# Predictability of severe weather phenomena with a convection-permitting ensemble

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Outline

- The COSMO-2I-EPS ensemble

- Predictability of thunderstorms: role of IC and parameter perturbations

    ⇒ objective verification

    ⇒ subjective evaluation
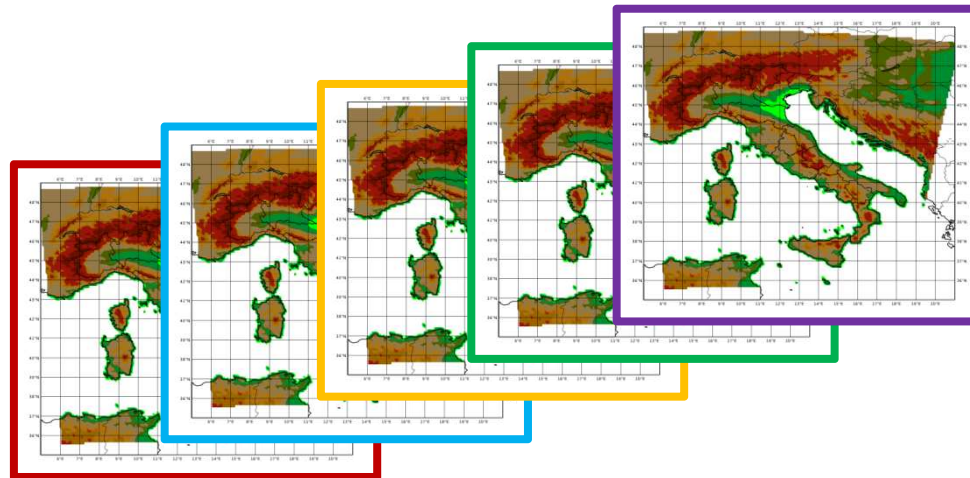
- Conclusions and future work
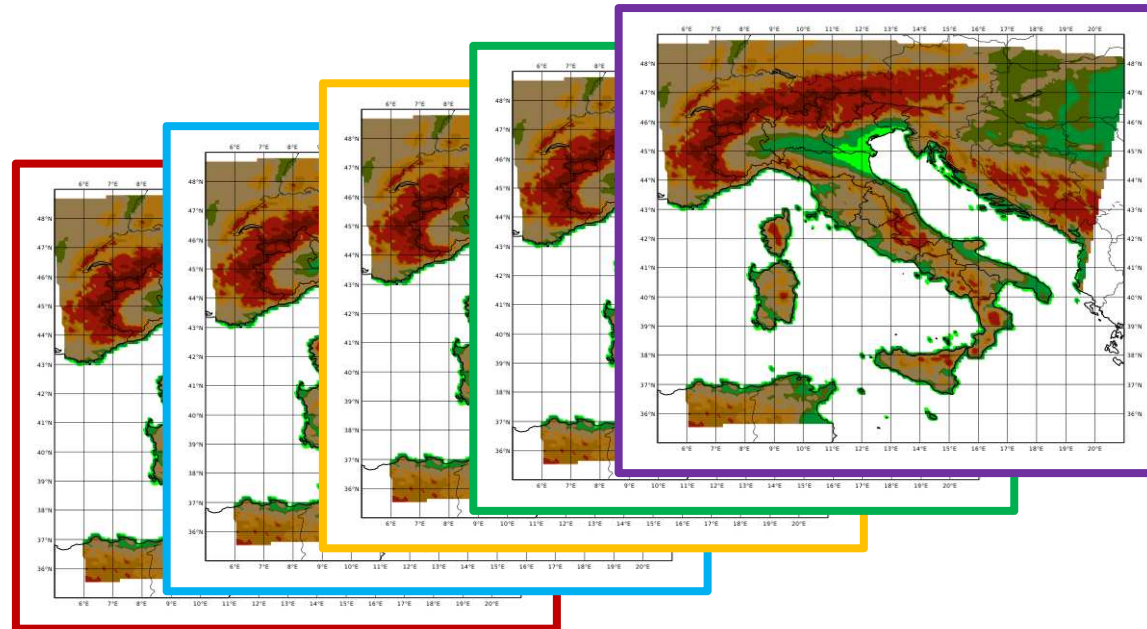
COSMO-2I-EPS

- running pre-operational at CINECA

- set-up:

  - COSMO 2.2 km, 65 levels

  - 20 members

  - 1 run per day at 00 UTC, +48 h forecast range

  - Boundary Conditions from COSMO-ME-EPS

  - Initial Conditions from LETKF analyses (KENDA), including also LHN and soil moisture perturbation
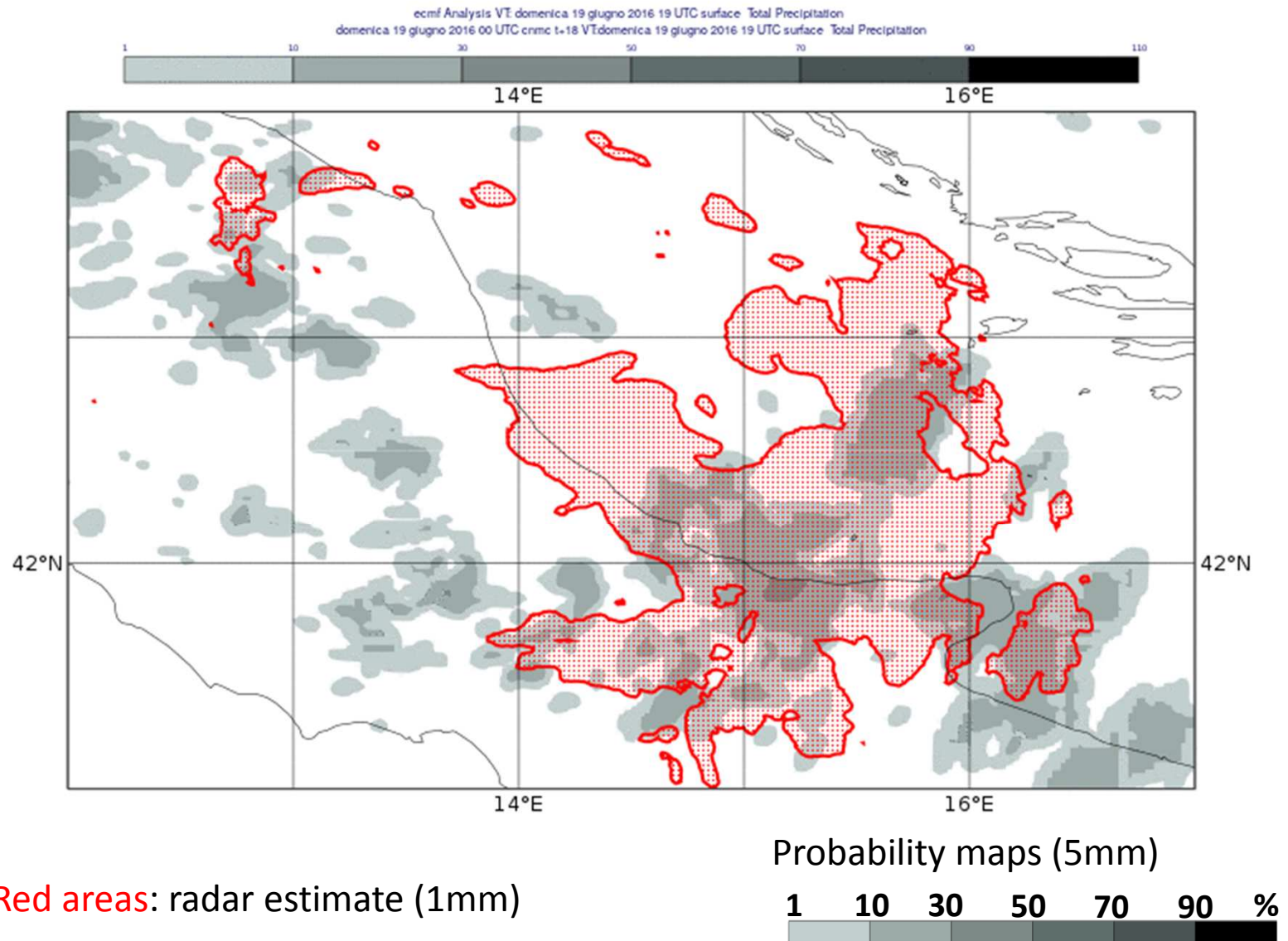
  - no model perturbation

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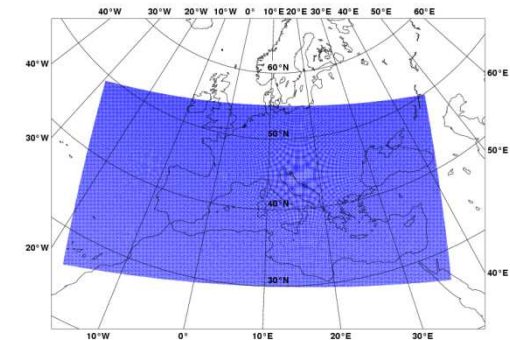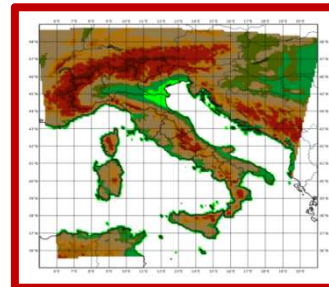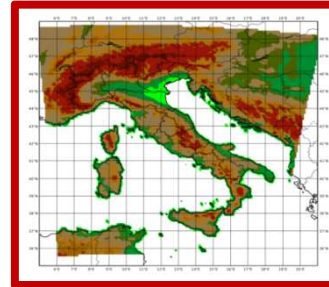
Experimental set-up for thunderstorm prediction

- SRNWP-EPS II Programme of EUMETNET

- 14 runs (one per day) on a period with several thunderstorms in Italy: 19 June – 07 July 2016

- two experiments:
  - Initial Condition perturbation: LETKF (KENDA), including also LHN and soil moisture perturbation
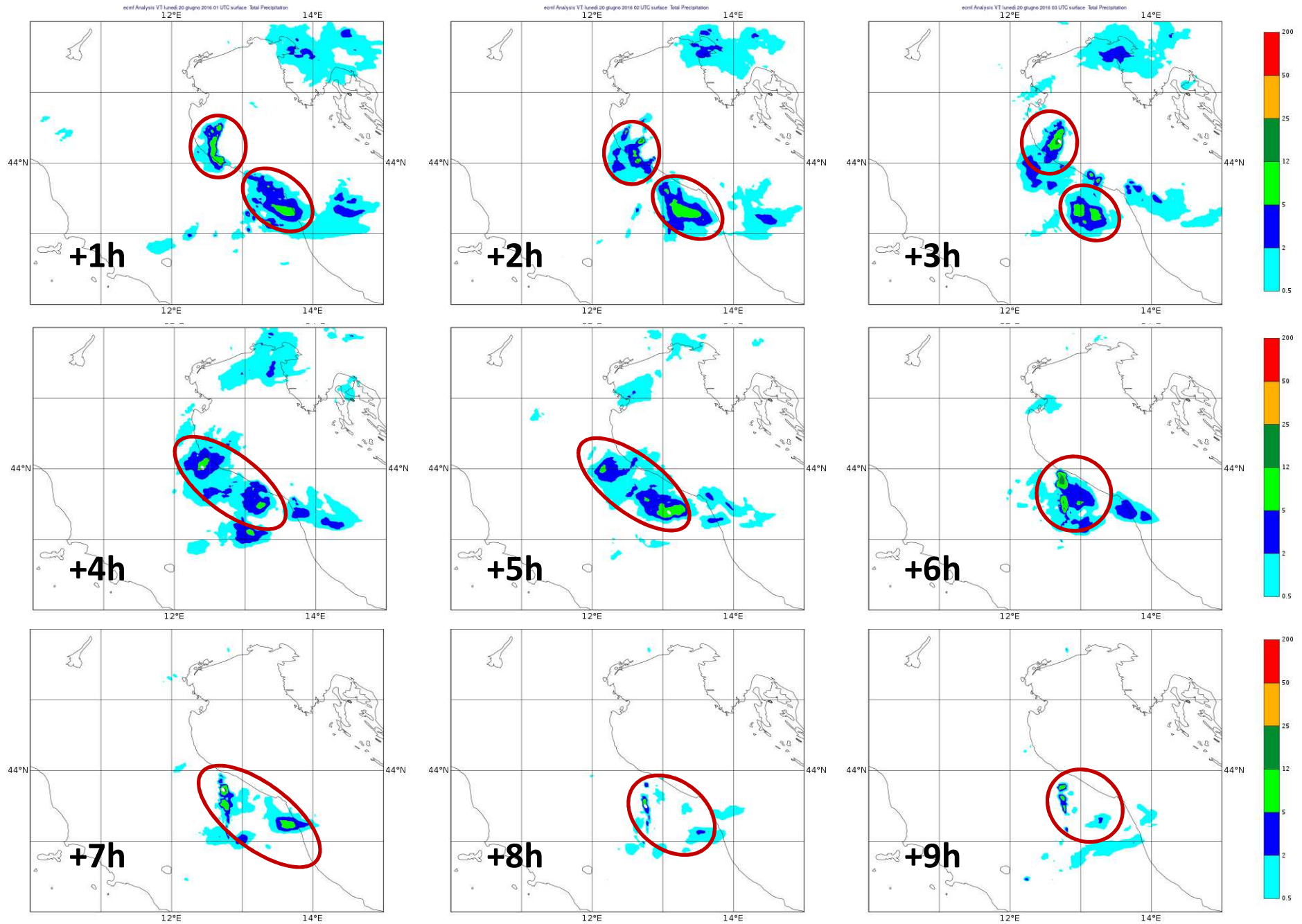 - Model perturbation: Perturbed Parameters

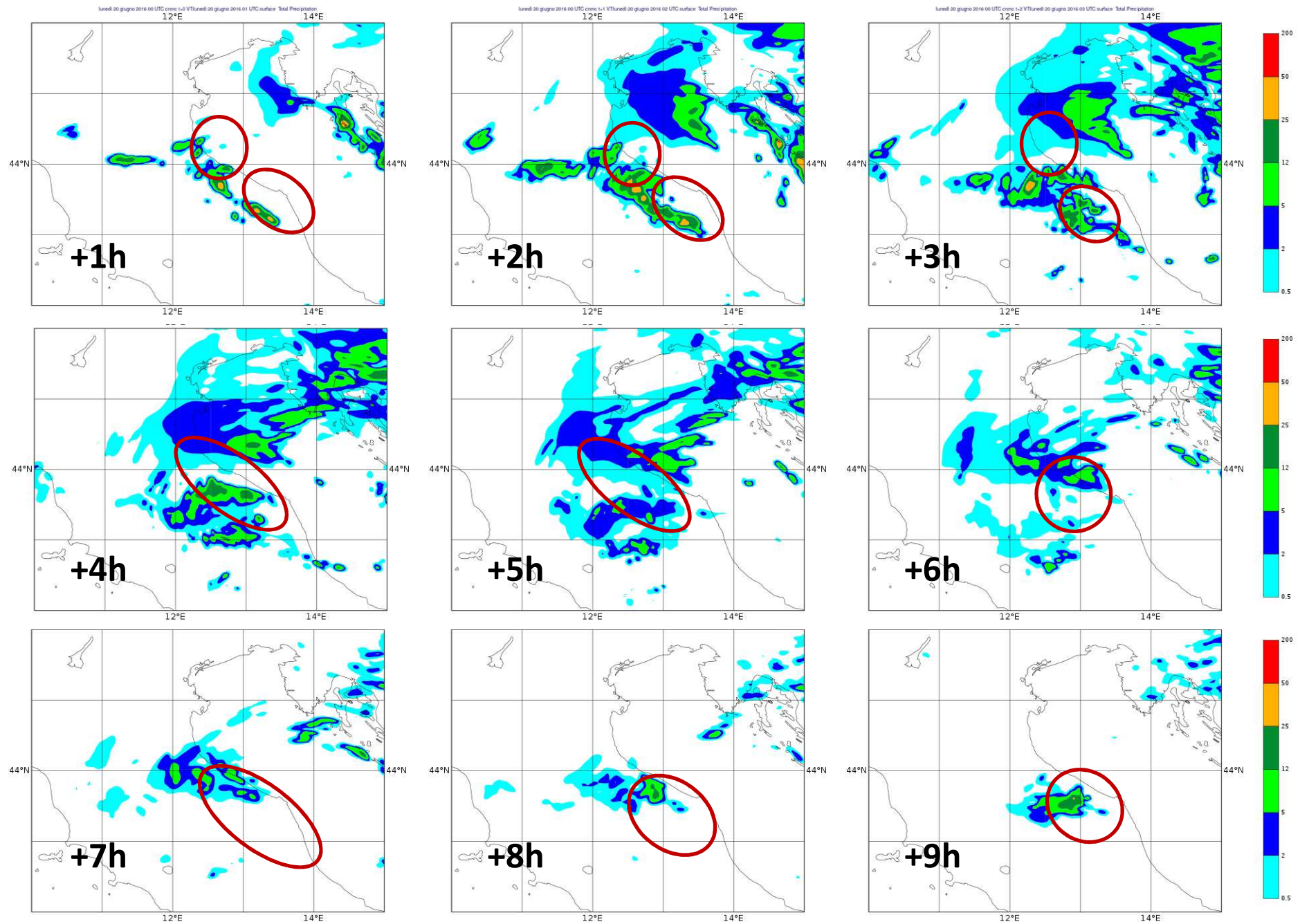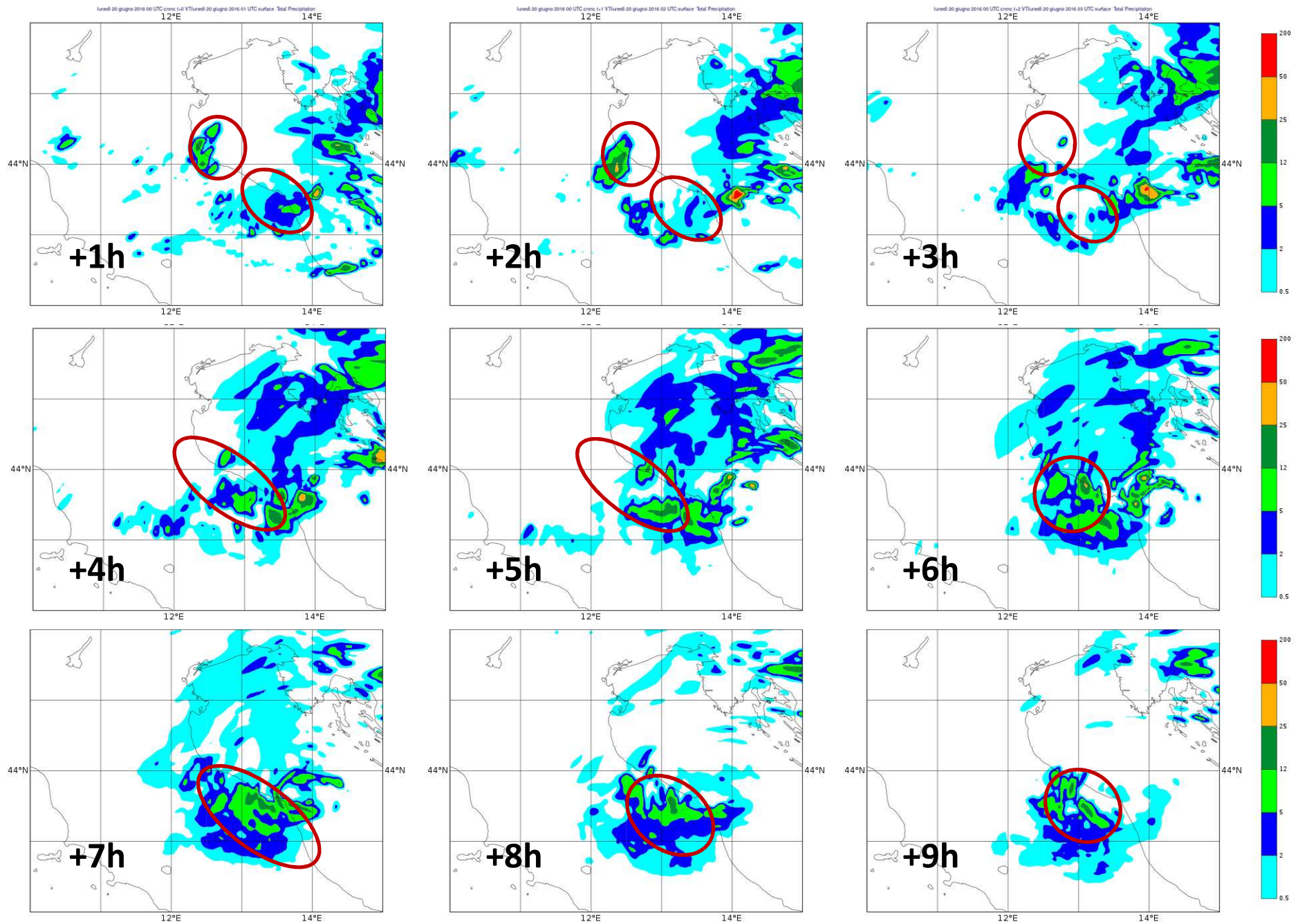# probabilistic prediction of the thunderstorms

ecmf Analysis VT: domenica 19 giugno 2016 19 UTC surface Total Precipitation
domenica 19 giugno 2016 00 UTC cnmc t+18 VT domenica 19 giugno 2016 19 UTC surface Total Precipitation

Red areas: radar estimate (1mm)

Probability maps (5mm)

1   10   30   50   70   90   %

20 June 2016 — radar estimate of hourly precipitation

forecasted hourly precipitation – physics only - member 1

forecasted hourly precipitation – physics + IC - member 1

Verification of precipitation during thunderstorm events:

# quality of the ensemble forecasts

7 days – 20/06 - 07/07 2016

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Probabilistic scores
6h total precipitation vs radar estimate adjusted with rangauges
maximum precipitation over boxes 02
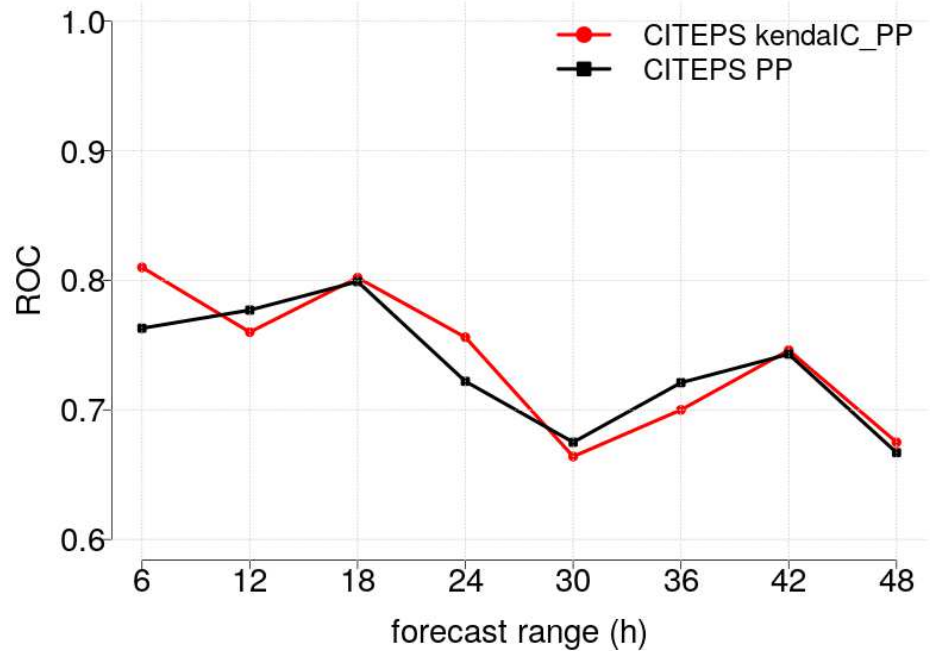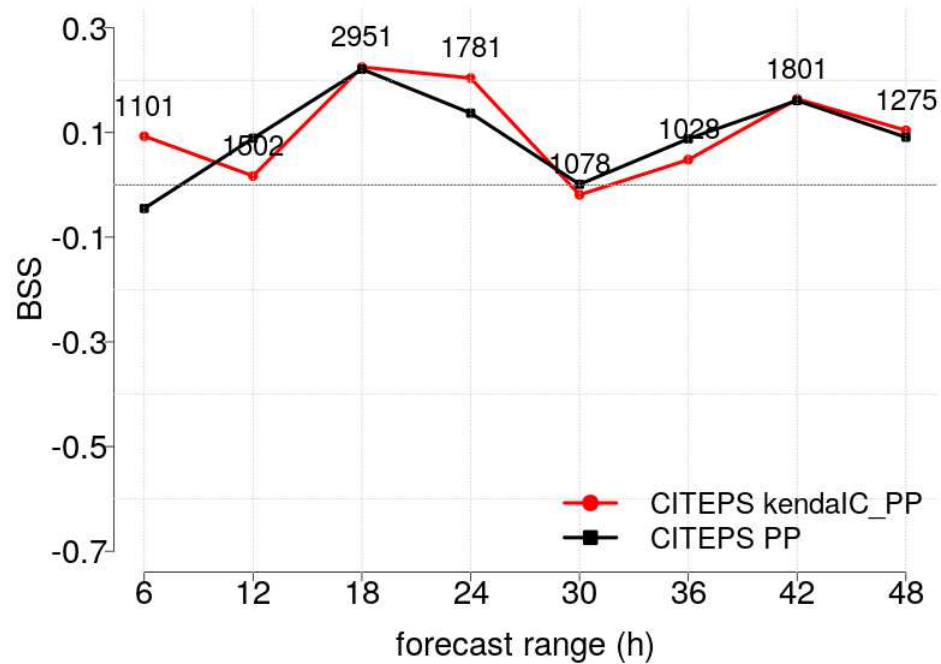
Verification of precipitation
for thunderstorm events:

SAL method

7 days – 20/06 - 07/07 2016

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ambiente energia
emilia-romagna

SAL method - radar adj – 25 June 2016

PP
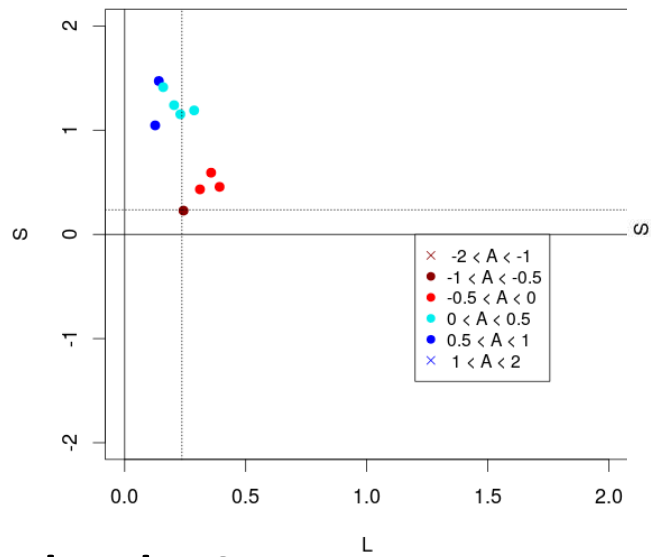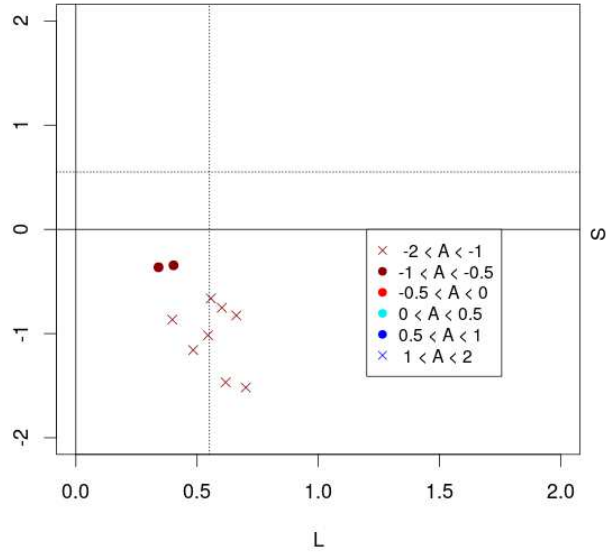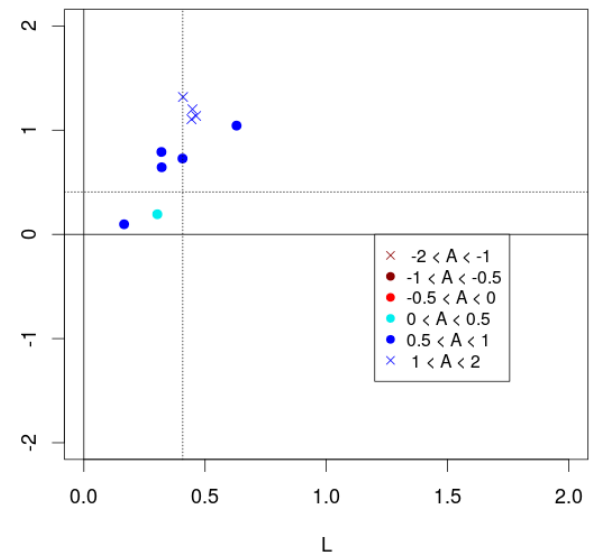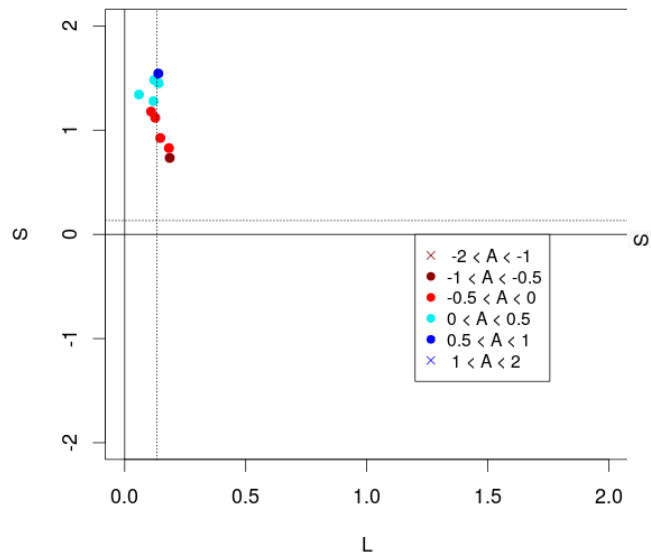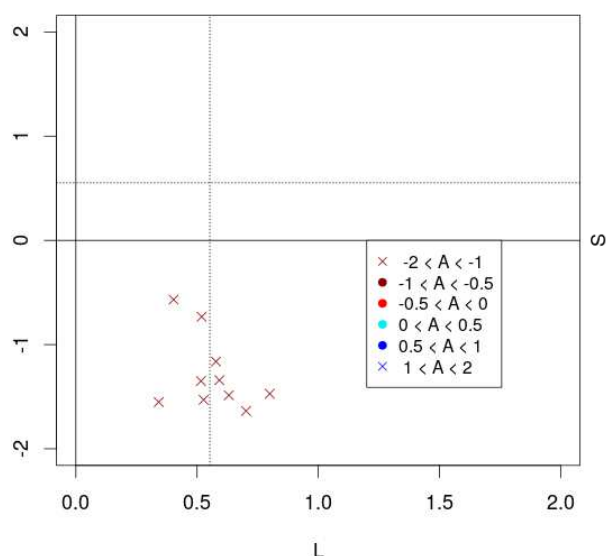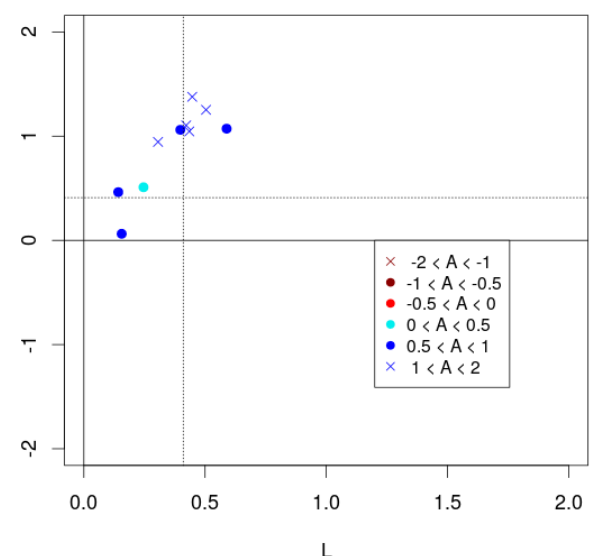
kenda IC PP

Verification of precipitation during thunderstorm events:

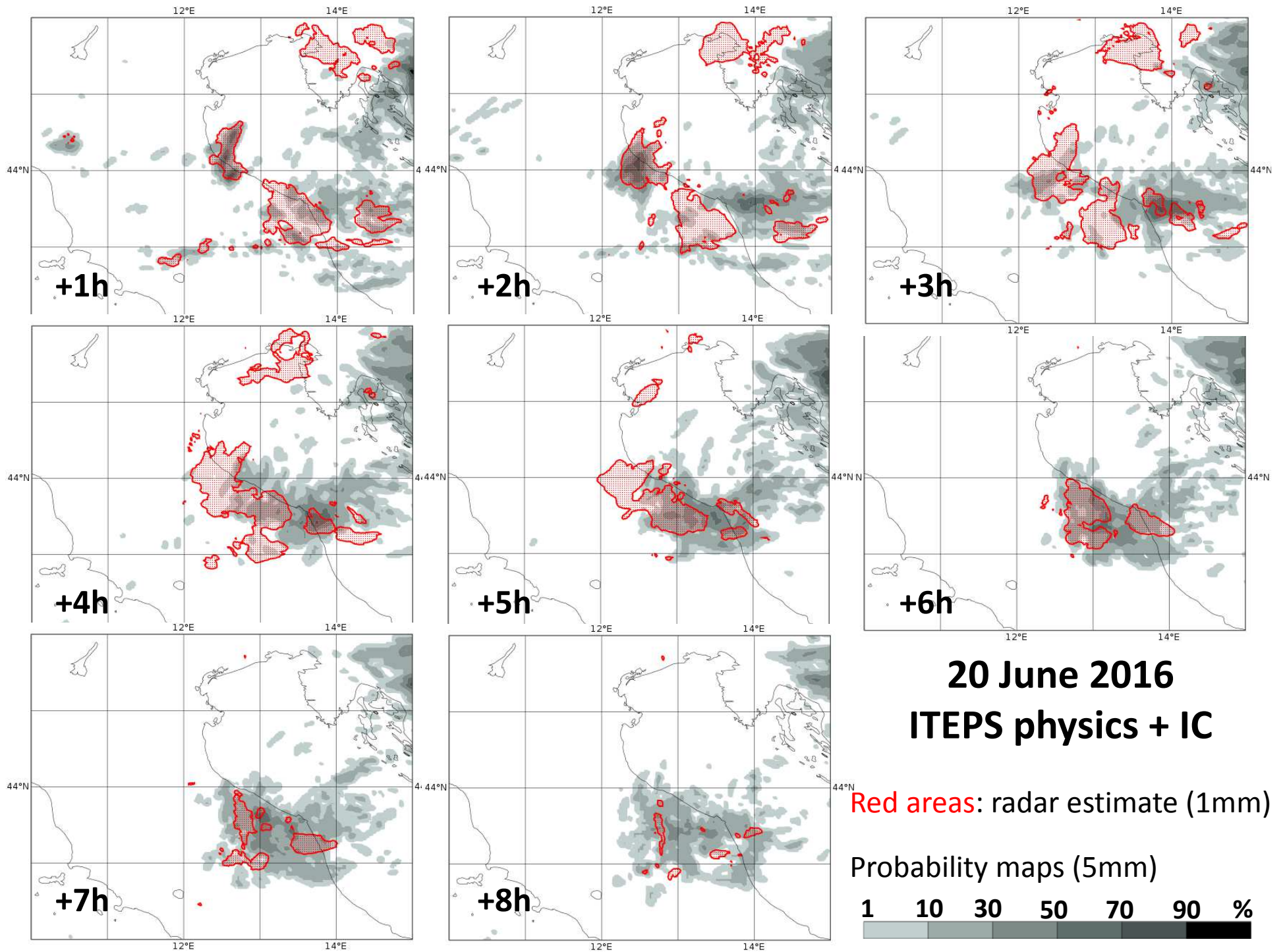## quality of each ensemble member

7 days – 20/06 - 07/07 2016

1mm

5mm

10mm
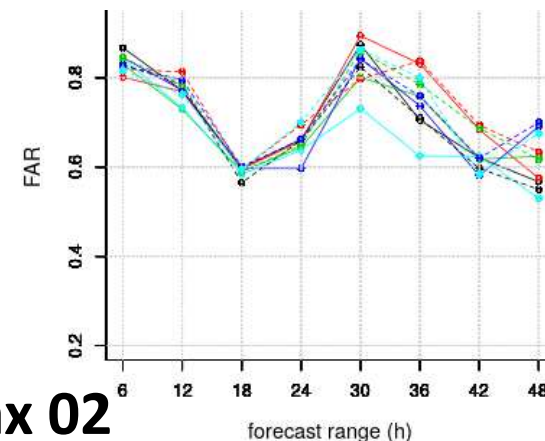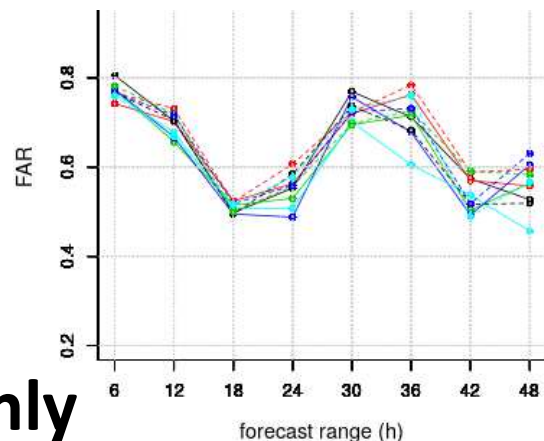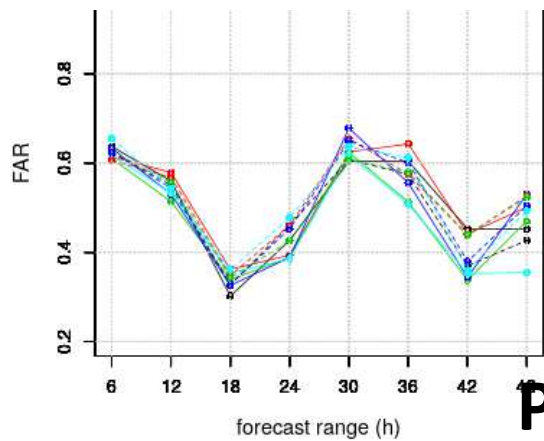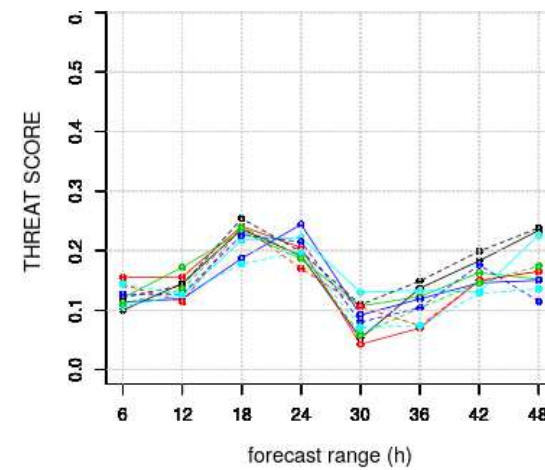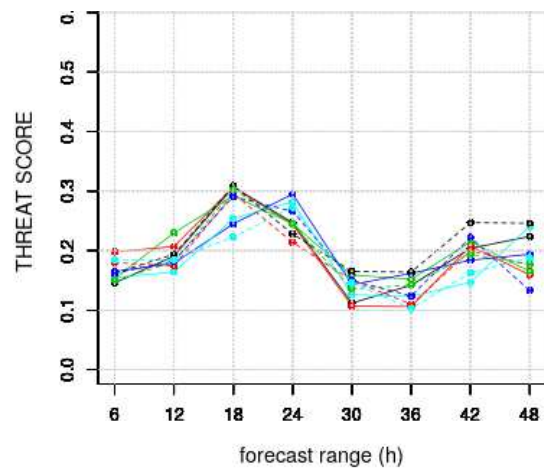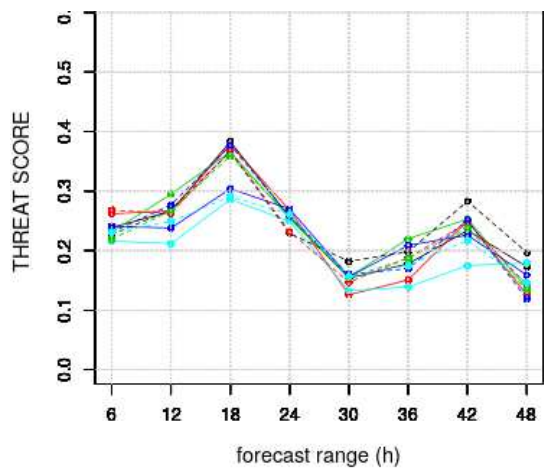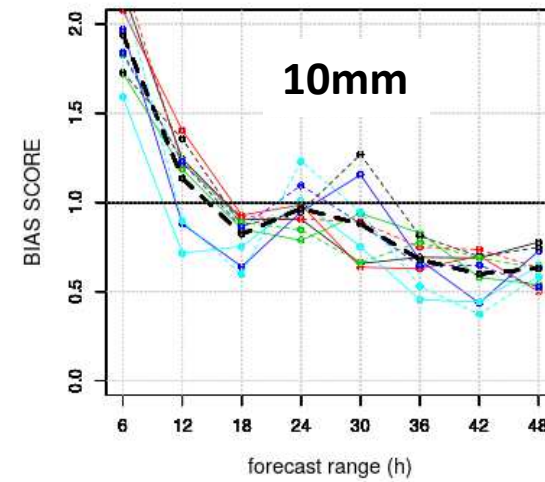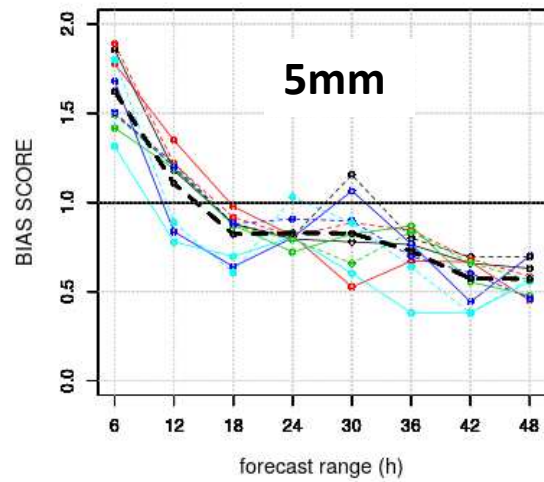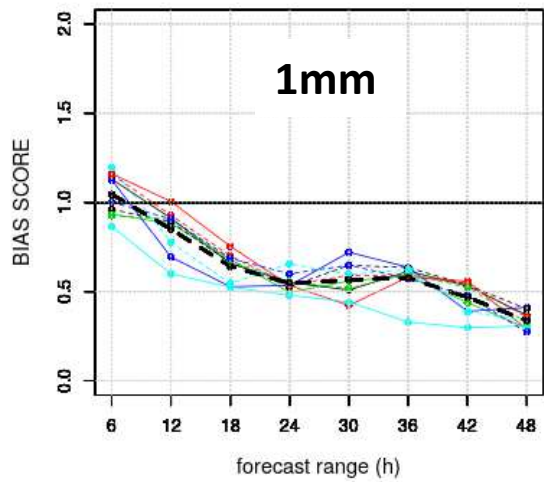
PP only
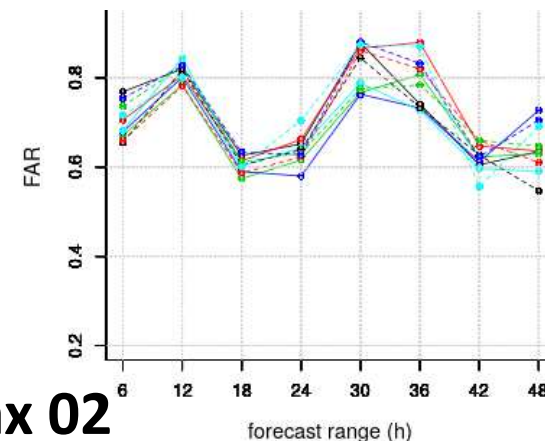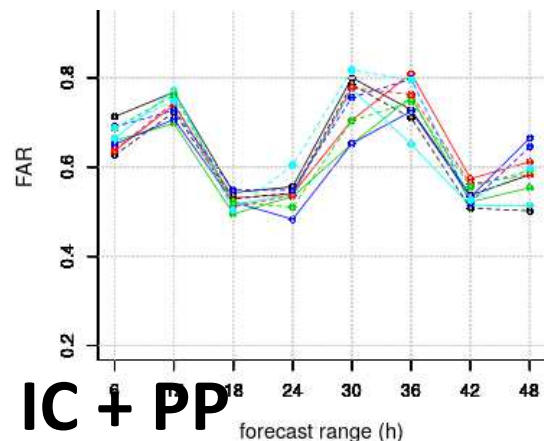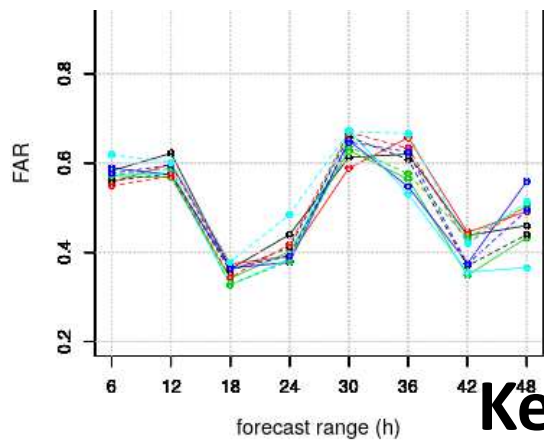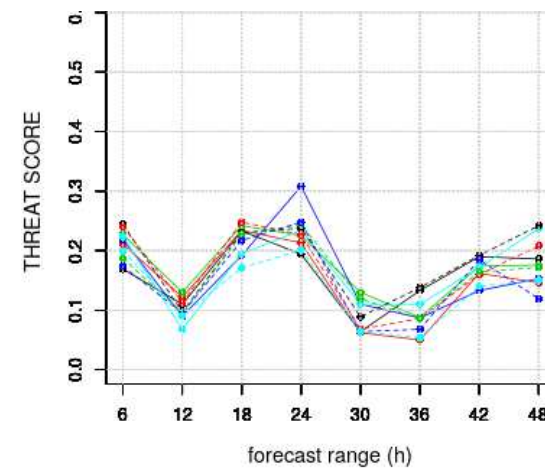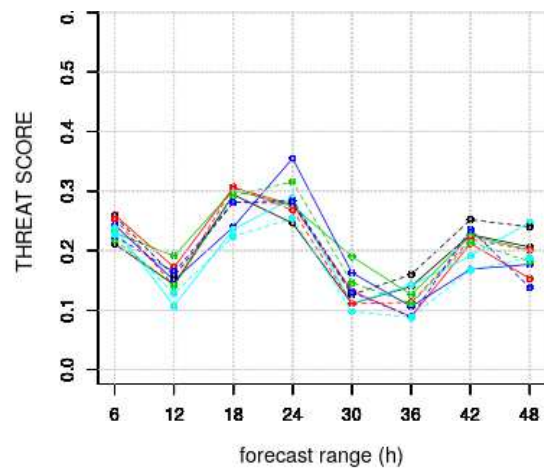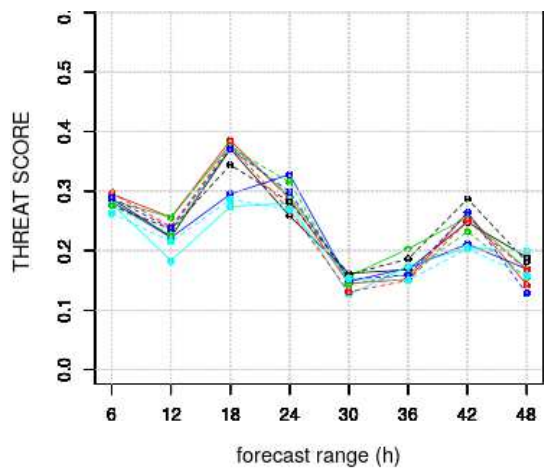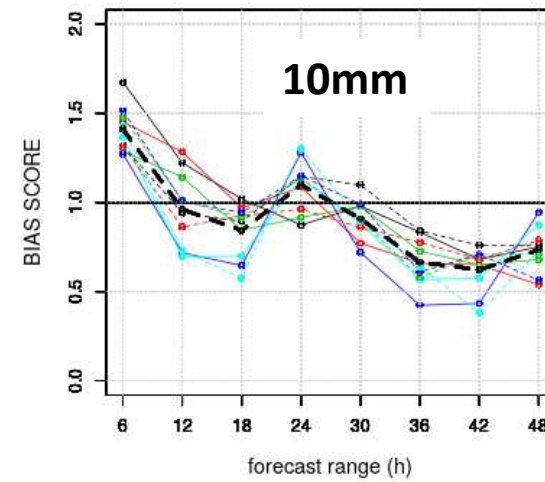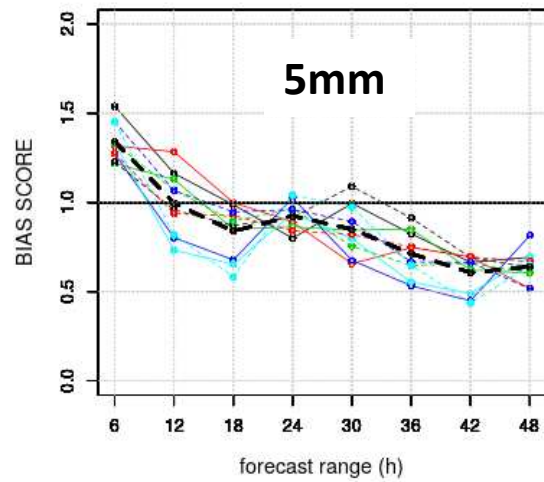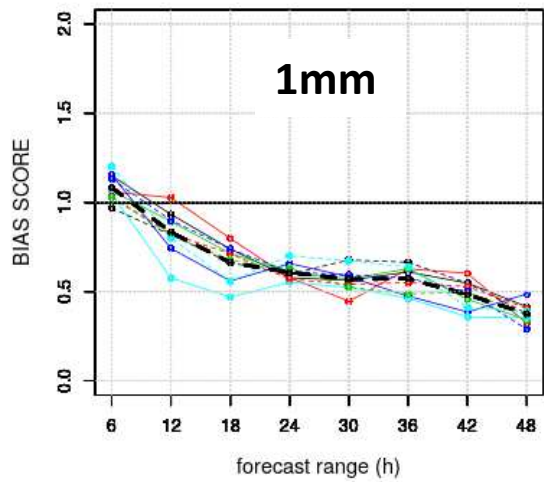
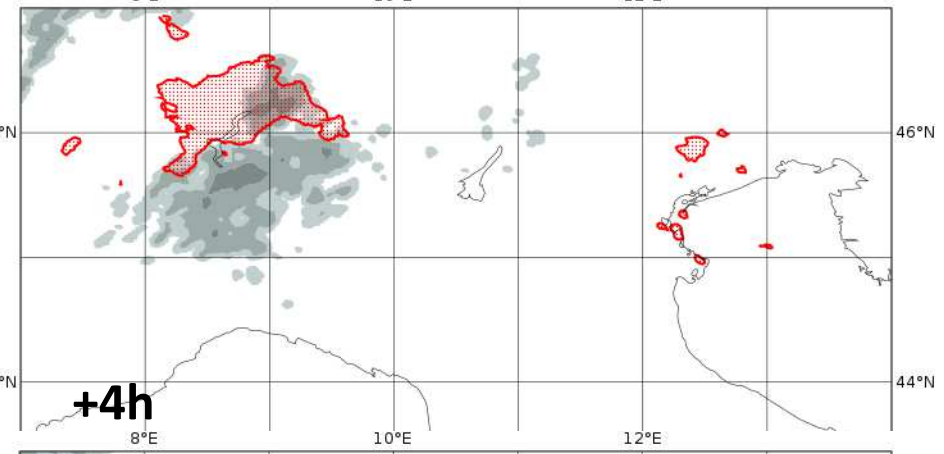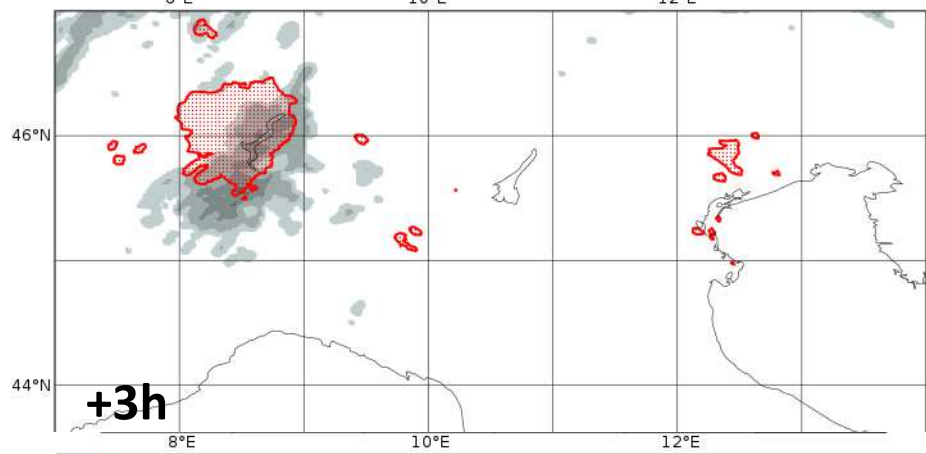**max 02**
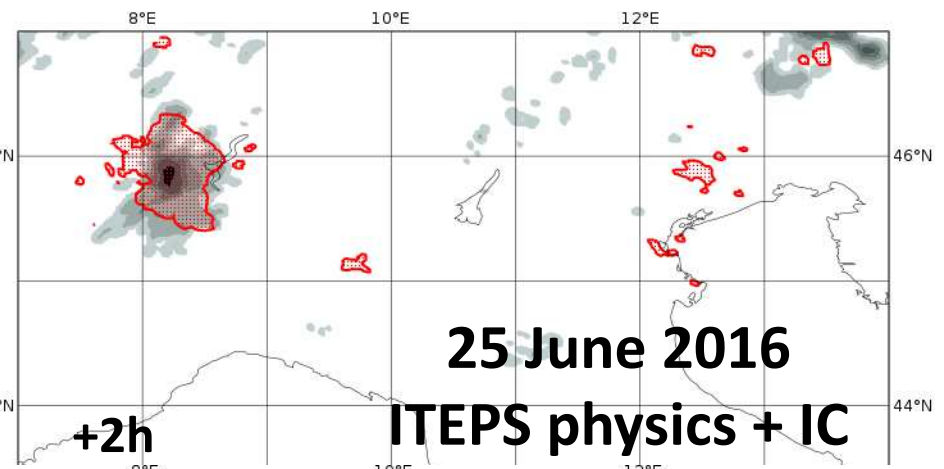
Kenda IC + PP   max 02

Impact of perturbed ICs from LETKF
on thunderstorm prediction

subjective evaluation

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+1h +2h +3h +4h +5h +6h +7h +8h

20 June 2016
ITEPS only physics

Red areas: radar estimate

Probability maps

1 10 30 50 70 90 %

20 June 2016
ITEPS physics + IC

Red areas: radar estimate (1mm)

Probability maps (5mm)

1 10 30 50 70 90 %

+1h

+2h

25 June 2016
ITEPS only physics

+3h

+4h

+5h

+6h

Red areas: radar estimate

Probability maps

1   10   30   50   70   90   %

25 June 2016
ITEPS physics + IC

+1h
+2h
+3h
+4h
+5h
+6h

Red areas: radar estimate

Probability maps
1   10   30   50   70   90   %

2 July 2016 – ITEPS only physics

+1h
+4h
+5h
+6h
+7h
+8h
+9h
+10h
+11h

Red areas: radar estimate

Probability maps

1   10   30   50   70   90   %

2 July 2016 – ITEPS physics + IC

+1h
+4h
+5h
+6h
+7h
+8h
+9h
+10h
+11h

Red areas: radar estimate

Probability maps

1   10   30   50   70   90   %

Concluding remarks

- The ensemble shows good potential for the prediction of the thunderstorms
- The skill of the forecast is greatly improved in the first hours by the KENDA IC conditions
- Care to false alarms should be taken

- Verification for no thunderstorm cases
- Assimilation of radar reflectivity volumes
- Operational use: spatial and temporal aggregation dependent on the predictability of the phenomena
- How to properly perform probabilistic verification of thunderstorms?

SAL method - radar adj – 20 June 2016

kenda IC PP
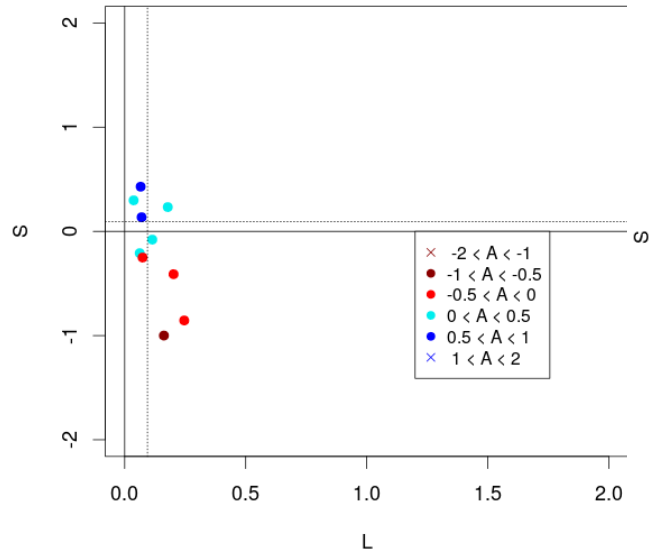
PP
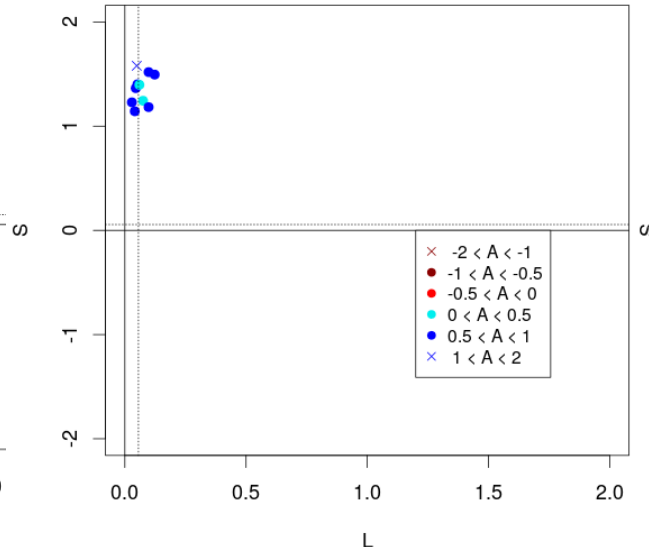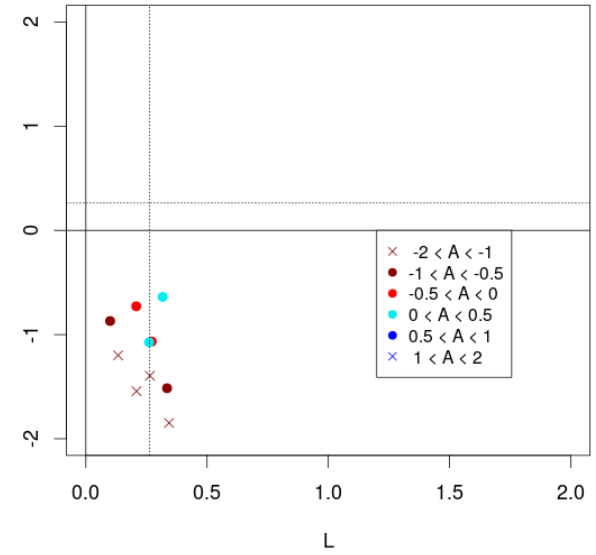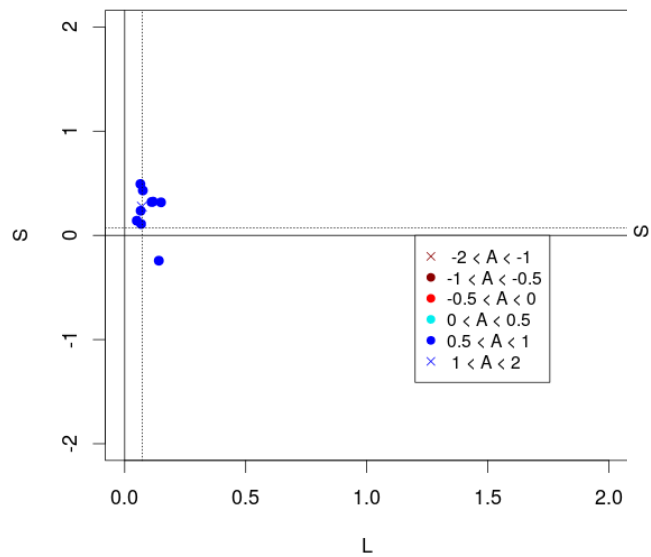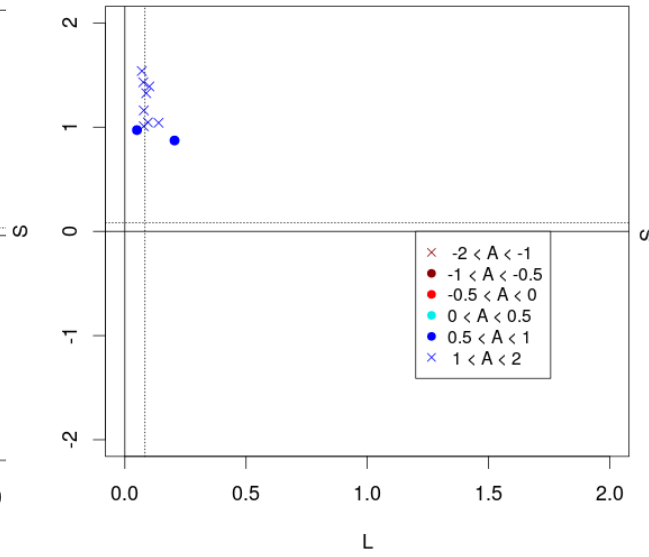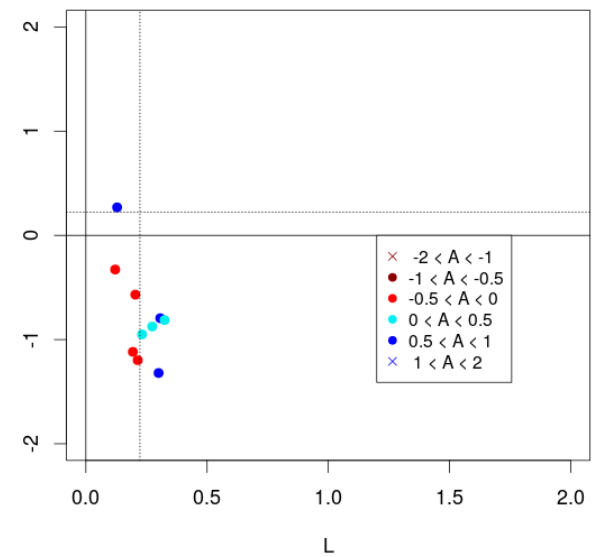
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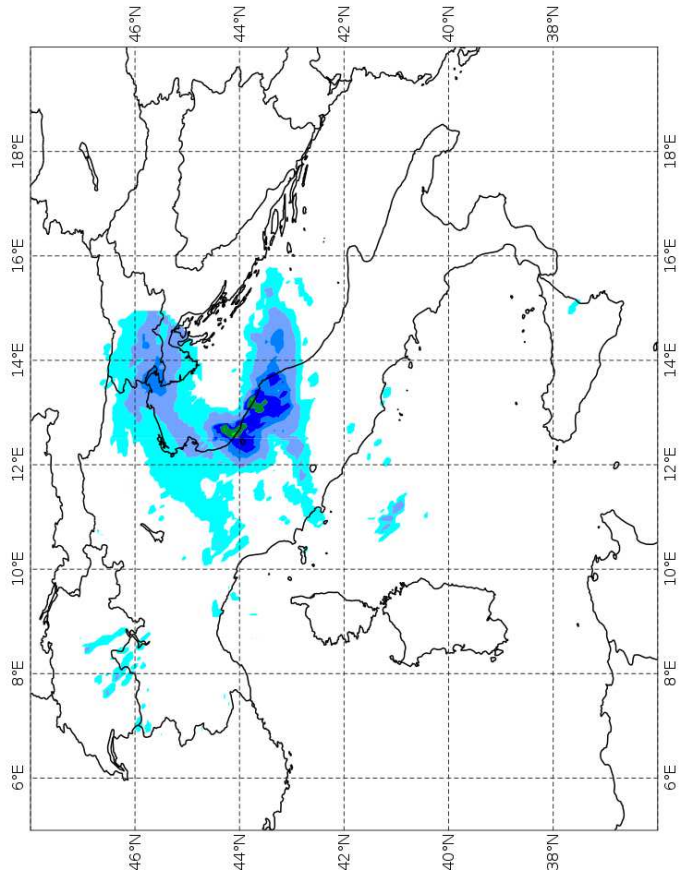
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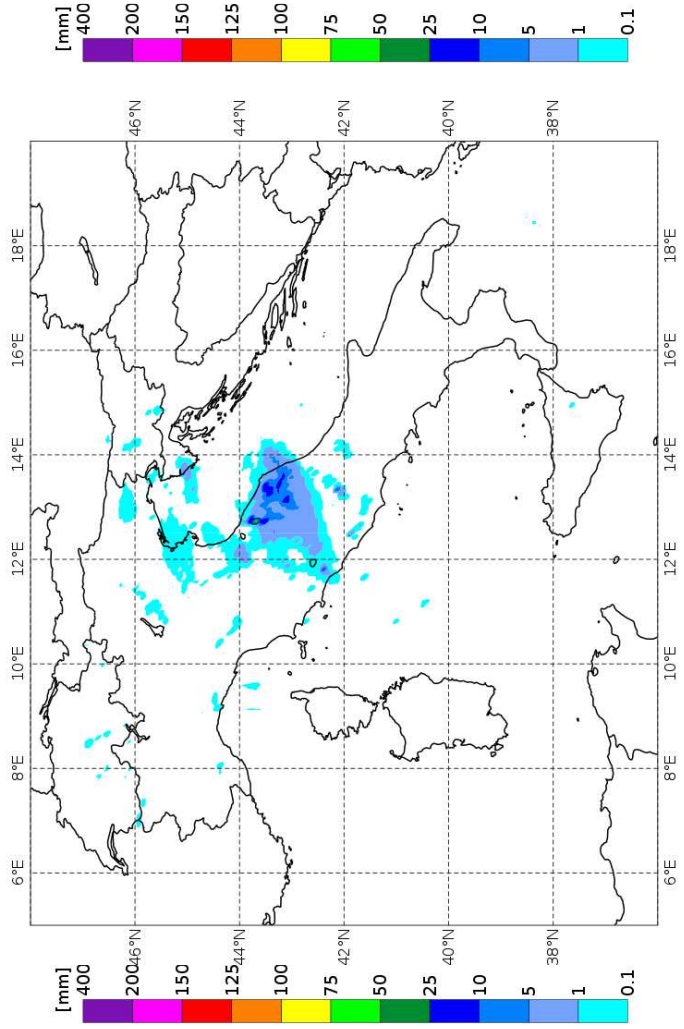
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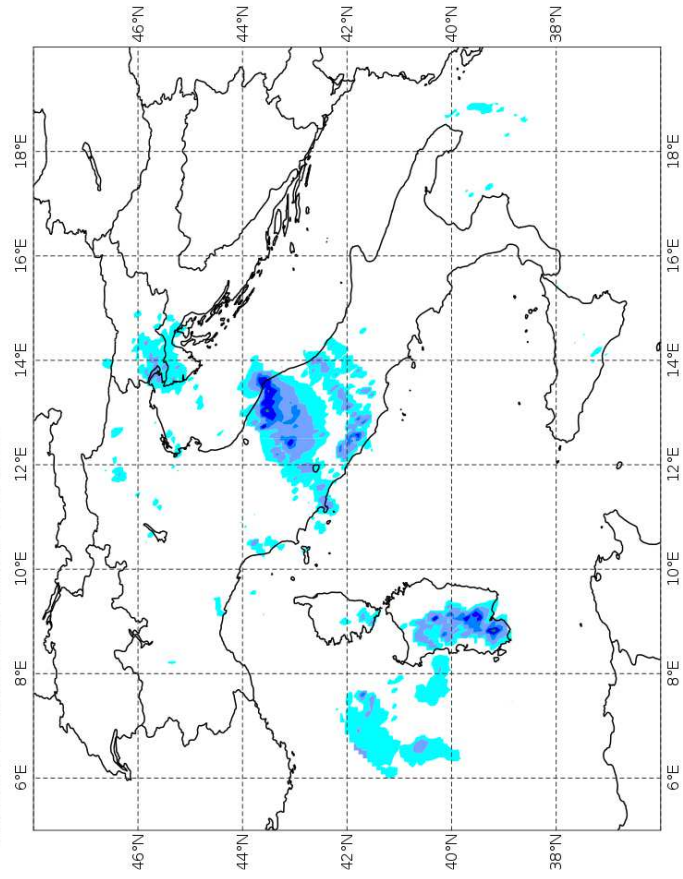
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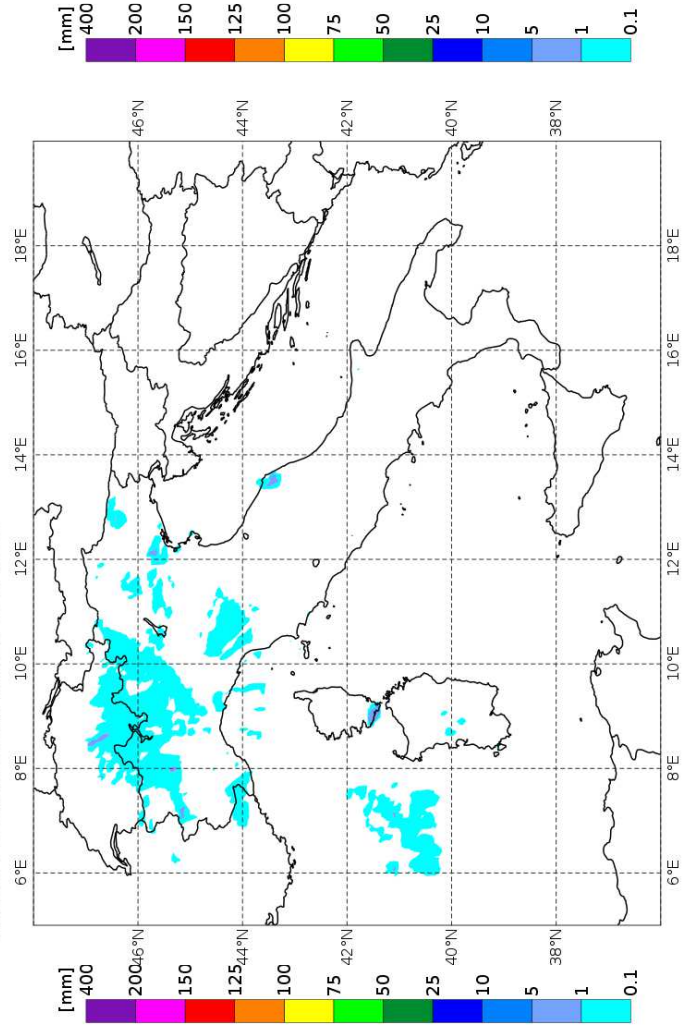
[mm]
400
200
150
125
100
75
50
25
10
5
1
0.1

SAL method - radar adj – 2 July 2016

kenda IC PP
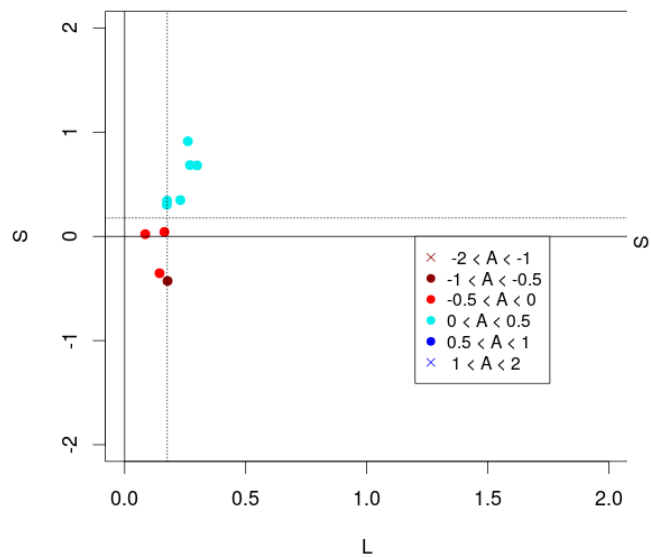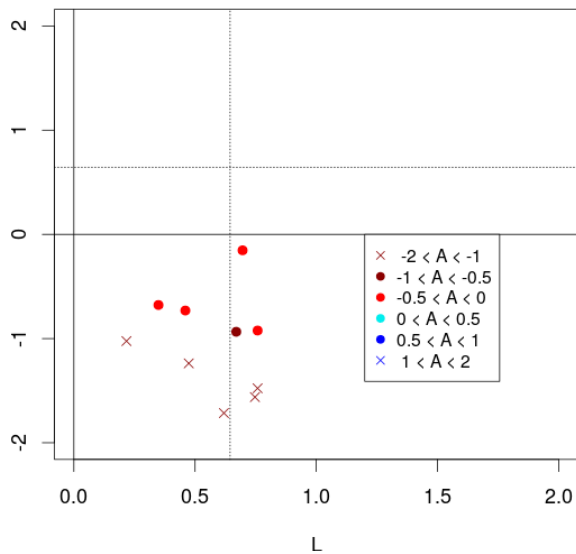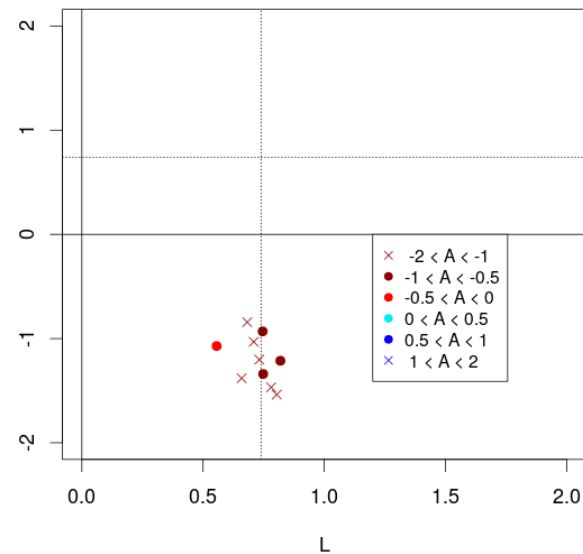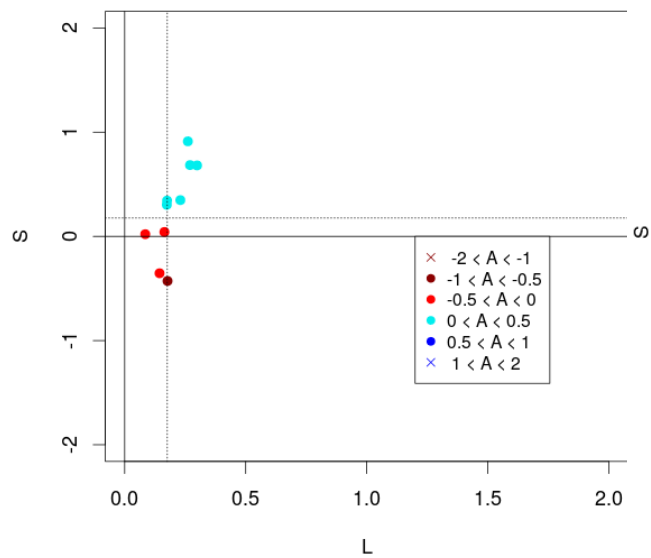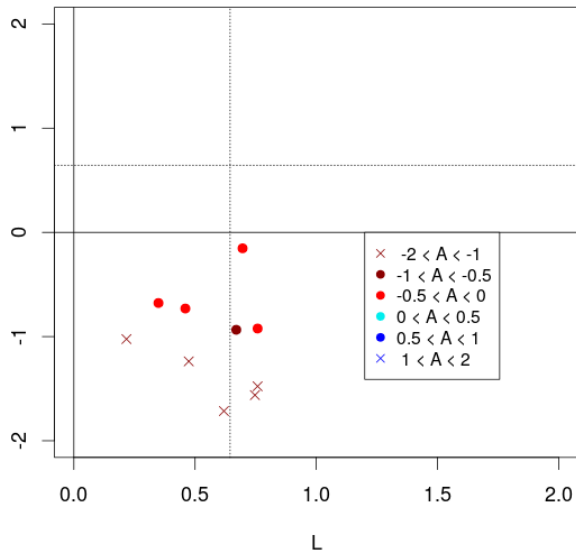
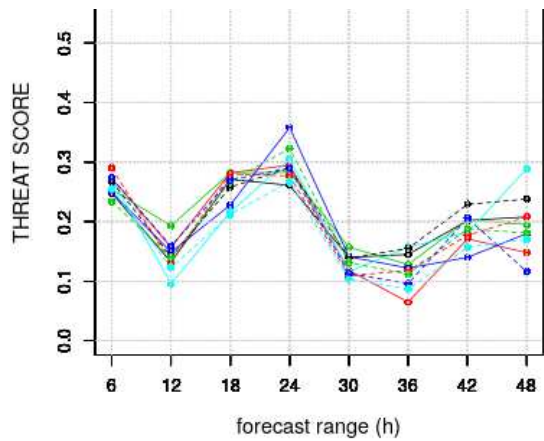**PP**
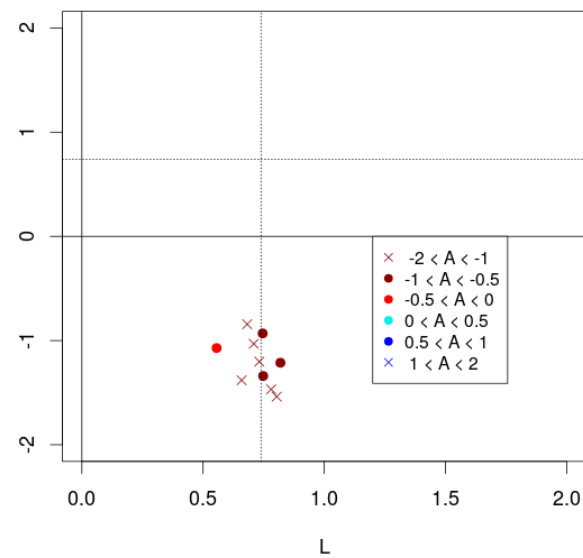
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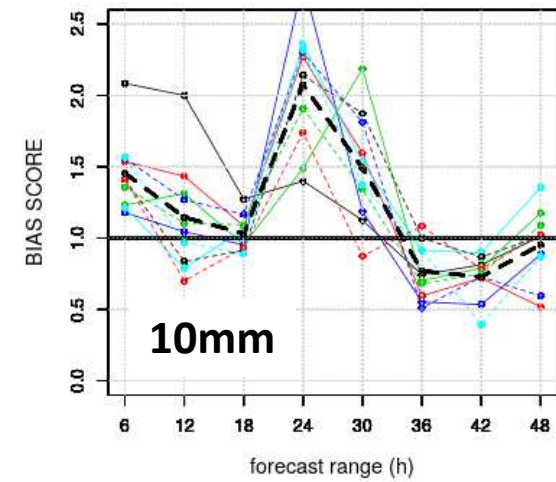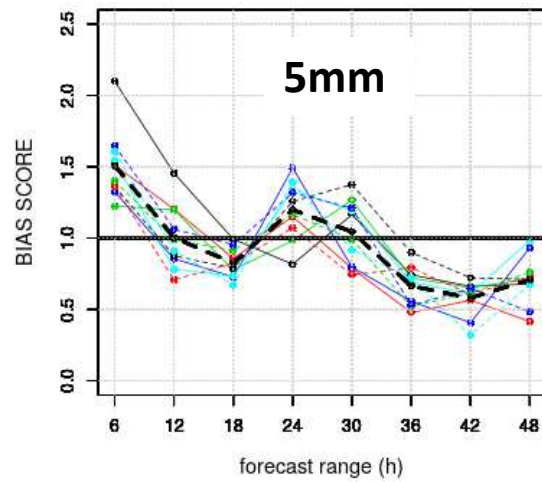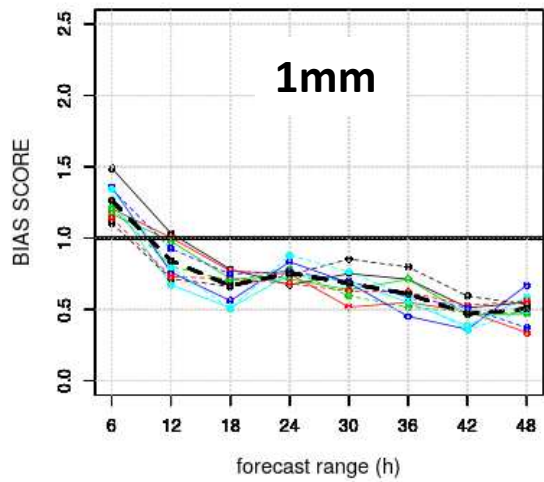## 6h total precipitation vs radar estimate adjusted with rangauges
average precipitation over boxes 02
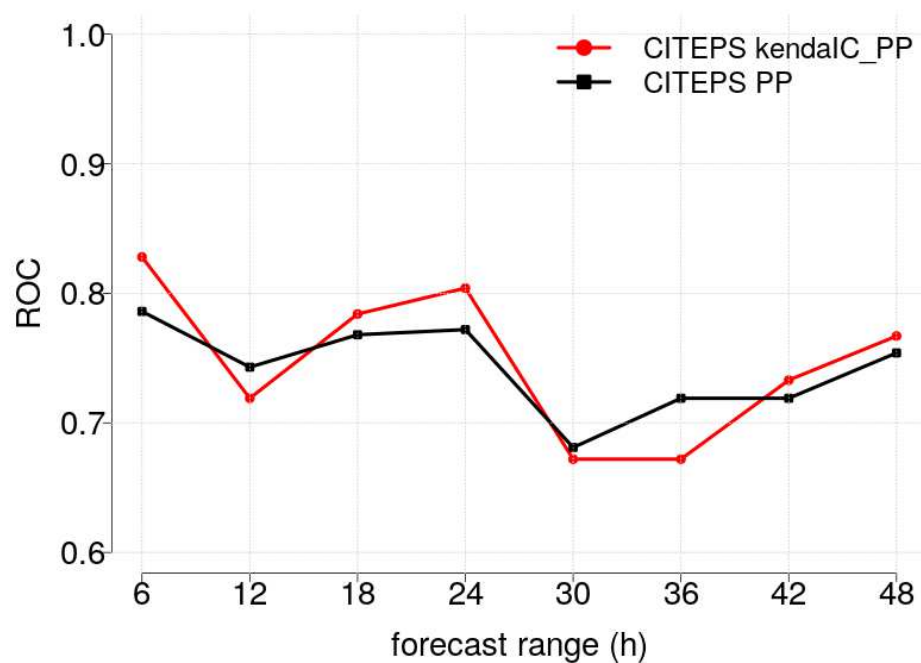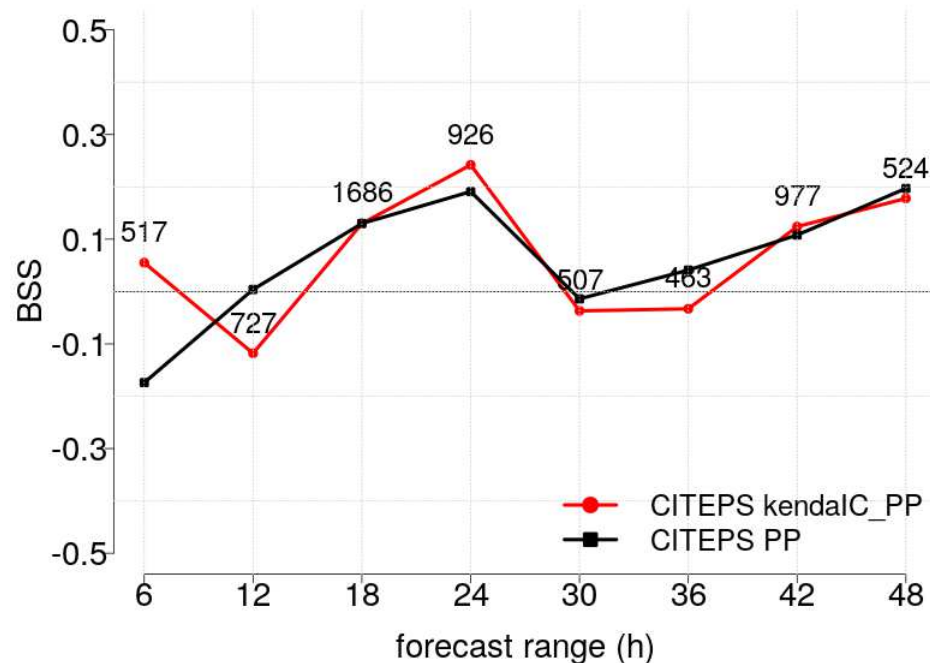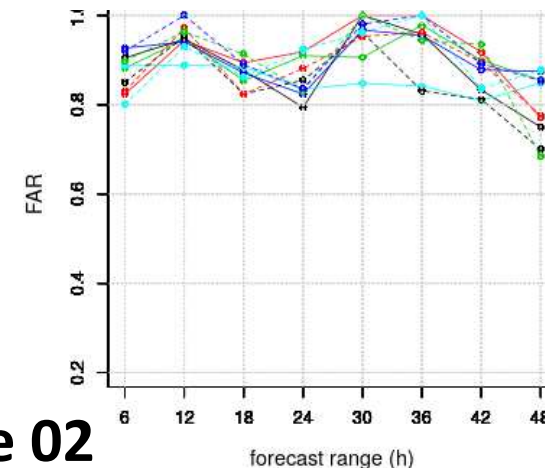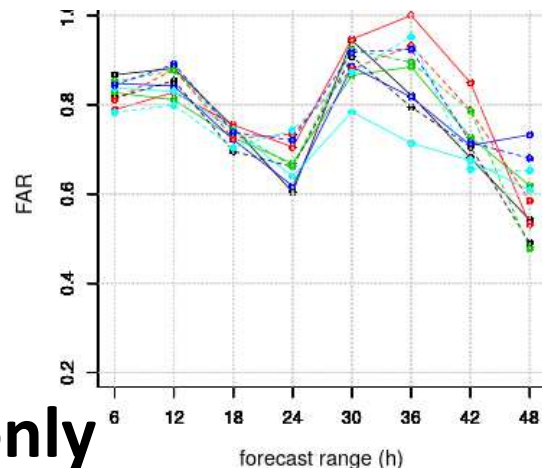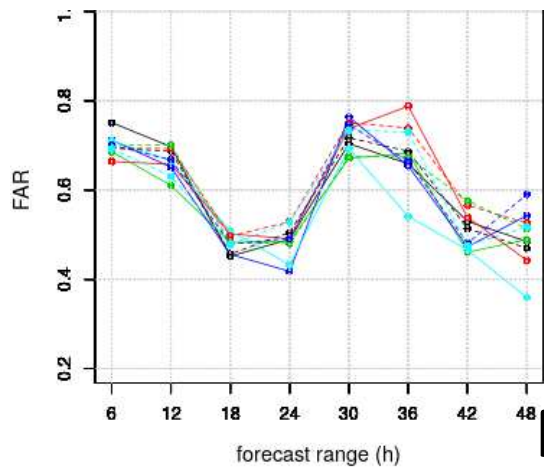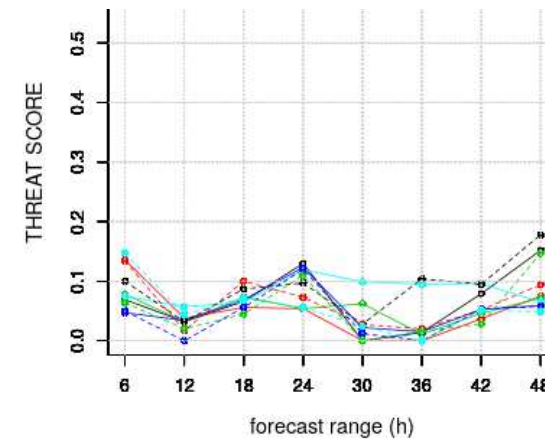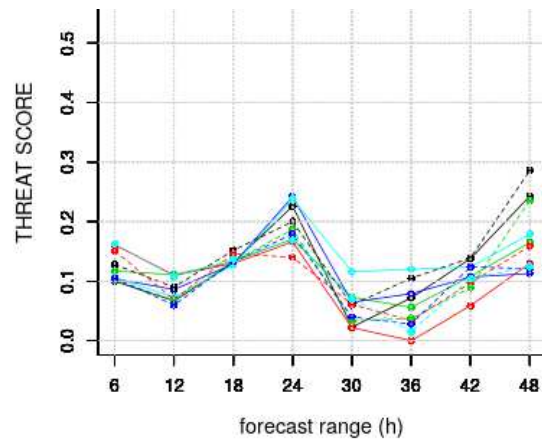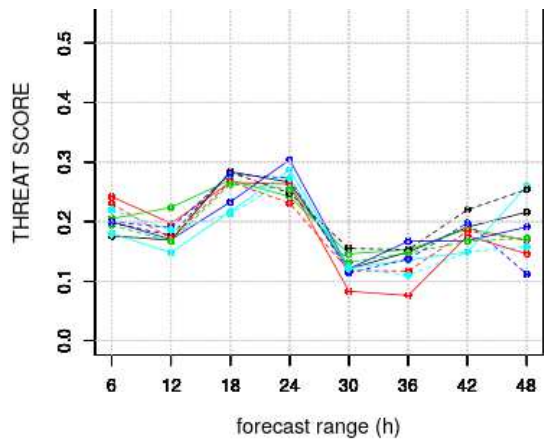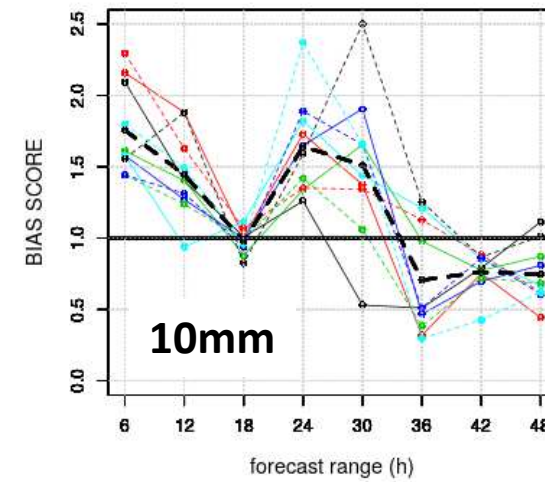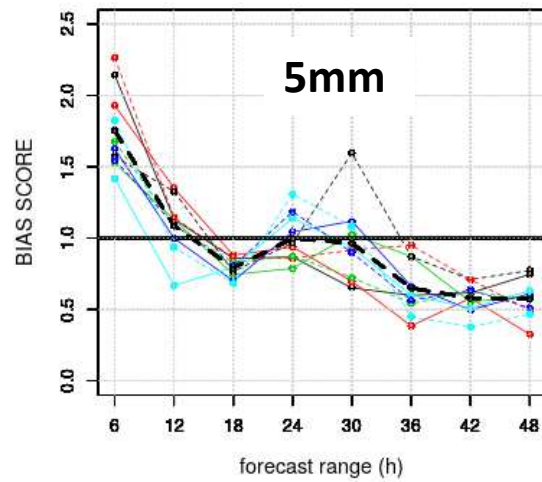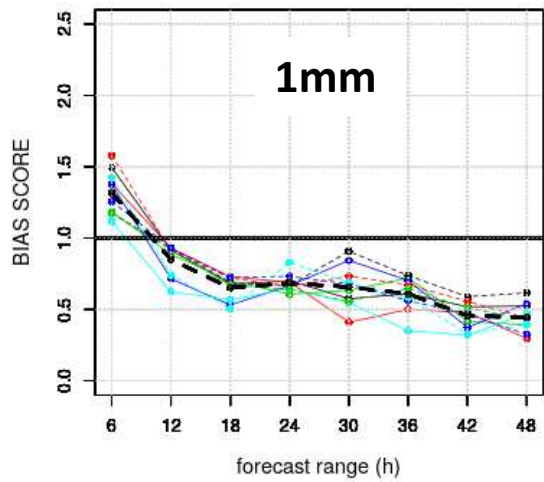
PP only   **ave 02**
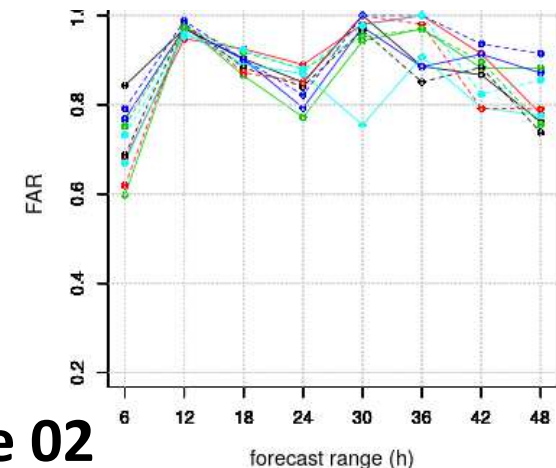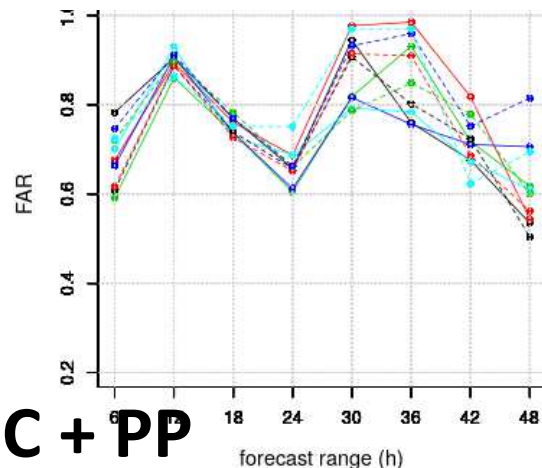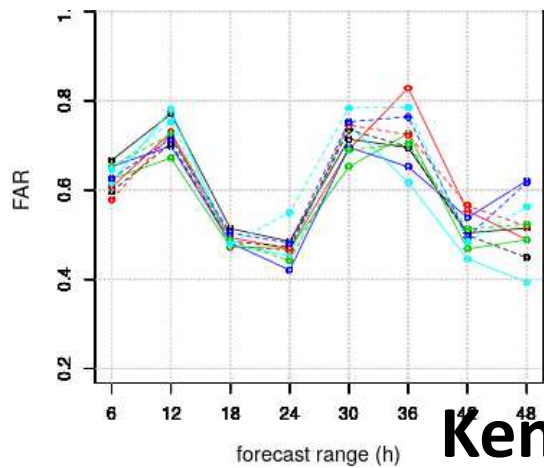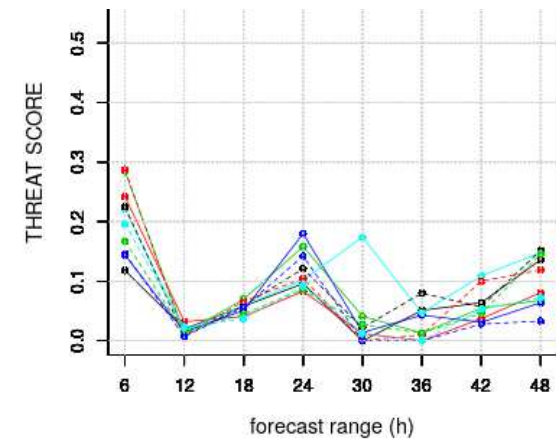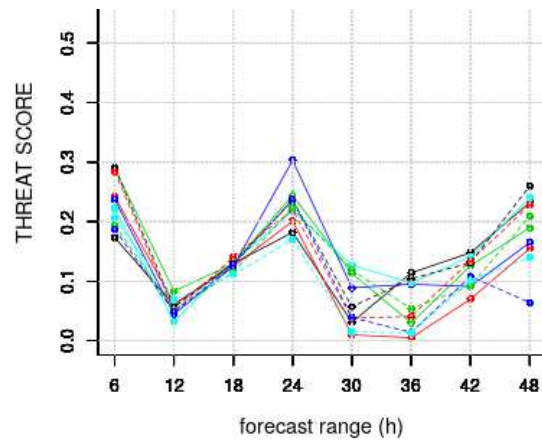
Kenda IC + PP   ave 02

KENDA (Kilometer-scale ENsemble Data Assimilation)