

RMI-EPS: a prototype convection-permitting EPS for Belgium

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Outline

1. Current set-up
2. Thunderstorm cases
3. Verification scores
4. Future plans

Current set-up

- ▶ AROME and ALARO models (both at 2.5km) are coupled to ECMWF ENS (vertical 65L).
- ▶ 22 limited area ensemble members:
10+1 from ALARO and 10+1 from AROME (cy38h1.1, both with SURFEX).
- ▶ Forecast range: 36 hours (at 00 and 12 UTC).
- ▶ Surface assimilation cycle (CANARI) + 3DVar upper-air data assimilation for control members.

Current set-up

- ▶ Computation at ECMWF (ecgate/cca) and results automatically transferred to RMI.
- ▶ HarmonEPS system + RMI preprocessing and postprocessing scripts.
- ▶ One run takes about 100K SBU's, and roughly 4 hours computation time...

RMI-EPS Prob PCP3h over 5mm (Legend)
Analysis: 2015/08/13 00UTC T+018 VT: 2015/08/13 18UTC

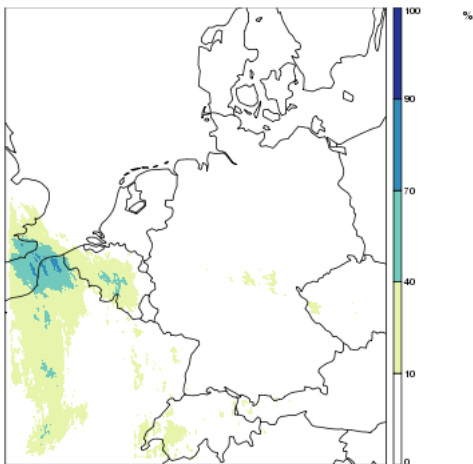


Figure: Probability plot RMI-EPS: 3h accumulated precipitation (> 5mm), forecast of 20150813 (00h UTC run) over full domain.

Current set-up

HarmonEPS_1 domain

- ▶ Standard domain of HarmonEPS system:
 $N = N_{lon} * N_{lat} = 450 * 540 = 291600$
($N = 870 * 660 = 574200$ for GLAMEPSv2).
- ▶ Changing domain also requires recomputing B-matrix for 3DVar (upper-air DA)...

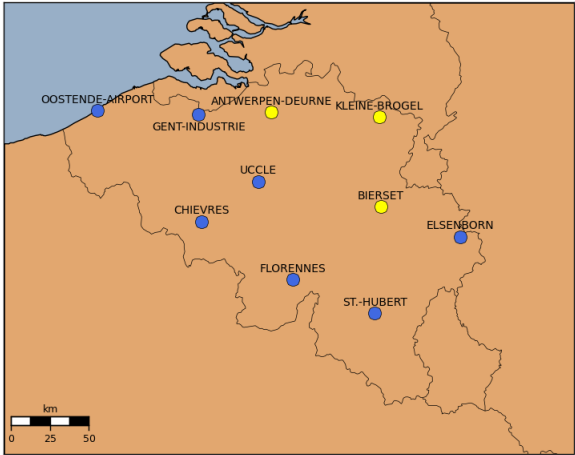


Figure: INDRA alert map for RMI-EPS: 6h accumulated precipitation forecast of 20150813 (00h UTC run).

RMI-EPS Precipitation forecast (3 hour accumulation)

Latest forecast: [2015-08-13 00 00 UTC](#)

Ensemble mean precipitation

RMI-EPS forecast of 13/08 00:00:

Stations / Forecast	13/08 03:00	13/08 06:00	13/08 09:00	13/08 12:00	13/08 15:00	13/08 18:00	13/08 21:00	14/08 00:00
Oostende-Airport	0.0	0.0	0.0	0.1	0.1	2.0	5.7	1.4
Gent-Industrie	0.0	0.0	0.0	0.0	0.0	1.0	3.7	1.3
Chievres	0.0	0.0	0.0	0.1	0.0	3.3	2.6	0.9
Uccle	0.0	0.0	0.0	0.0	0.0	4.9	2.9	1.1
Antwerpen-Deurne	0.0	0.0	0.0	0.0	0.0	1.4	6.4	4.0
Florennes	0.0	0.0	0.0	0.0	0.3	4.9	2.0	0.2
St.-Hubert	0.0	0.0	0.0	0.0	0.4	4.5	2.5	1.2
Bierset	0.0	0.0	0.0	0.0	0.0	3.5	3.2	8.5
Kleine-Brogel	0.0	0.0	0.0	0.0	0.0	0.3	3.8	7.6
Eisenborn	0.0	0.0	0.0	0.0	0.0	0.0	1.1	7.1

Click station names for detailed forecasts.

Figure: INDRA station table for RMI-EPS: 3h accumulated precipitation forecast of 20150813 (00h UTC run).

Probability plot

Probability of exceeding thresholds.

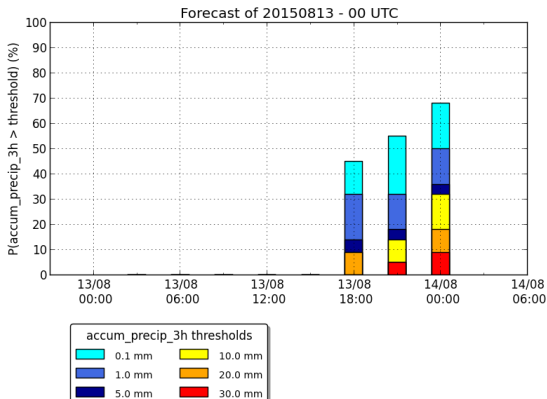


Figure: Probability plot RMI-EPS: 3h accumulated precipitation forecast of 20150813 (00h UTC run) for station Bierset (Belgium).

Thunderstorm cases

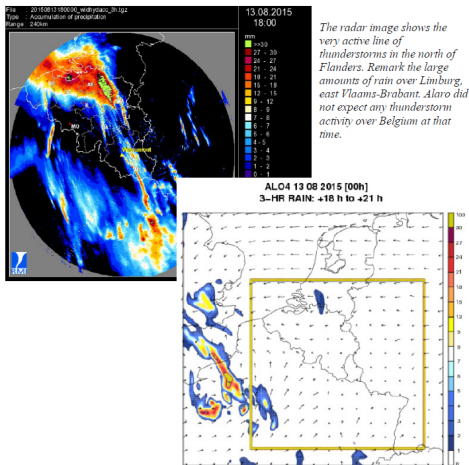


Figure: Thunderstorm on 13 August 2015: ALARO4 vs radar.
(Courtesy: S. Caluwaerts)

Thunderstorm cases

13 August 2015

Waarschuwingen

Begin : 13/08/2015 17H - (lokale tijd)
Einde : 14/08/2015 05H - (lokale tijd)



Avertissements

Début : 13/08/2015 17H - (heure local)
Fin : 14/08/2015 05H - (heure local)

Onweer Wind Regen - Orage Vent Pluie

In de loop van donderdagnamiddag, donderdagavond en tijdens de nacht van donderdag op vrijdag verwachten we felle buien vanaf de Franse grens.

Die buien kunnen gepaard gaan met onweer, plaatselijk hagel en rukwinden.

In westen (West-Vlaanderen en het westen van Oost-Vlaanderen en Henegouwen) kan er veel neerslag op korte tijd vallen. Plaatselijk kan er tussen 20 en 30 l/m² vallen.

Provincies	13/8	14/8	15/8
Vlaanderen			
Kant			
West-Vlaanderen			
Oost-Vlaanderen			
Antwerpen			
Limburg			
Vlaams-Brabant			
Brussel			
Brussel			

groen - Er worden geen significante problemen verwacht ten gevolge van onweer.

geel - Er is plaatselijk kans op onweer. Een lokaal onweer is niet zonder gevaar. Er is kans op intense regenval, hagelbuien, blikseminslagen en/of felle rukwinden die lokaal voor overlast kunnen zorgen.

oranje - Er is verspreid kans op hevige onweer met mogelijk overlast op meerdere plaatsen. Intense regenval, hagelbuien, blikseminslagen en/of hevige rukwinden kunnen in grote schaal veroorzaken. Overvloedige regen is mogelijk en kan voor wateroverlast zorgen. Er is ook kans op vallende bomen/takken. Wees dus op uw hoofd en blijf in de mate van het mogelijke binnen.

rood - Er is een grote kans op hevige onweer met waarschijnlijk overlast op meerdere plaatsen. Intense regenval, hagelbuien, blikseminslagen en/of hevige rukwinden kunnen grote schade veroorzaken. Overvloedige regen is mogelijk en kan voor wateroverlast zorgen. Er is ook kans op vallende bomen/takken. Wees dus op uw hoofd en blijf in de mate van het mogelijke binnen.

Jeu di dans l'après-midi, jeudi soir et encore la nuit de jeudi à vendredi, nous prévoyons des averses intenses à partir de la frontière française.

Ces averses pourront être accompagnées d'orage, localement de grêle et de rafales de vent.

Dans l'ouest (la Flandre Occidentale et l'ouest de la Flandre Orientale et du Hainaut) on prévoit de fortes précipitations en peu de temps. Localement des quantités comprises entre 20 et 30 l/m² seront possibles.

Provincies	13/8	14/8	15/8
Wallonie			
Liège			
Hainaut			
Namur			
Luxembourg			
Brabant wallon			
Bruxelles			
Bruxelles			

vert - On ne prévoit pas de problèmes significatifs suite aux orages.

jaune - Il y a un risque d'orage local. Un orage local n'est pas sans danger. Des pluies intenses, des averses de grêle, des impacts de boue et/ou de fortes rafales de vent peuvent provoquer des problèmes localement.

orange - Il y a un risque répandu d'orages violents et des problèmes sont possibles en plusieurs endroits. Des pluies intenses, des averses de grêle, des impacts de boue et/ou de fortes rafales de vent peuvent causer des dégâts assez importants. Des pluies abondantes sont possibles et peuvent conduire à des inondations. Il y a également un risque de chute (de branches) d'arbres. Soyez donc sur vos gardes et évitez autant que possible de prendre la route.

rouge - Il y a un risque élevé d'orages violents avec probablement des problèmes en plusieurs endroits. Des pluies intenses, des averses de grêle, des impacts de boue et/ou de fortes rafales de vent peuvent causer des dégâts importants. Des pluies abondantes sont possibles et peuvent conduire à des inondations. Il y a également un risque de chute (de branches) d'arbres. Soyez donc sur vos gardes et évitez autant que possible de sortir.

Thunderstorm cases

13 August 2015

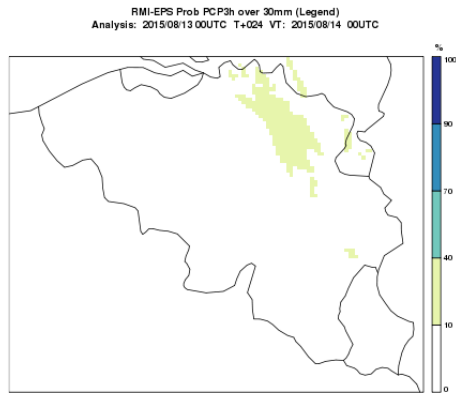


Figure: Probability plot RMI-EPS: 3h accumulated precipitation (> 30mm), forecast of 20150813 (00UTC) +24h over Belgium.

Thunderstorm cases

13 August 2015

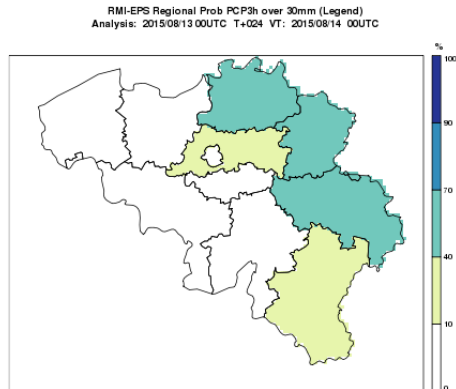


Figure: Regional probability plot RMI-EPS: 3h accumulated precipitation ($> 30mm$), forecast of 20150813 (00UTC) +24h.

Thunderstorm cases

13 August 2015

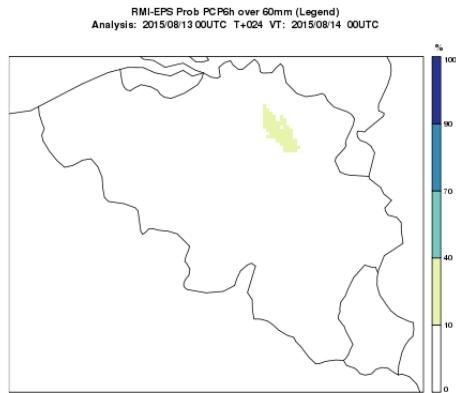


Figure: Probability plot RMI-EPS: 6h accumulated precipitation (> 60mm), forecast of 20150813 (00UTC) +24h over Belgium.

Thunderstorm cases

13 August 2015

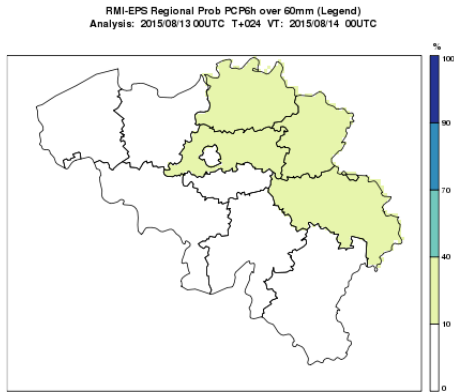
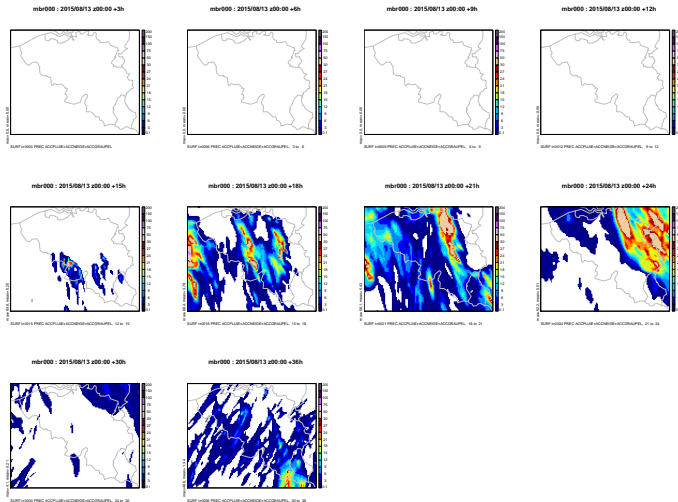


Figure: Regional probability plot RMI-EPS: 6h accumulated precipitation ($> 60mm$), forecast of 20150813 (00UTC) +24h.

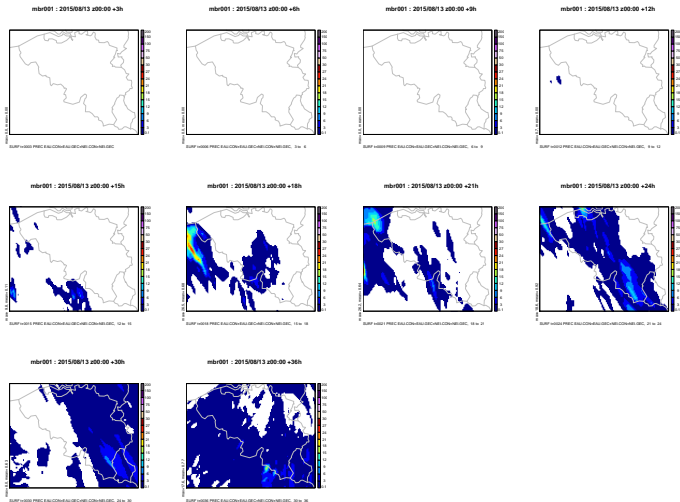
Thunderstorm cases

13 August 2015: Arome control member of RMI-EPS



Thunderstorm cases

13 August 2015: Alaro control member of RMI-EPS



Thunderstorm cases

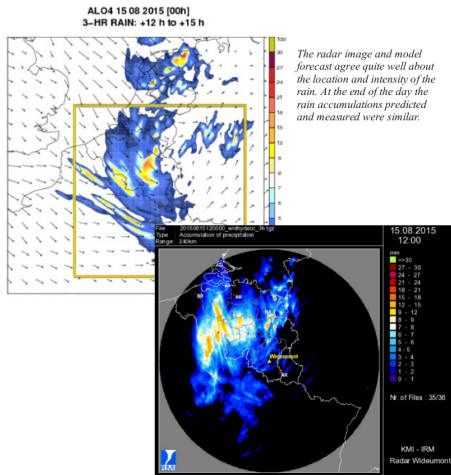


Figure: Thunderstorm on 15 August 2015: ALARO4 vs radar.
(Courtesy: S. Caluwaerts)

Thunderstorm cases

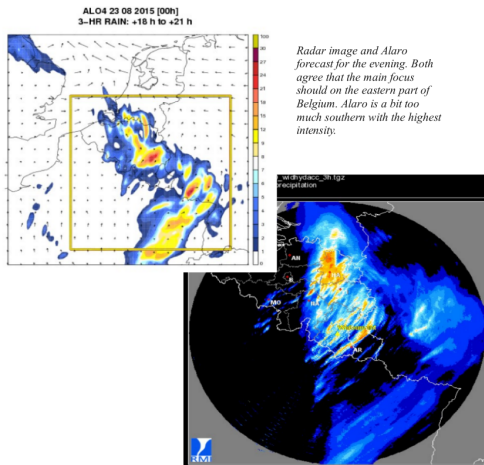


Figure: Thunderstorm on 23 August 2015: ALARO4 vs radar.
(Courtesy: S. Caluwaerts)

Verification scores

- ▶ Two periods:
August 2015: several thunderstorms (15 forecasts).
Feb-March 2016: 3 weeks of daily forecasts.
- ▶ Point-based (not spatial): 10 standard synop stations spread evenly over Belgium.
- ▶ INDRA verification tools.
(Courtesy: J. Van den Bergh)

Verification scores

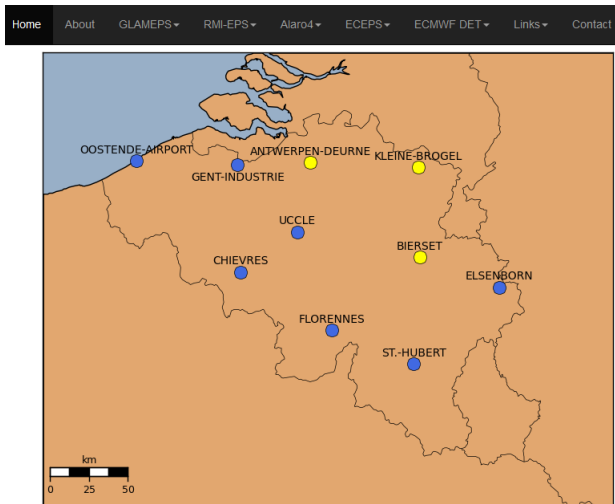


Figure: INDRA synop stations.

Verification scores

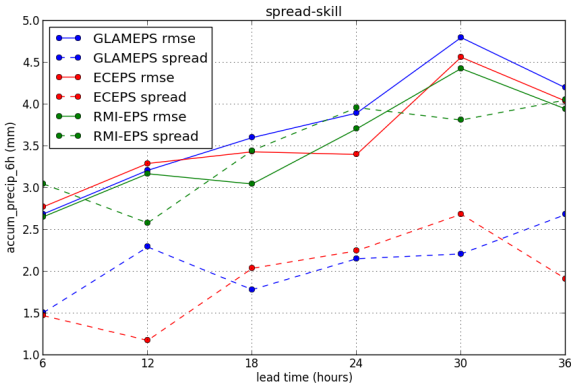


Figure: RMSE and spread for 6h accumulated precipitation: thunderstorm cases of August 2015 (averages over 10 standard stations in Belgium).

Verification scores

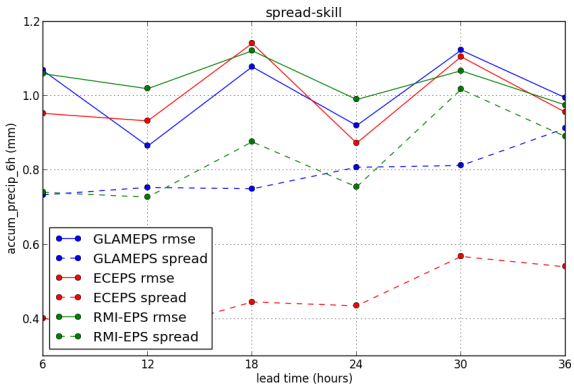


Figure: RMSE and spread for 6h accumulated precipitation: 19feb-11march2016 (averages over 10 standard stations in Belgium).

Verification scores

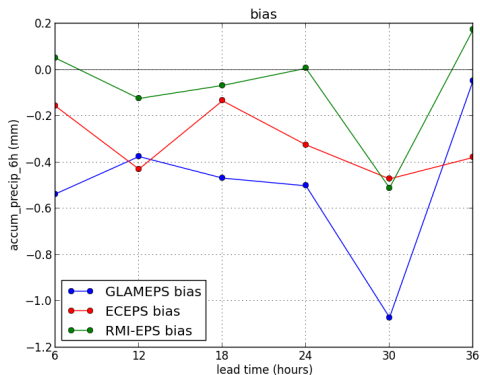


Figure: Bias for 6h accumulated precipitation: thunderstorm cases of August 2015 (averages over 10 standard stations in Belgium).

Verification scores

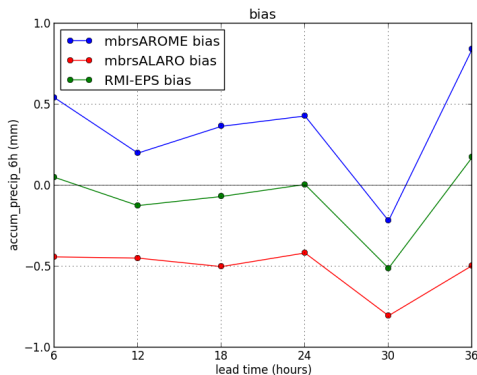


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Verification scores

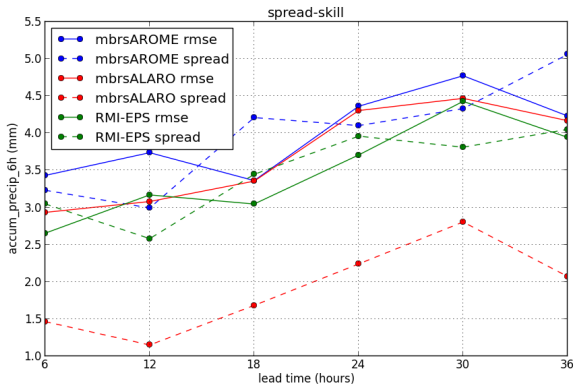


Figure: RMSE and spread for 6h accumulated precipitation: thunderstorm cases of August 2015 (averages over 10 standard stations in Belgium).

Verification scores

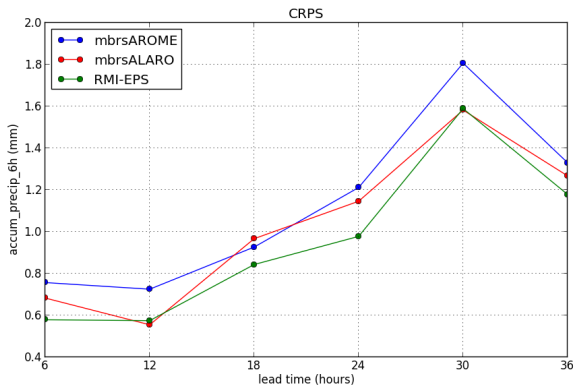


Figure: CRPS for 6h accumulated precipitation: thunderstorm cases of August 2015 (averages over 10 standard stations in Belgium).

Verification scores

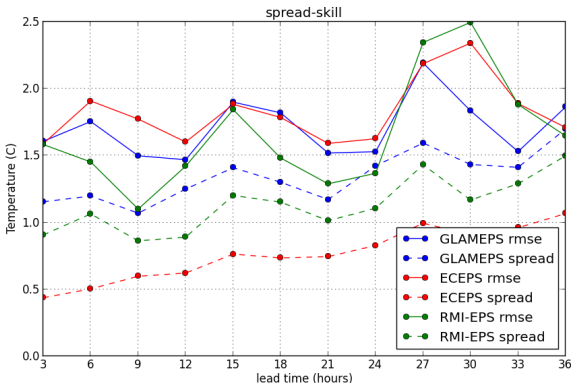


Figure: RMSE and spread for T2M: thunderstorm cases of August 2015 (averages over 10 standard stations in Belgium).

Verification scores

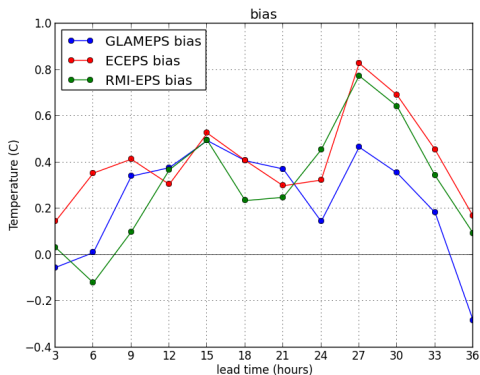


Figure: Bias for T2M: thunderstorm cases of August 2015 (averages over 10 standard stations in Belgium).

Future plans

Short term

- ▶ Statistical verification over long(er) time period.
- ▶ Additional surface perturbations.
 - Should improve T2m spread.
 - Influence on thunderstorm forecasts?
- ▶ Daily semi-operational runs with an automatic monthly verification (of INDRA).
- ▶ New domain centred around Belgium.

Future plans

Long term

Upper-air physics

- ▶ Multiphysics (e.g. different tunings).
- ▶ Tests with Alaro-1 (instead of Alaro-0).
- ▶ Perturbation of physical processes (parameter perturbation).

THANK YOU