ALARO-0 at the RMI

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Piet(’s first operational talk)

Operational use of Alaro-0 at RMIB

The model (cy35t1) is run 4 times a day, at:

1. Resolution 4km (square domain 770 km, up to 36h)
2. Resolution 7km (square domain 1671 km, up to 60h).

There are presently 46 vertical hybrid levels. Both runs are hydrostatic.

The model is coupled with:
Aladin-France up to 48/54h, then with Arpège; the coupling with the global circulation model Arpège only is in test, together with the use of 60 vertical levels.

The main features, differing from earlier Aladin are:

- Semi-Lagrangian horizontal diffusion scheme (Vána 2006).

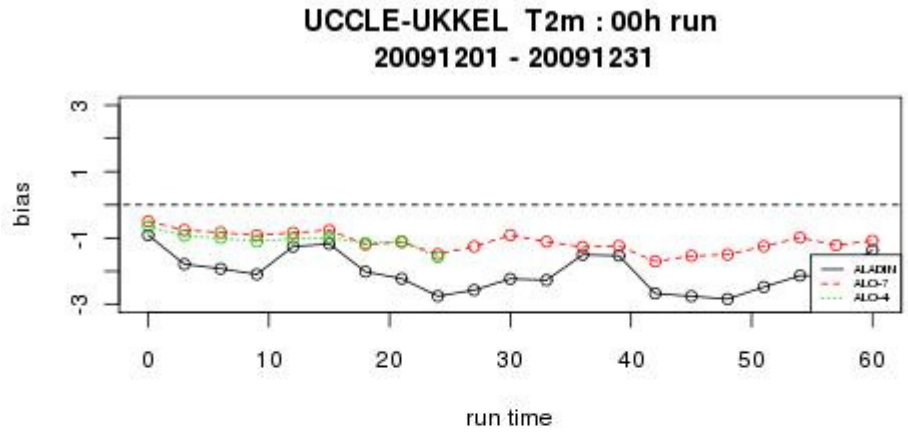
- Refined radiation scheme including Voigt effect.

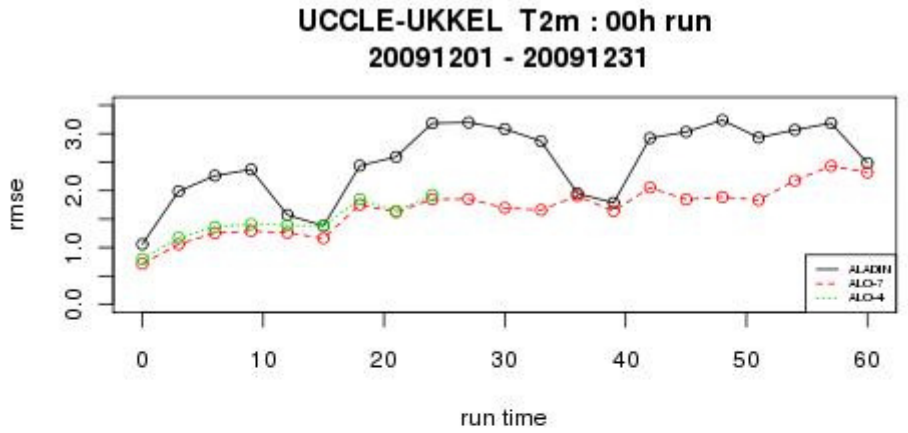
- Prognostic pseudo-TKE vertical turbulent diffusion scheme.

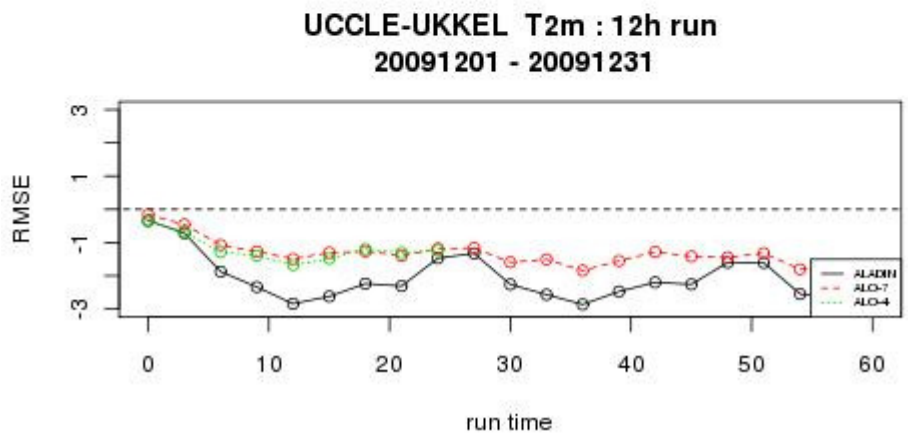
- Microphysics with 5 prognostic water phases (vapour, cloud ice and droplets, snow, rain) plus a diagnostic pseudo-graupel. Probabilistic sedimentation of precipitation (Geleyn et al. 2008) and accounting for partial cloudiness.

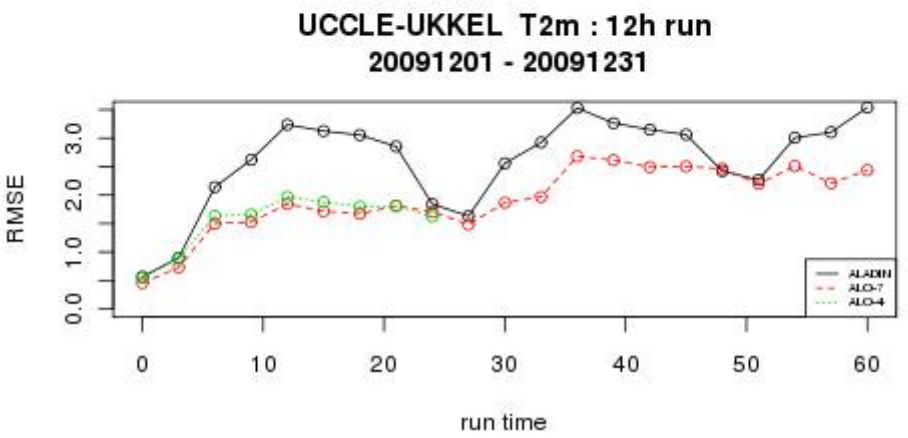
- The 3MT package:
  - Prognostic mass-flux deep-convection scheme, including prognostic vertical motion equations, a prognostic moisture-convergence updraught closure and a separated downdraught closed by the coolin associated to precipitation.
  - Interfacing of deep convection follows the MTCS concept (Piriou et al 2007).
  - Explicit estimation of updraught condensation, detrained condensates are combined with those produced by the stratiform condensation scheme before entering the microphysics.
  - Cascaded organisation following Gerard (2007) allowing a consistent treatment of condensates produced by stratiform and deep convective schemes with no double counting.
  - Special caution for interactions of packages within and between time steps.

Alaro-0 brought a significant improvement of the forecasts; especially for cloud location, precipitation location and evolution, 2m-temperatures







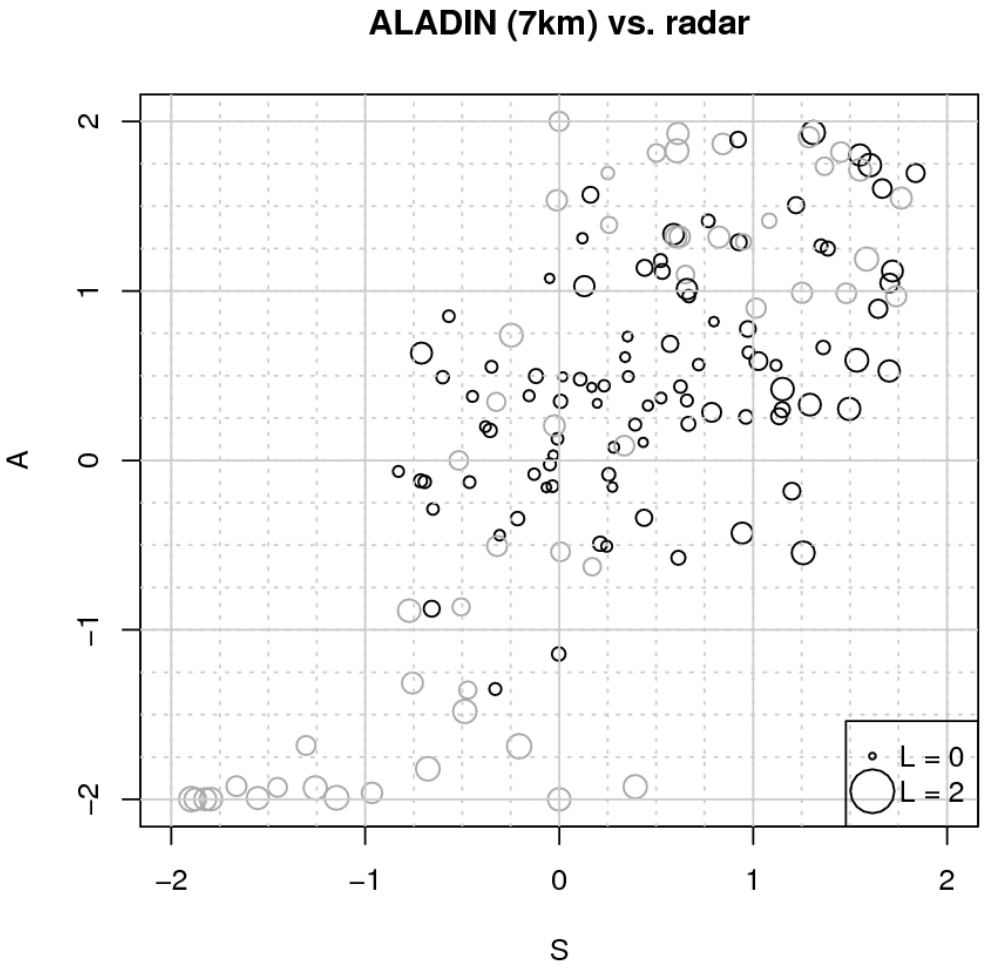


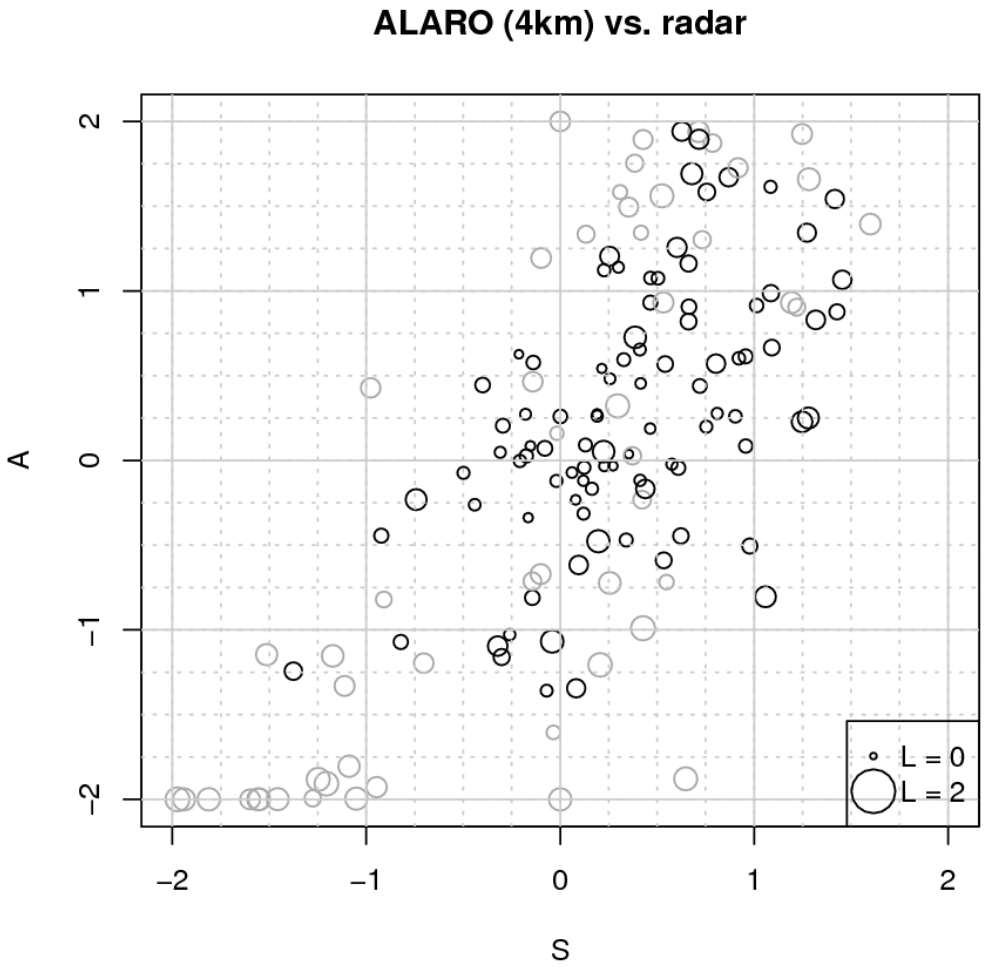
Verification of precipitation

- Forecasters are more satisfied with precipitation from ALARO than from ALADIN
- Compared to ALADIN, the reputation of ALARO greatly increased
- This is of cousre subjective
- We also did a (modest) effort to make a subjective comparison, with the SAL method …

Precipitation verification with SAL [Wernli et al., MWR(2008)]

March 2009 – July 2009





S : -2 (predicted structures too small) ✸ 2 (predicted structures too large)

A : -2 (predicted amount too small) ✸ 2 (predicted amount too large)

L : 0 (correct predicted location) ✸ 2 (wrong location)

Precipitation verification with SAL [Wernli et al., MWR(2008)]

March 2009 – July 2009

	S		A		L	
	mean	sdev	mean	sdev	mean	sdev
ALADIN	0.484	0.694	0.466	0.673	0.112	0.112
ALARO	0.347	0.558	0.255	0.761	0.111	0.095

- Structure and Amplitude scores are significantly better for ALARO than for ALADIN
- Scatter on Structure and Location scores is less for ALARO than for ALADIN

Remember this is with respect to radar, so Amplitude such be taken with a ``pinch of salt''

So

- Solution to the stable cases in winter
- Change in attitude w.r.t. ALADIN/ALARO in the RMI

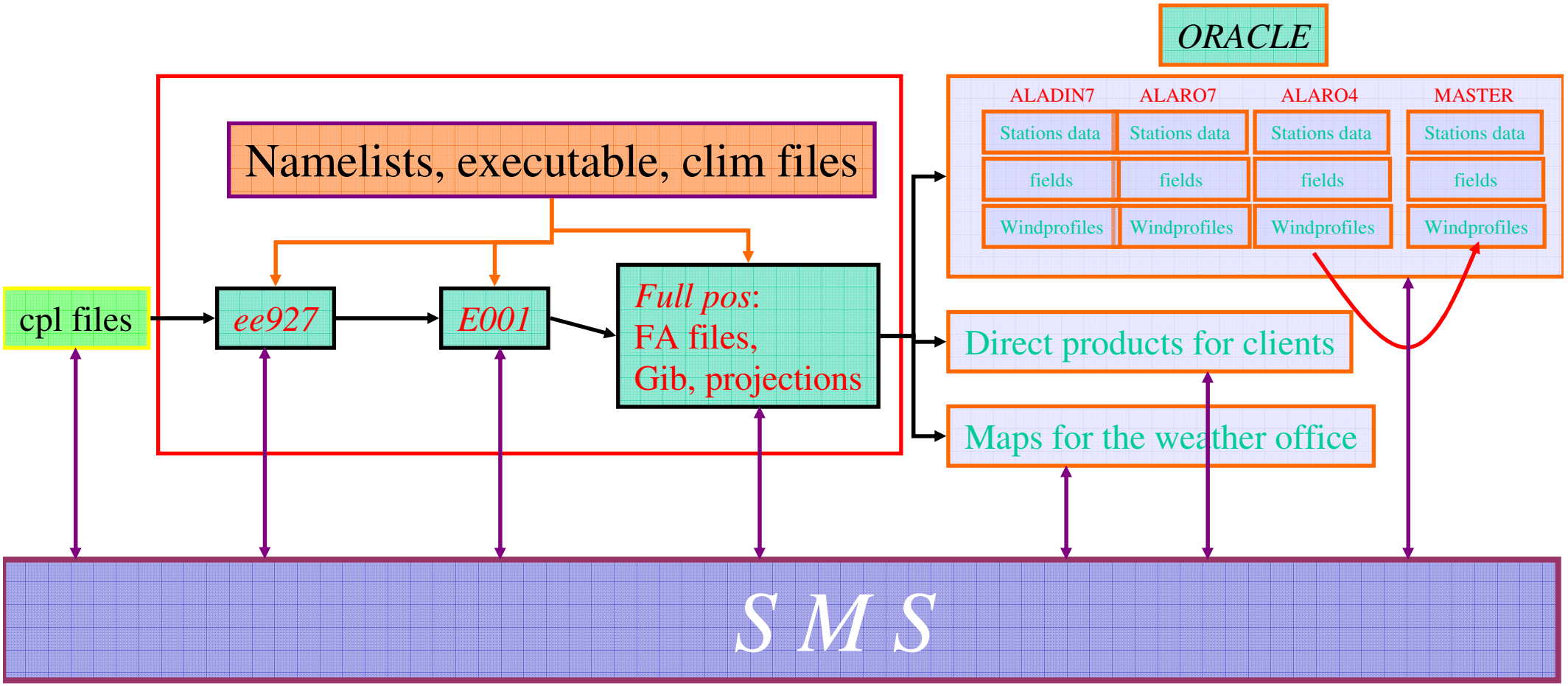
Products

- Several clients for hydrology applications
- Wind energy: direct ALADIN output
- Air pollution, is done by the regions, relies on ECMWF output ad ALADIN
- Ad hoc clients, e.g for constuction

SWAP (Switch ALADIN/ALARO Products)

- How to delineate the responsibilities?
  - The ALADIN team belongs to research: responsibility is scientific, i.e. decide what is the “best” model version and install and maintain it
  - The rest of the RMI should be able to exploit the ALADIN output as freely as possible to create (new) products
- What products depend on ALADIN/ALARO output?
- How to communicate with users?

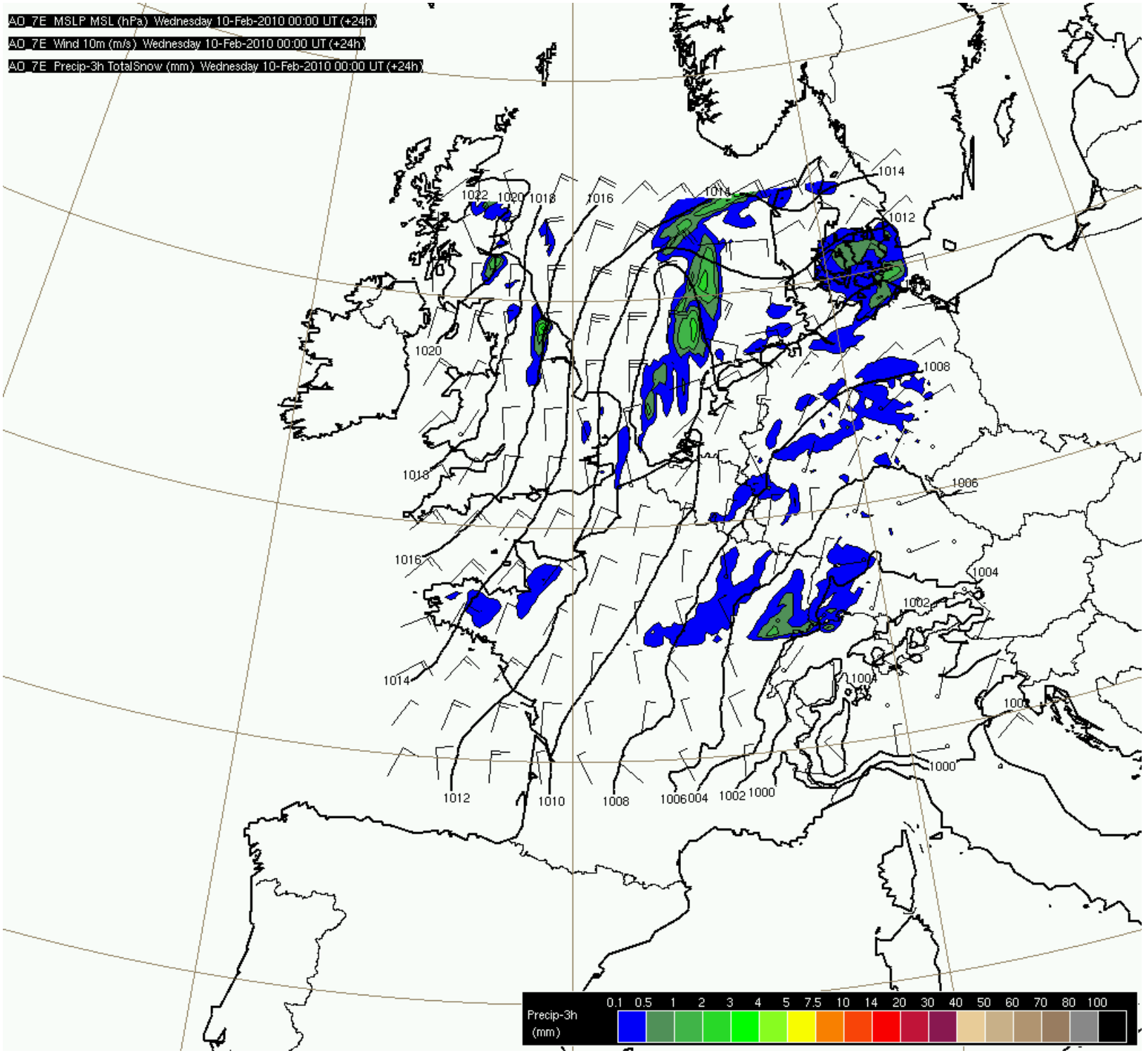
The responsibility of the ALADIN team



A recent case: snow in Belgium

- Last Wednesday 10/2 there were large traffic jams
- In fact this was due to a short “snow storm” starting in the morning of 10/2, with most of the snow over some one of the important traffic axes of the country: Antwerp – Brussels
- This caused about 900 km of traffic jams, a national record!
- The road maintenance of course put the blame on the weather forecasts …

7-km resolution run on 9/2 0000 UTC


AO_7E MSLP MSL (hPa) Wednesday 10-Feb-2010 00:00 UT (+24h)
AO_7E Wind 10m (m/s) Wednesday 10-Feb-2010 00:00 UT (+24h)
AO_7E Precip-3h TotalSnow (mm) Wednesday 10-Feb-2010 00:00 UT (+24h)
1022
1020
1018
1016
1014
1012
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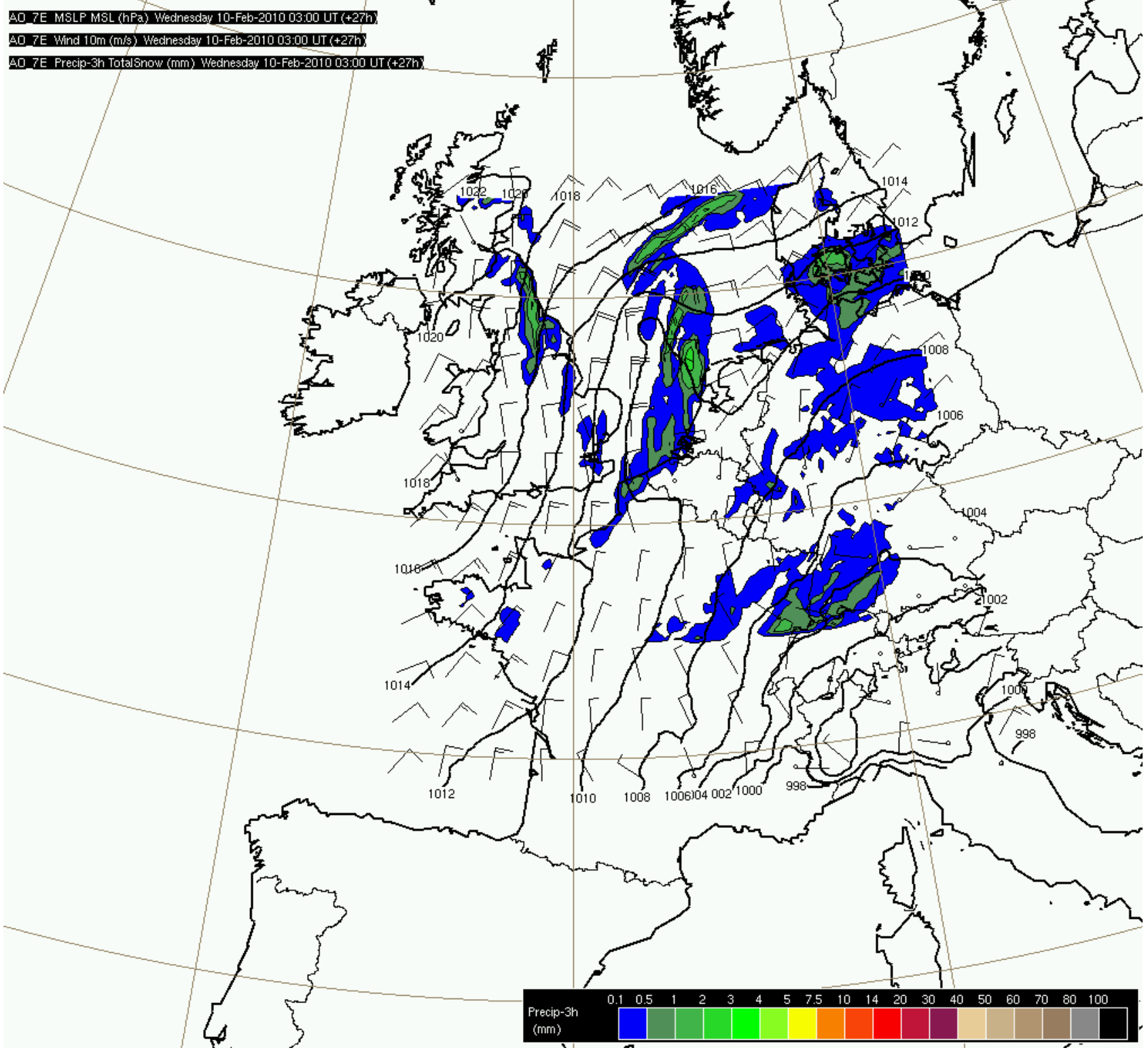
1008
1006
1004
1002
1000
Precip-3h (mm)
0.1 0.5 1 2 3 4 5 7.5 10 14 20 30 40 50 60 70 80 100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AO_7E Wind 10m (m/s) Wednesday 10-Feb-2010 03:00 UT (+27h)
AO_7E Precip-3h TotalSnow (mm) Wednesday 10-Feb-2010 03:00 UT (+27h)
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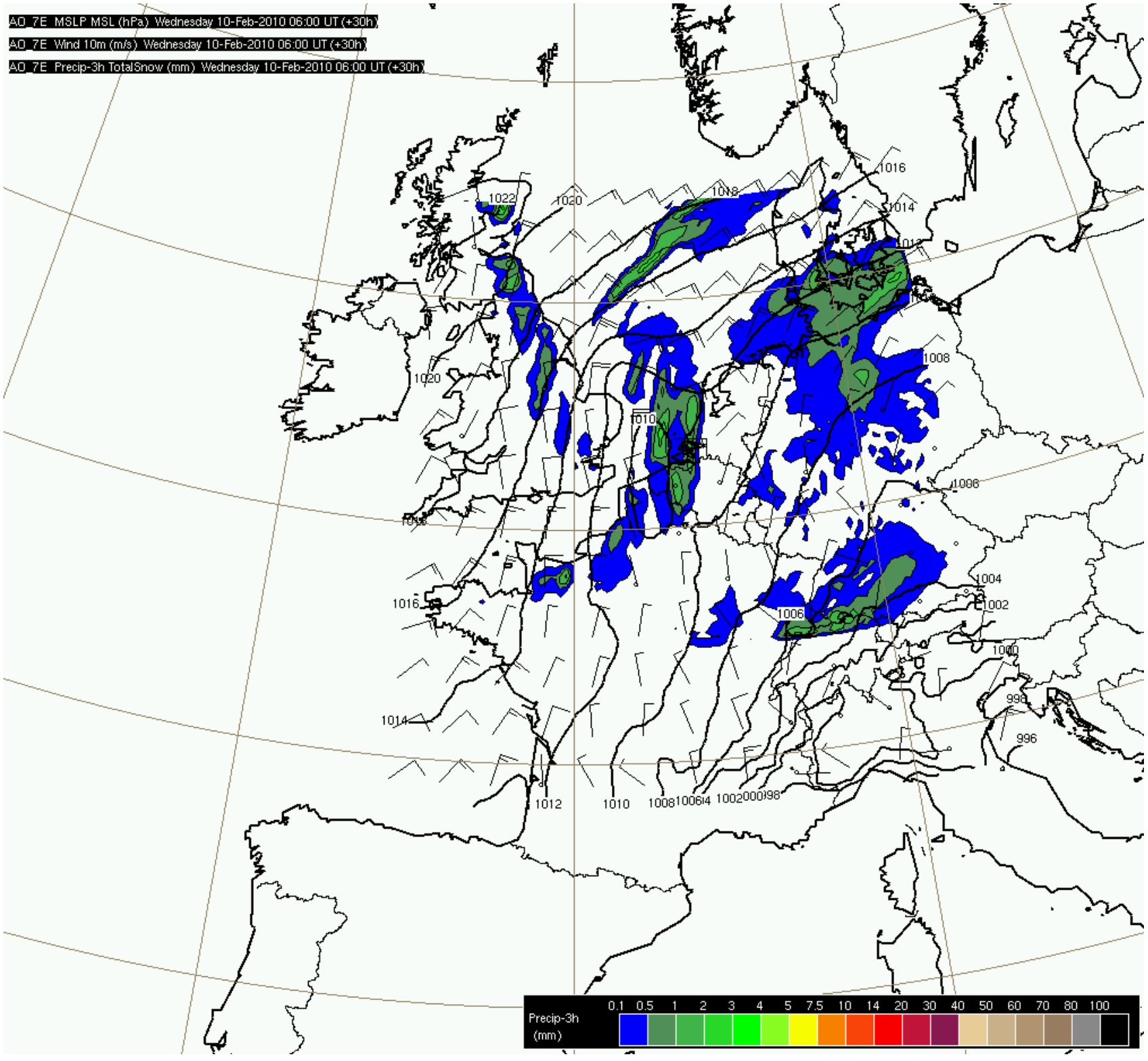
Precip-3h (mm)
0.1 0.5 1 2 3 4 5 7.5 10 14 20 30 40 50 60 70 80 100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AO_7E Precip-3h TotalSnow (mm) Wednesday 10-Feb-2010 06:00 UT (+30h)
1022
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1002
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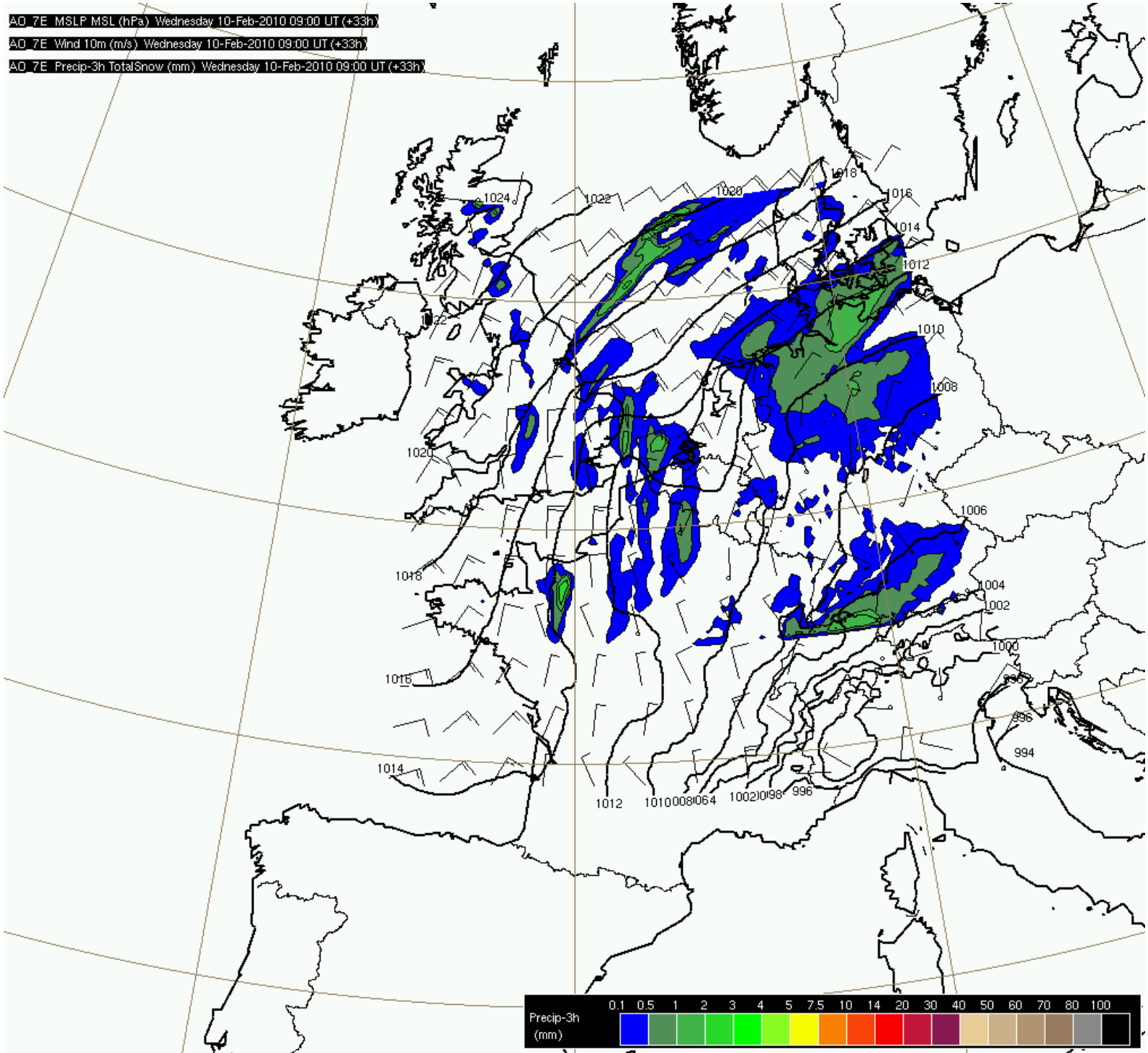
996
Precip-3h (mm)
0.1 0.5 1 2 3 4 5 7.5 10 14 20 30 40 50 60 70 80 100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AO_7E Wind 10m (m/s) Wednesday 10-Feb-2010 09:00 UT (+33h)
AO_7E Precip-3h TotalSnow (mm) Wednesday 10-Feb-2010 09:00 UT (+33h)
1024
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1016
1014
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1010
1008
1006
1004
1002
1000
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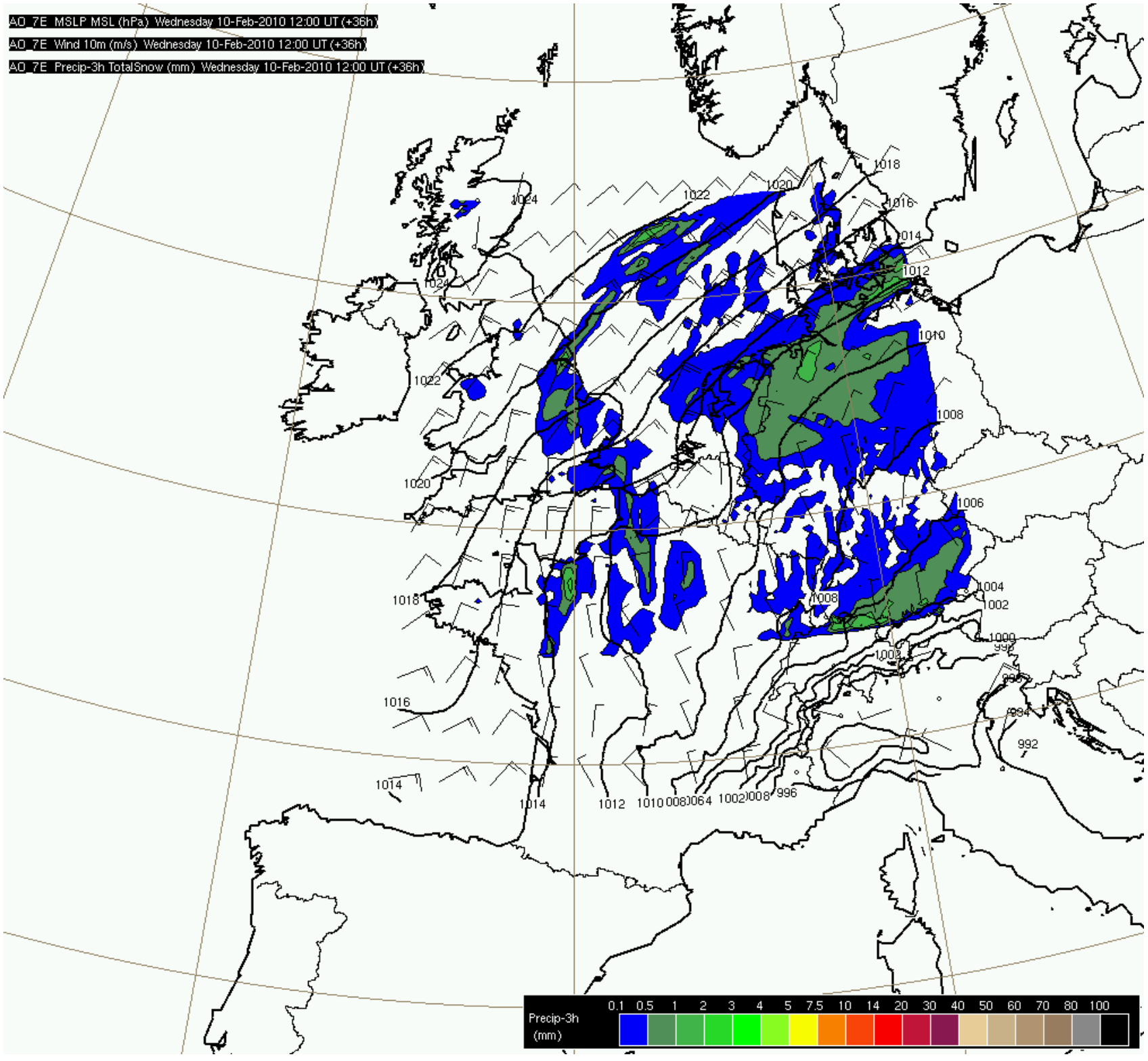
996
Precip-3h (mm)
0.1 0.5 1 2 3 4 5 7.5 10 14 20 30 40 50 60 70 80 100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AO_7E Wind 10m (m/s) Wednesday 10-Feb-2010 12:00 UT (+36h)
AO_7E Precip-3h TotalSnow (mm) Wednesday 10-Feb-2010 12:00 UT (+36h)
1024
1022
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1004
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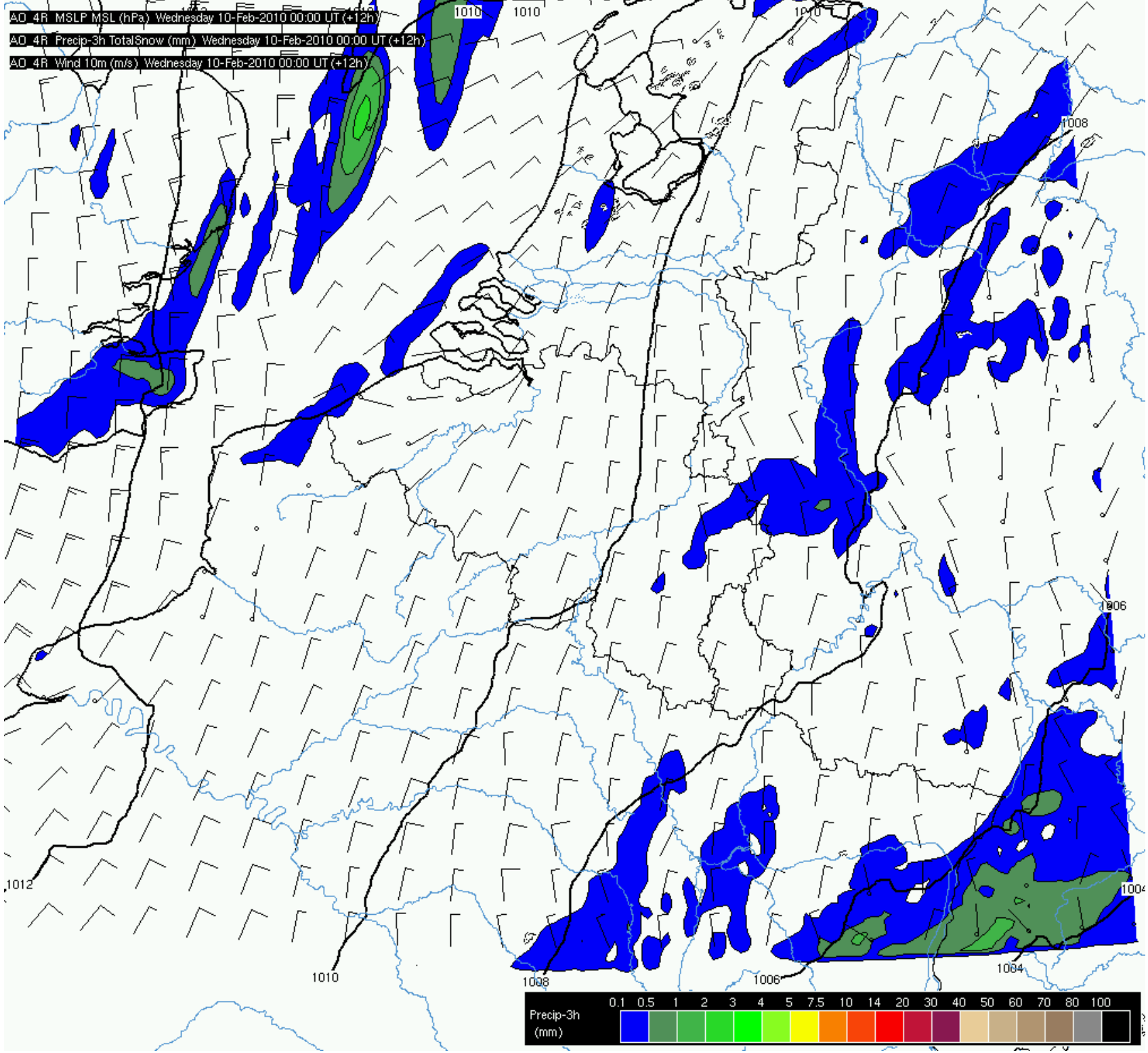
996
994
992
1024
1022
1020
1018
1016
1014
1012
1010
1008
1006
1004
1002
1000
998
996
994
992
Precip-3h (mm)
0.1 0.5 1 2 3 4 5 7.5 10 14 20 30 40 50 60 70 80 100

ALARO at 4 km resolution, run on 9/2 at 1200 UTC

The 7-km run was similar


AO_4R MSLP MSL (hPa) Wednesday 10-Feb-2010 00:00 UT (+12h)
AO_4R Precip-3h TotalSnow (mm) Wednesday 10-Feb-2010 00:00 UT (+12h)
AO_4R Wind 10m (m/s) Wednesday 10-Feb-2010 00:00 UT (+12h)
1010
1010
1010
1008
1006
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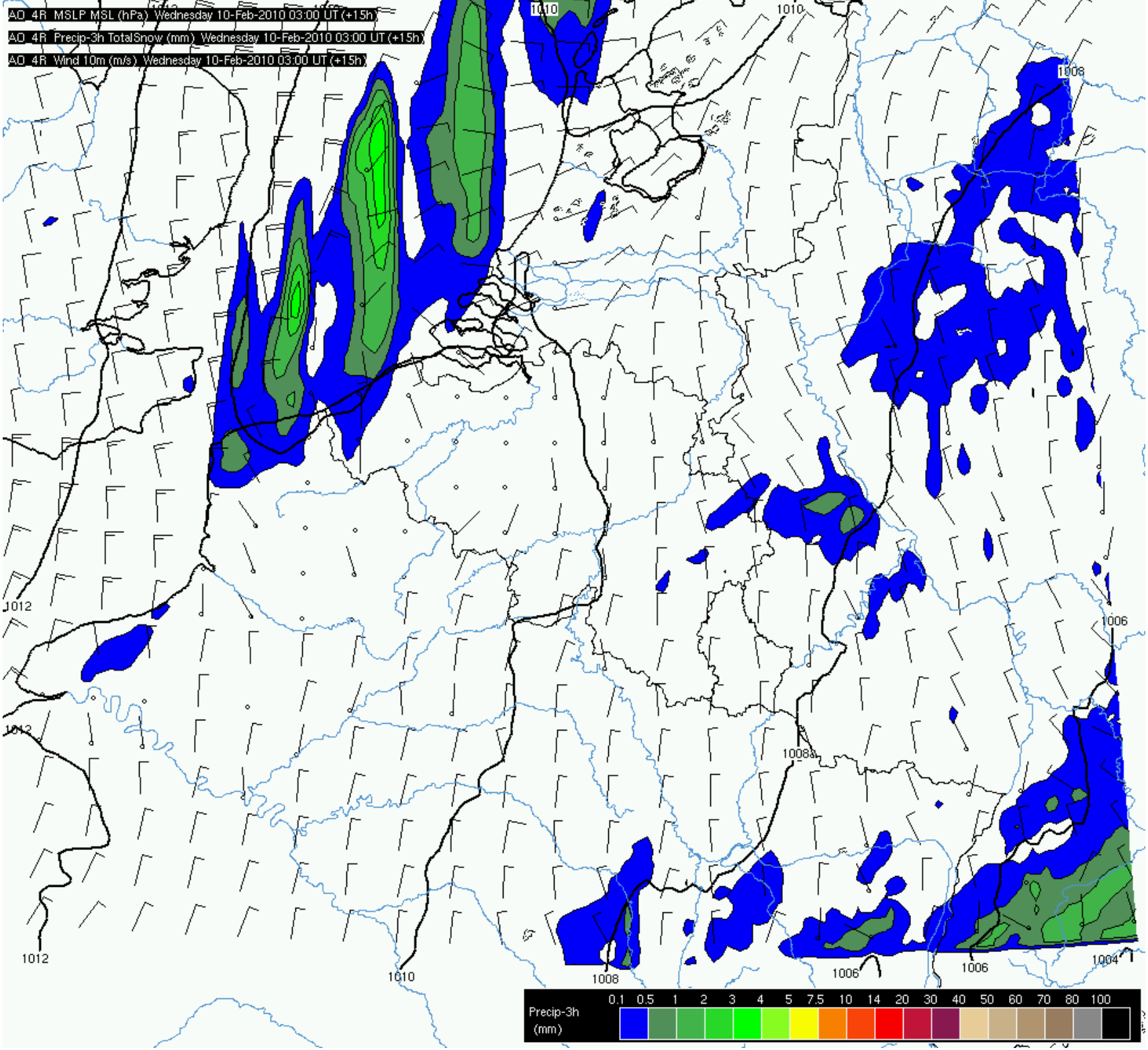
1008
1006
1004
Precip-3h (mm)
0.1 0.5 1 2 3 4 5 7.5 10 14 20 30 40 50 60 70 80 100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AO 4R Precip-3h TotalSnow (mm) Wednesday 10-Feb-2010 03:00 UT (+15h)
AO 4R Wind 10m (m/s) Wednesday 10-Feb-2010 03:00 UT (+15h)
1010
1010
1008
1012
1006
1012
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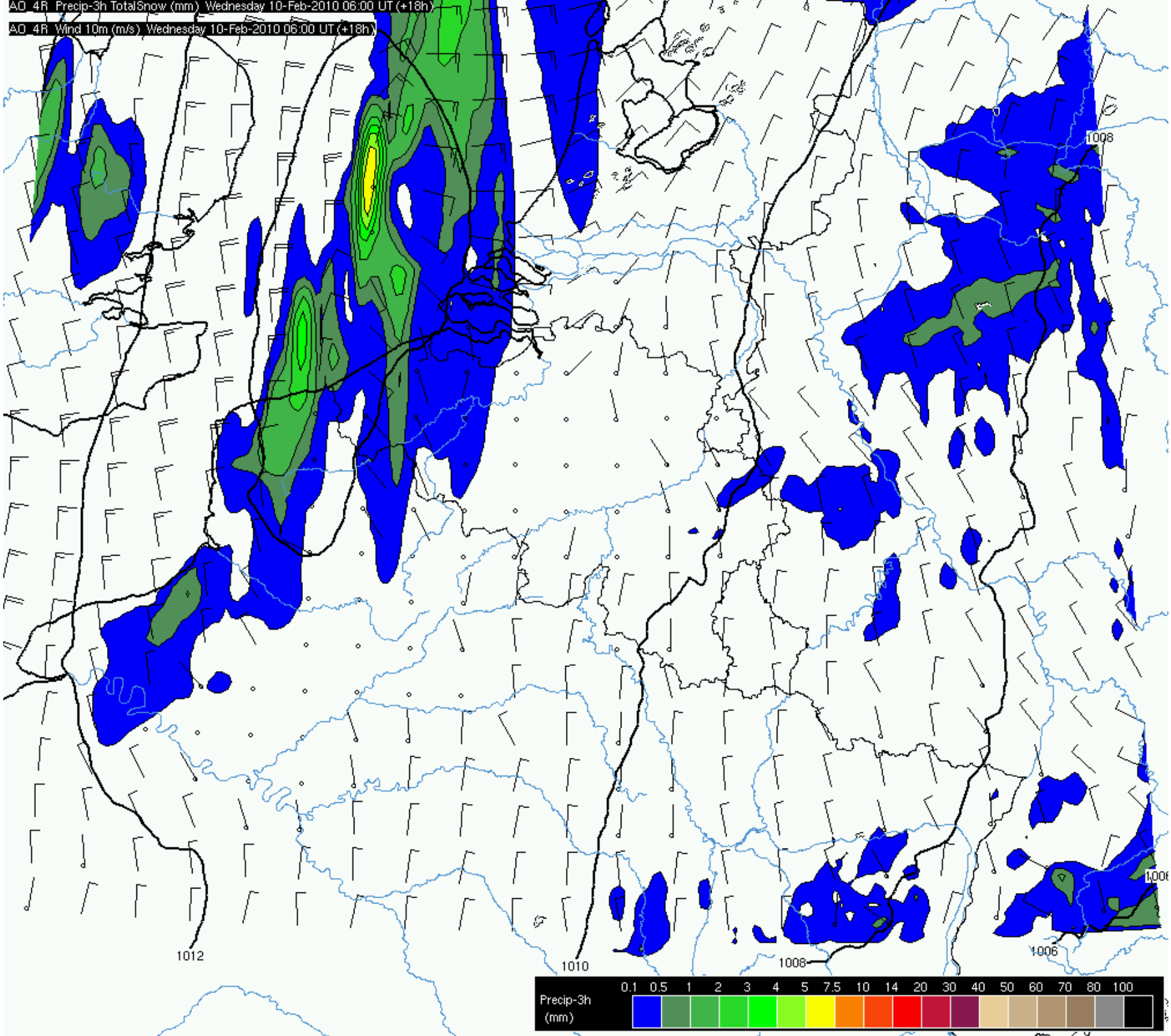
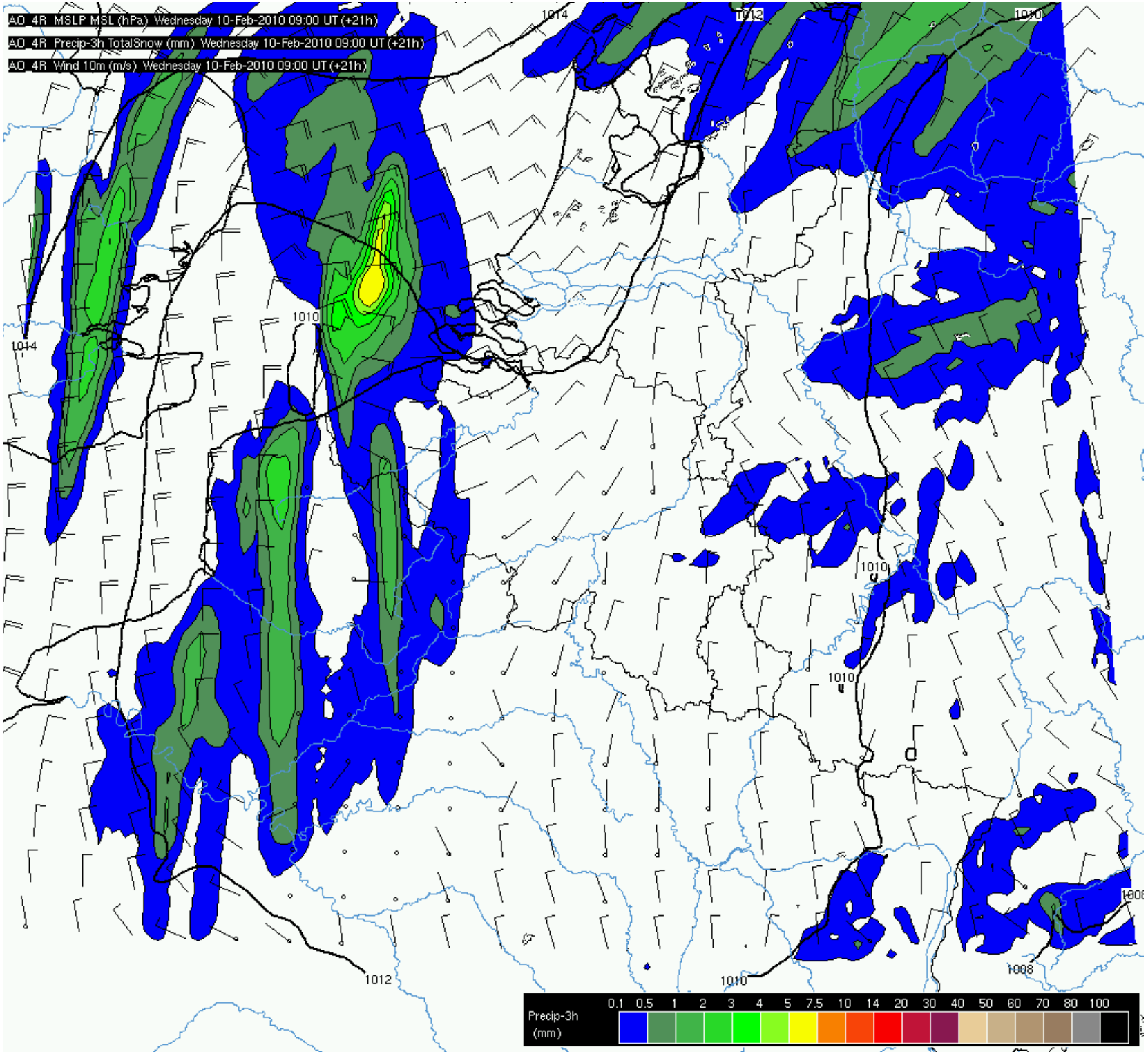
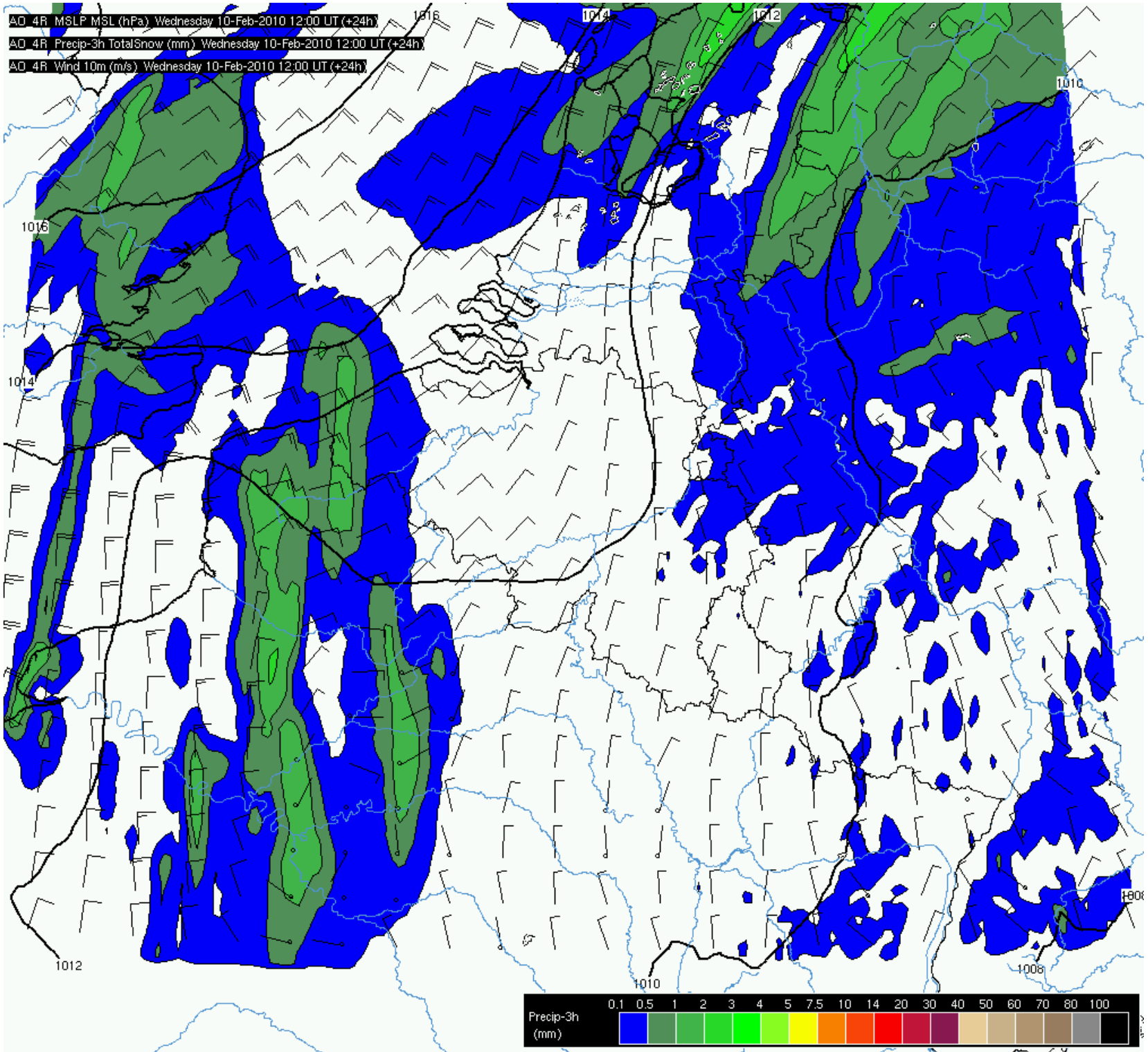
1012
1010
1008
1006
1006
1004
Precip-3h (mm)
0.1 0.5 1 2 3 4 5 7.5 10 14 20 30 40 50 60 70 80 100

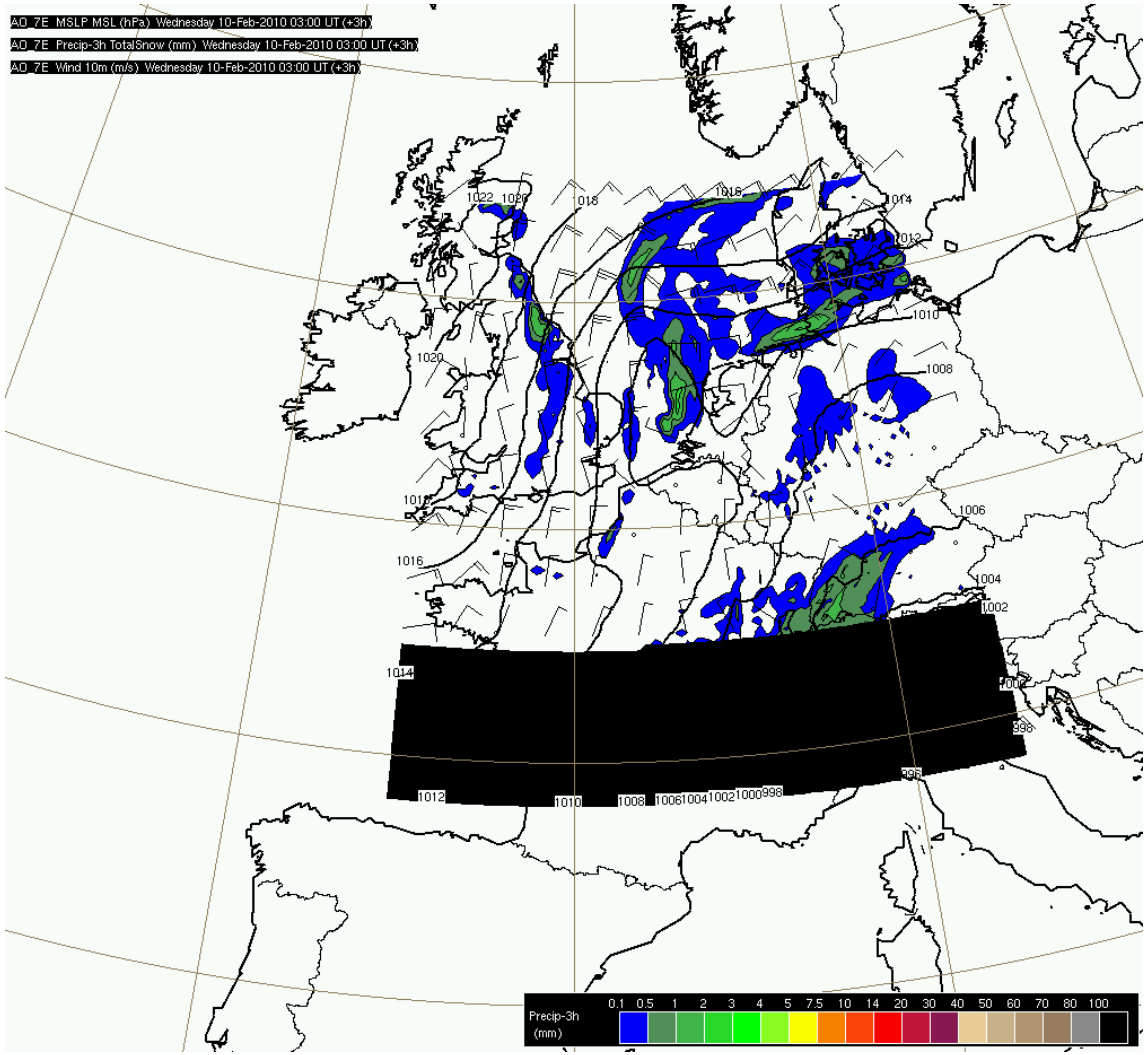

AO 4R Precip-3h TotalSnow (mm) Wednesday 10-Feb-2010 06:00 UT (+18h)
AO 4R Wind 10m (m/s) Wednesday 10-Feb-2010 06:00 UT (+18h)
1008
1012
1010
1008
1006
Precip-3h (mm)
0.1 0.5 1 2 3 4 5 7.5 10 14 20 30 40 50 60 70 80 100


AO 4R MSLP MSL (hPa) Wednesday 10-Feb-2010 09:00 UT (+21h)
AO 4R Precip-3h TotalSnow (mm) Wednesday 10-Feb-2010 09:00 UT (+21h)
AO 4R Wind 10m (m/s) Wednesday 10-Feb-2010 09:00 UT (+21h)
1014
1012
1010
1010
1014
1010
1010
1012
1010
1008
Precip-3h (mm)
0.1 0.5 1 2 3 4 5 7.5 10 14 20 30 40 50 60 70 80 100

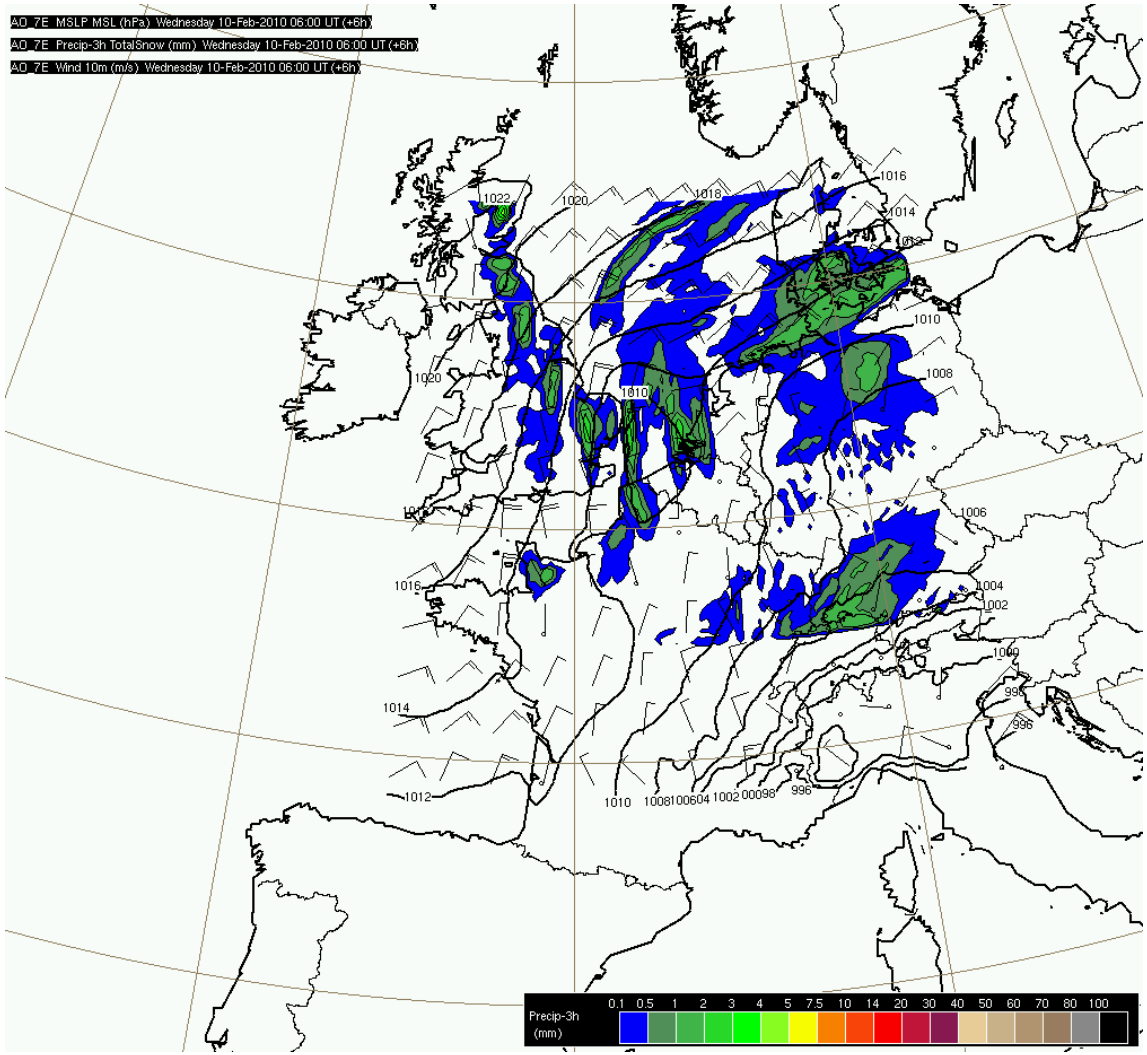

AO_4R MSLP MSL (hPa) Wednesday 10-Feb-2010 12:00 UT (+24h)
AO_4R Precip-3h TotalSnow (mm) Wednesday 10-Feb-2010 12:00 UT (+24h)
AO_4R Wind 10m (m/s) Wednesday 10-Feb-2010 12:00 UT (+24h)
1016
1014
1012
1010
1008
Precip-3h (mm)
0.1 0.5 1 2 3 4 5 7.5 10 14 20 30 40 50 60 70 80 100

ALARO 7-km run on 10/2 0000 UTC

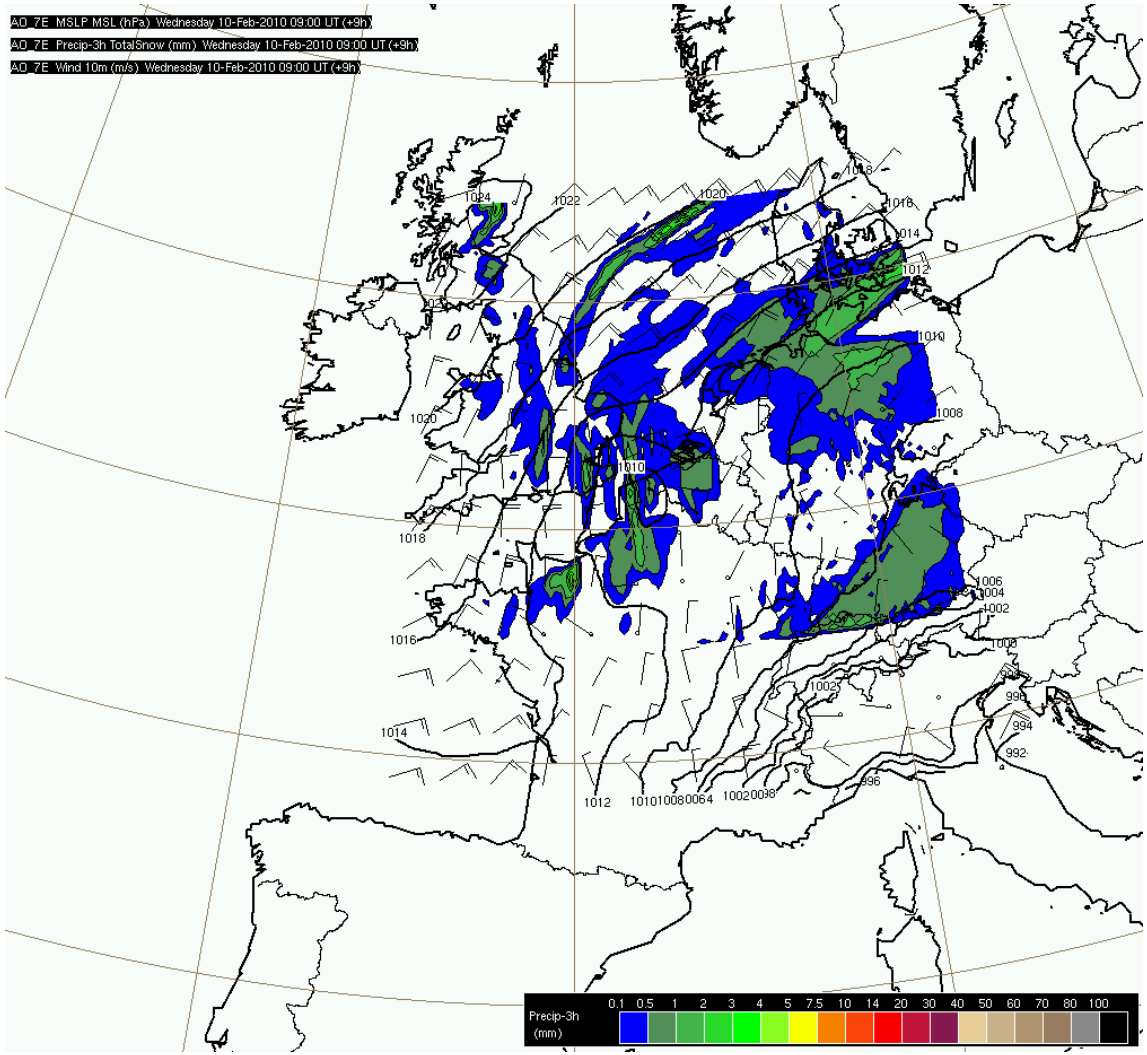
ALARO 7-km run on 10/2 0000 UTC, +03



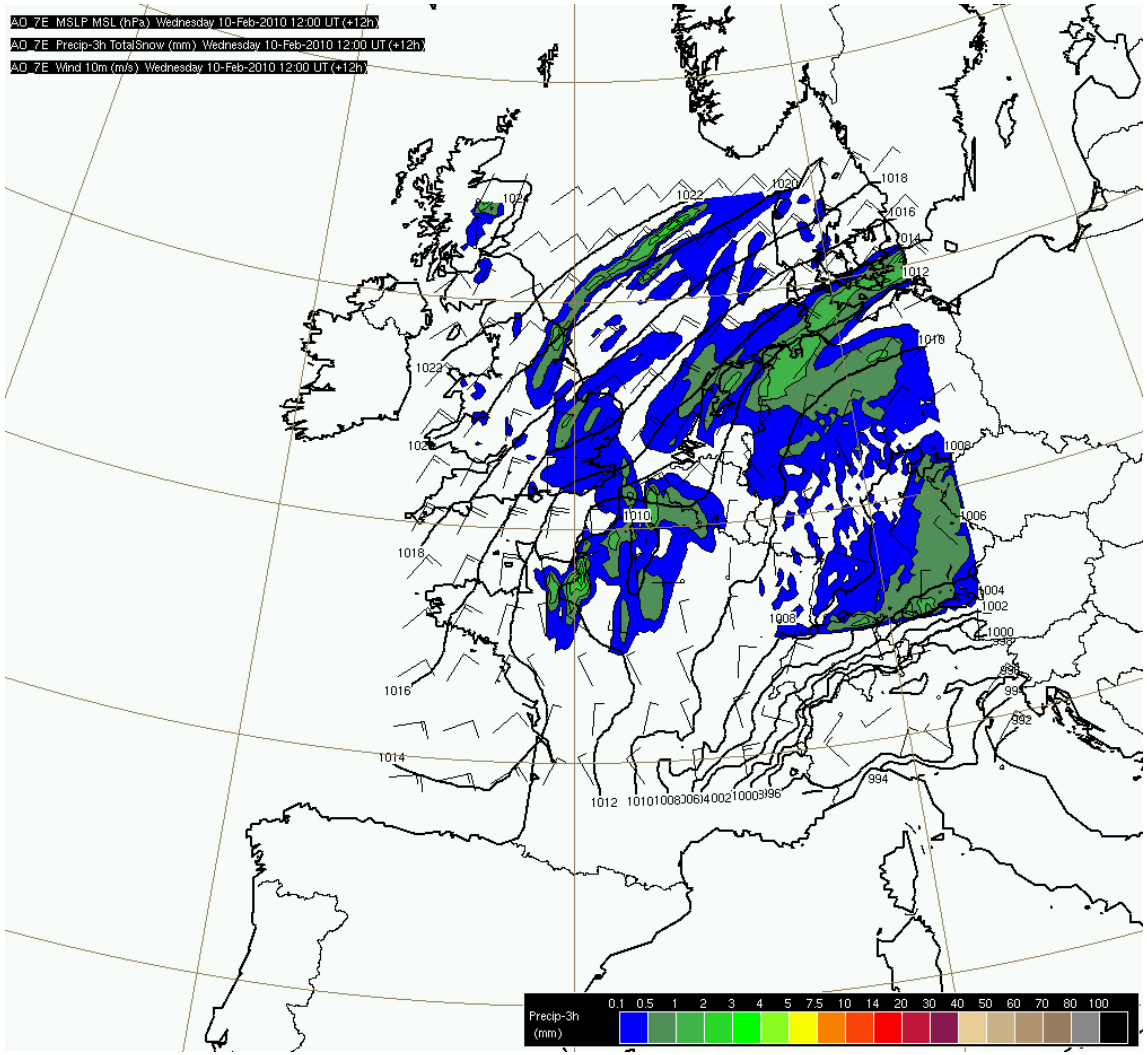
ALARO 7-km run on 10/2 0000 UTC, +06



ALARO 7-km run on 10/2 0000 UTC, +09

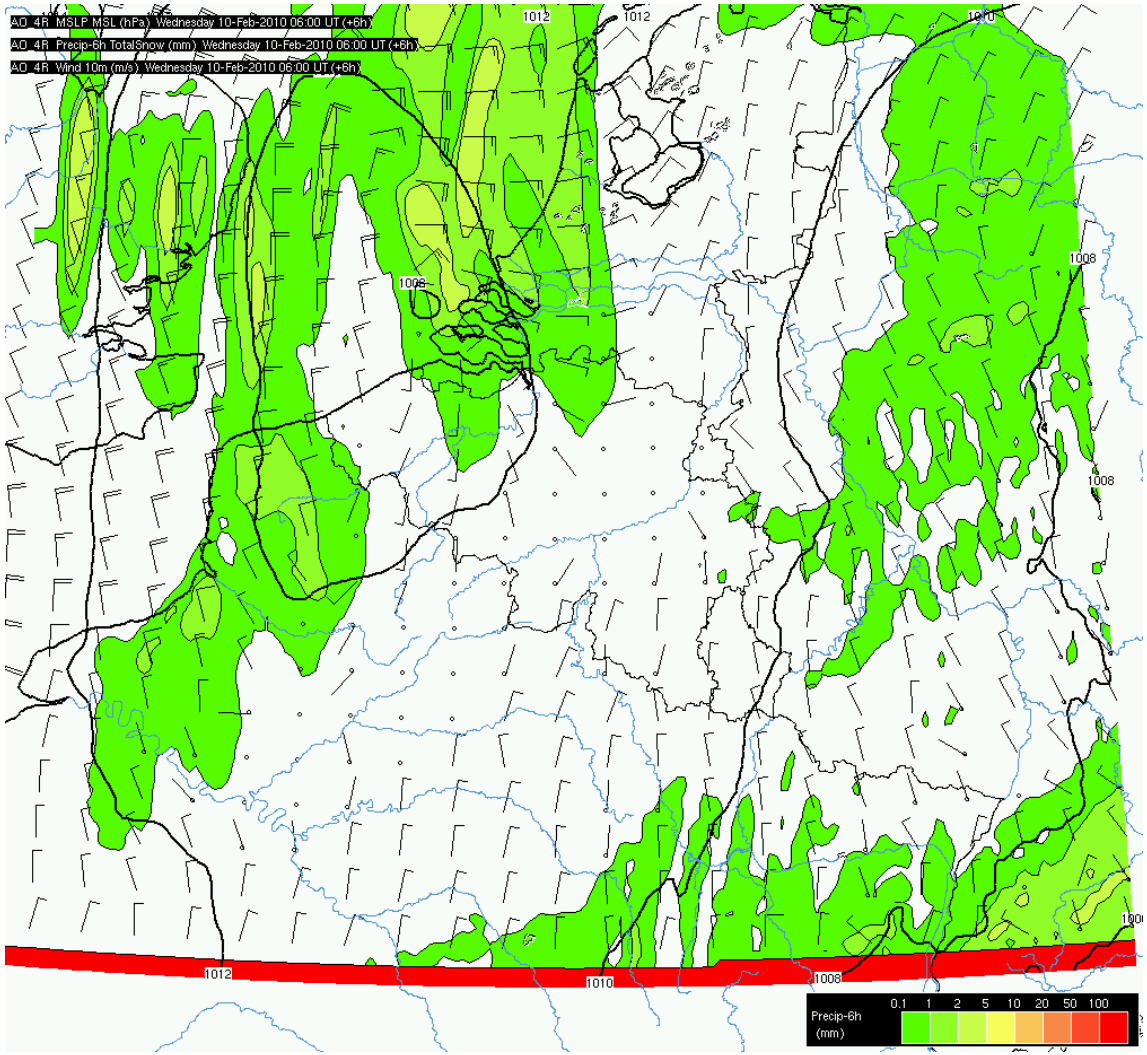


ALARO 7-km run on 10/2 0000 UTC, +12

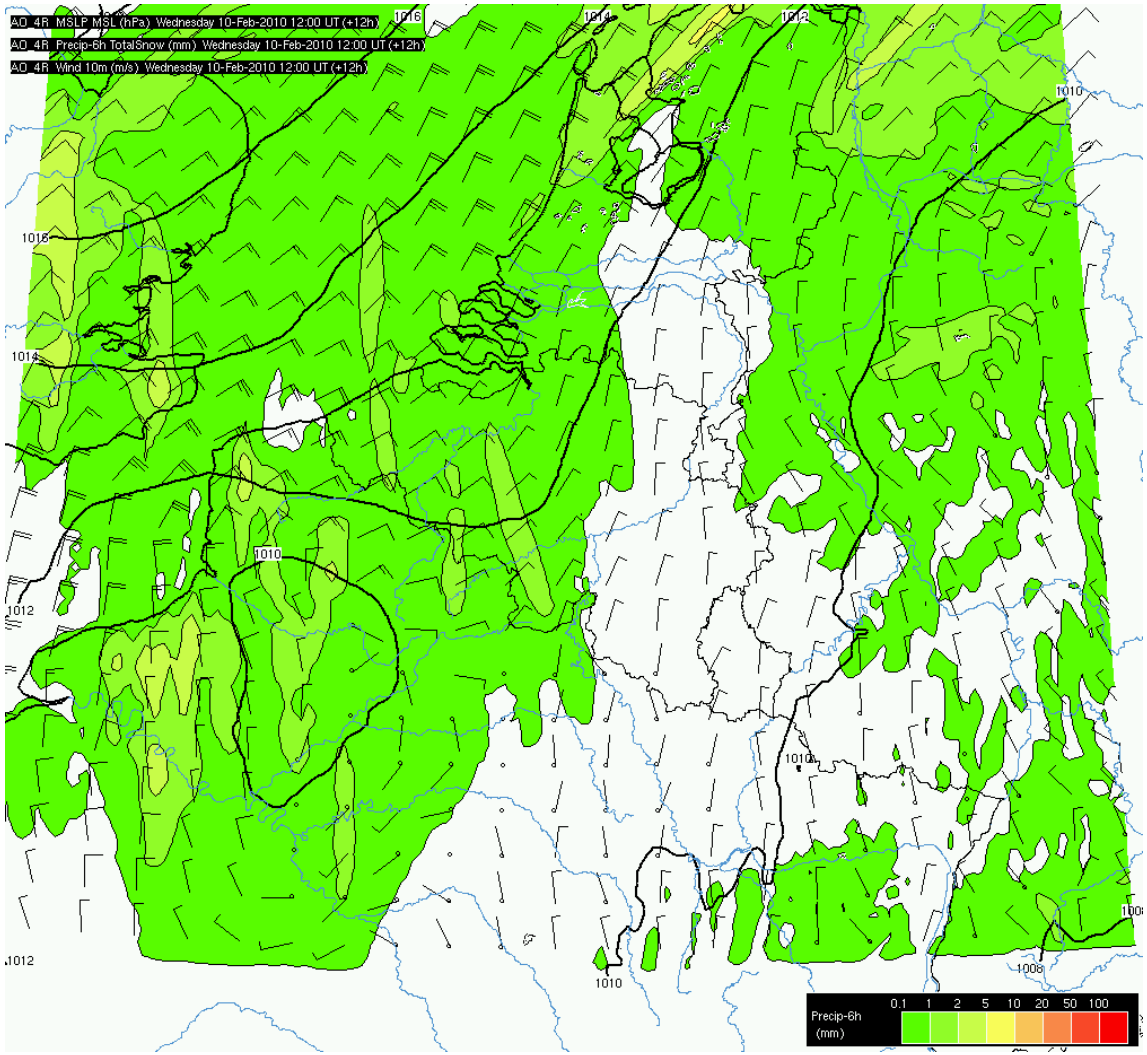


ALARO at 4 km resolution

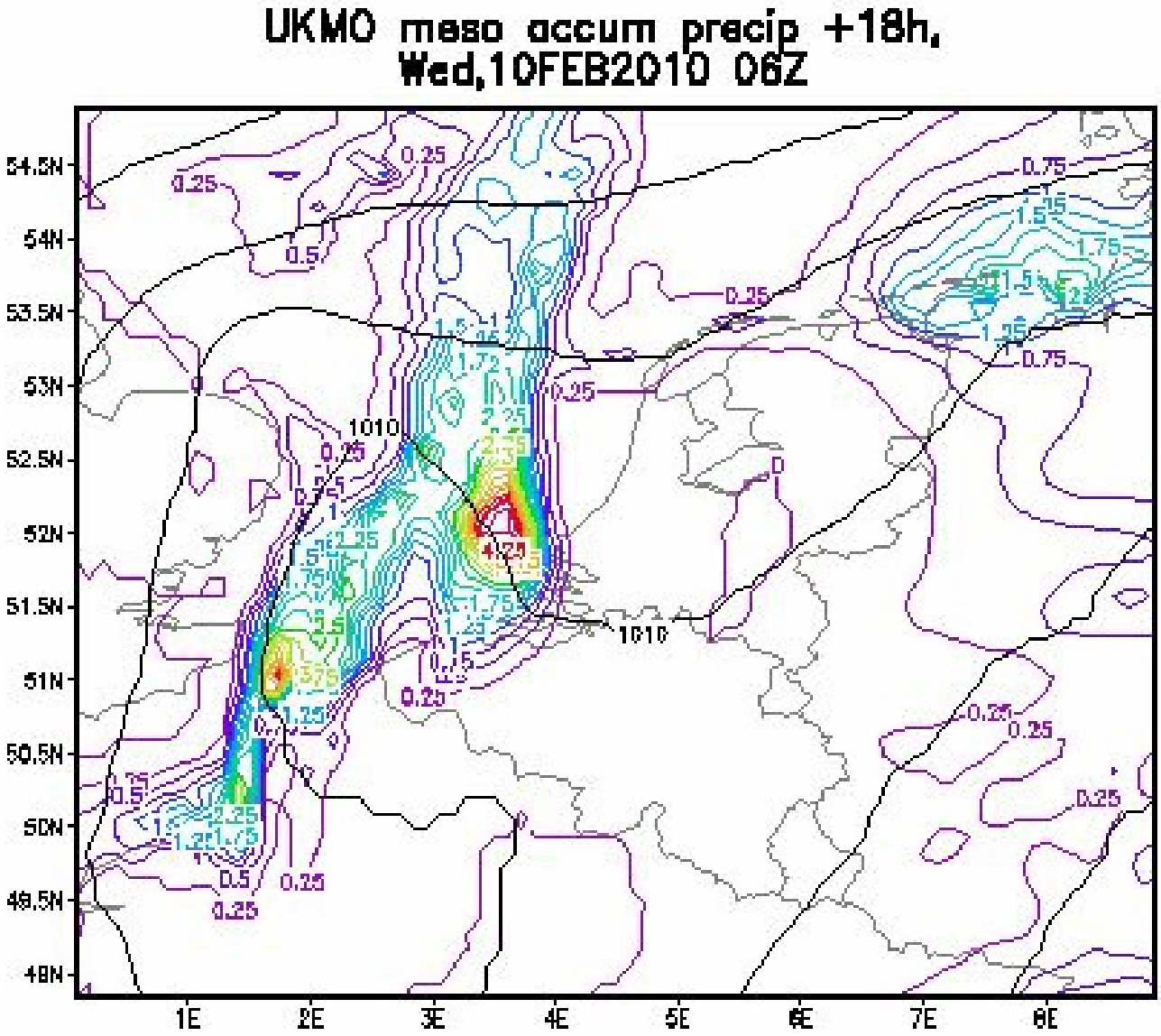
ALARO 4-km run on 10/2 0000 UTC, +06

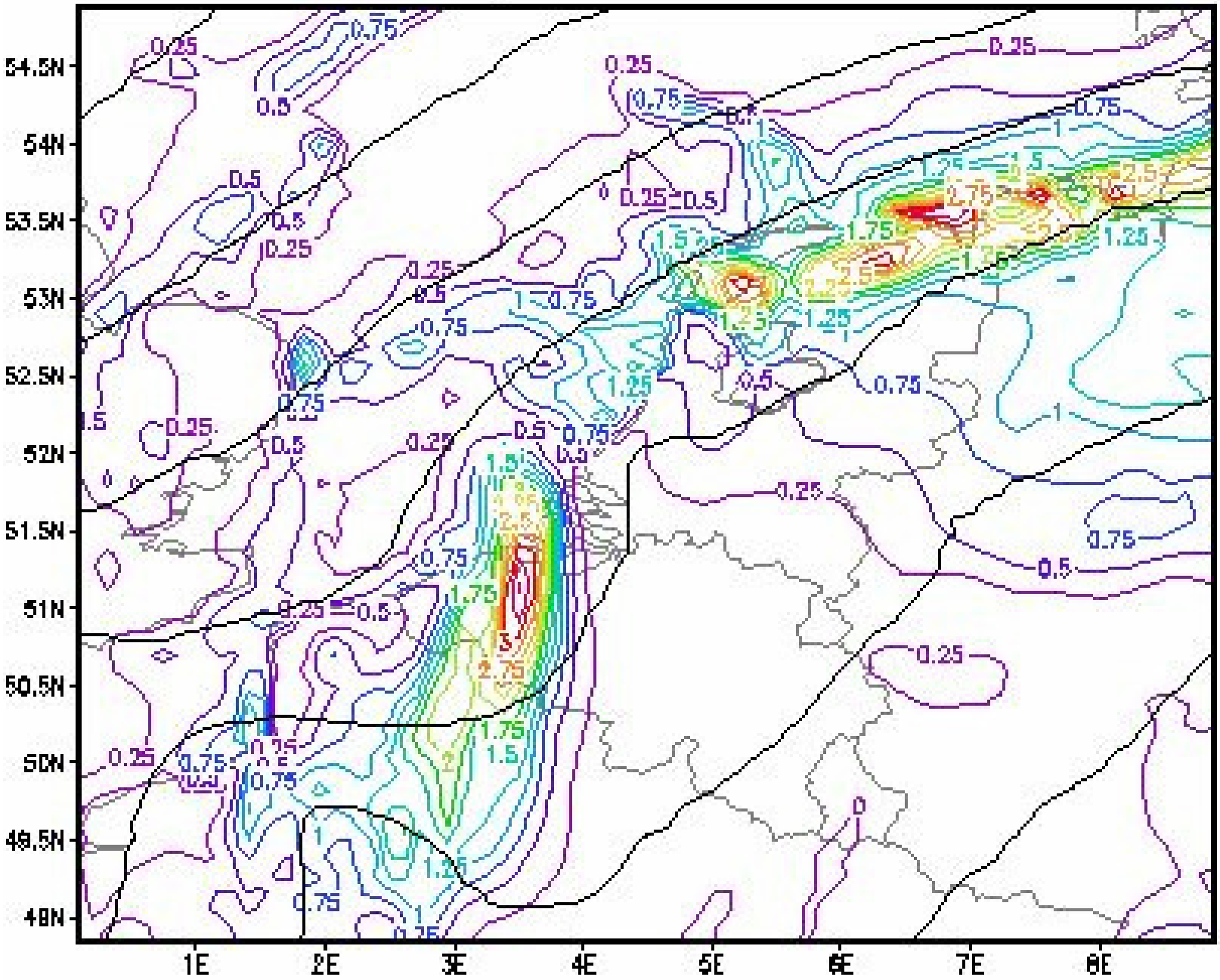


ALARO 4-km run on 10/2 0000 UTC, +12



Met Office


UKMO meso accum precip +18h,
Wed,10FEB2010 06Z
54.5N
54N
53.5N
53N
52.5N
52N
51.5N
51N
50.5N
50N
49.5N
48N
1E
2E
3E
4E
5E
6E
7E
8E
1010
1010


UKMO meso accum precip +24h,
Wed,10FEB2010 12Z
54.5N
54N
53.5N
53N
52.5N
52N
51.5N
51N
50.5N
50N
49.5N
48N
1E
2E
3E
4E
5E
6E
7E
8E

Conclusions

- In general ALARO performs better than our previous ALADIN version:
  - The problem of underestimated temperature in stable winter case is as good as solved
  - Forecasters are more satisfied with precipitation. We have some data confirming this, but could carry out an in-depth study (if some of us had the time to do it).
- I discussed a ``Belgian national'' case of last week: ALARO did as well as the other models.