A scenic landscape featuring a paved road that curves through a rural area. The road is flanked by green grass and fields of golden-brown crops. In the background, there are rolling hills and a small body of water under a sky filled with large, white, fluffy clouds. The overall atmosphere is bright and open.

AROME and ALADIN with HIRLAM physics at DMI

Bjarne Stig Andersen, DMI
Bent Hansen Sass, DMI

ASM Oslo April 23-26, 2007

Overview

- Status
- Performance
- Maps
- Verifications
- Conclusions

Status for ALADIN at DMI

From January 2006

- Regular daily run of a 24h forecast since January 2006
- Two nested domains with lateral boundaries from HIRLAM T15 00 UTC
- ALADIN-H/NH with default physics
- ALADIN-H/NH with HIRLAM physics
- Based on CY29T2

Status for ALADIN at DMI

From December 2006

- Regular daily runs with ALADIN/AROME
- Regular daily run with ALADIN/HIRLAM
- Based on CY31T1

The following physics processes from HIRLAM have been implemented in ALADIN

1. Radiative processes (solar and longwave)
2. Turbulence processes (HIRLAM CBR scheme for momentum heat, humidity and cloud condensates)
3. Cloud and precipitation processes (cloud cover, stratiform and convective condensation and precipitation release including evaporation of precipitation)
4. Surface fluxes supplied by ALADIN ISBA scheme

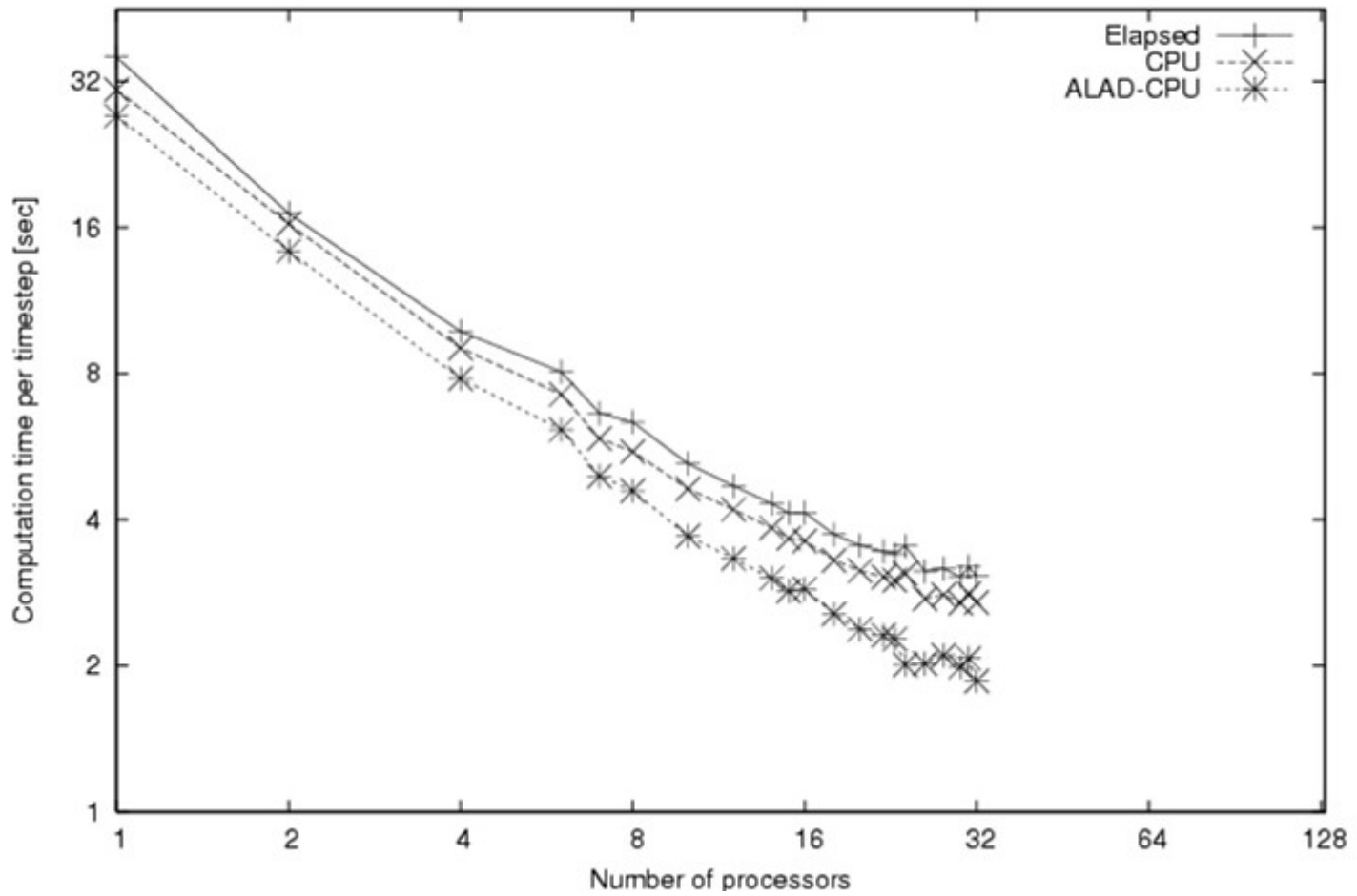
NB:2.5 km NH ALADIN with HIRLAM physics runs currently without convective parameterization.

The forecast domains

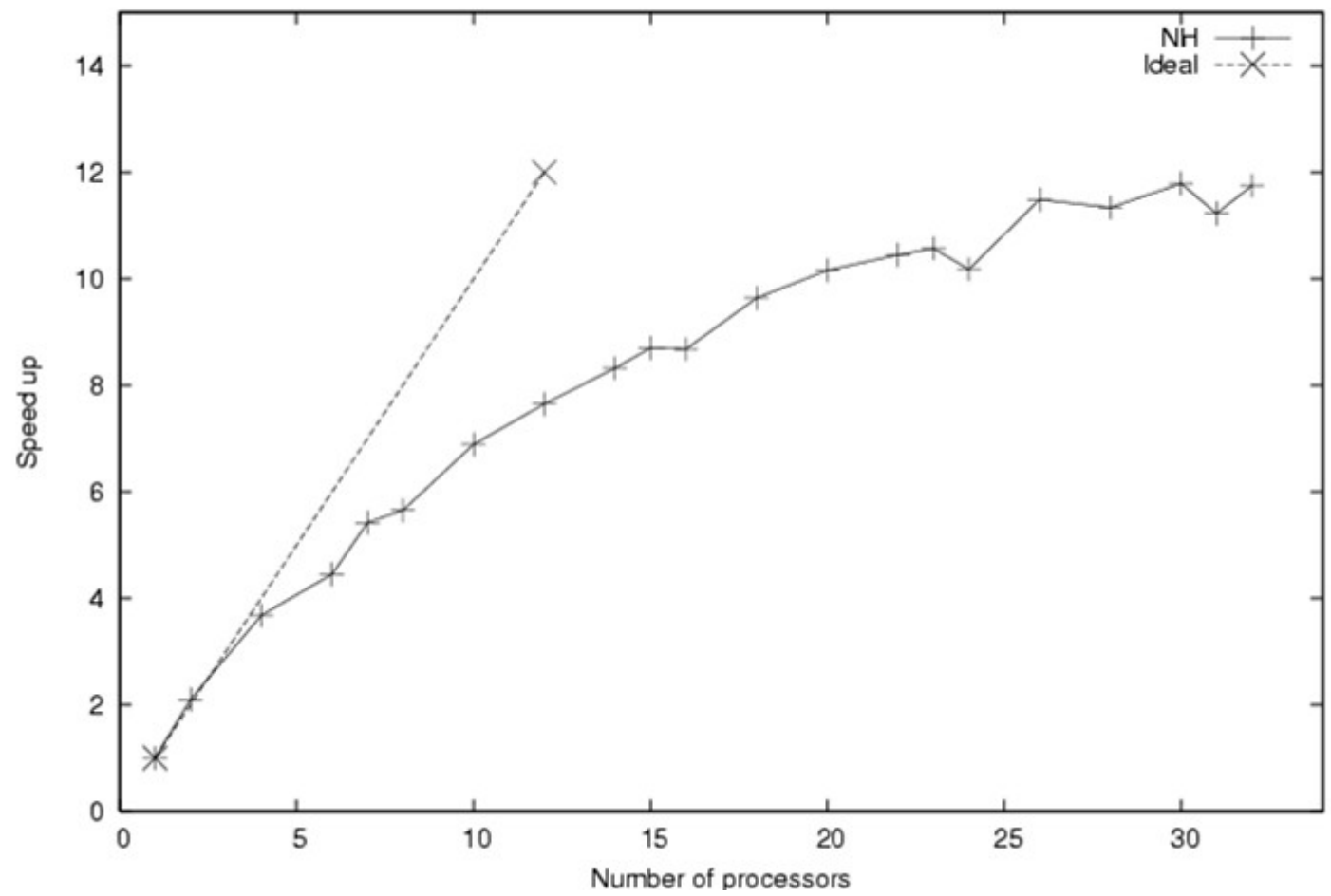
Scandinavian domain	Danish domain
NLON=245	NLON=373
NLAT=277	NLAT=389
NLEV=40	NLEV=40
RLONC=14.00	RLONC=9.90
RLATC=59.20	RLATC=56.30
RDELX=11000	RDELX=2500
RDELY=11000	RDELY=2500

ALADIN/AROME Performance on NEC-SX6

ALADIN-NH performance on NEC SX-6 cluster, Grid: 389x373x41, Timestep: 60 s, Forecast: 1 h.



ALADIN performance on NEC SX-6 cluster, Grid: 389x373x41, Timestep: 60 s, Forecast: 3 h



ALADIN Timings on NEC-SX6

Wall clock, 16 procs, 24 h fcst.

	Scandinavian area	Danish area
Boundary interpolation	2646	2868
Forecast	536	4495
Post processing	407	1188
Total	2589	8551

AROME Timings on NEC-SX6

Wall clock, 16 procs, 24 h fcst.

	Scandinavian area	Danish area
Boundary interpolation	1795	1963
Forecast	599	7178
Post processing	414	492
Total	2808	9633

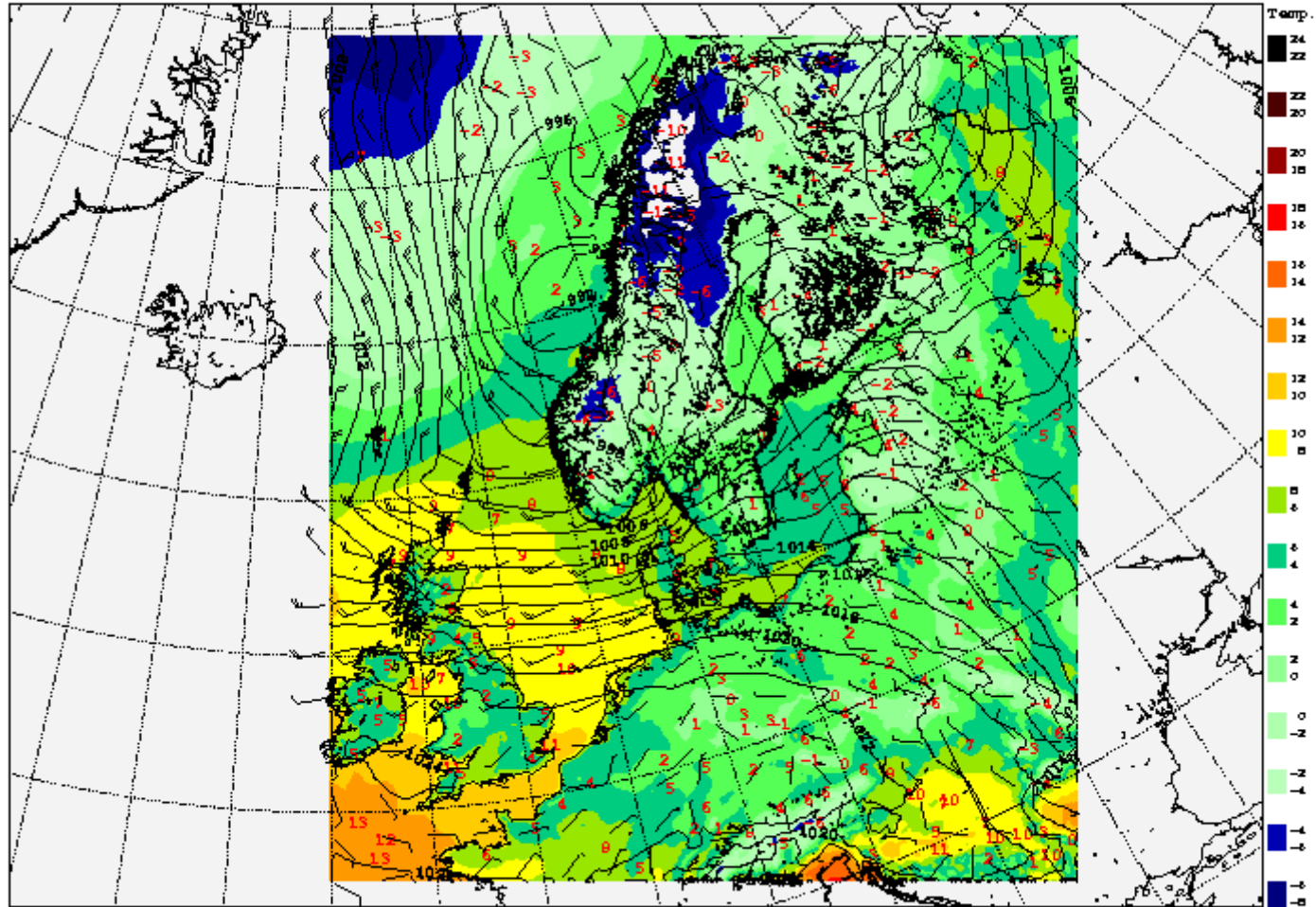
Maps

AROME

— unknown m.s.l.

— Temp. 2 m.

— Hor. Wind 10 m.

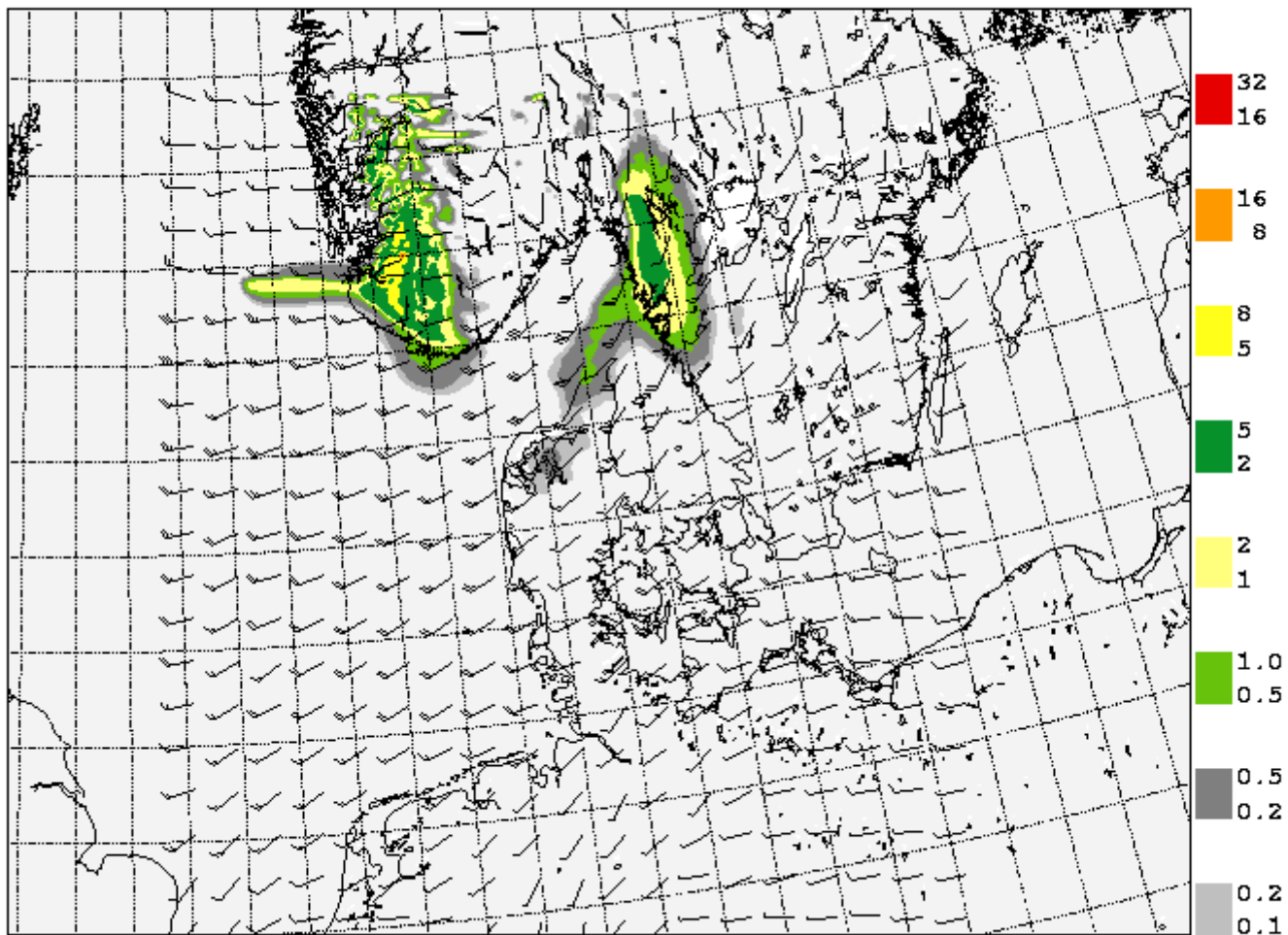


Thu 19 Apr 2007 00Z +02h
valid Thu 19 Apr 2007 02Z

ALDOFF, GRIDCARD1+00Z

— Hor. Wind 10 m.

— 1-hr Tot. Prec +02h - +01h

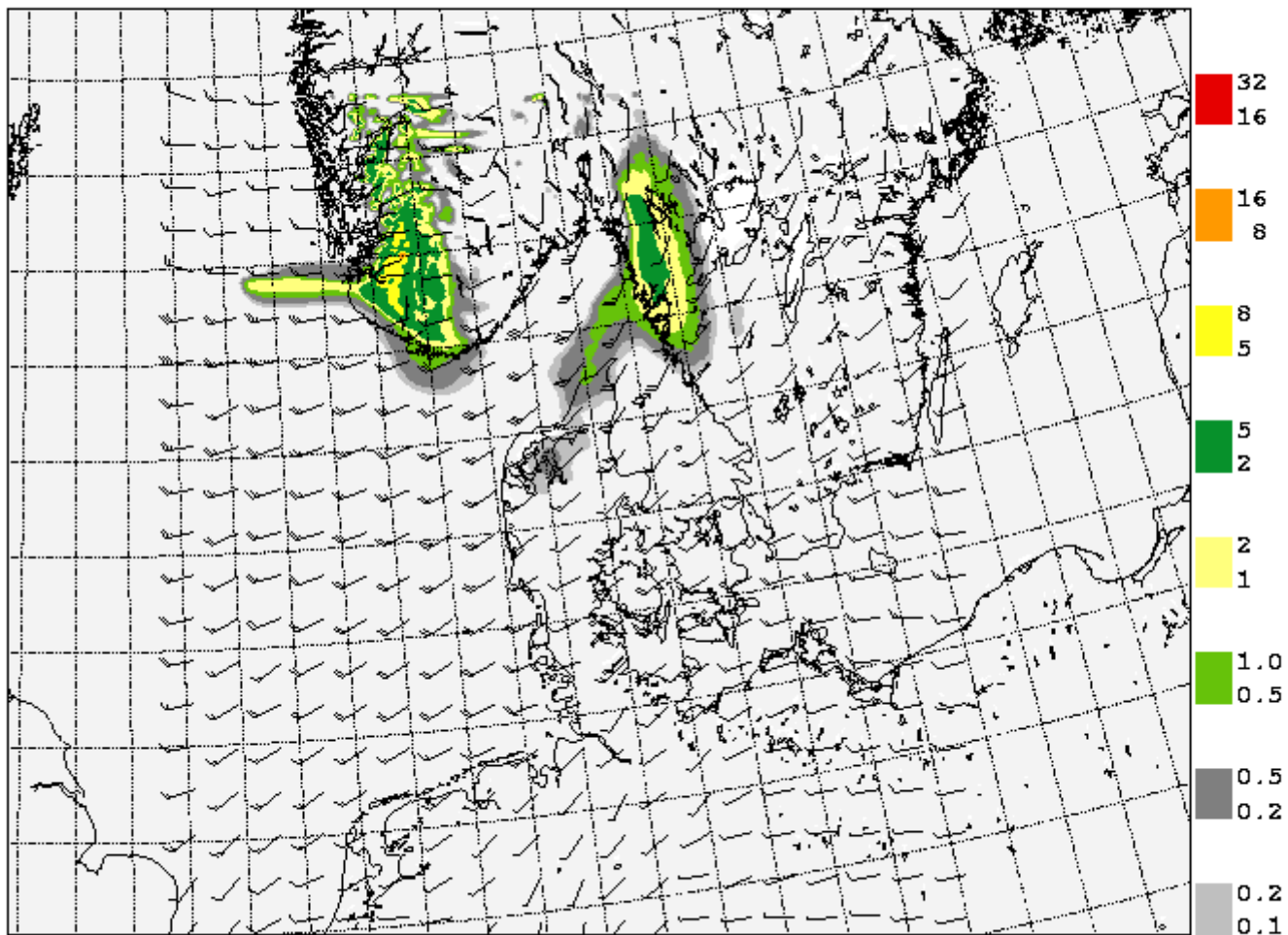


Thu 19 Apr 2007 00Z +02h - Thu 19 Apr 2007 00Z +01h
valid Thu 19 Apr 2007 02Z

GRIDCAREM+000Z

— Hor. Wind 10 m.

— 1-hr Tot. Prec +02h - +01h



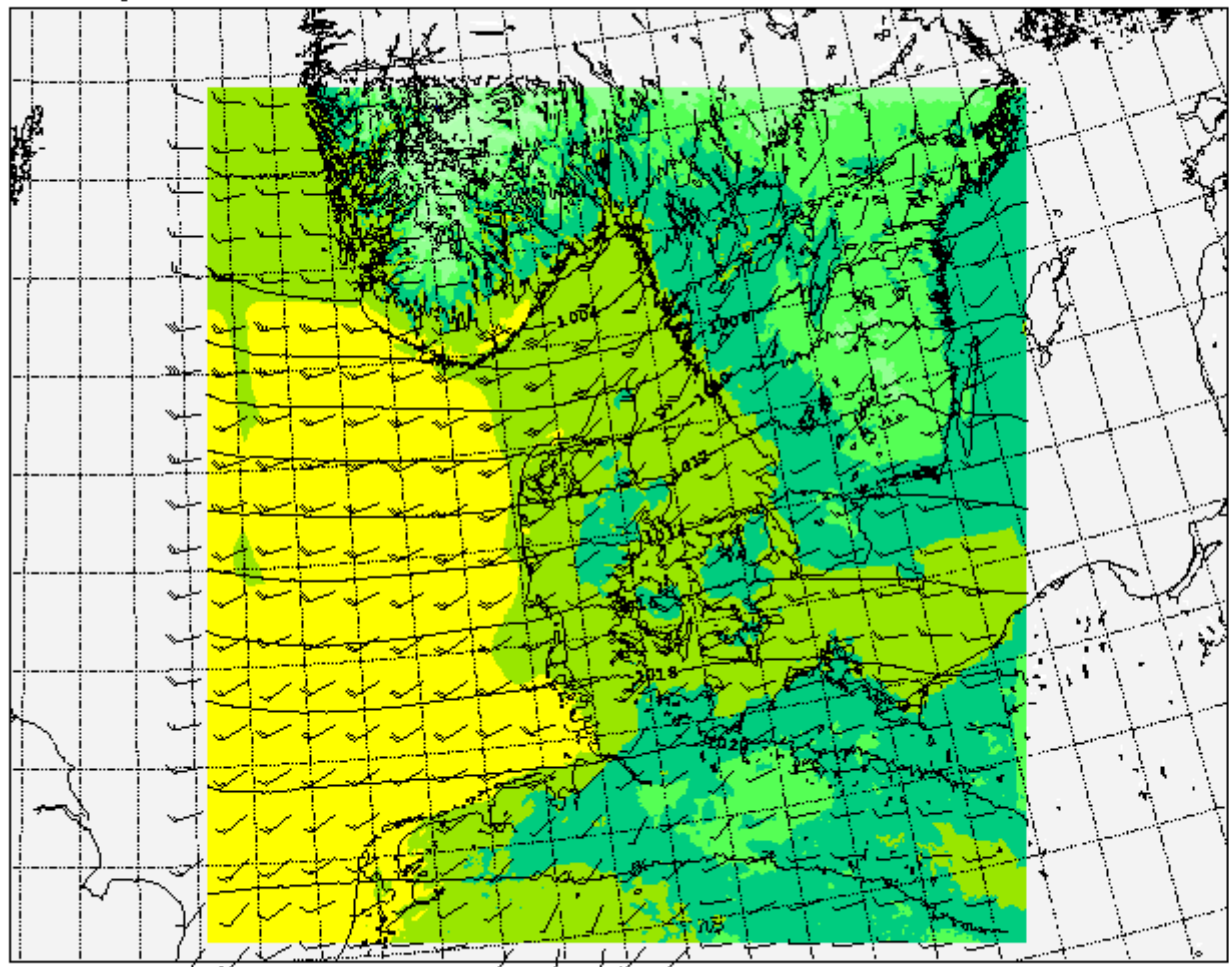
Thu 19 Apr 2007 00Z +02h - Thu 19 Apr 2007 00Z +01h
valid Thu 19 Apr 2007 02Z

GRIDCAREM+000Z

— Press. m.s.l.

— Temp. 2 m.

— Hor. Wind 10 m.



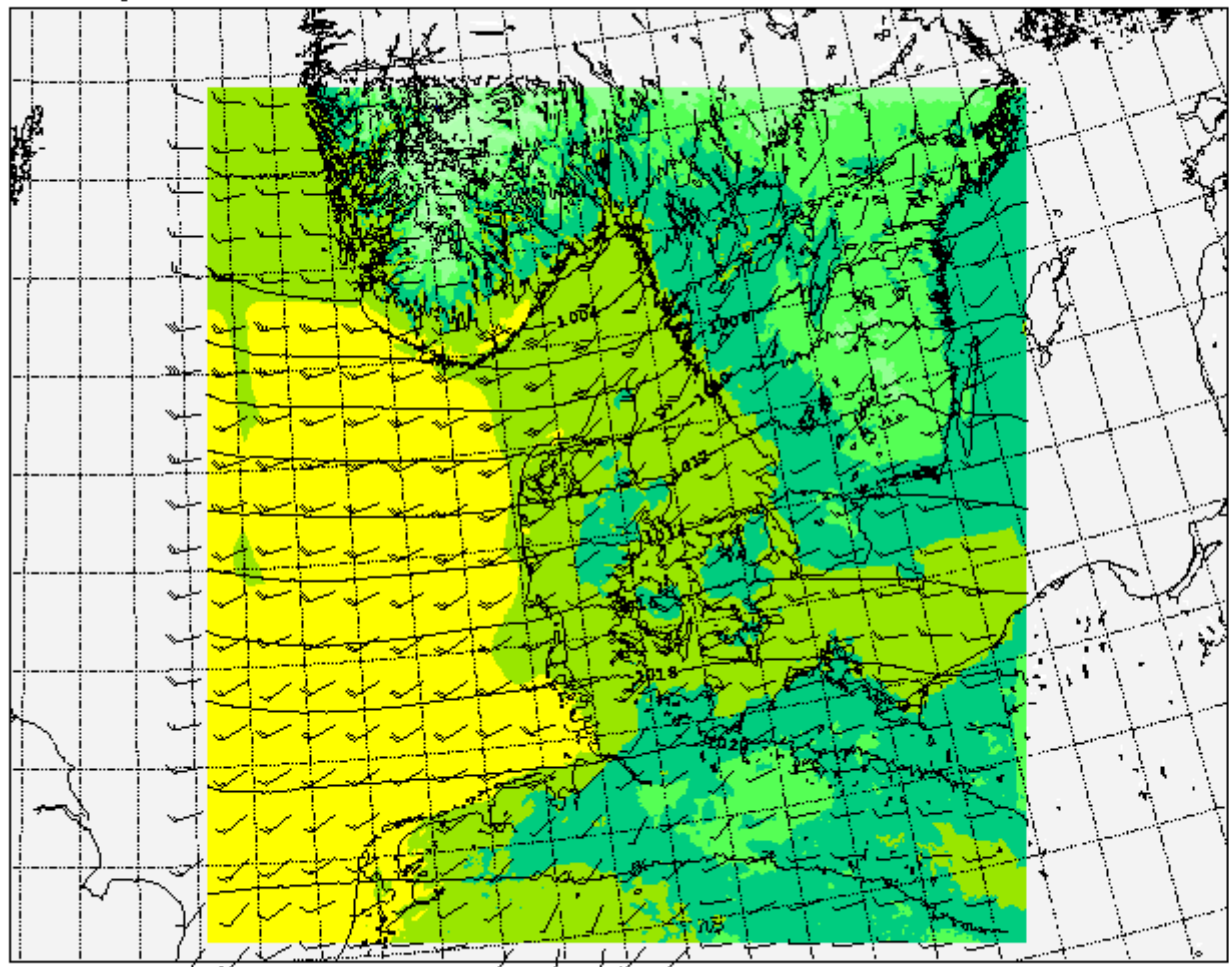
Thu 19 Apr 2007 00Z +02h
valid Thu 19 Apr 2007 02Z

GRIDGABEM+000Z

— Press. m.s.l.

— Temp. 2 m.

— Hor. Wind 10 m.



Thu 19 Apr 2007 00Z +02h
valid Thu 19 Apr 2007 02Z

GRIDGARIEM+000Z

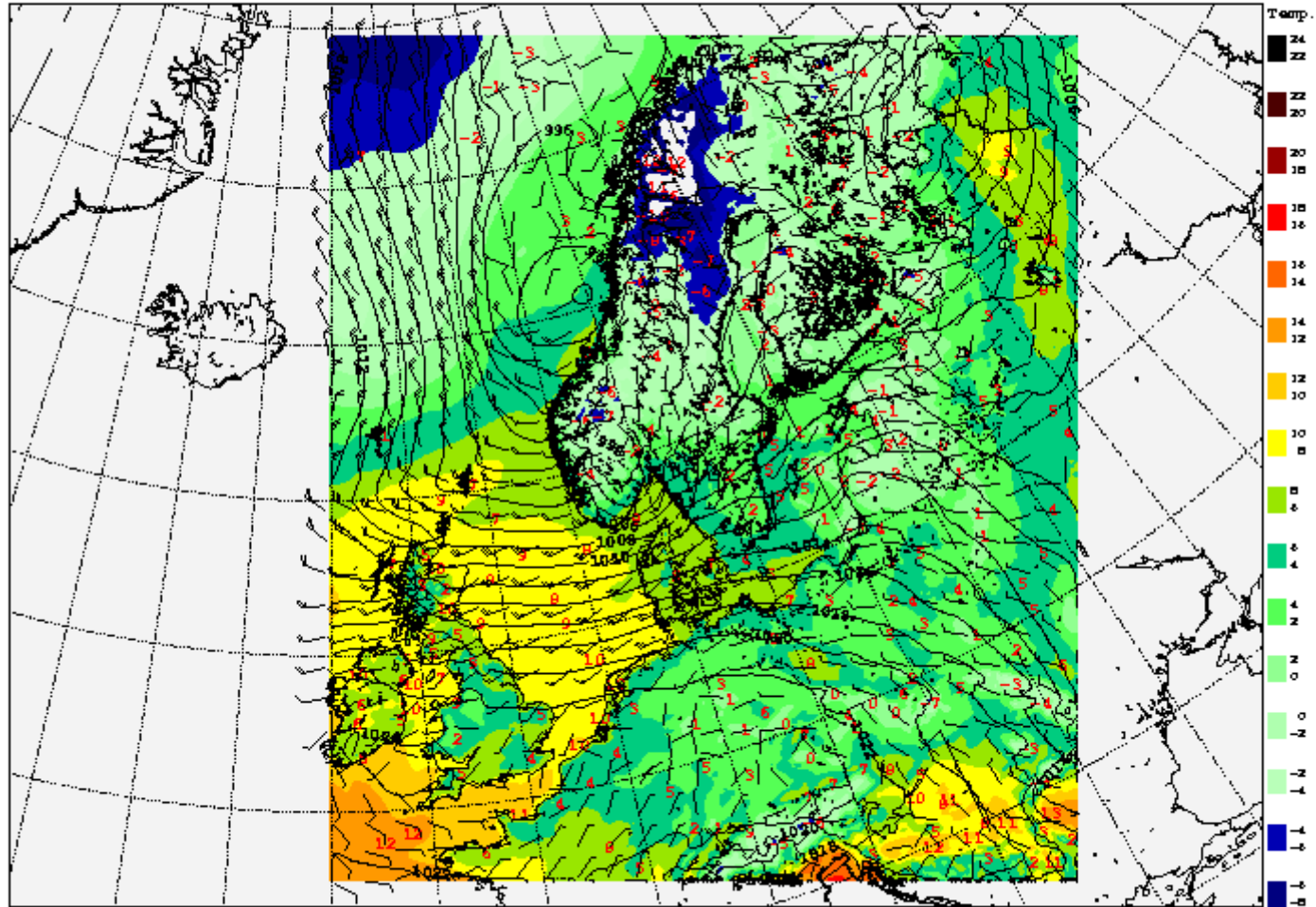
Maps

ALADIN with HIRLAM physics

— unknown m.s.l.

— Temp. 2 m.

— Hor. Wind 10 m.

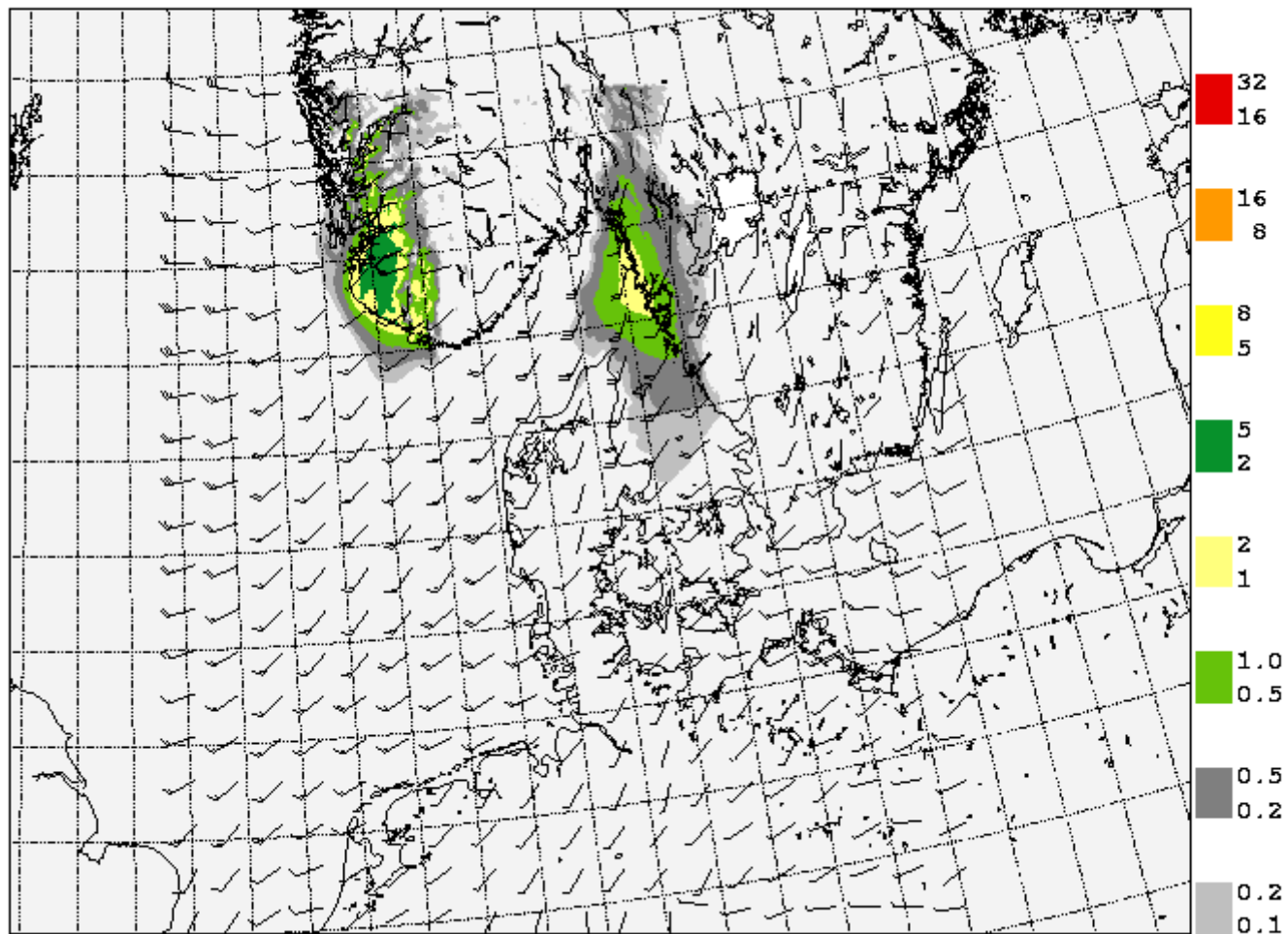


Thu 19 Apr 2007 00Z +02h
valid Thu 19 Apr 2007 02Z

ALL797, GRIDCARD1+000Z

— Hor. Wind 10 m.

— 1-hr Tot. Prec +02h - +01h

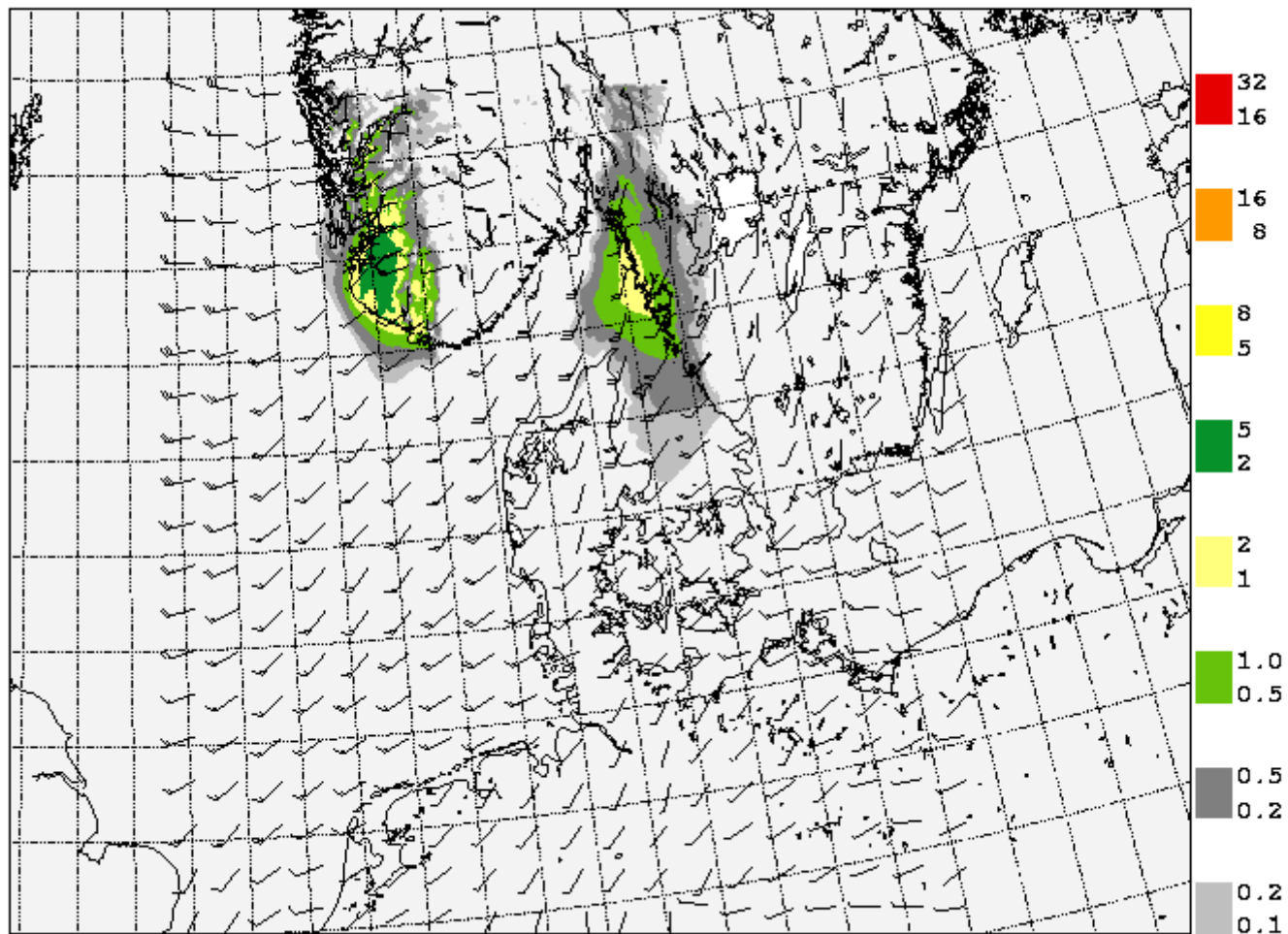


Thu 19 Apr 2007 00Z +02h - Thu 19 Apr 2007 00Z +01h
valid Thu 19 Apr 2007 02Z

GRIDCARTN+000Z

— Hor. Wind 10 m.

— 1-hr Tot. Prec +02h - +01h



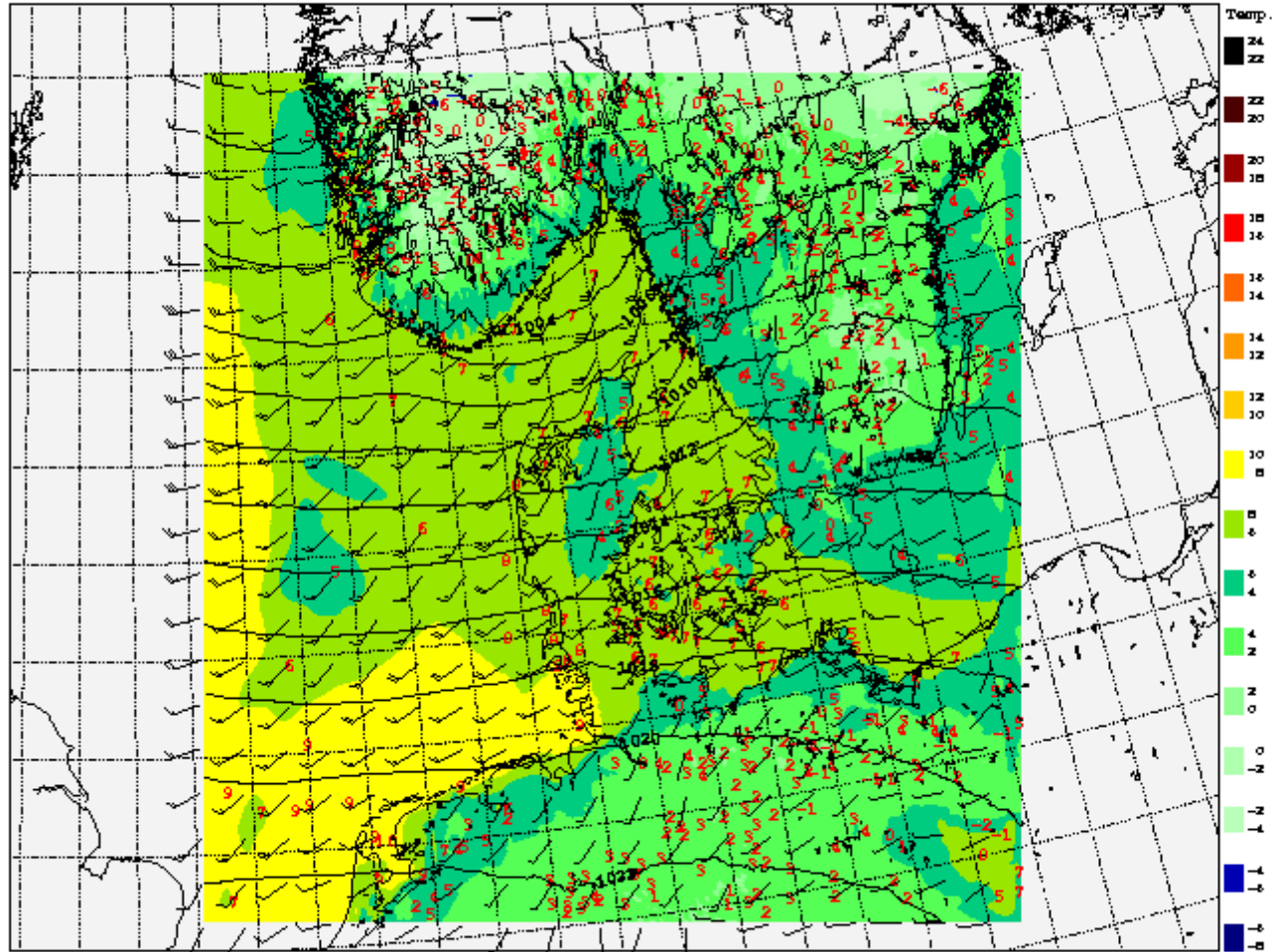
Thu 19 Apr 2007 00Z +02h - Thu 19 Apr 2007 00Z +01h
valid Thu 19 Apr 2007 02Z

GRIDCAREM+000Z

— unknown m.s.l.

— Temp. 2 m.

— Hor. Wind 10 m.



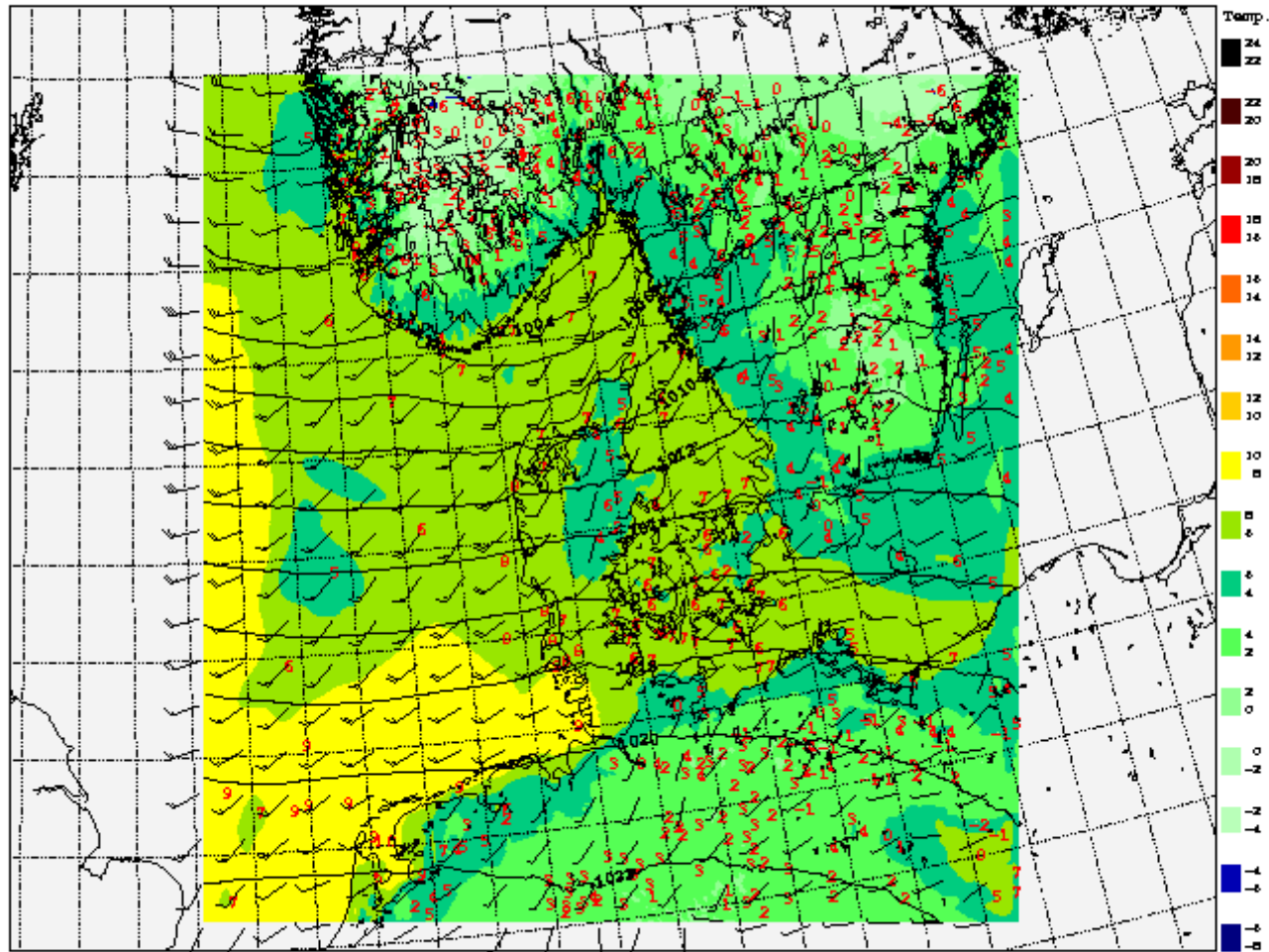
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valid Thu 19 Apr 2007 02Z

GRIDGABNH+000Z

— unknown m.s.l.

— Temp. 2 m.

— Hor. Wind 10 m.



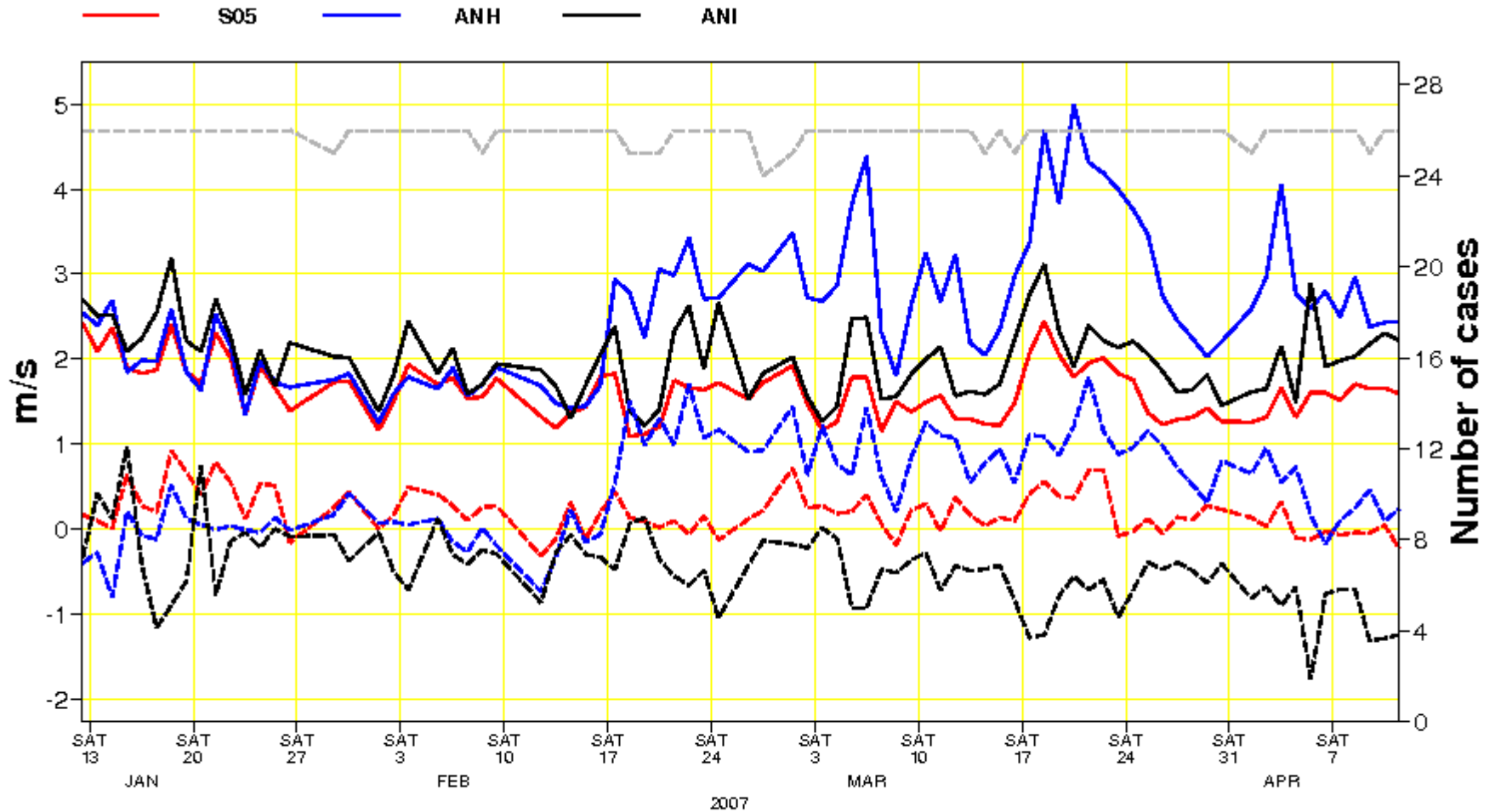
Thu 19 Apr 2007 00Z +02h
valid Thu 19 Apr 2007 02Z

GRIDGABNH+000Z

Verifications

Statistics for 27 stations
Wind speed

Forecast lengths used: 06 12 18 24 Window: 24h
Solid RMS; Dashed BIAS; Dashed grey is number of cases

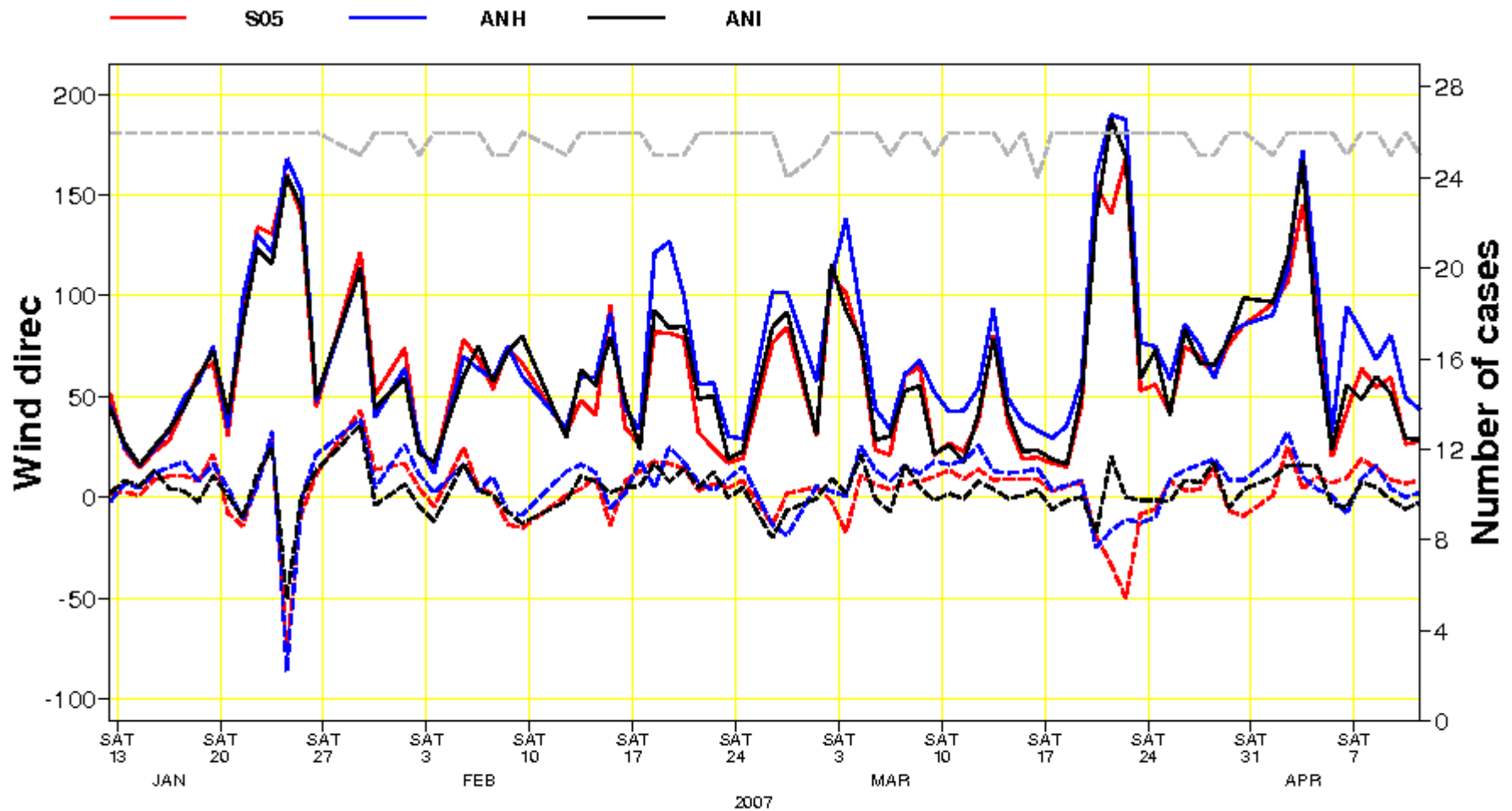


Statistics for 27 stations

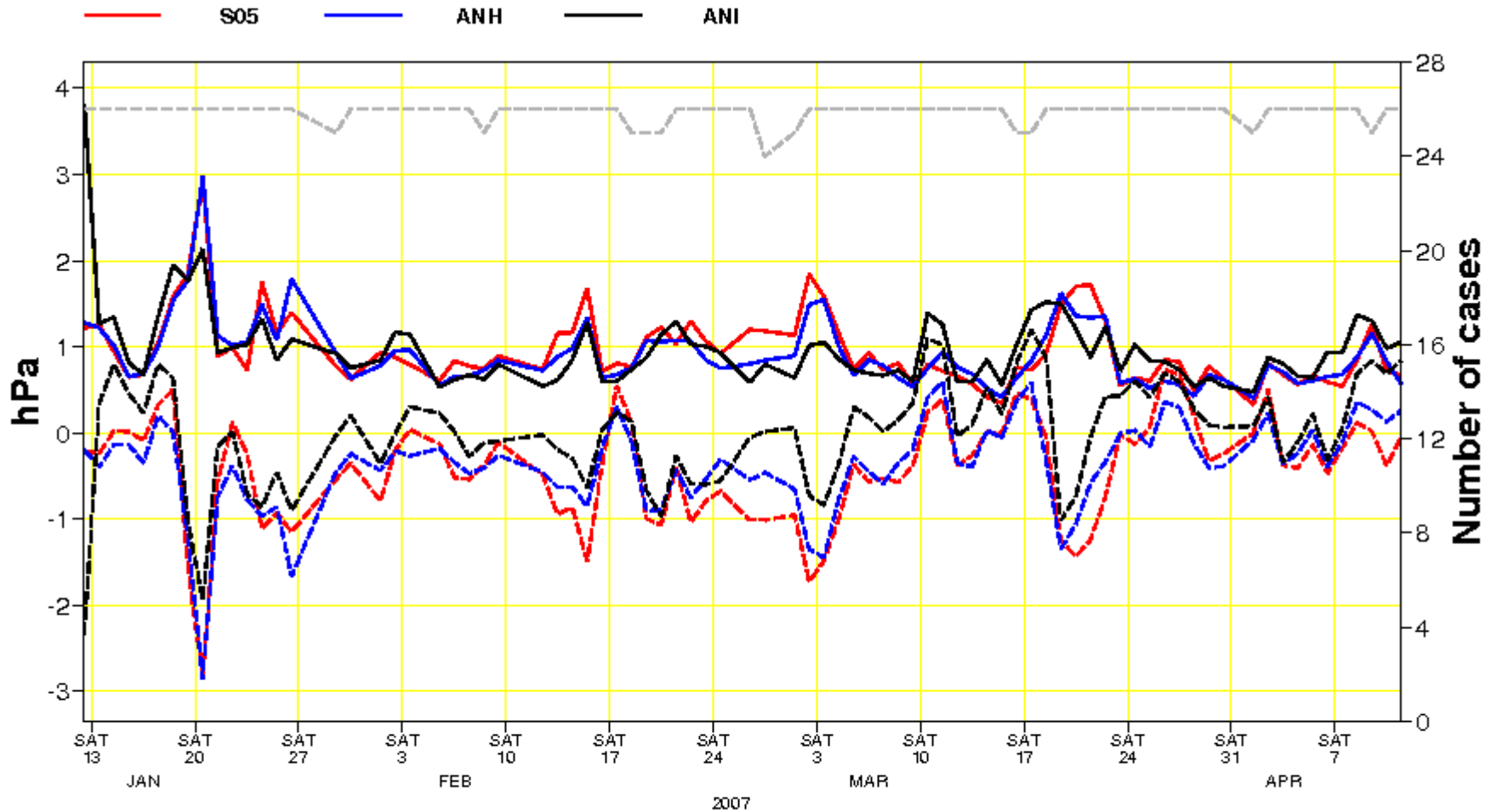
Wind direction

Forecast lengths used: 06 12 18 24 Window: 24h

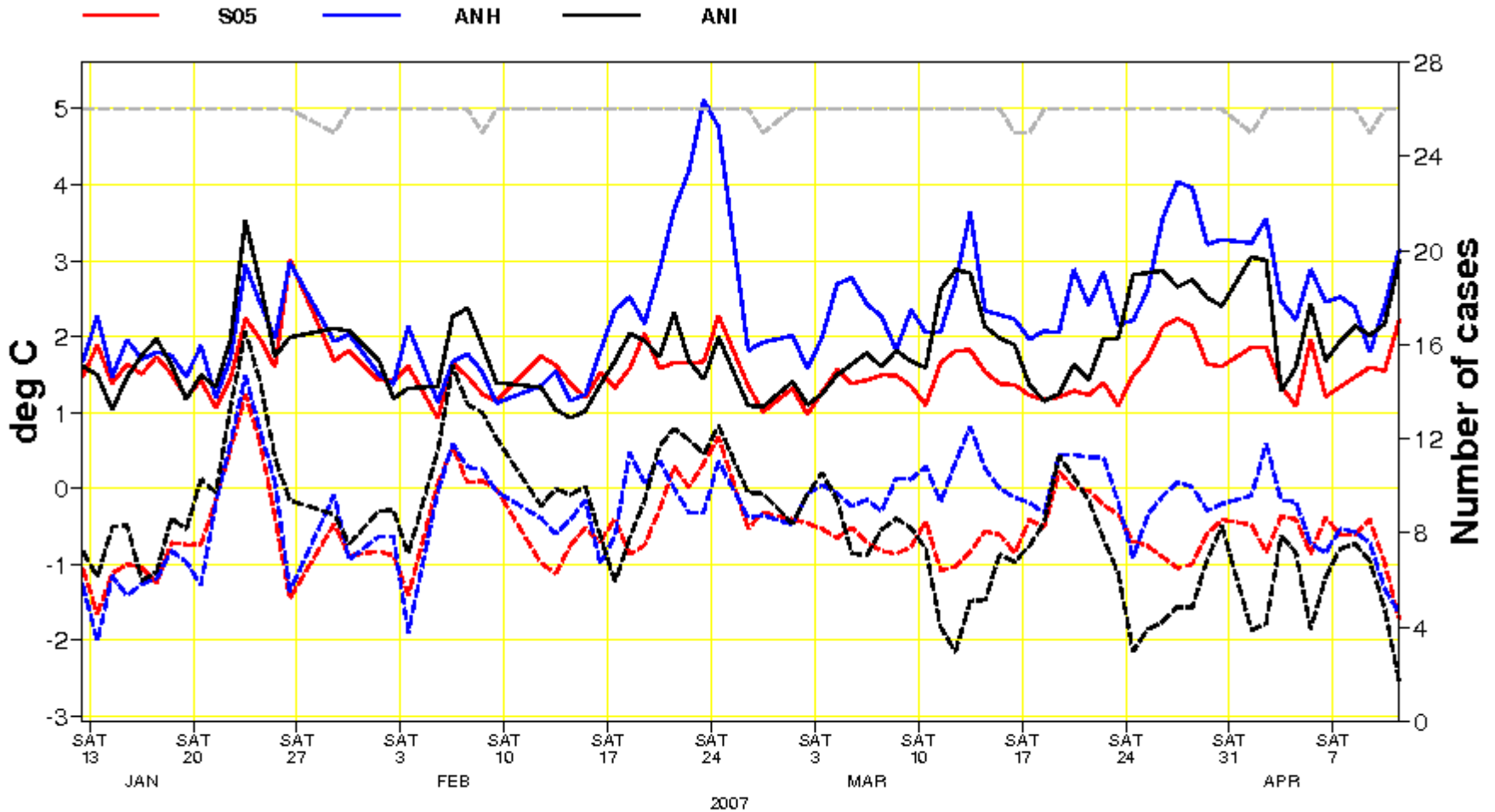
Solid RMS; Dashed BIAS; Dashed grey is number of cases



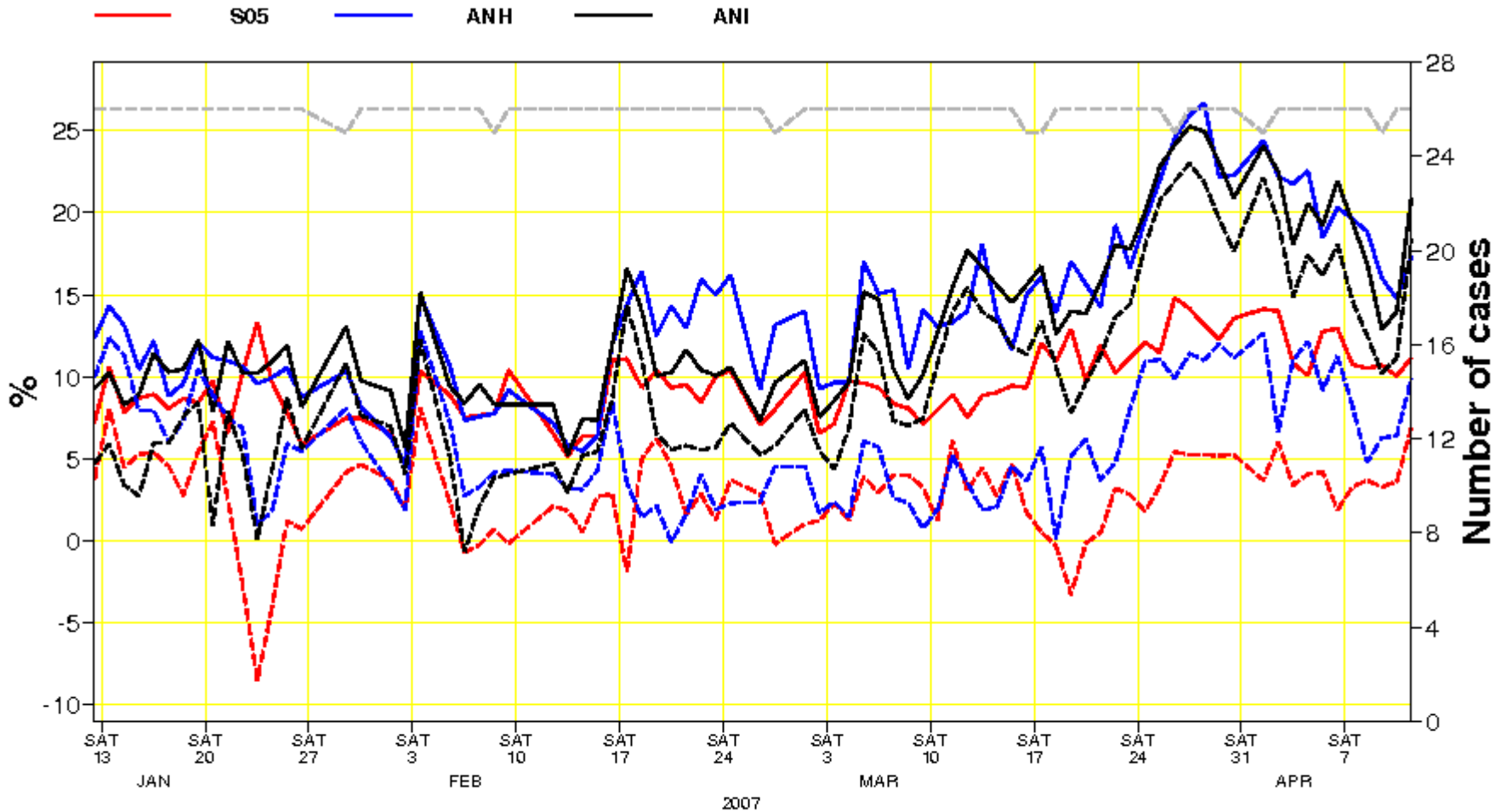
Statistics for 26 stations
Surface pressure
Forecast lengths used: 06 12 18 24 Window: 24h
Solid RMS; Dashed BIAS; Dashed grey is number of cases



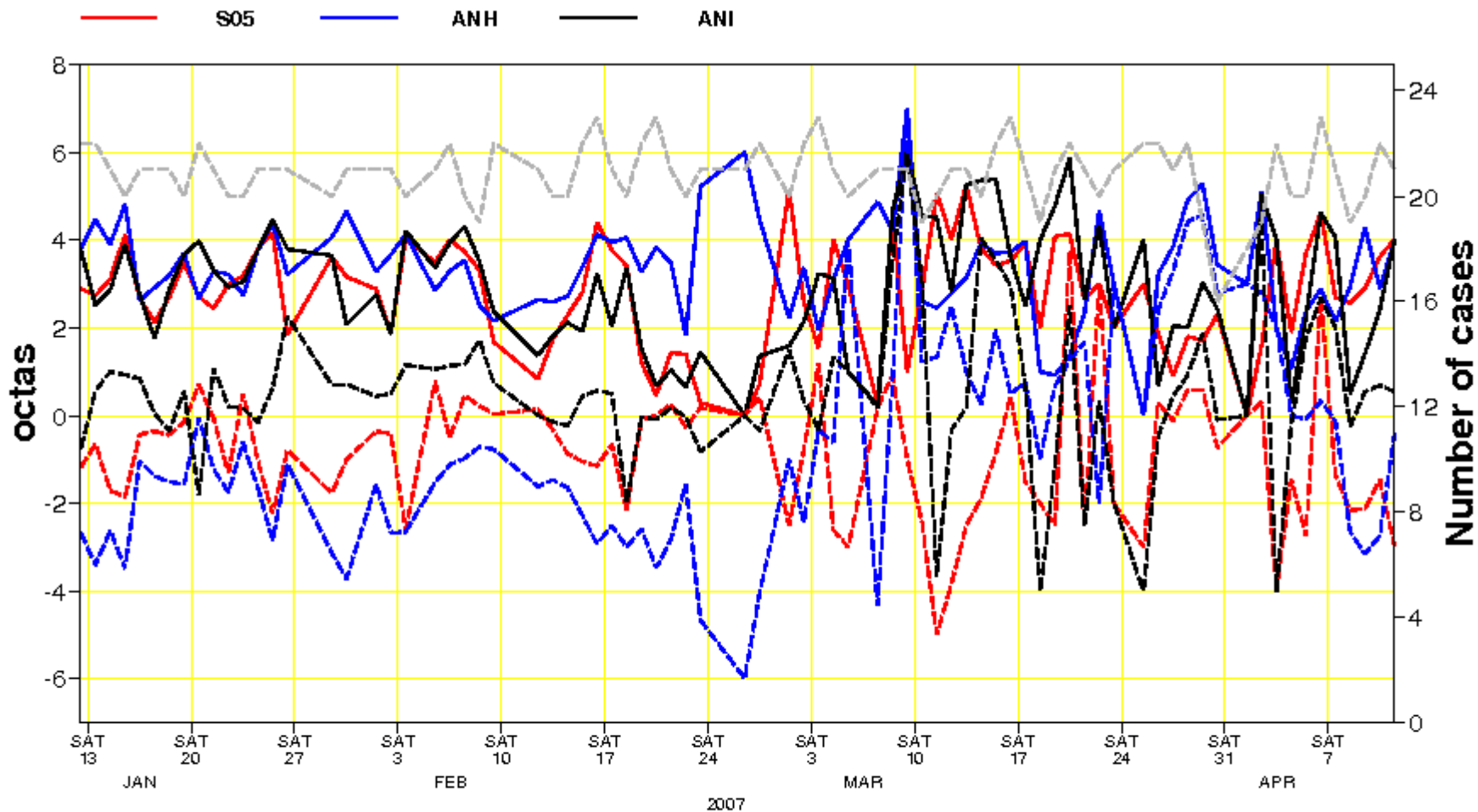
Statistics for 26 stations
Temperature
 Forecast lengths used: 06 12 18 24 Window: 24h
 Solid RMS; Dashed BIAS; Dashed grey is number of cases



Statistics for 26 stations
Relative Humidity
Forecast lengths used: 06 12 18 24 Window: 24h
Solid RMS; Dashed BIAS; Dashed grey is number of cases

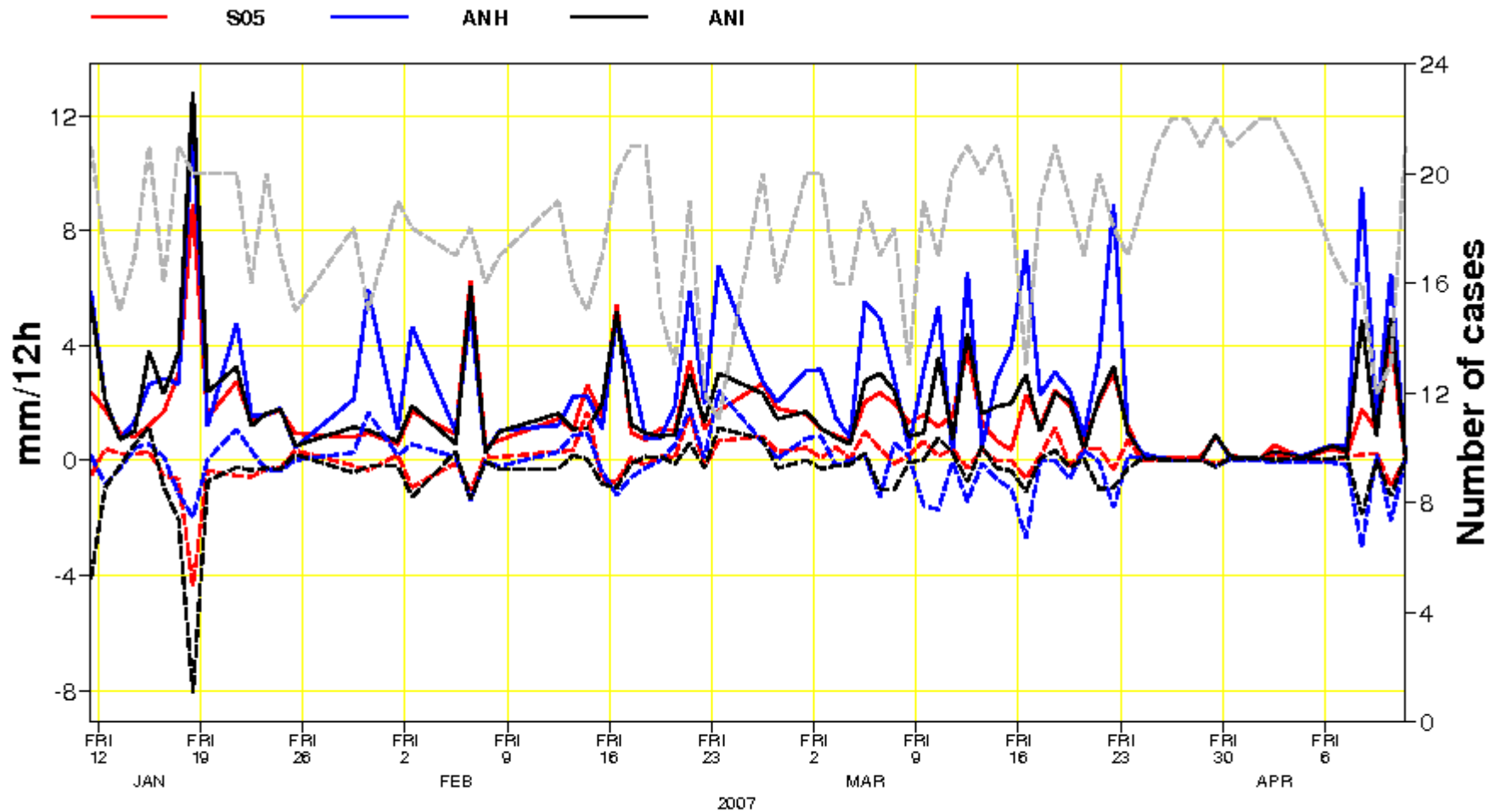


Statistics for 23 stations
Cloud cover (octas)
Forecast lengths used: 06 12 18 24 Window: 24h
Solid RMS; Dashed BIAS; Dashed grey is number of cases



Statistics for 22 stations Precipitation

Forecast lengths used: 06 12 18 24 Window: 24h
Solid RMS; Dashed BIAS; Dashed grey is number of cases



Experiences from daily runs

- Both AROME-2.5 and HIRALD-2.5 runs stable without crashing in CY31T1.
- Averaged over the test period (several months with CY31T1 neither AROME-2.5 or HIRALD-2.5 beat the HIRLAM S05 at this stage (objective verification results when all parameters are taken into account). This result is likely to change in the future provided that more efforts are spent in the ALADIN setup.

AROME-2.5

- It is our impression that small scale precipitation is often too vigorous. This will be studied further during summer 2007.
- It has been seen that precipitation for southwestern Norway varies a lot from case to case with regard to precipitation occurrence on the coast. Sometimes the precipitation starts only a significant distance inland which occasionally appears exaggerated.

AROME-2.5 continued

- During cold winter conditions the 2m temperatures using AROME has been significantly too high compared to the model run using HIRLAM physics. This feature may be related to the initialization of soil ice (different surface schemes are involved).

HIRALD-2.5

- The run using HIRLAM physics without convective parameterization has appeared "surprisingly realistic" with regard to precipitation.
- Precipitation on Norwegian mountains starts close to the coast but penetrates a significant distance inland as opposed to the old ALADIN physics (no cloud condensates) which precipitate right on the coast.

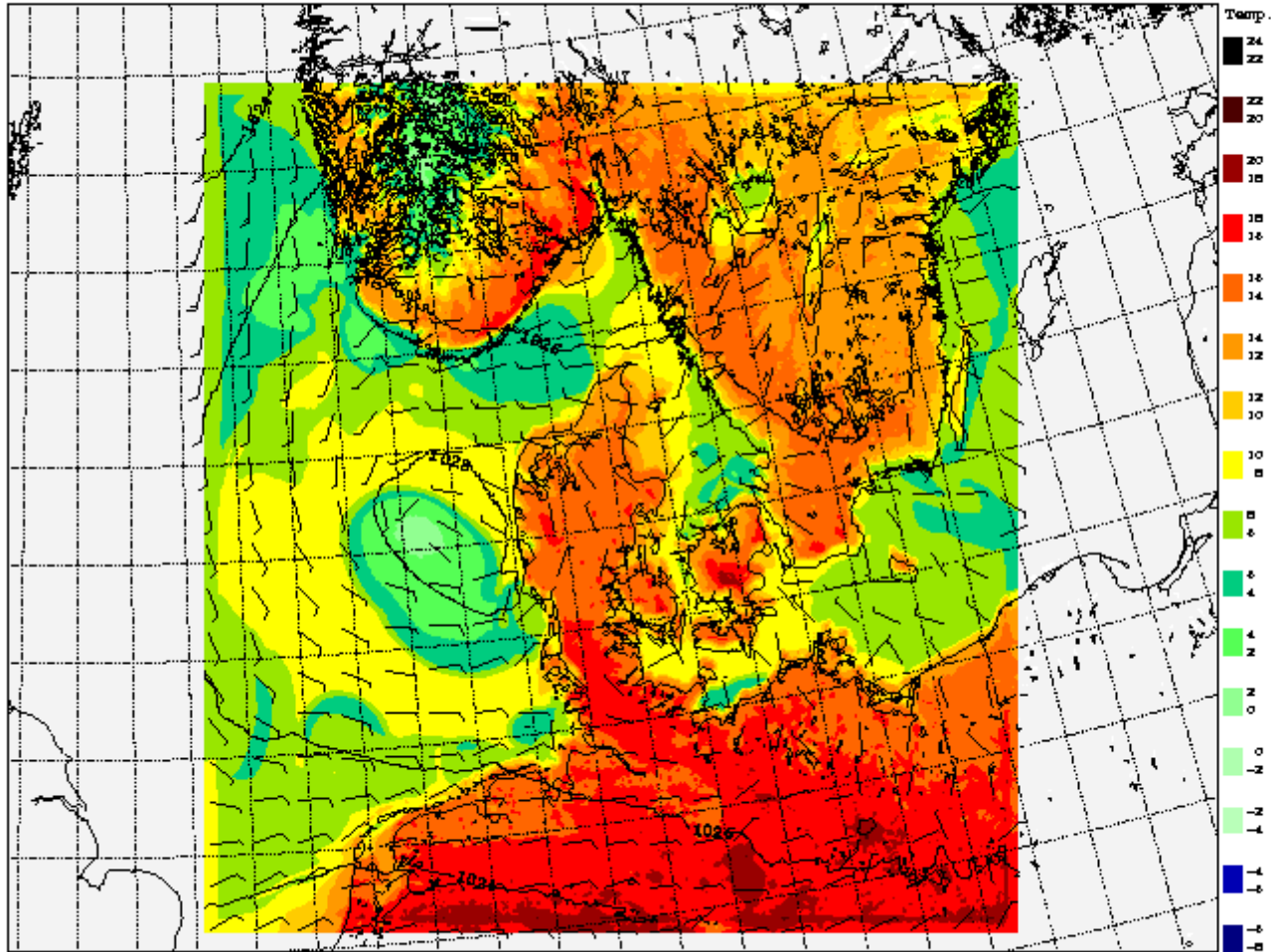
HIRALD-2.5 continued

- Performance during summer in more convective situations will be followed closely.
- A weakness of the current HIRLAM implementation is the coupling at the surface where the fluxes are generated through the ALADIN ISBA and turbulence scheme. This may lead to unrealistic cold fogs over sea in the HIRALD forecast during calm wind but may become more severe in certain spring conditions with present HIRALD system

— Press. m.s.l.

— Temp. 2 m.

— Hor. Wind 10 m.



Thu 12 Apr 2007 00Z +12h
valid Thu 12 Apr 2007 12Z

GRIDCARSIM+0012

Wish list as seen from DMI.

- More work should be done to improve the existing setups.
- More work should be spent to improve the HIRALD setup, e.g. studying the effect of calling externalized surface scheme and the effect of using convection at 2.5 km resolution.
- It should be possible to couple AROME and HIRALD directly to a HIRLAM forecast (without using an intermediate hydrostatic ALADIN model)

FIN