

ALARO-0 experience in Belgium

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*With additional input from
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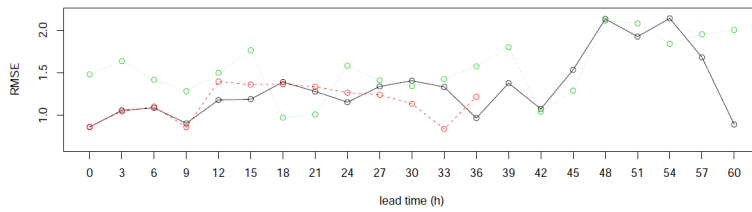
Overview

- Some scores
- Cold bias, but nevertheless a substantial improvement.
- ALARO-0 as a component of GLAMEPS
- Important cases: the 2010 snow case and Pukkelpop.
- Climate runs
- Summary and conclusions

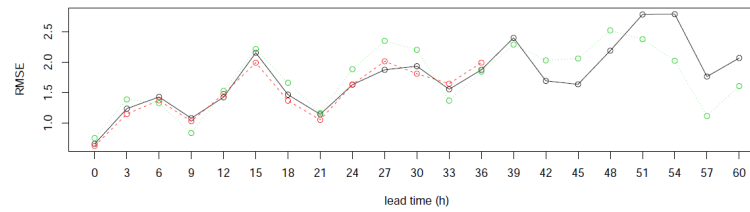


First some scores of ALARO-0 at 7 km and 4.5 km, and ECMWF

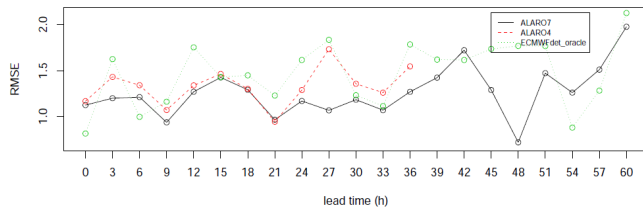
T2m: 0h run (20120301–20120314, station(s):6407)



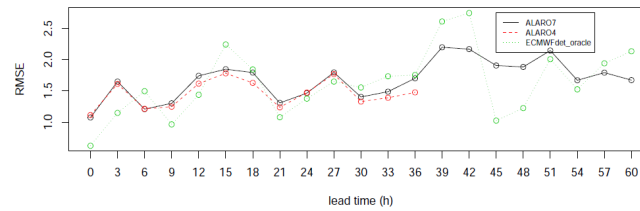
T2m: 0h run (20120301–20120314, station(s):6432)



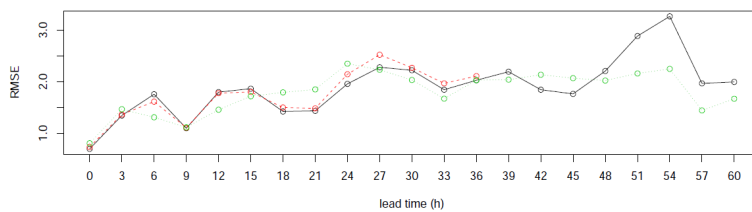
T2m: 12h run (20120301–20120314, station(s):6407)



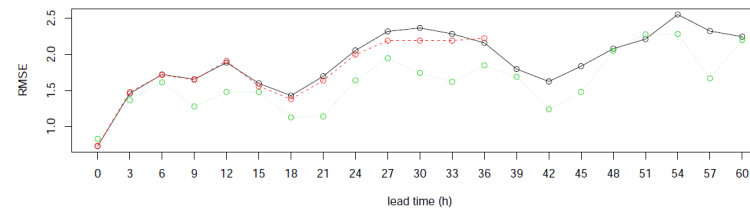
T2m: 12h run (20120301–20120314, station(s):6432)



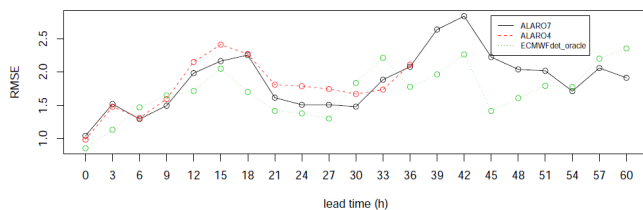
T2m: 0h run (20120301–20120314, station(s):6447)



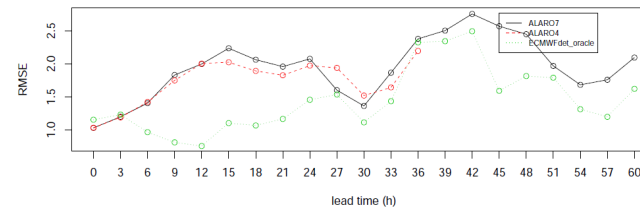
T2m: 0h run (20120301–20120314, station(s):6479)



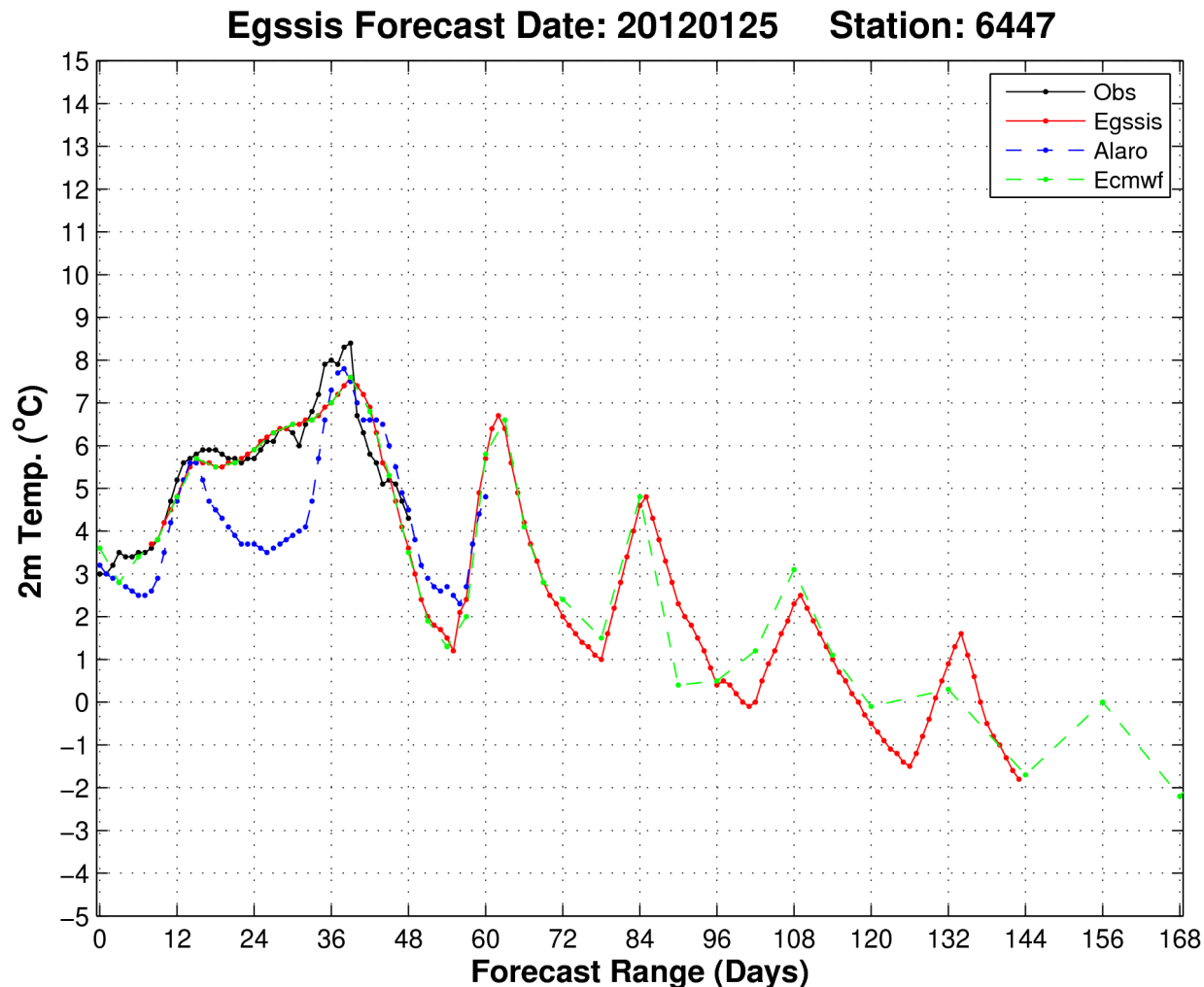
T2m: 12h run (20120301–20120314, station(s):6447)



T2m: 12h run (20120301–20120314, station(s):6479)



The RMI problem of the last year in a product for one of our clients

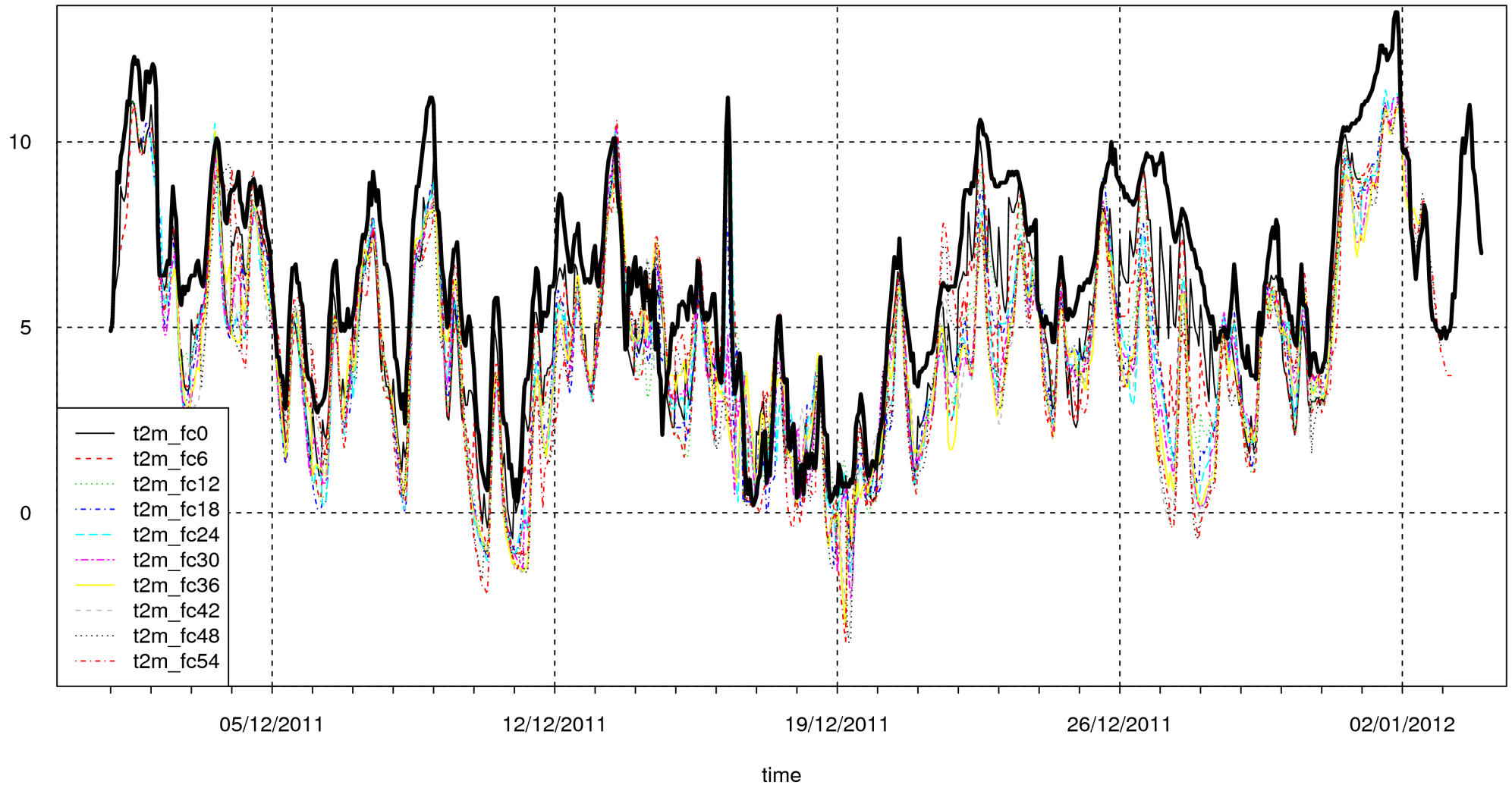


ALARO-0 experience in Belgium



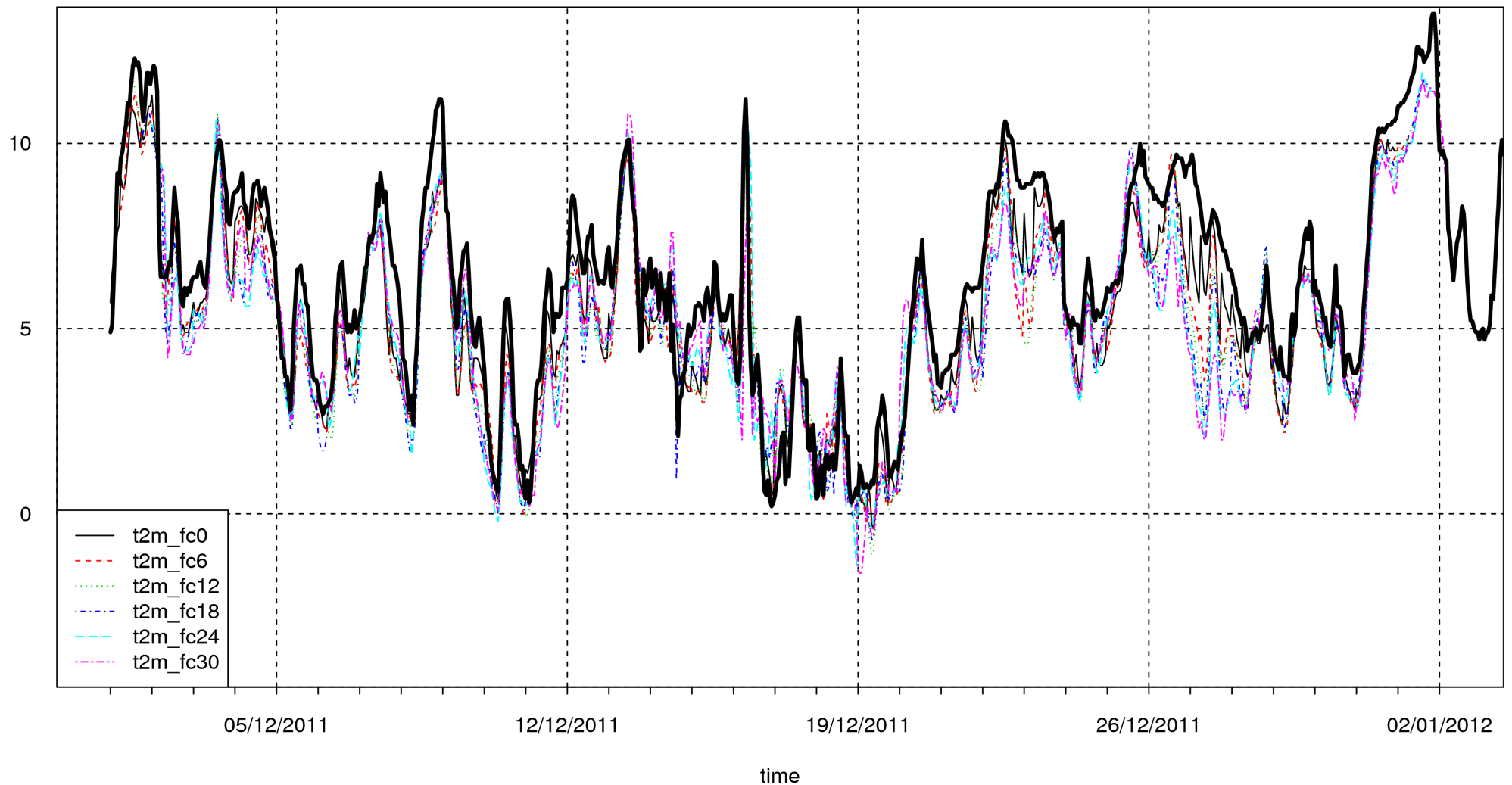
The winter cold bias: ALADIN 7km

Old Aladin



The winter cold bias: ALARO 4.5 km

Alaro-4



Overview of quick, defensive tests, no deep science

- FMR/RRTM vs. ACRANEB radiation scheme
- [Xu-Randall vs. Smith-Gerard (protection of the convective part)]
- [ALARO-Lopez v.s Rasch-Kristjansson scheme (RK)]
- SURFEX vs. ISBA
- Nothing really completely solved the problem.
- **BUT, still it should be highlighted that ALARO improves substantially over ALADIN!**
- **It seems necessary to address the formulation of the turbulent exchanges. Could TOUCANS improve this?**



Scores

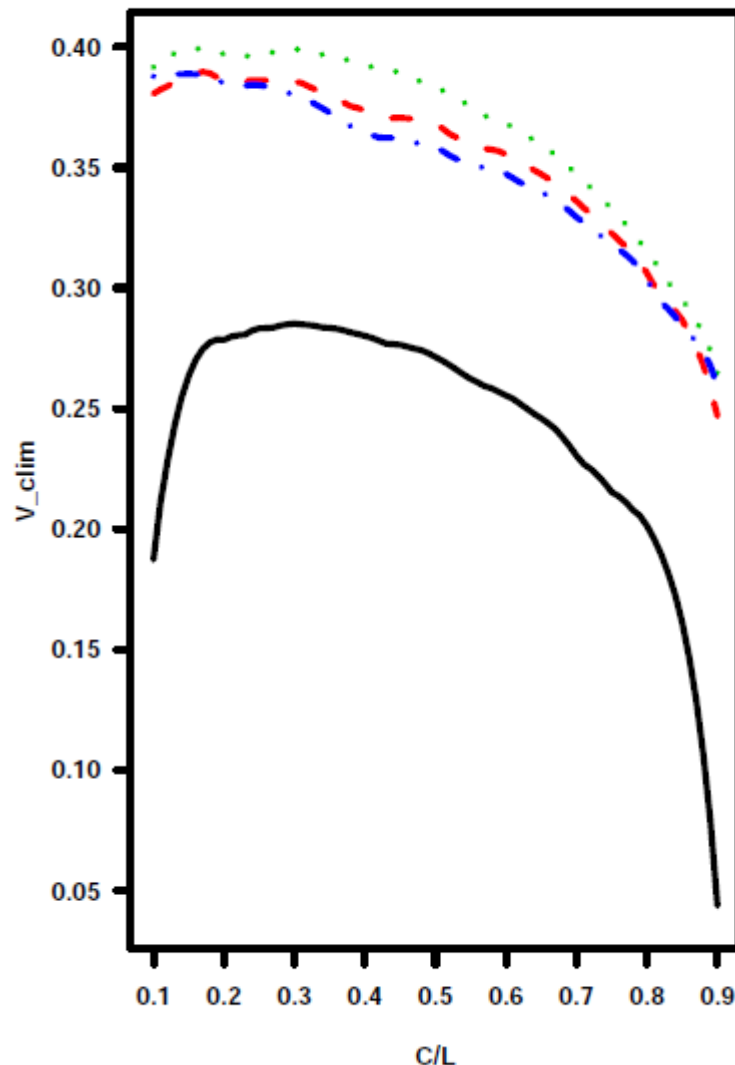
- The skills of ALARO are, at the RMI, judged in comparison to ECMWF
- One can say that on average the scores are comparable to ECMWF (the previous slide is only an illustration), although there is a big difference between stations and variables, but
- we have a problem with a cold bias in stable situations in winter. The latter exists in all models, but ECMWF performs very well over Belgium :-)
- We now plan to implement a MOS system based on the work of Vannitsem, 2010, so-called EVMOS.



GLAMEPS over Belgium (including ALARO-0)

Smet et al. 2012

S10m: 12h run (20100401-20101229, station(s):ALL)



- Potential **Continuous Relative Economic Value** (CREV) for 10-m wind, relative to (sample) climatology of
 - ECMWF's EPS (**black full line**),
 - GLAMEPS (**red dashed line**),
 - GLAMEPS-LAEF (**green dotted line**) and
 - ECEPS-GLAMEPS-LAEF (**blue dash dotted line**)
- You can think of this as an assessment of the potential for wind-energy applications
- **The green line shows the extra potential we are currently producing within the HIRLAM-ALADIN collaboration on top of ECMWF!**



Two cases



Example: snow on 10th of February

Record traffic jams



- ▶ **Pulverized record: 950 km of traffic jams.**
(Source: Touring Mobilis)
- ▶ **Estimated total economic damage of 20 million €.**
(Source: Transport & Mobility Leuven)

Example: snow on 10th of February

Deterministic forecasts vs probabilistic forecasts

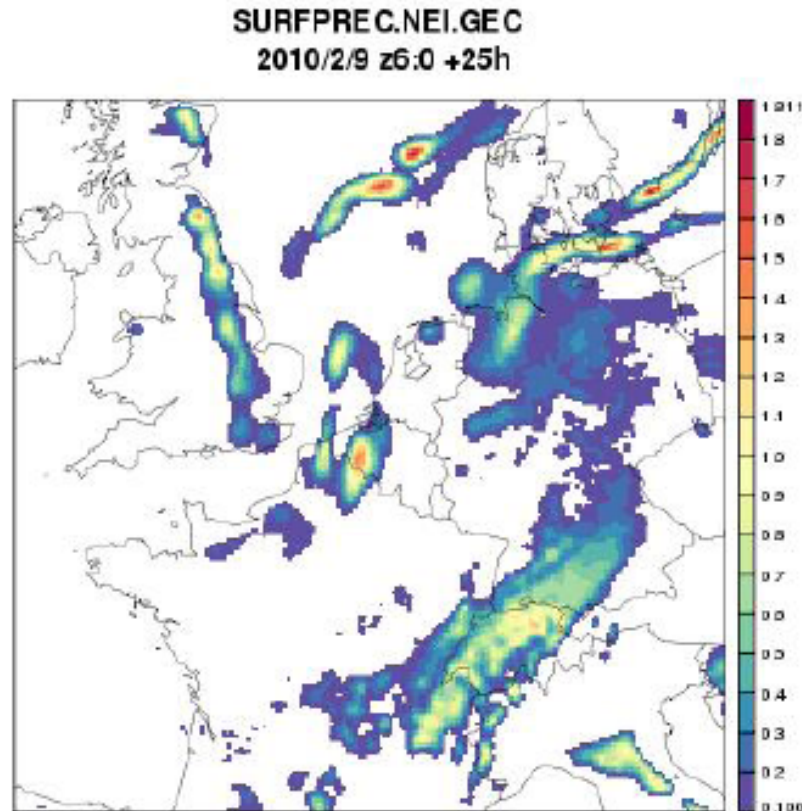


Figure: Deterministic forecast: amount of snow (water equivalent in mm) between 6h and 8h.

Example: snow on 10th of February

Deterministic forecasts vs probabilistic forecasts

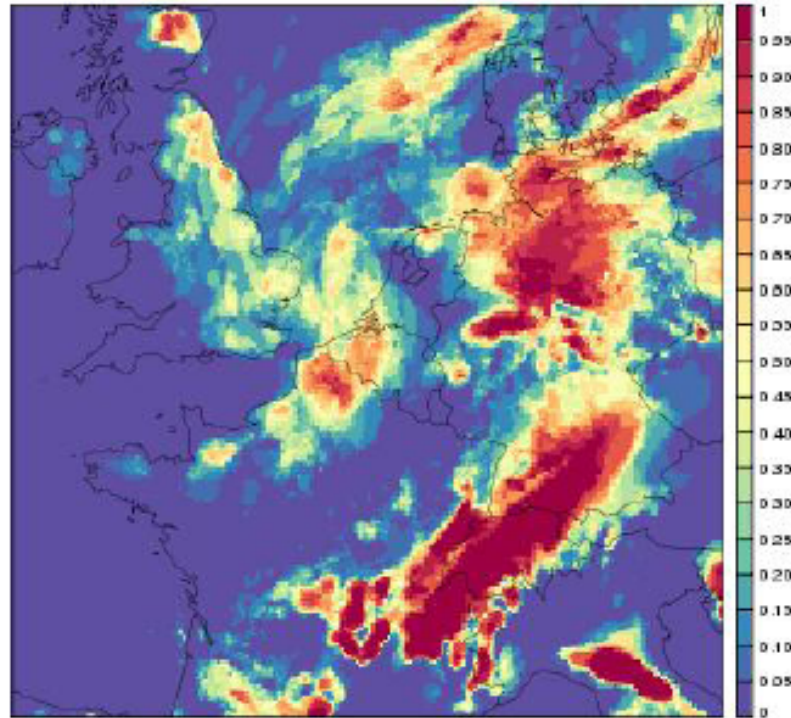
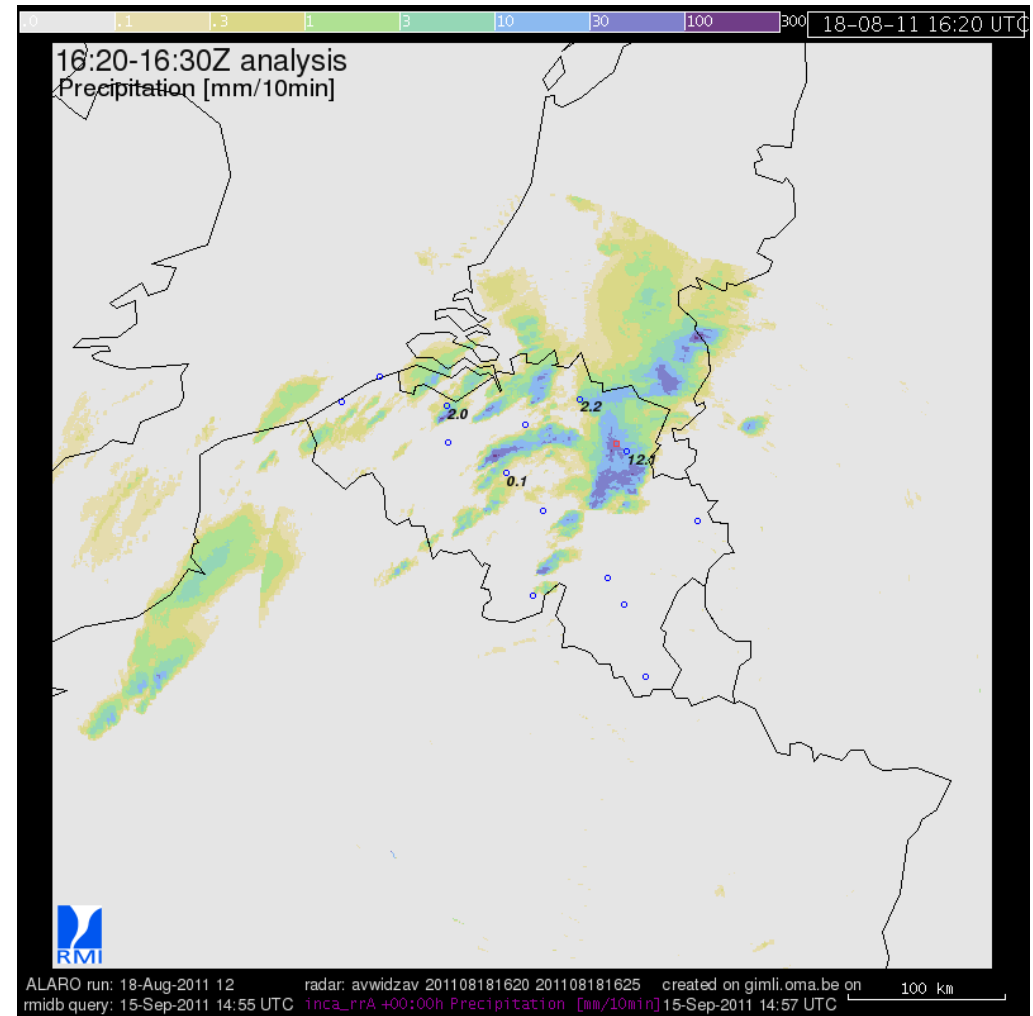


Figure: Probability forecast: probability of snow (more than 0.1 mm snow water equivalent) between 6h and 8h.

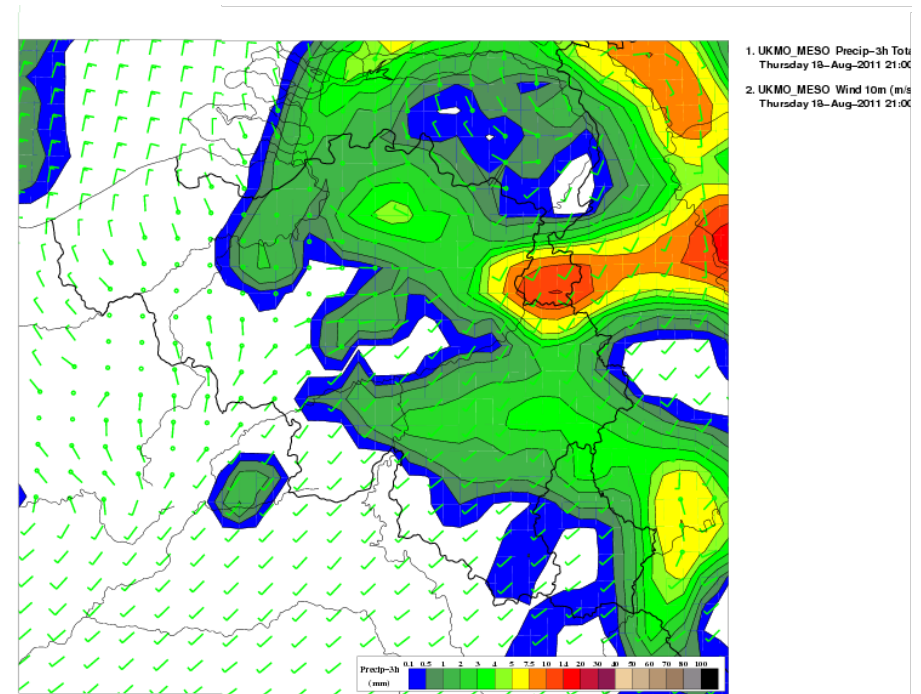
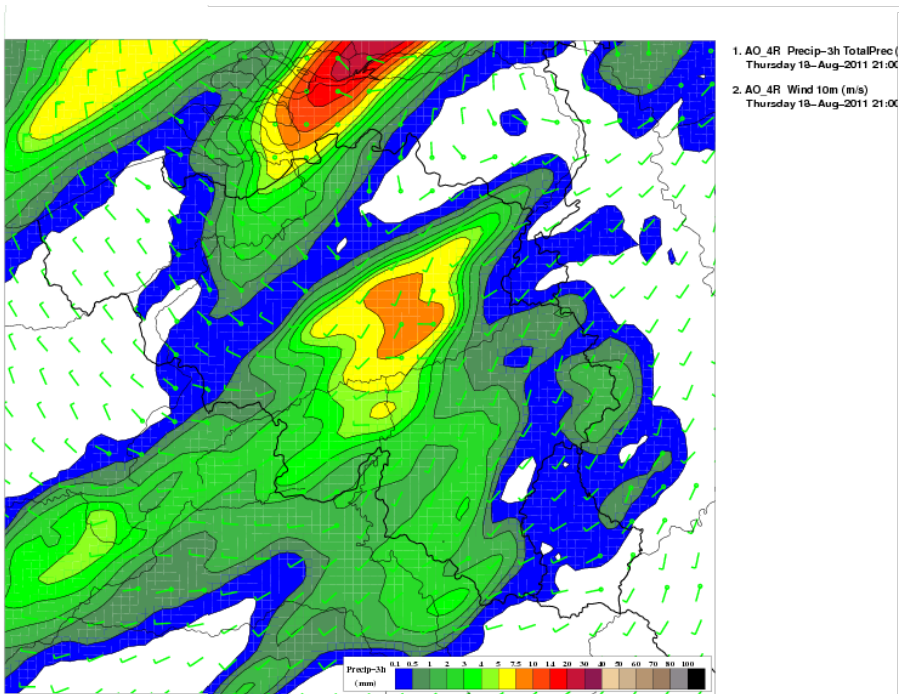
Pukkelpop, 18 August 2012

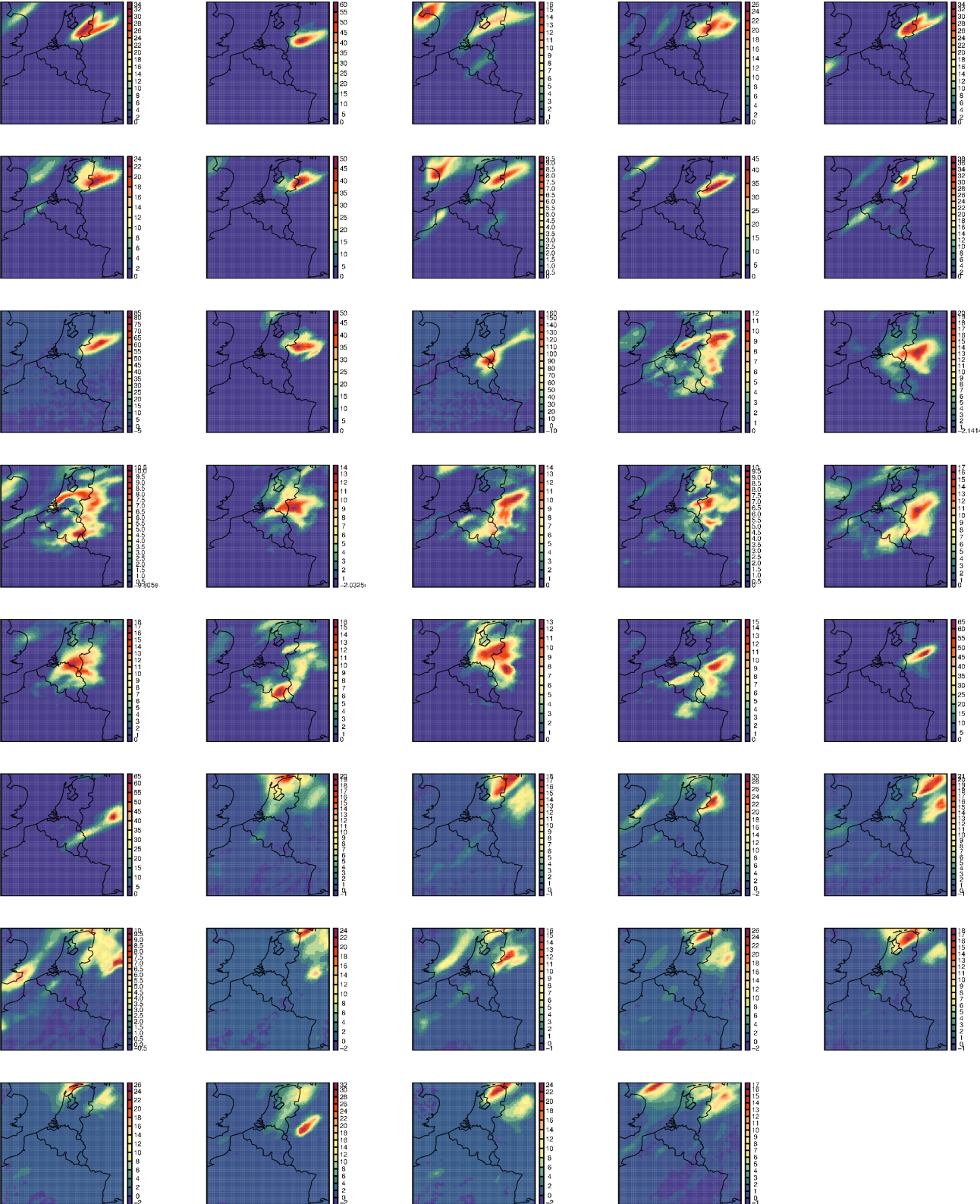


- Was a case of a strong downburst during a music festival near Hasselt.
- Scale was about 100m
- So too small to be simulated in our models
- 4 casualties



Precipitation forecast 2100 UTC: ALARO (left), UK model (right)



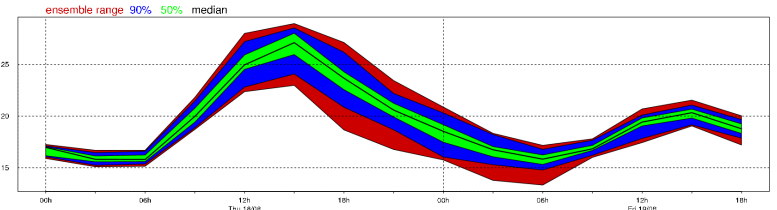


GLAMEPS-o-GRAM

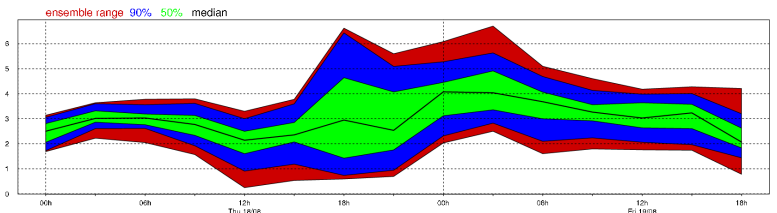
Hasselt

Forecast date: Thursday 18 August 2011, 00h UTC

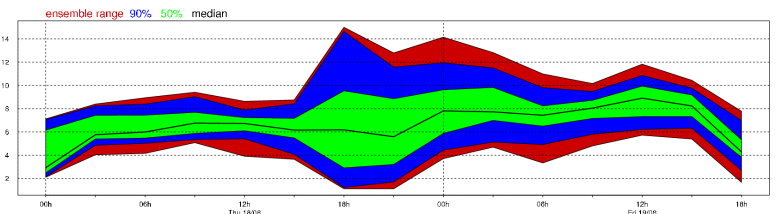
2m Temperature



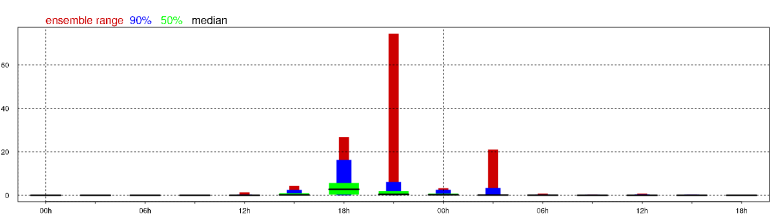
10m Wind



10m Wind Gusts



3h Precipitation



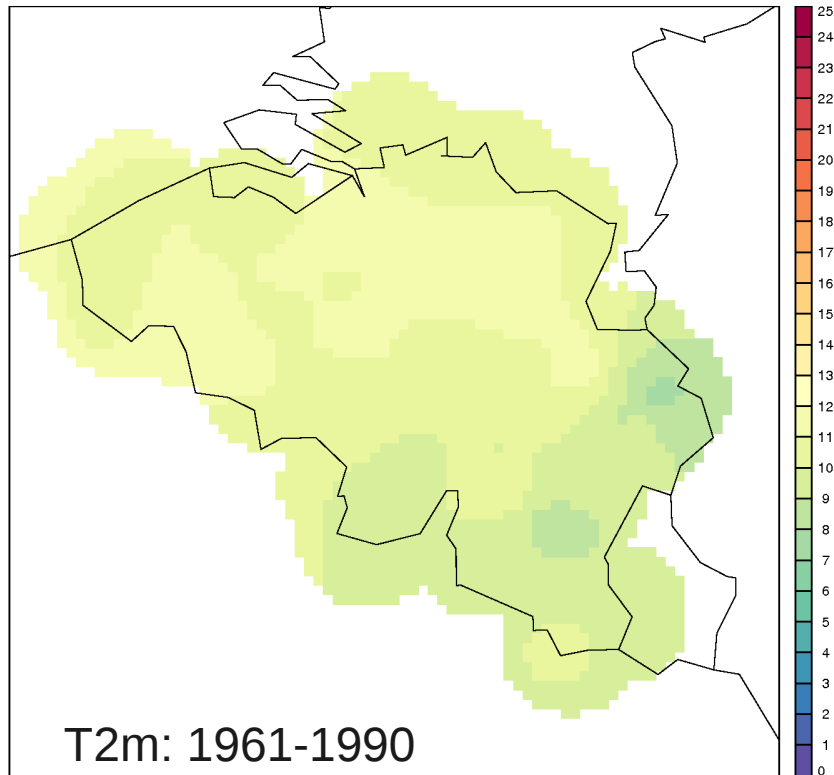
Some conclusions

- One can imagine some signals in the mesoscale model, but the resolution is not sufficient
- Nevertheless, the EPS system shows some *finger print*, even if the quantities are not correct at the hectometric scale of the festival.
- We would need these small scales otherwise we have to send an alert to many festivals, ...

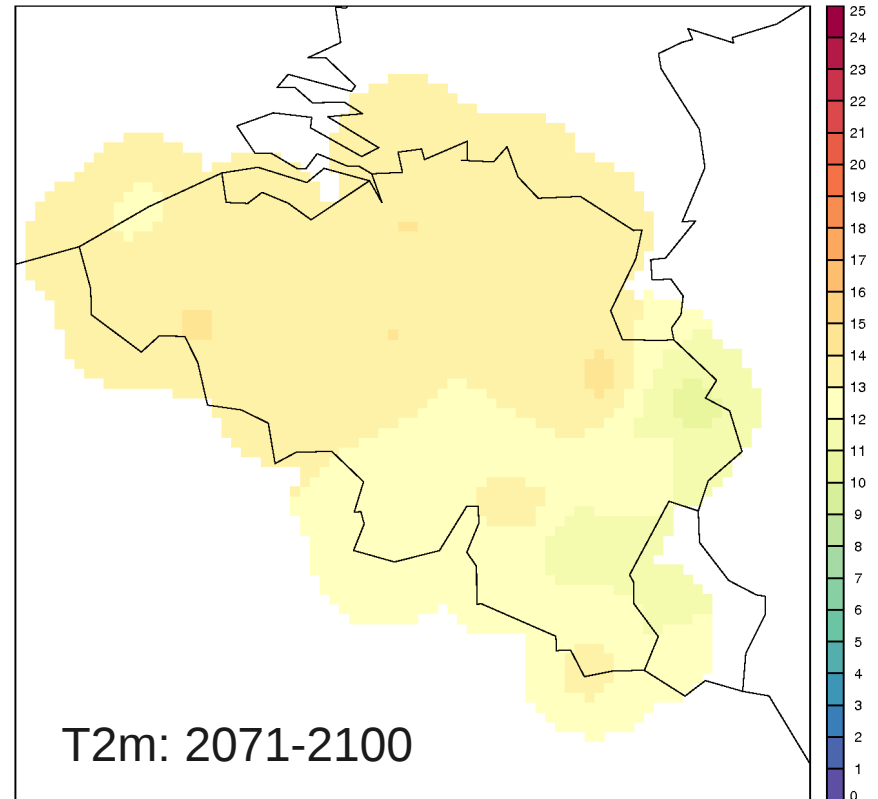


Climate. First Belgian RMI scenario computed (A1B) in 2011

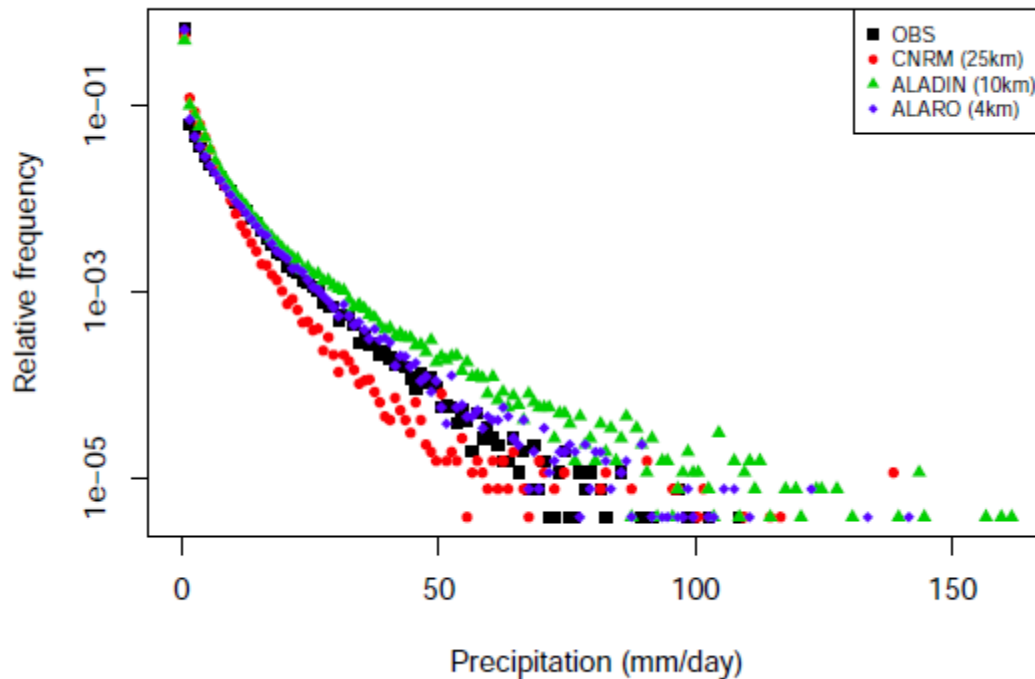
T2M_MEAN, Annual= 10.54 °C



T2M_MEAN, Annual= 13.14 °C



Validation of climate = validation of NWP



Courtesy of R. de Troch and R. Hamdi

- Relative frequency of precipitation events from downscaling of ERA-40 for the last 30 years compared to observations (black)
 - The CRNM (ALADIN) version of the EC ENSEMBLES project (red)
 - The older ALADIN version at 10-km resolution (green)
 - ALARO at 4 km (blue)
- **Conclusion: the work to go to higher resolution payed off by a better climatology, including the one of extreme events (cfr. Floodings).**



Summary

- The **cold bias** in winter is our main minor point. We are currently working to implement the so-called EVMOS [Vannitsem, QJRMS, 2009], that will combines ECMWF with ALARO to make a “BEST” forecast for for pointwise variables, where the relative weight is dynamically adapted based on the spread of EPS (and later GLAMEPS).
- Nevertheless, we would like to have improvements of the cold bias in winter (although we lack time and man power to work on that now). Joint work with HIRLAM is to be stimulated (see work plan).
- **Pukkelpop** is an important case for us. If we can prove added skill on that it will help our Institute a lot. However, it is my feeling we need hectometric scales for that On the other hand, Pukkelpop justifies increases in resoliotn..
- **GLAMEPS has proved its value on top of ECMWF!** We add skill on top of ECMWF, and ALARO-0 is part of it! It gives a “raison d'existence”. As said, it will be implemented within the BEST system of the RMI (problem is still data policy). EPS is important for forecasts of extreme storms. ALARO-1 should find its place in it.
- **ALARO-0 has been used to downscale the A1B scenario** over Belgium. The aim is to study climate impact extreme events (heat waves, floodings). We have proved added skill with our ALARO-0 at 4 km (exactly the same as we have been using for our NWP forecasts. This is an indirect validation of the NWP model.



Main conclusion

- Being active in ALARO-0 allowed us to
 - **Build a team of 10 researchers on NWP. The fact that we contributed to it is, in my opinion, the most important element in this!**
 - **This allowed us to master NWP in (almost) all its aspects [although we are behind on 3Dvar data assimilation (but that is unrelated to ALARO-0)].**
 - **It allowed ourselves to valorize our research through the whole spectrum of activities, ranging from forecasting, to specific meteorological services, climate research, and link with academia (Ghent university).**

