALADIN EPS based on ALADIN native SV perturbations

ALADIN EPS coupled with ARPEGE EPS

- Downscaling directly PEACE forecasts (optimized for Western Europe)?
  - Are the PEACE provided initial and boundary conditions convenient for the local EPS run, for a Central European application?
  - What is the impact of different target domains and optimization times?

ARPEGE EPS runs at HMS

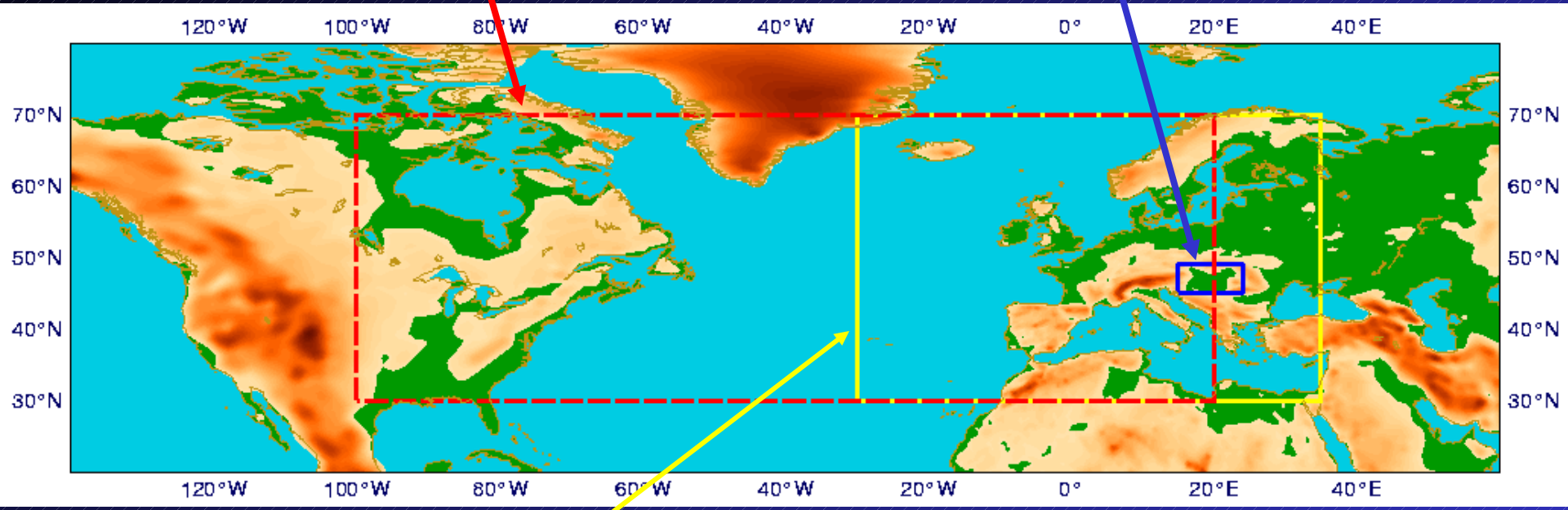
- 10+1 ensemble members using ARPEGE
- SV technique, 16 SVs $\Rightarrow$ 5 perturbations
- Total energy norm (initial and final time)
- Forecasts for 54 hours
- SV target domain: ?
- SV optimization time: ?

Experiments (1.)

- Target domains to try:
  - Atlantic Ocean and Western Europe
  - Europe and some of the Atlantic Ocean
  - ~ Hungary
- Optimization times to try:
  - 12 hours
  - 24 hours (plan)

Atlantic Ocean and Western Europe (target domain 1.)

~ Hungary (target domain 3.)



~ Europe (target domain 2.)

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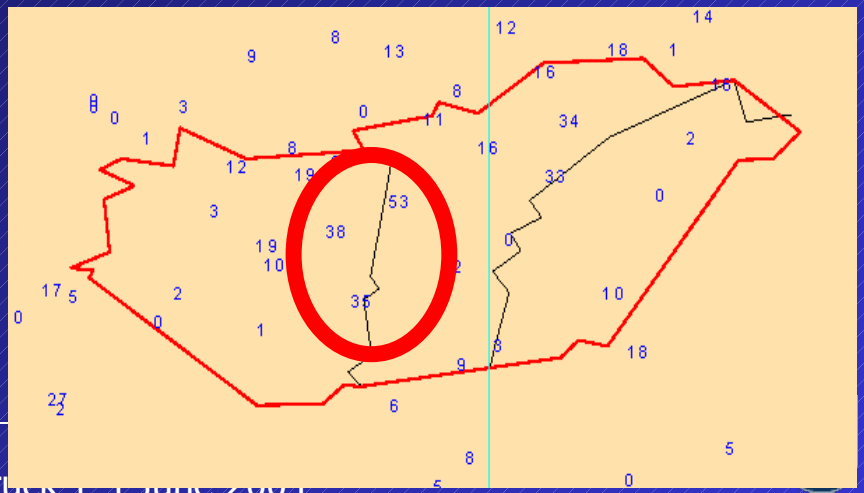
Experiments (2.)

- To answer the question of domains and times $\Rightarrow$ case studies:
  - different meteorological situations:
    - ***situation when local effects dominated***
    - fast moving cold front from Western Europe (experiments started)
    - cyclone from South Europe (plan)

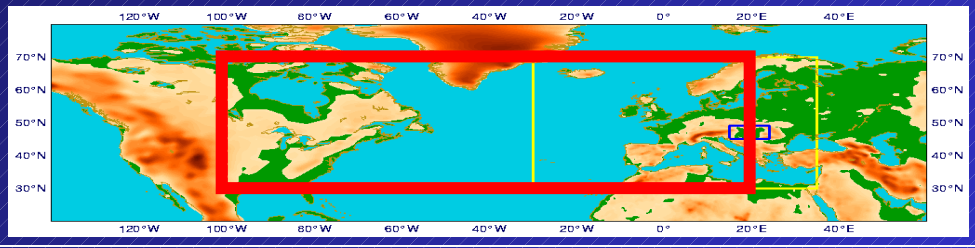
Situation when local effects dominated

- A convective event (18. 07. 2002.):
  - On 18 July it rained throughout the country, thunderstorms were reported, large quantity of precipitation (40-70 mm) was measured in some places along the Danube
  - The models failed to forecast the event



Results - Target domain 1.

- ***17. 07. 12UTC run, ALADIN EPS***
  - 24 hours precipitation (18/07 00UTC - 19/07 00UTC)
    - small spread
    - the quantity of 24h precipitation is not more than 10 mm in the area of interest
  - 30 hours precipitation (18/07 00UTC - 19/07 06UTC)
    - the same as for the 24h precipitation



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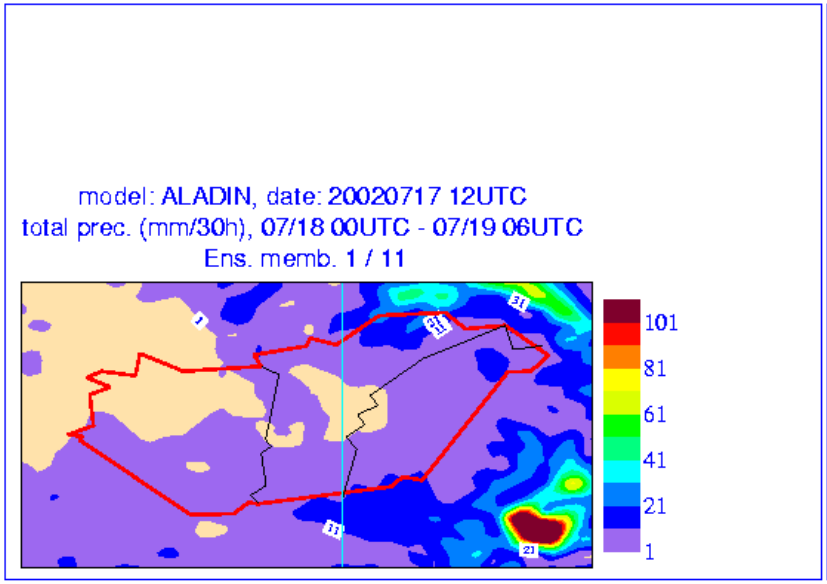
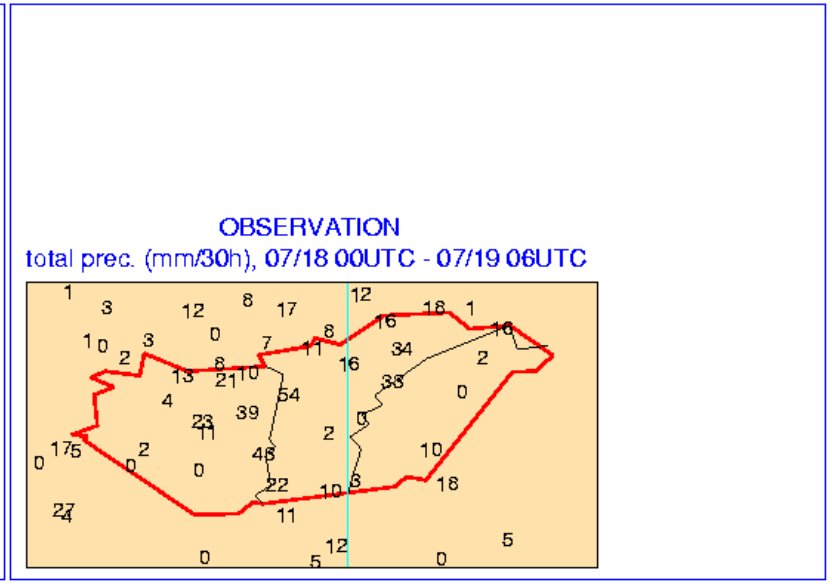
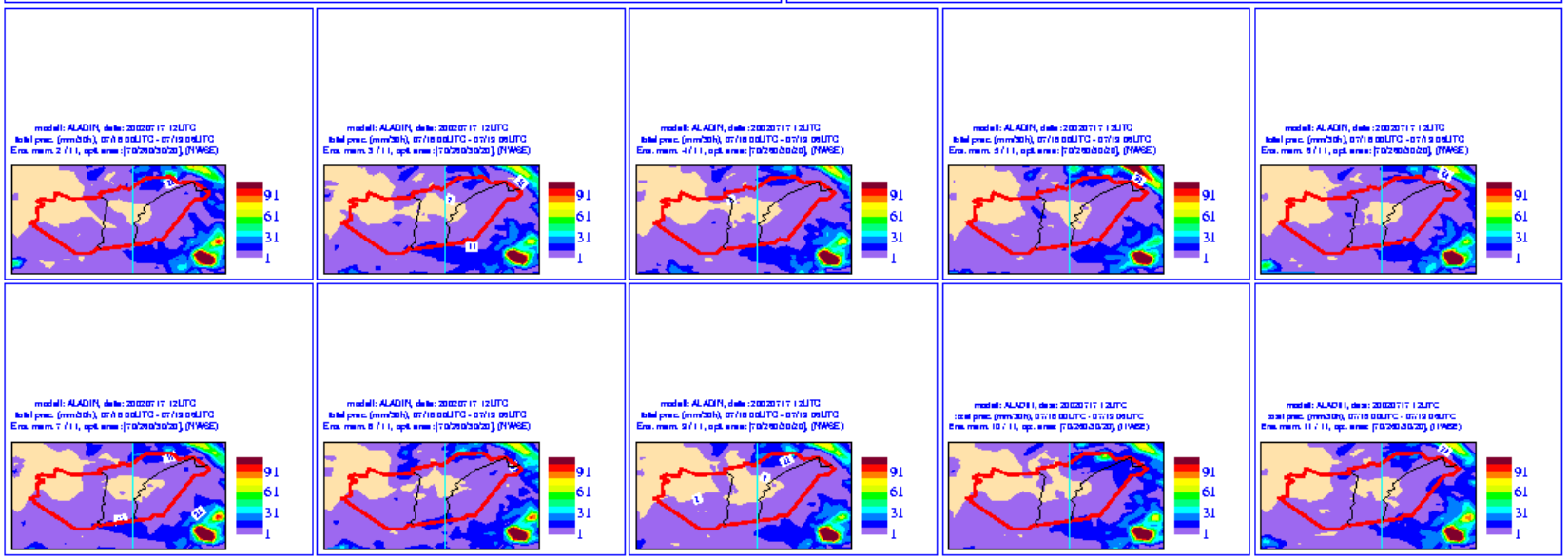
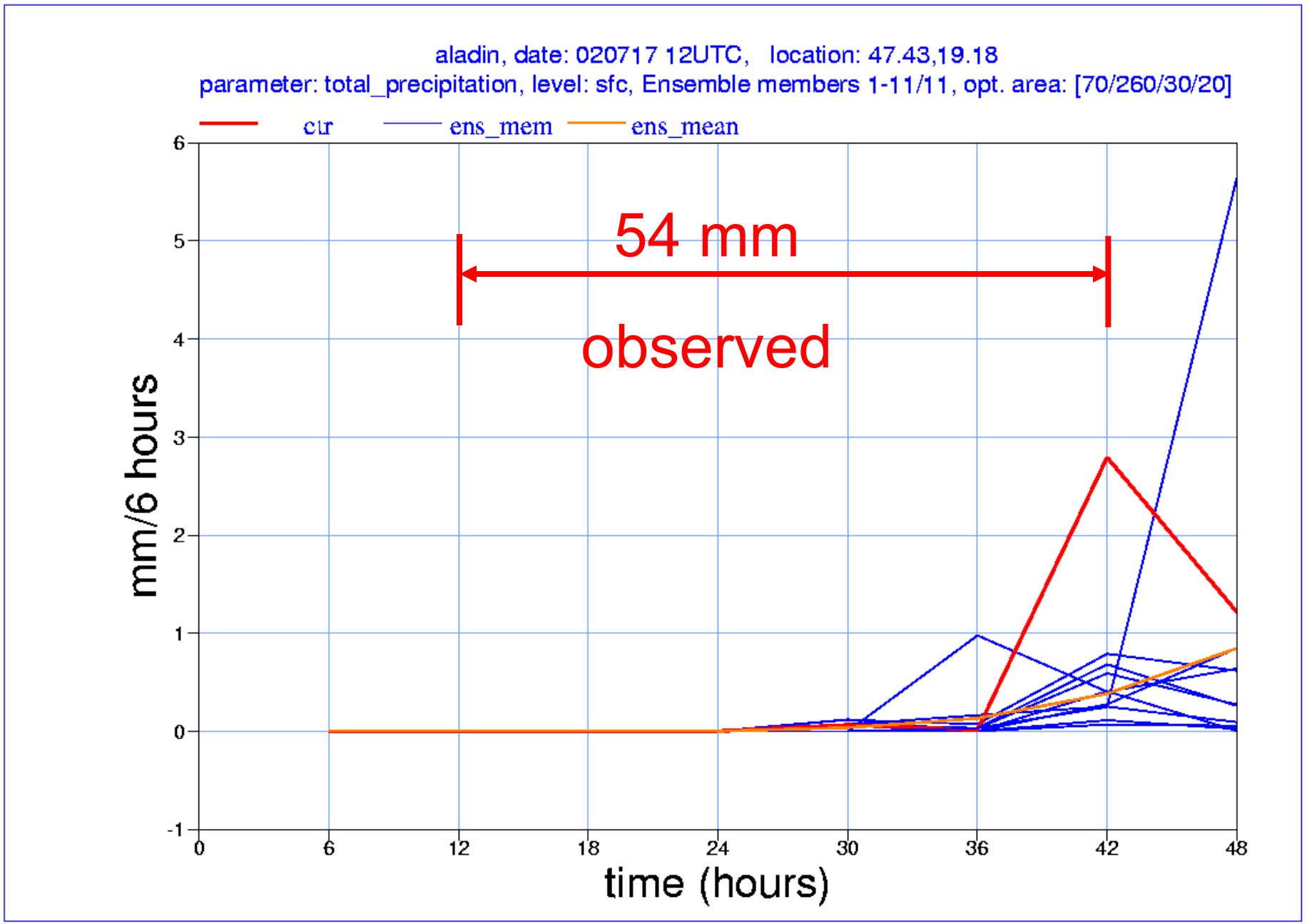
(18/07 00 UTC-19/07 06 UTC)



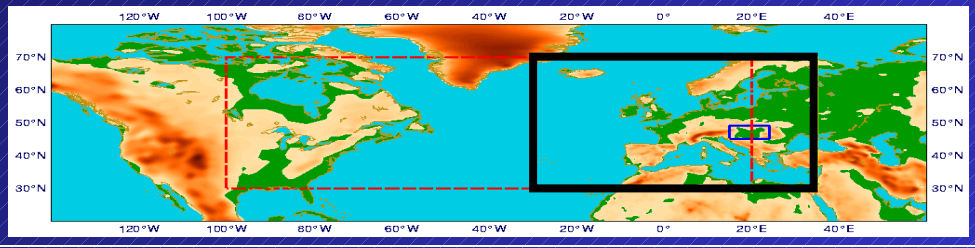





aladin, date: 020717 12UTC, location: 47.43,19.18
parameter: total_precipitation, level: sfc, Ensemble members 1-11/11, opt. area: [70/260/30/20]
ctr
ens_mem
ens_mean
54 mm
observed
mm/6 hours
time (hours)
6
5
4
3
2
1
0
-1
0
6
12
18
24
30
36
42
48

Results - target domain 2.

- ***17. 07. 12UTC run, ALADIN EPS***
  - 24 hours precipitation (18/07 00UTC - 19/07 00UTC)
    - the quantity of 24h precipitation is not more than 10 mm in the area of interest, small spread
  - 30 hours precipitation (18/07 00UTC - 19/07 06UTC)
    - slightly better results, the spread is bigger, but the location of the precipitation is not good



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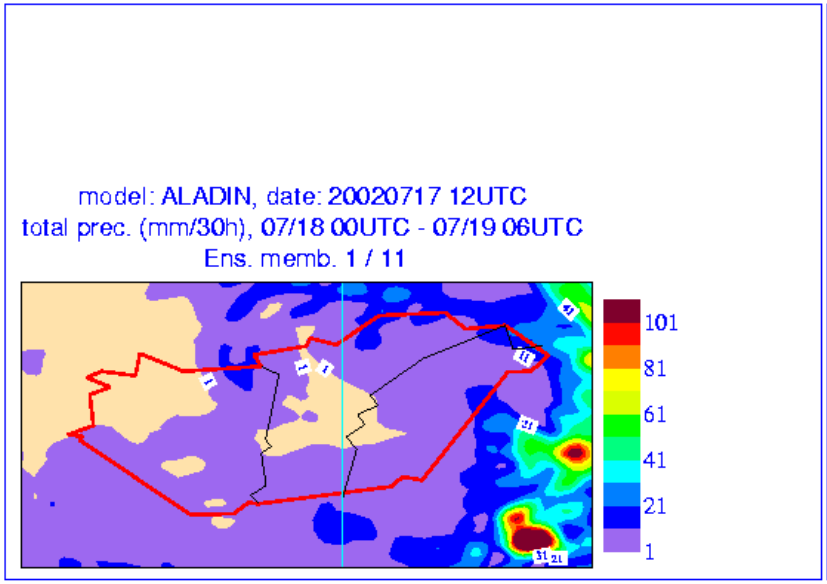
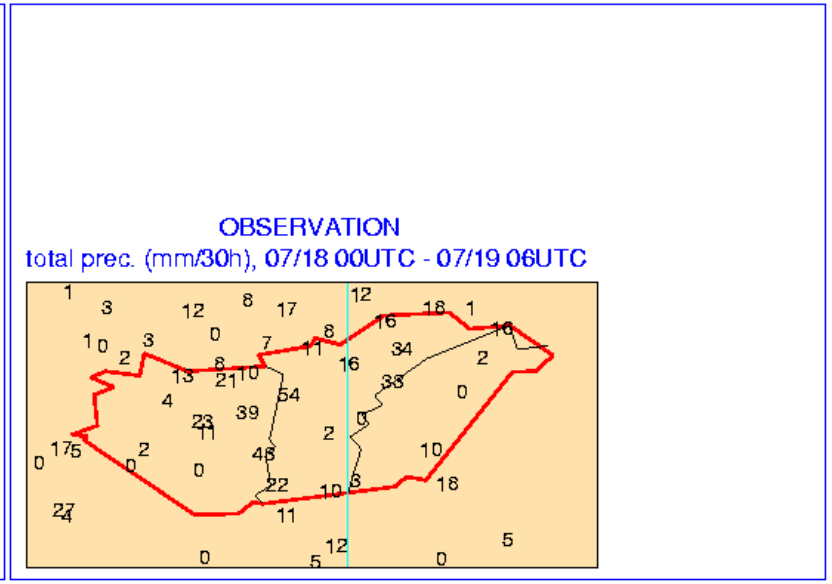
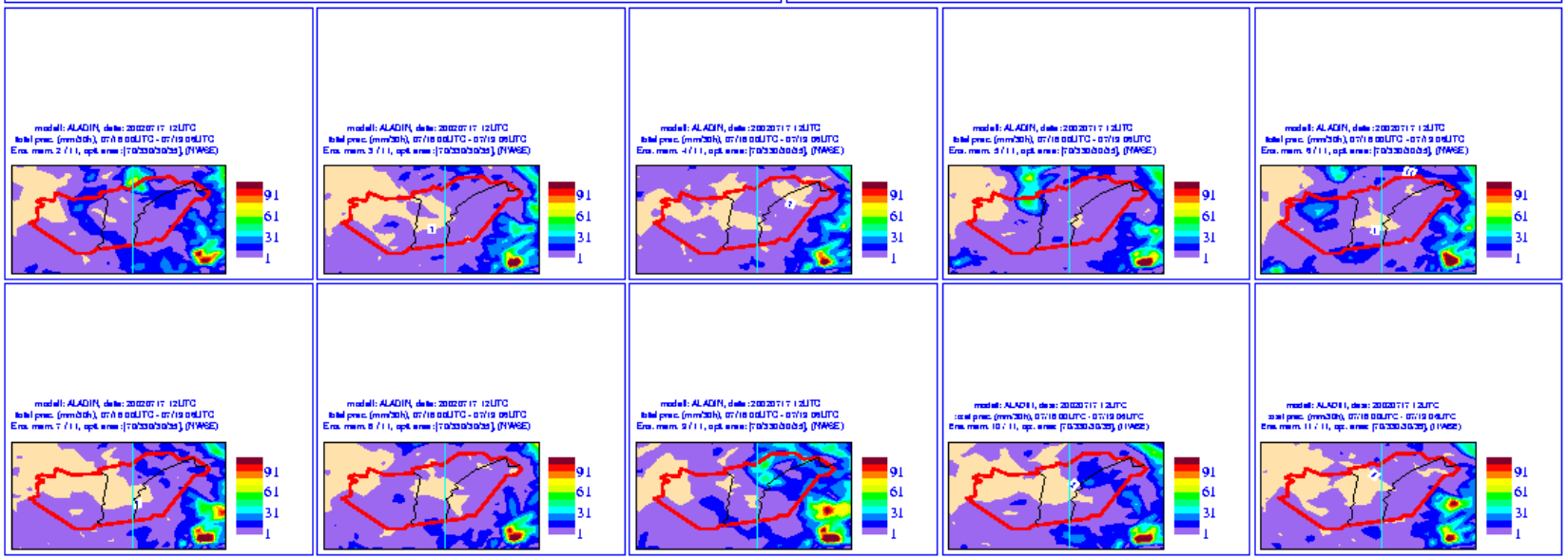
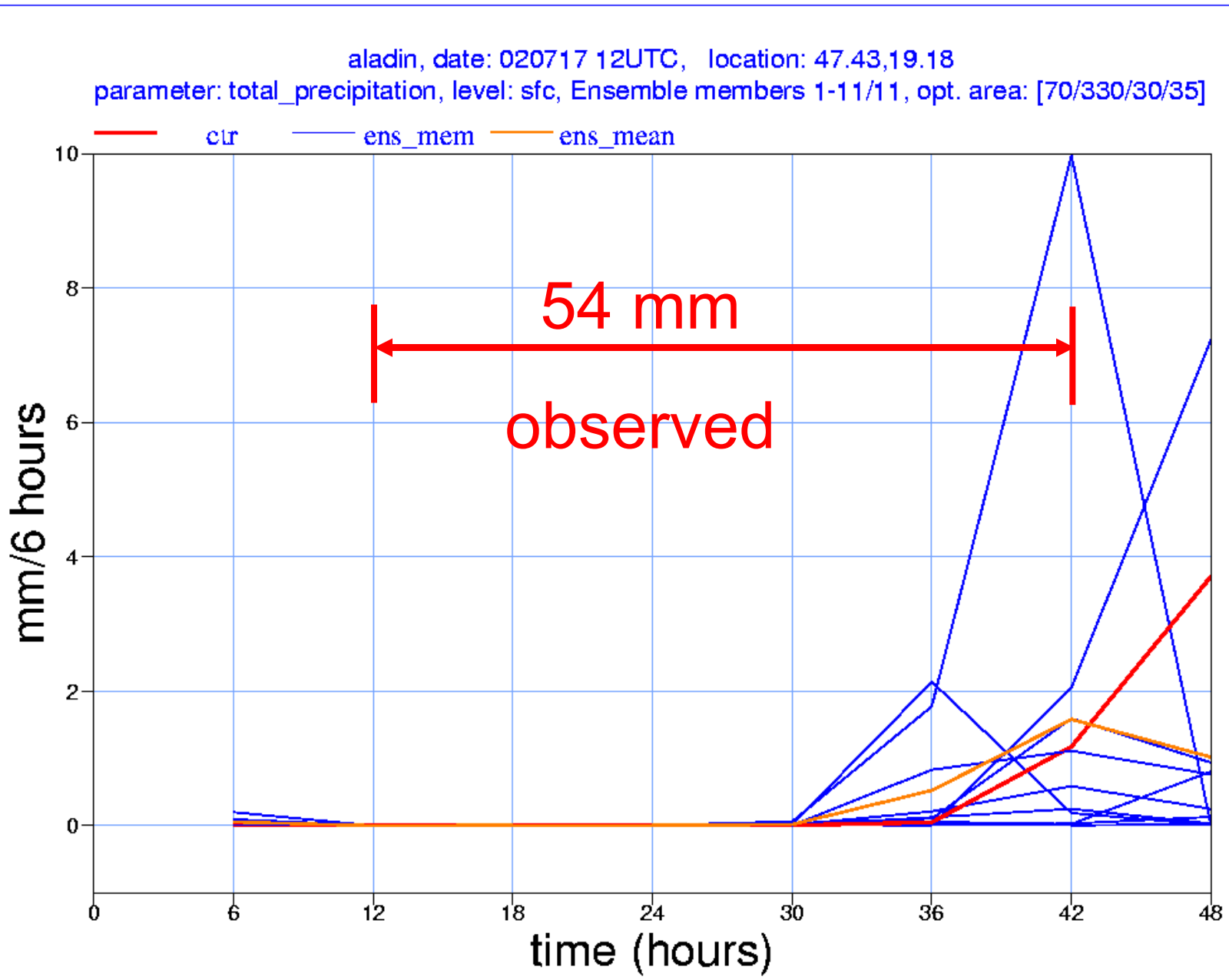
(18/07 00 UTC-19/07 06 UTC)





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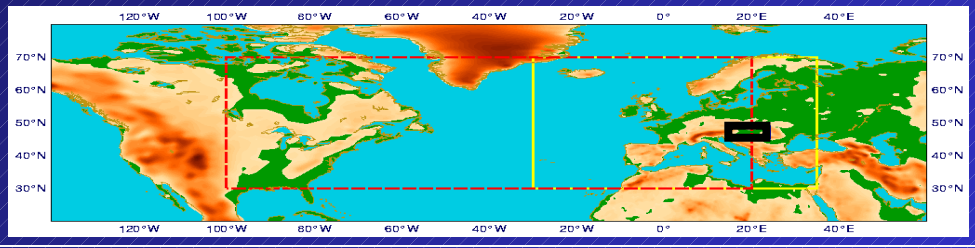
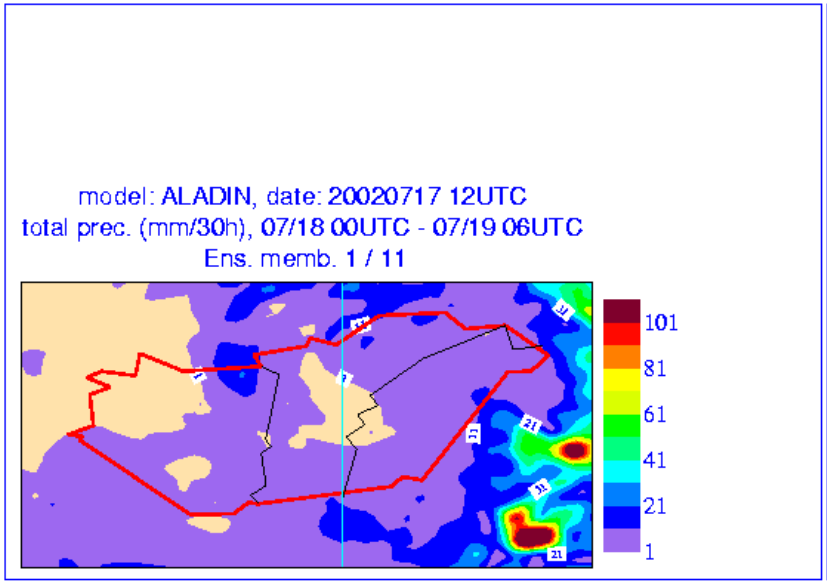
ctr
ens_mem
ens_mean
54 mm
observed
mm/6 hours
time (hours)
0
2
4
6
8
10
0
6
12
18
24
30
36
42
48

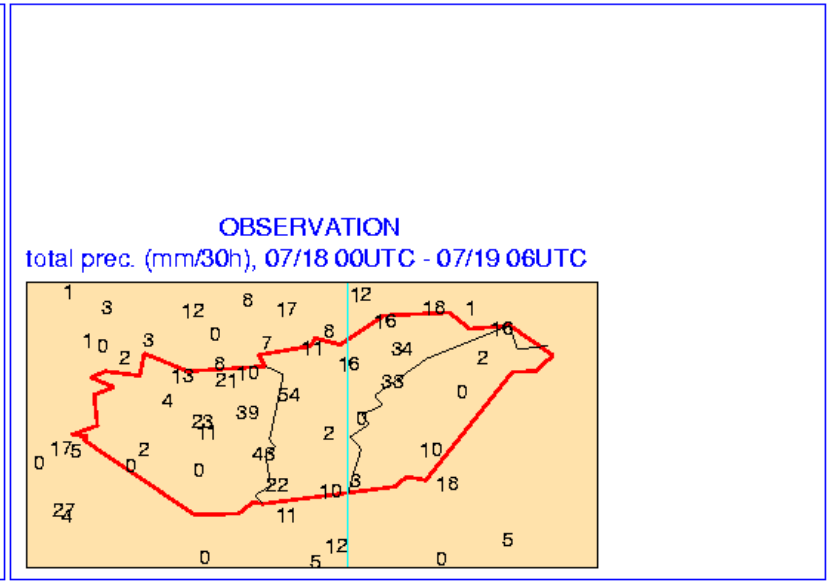
Results - Target domain 3.

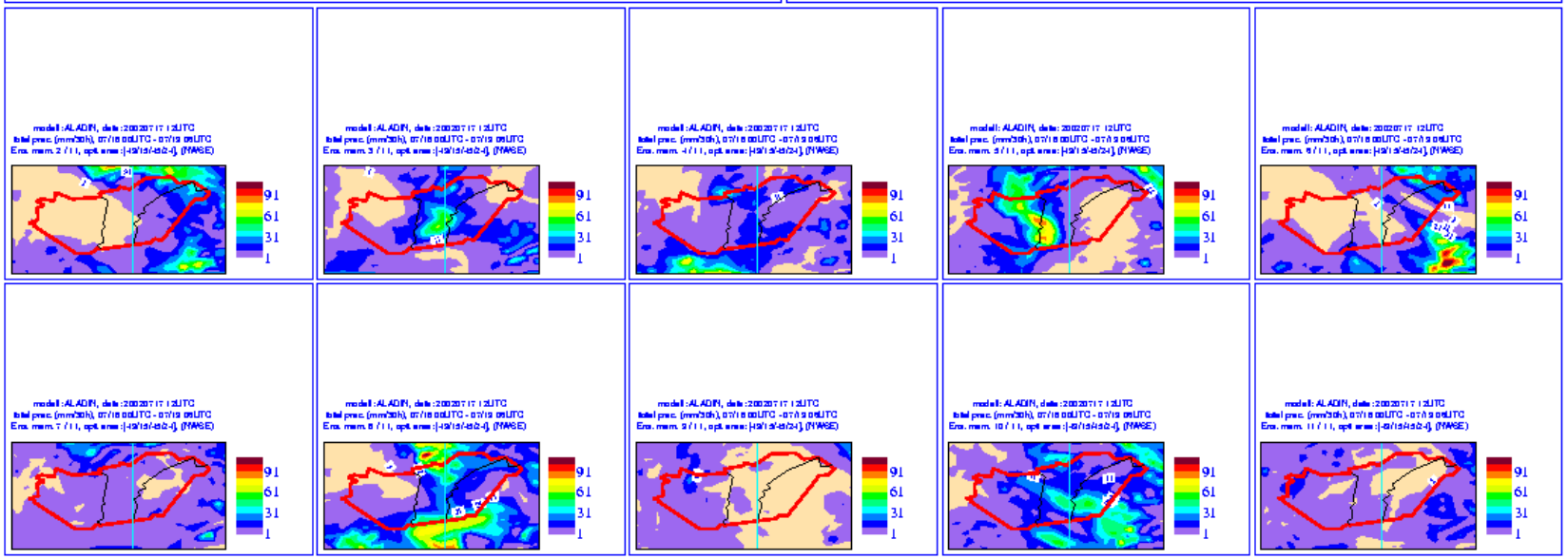
- ***17. 07. 12UTC run, ALADIN EPS***
  - 24 hours precipitation (18/07 00UTC - 19/07 00UTC)
  - 30 hours precipitation (18/07 00UTC - 19/07 06UTC)
    - the spread is much more bigger
    - some of the members show more precipitation, near the area of interest

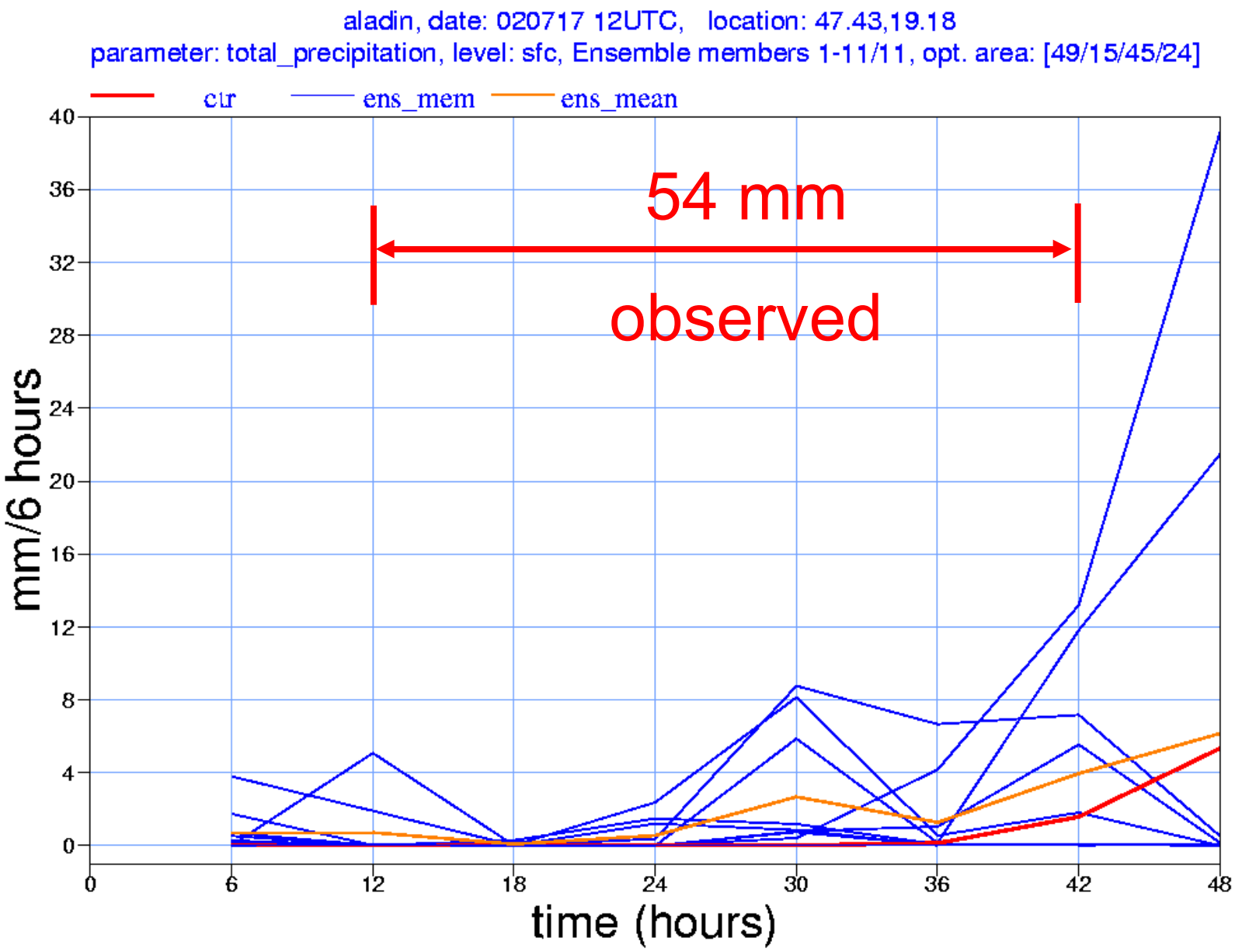


(18/07 00 UTC-19/07 06 UTC)





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ctr
ens_mem
ens_mean
54 mm
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time (hours)
0
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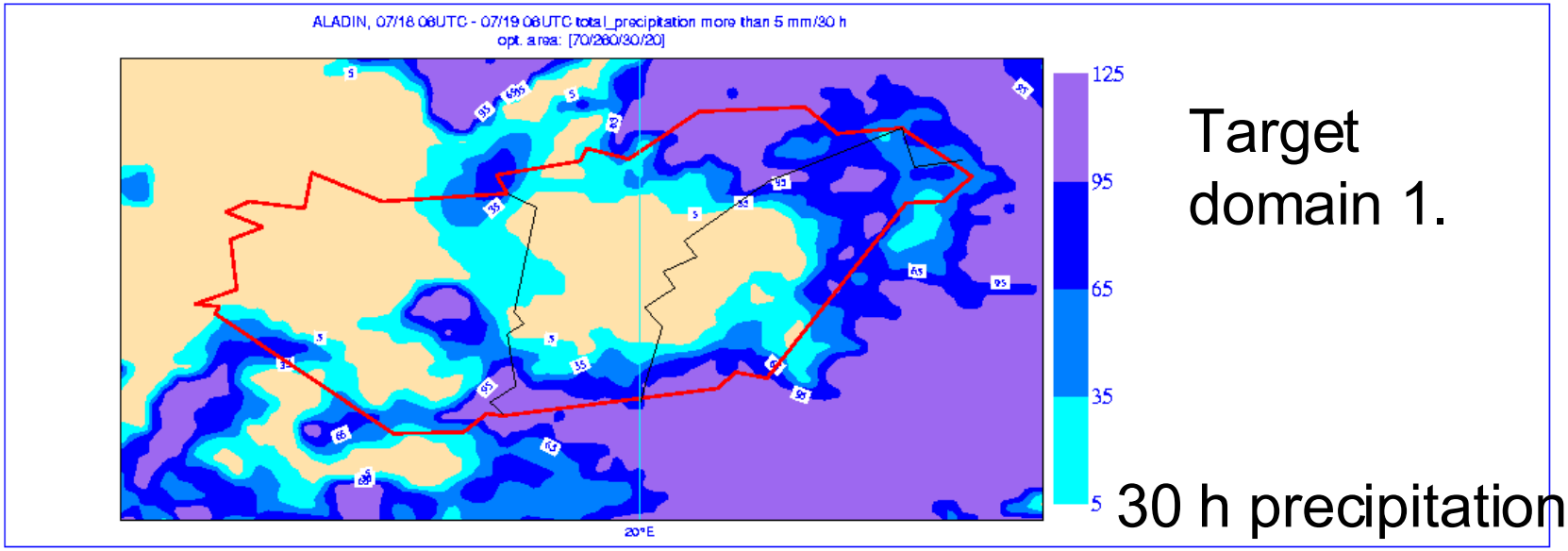
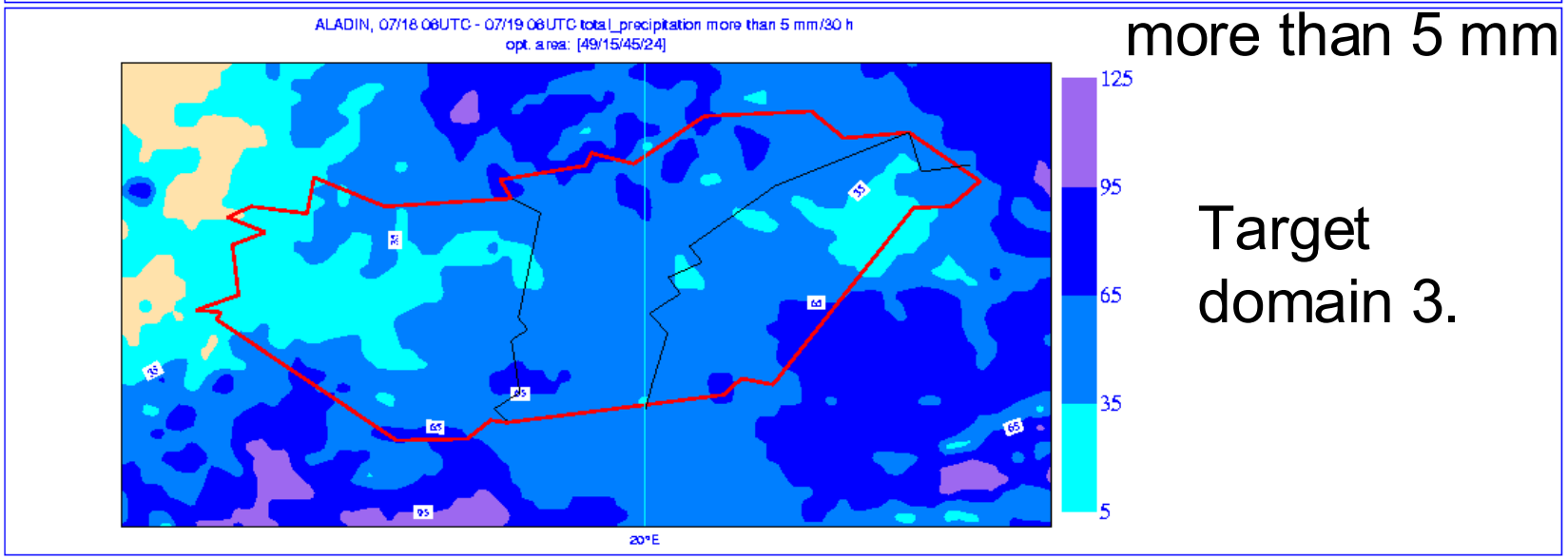
Probabilities



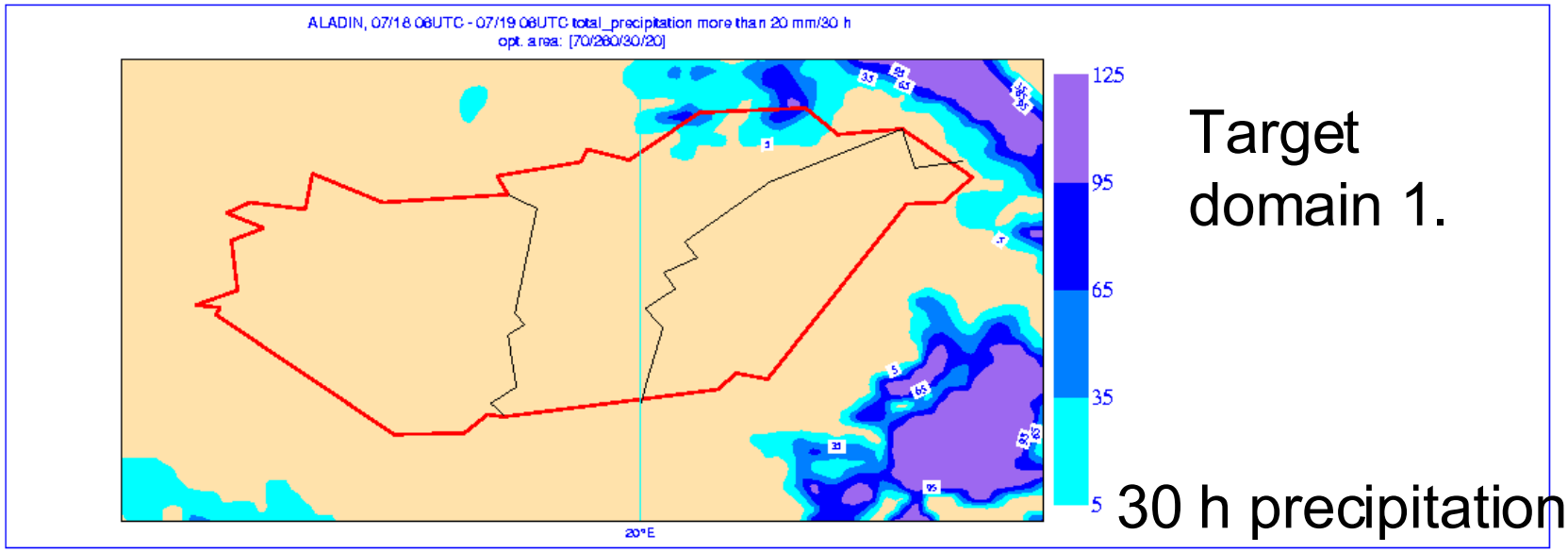
Target domain 1.

30 h precipitation more than 5 mm



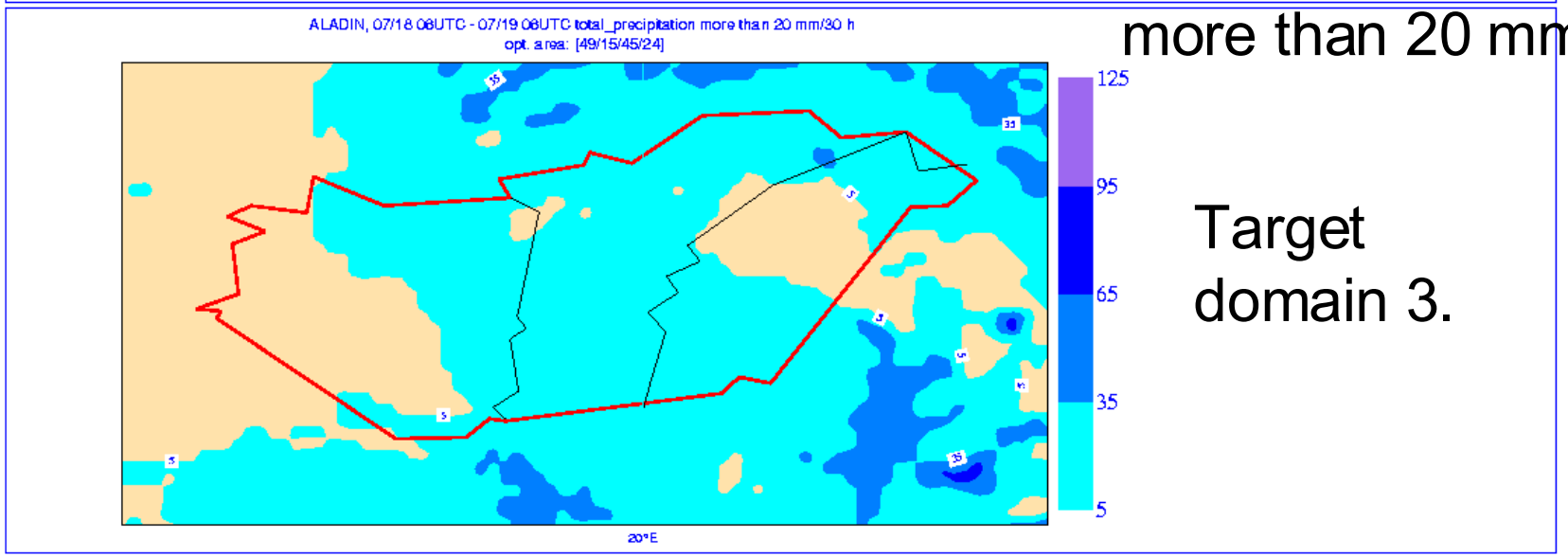
Target domain 3.

Probabilities



Target domain 1.

30 h precipitation more than 20 mm



Target domain 3.

Preliminary conclusions

- The PEACE provided initial and boundary conditions were not really convenient for the local EPS run, for a Central European application in the investigated cases⇒
- Need to find an optimal target domain
- Smaller target domain provides better results when local effects dominate. But what can we say in other situations?

Future plans

- More case studies to investigate the sensitivity $\Rightarrow$ find the optimal target domain and optimization time
- More experiments with ALADIN
- Continue the experiments with the other methods, especially with ALADIN native SVs

THANK YOU for listening!