Overview on Operational HIRLAM

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Acknowledgement of contributions from:

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FMI (Niko Sokka)
KNMI (Toon Moene)
Met Eireann (Eoin Whelan)
SMHI (Lars Meuller)
EMHI (Aarne Mannik)
INM (Estrella G. Marco)
LHMS (Paulius Jalinskas)
Met.no (John B. Bremnes)

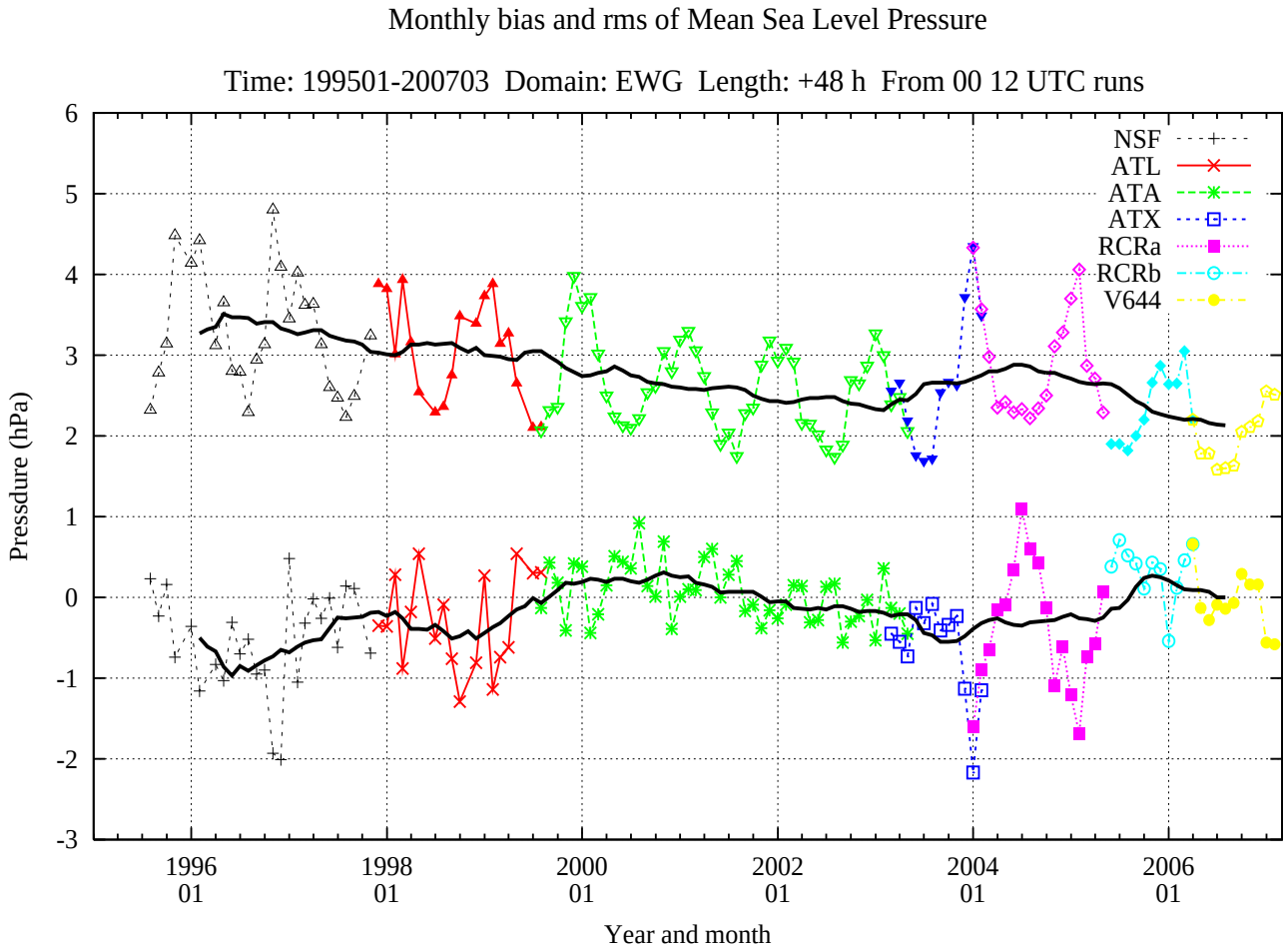
Reference HIRLAM upgrades

- Release 7.0, May 2 2006
  - Re-forecast cycling
  - ATOVS AMSU-A (NOAA-15, NOAA-16)
- Release 7.1, March 28 2007
  - Resolution increase (0.15 d, 60 level)
  - 6 h cycling with statistical structure function
  - F90 physics including moist CBR and STRACO tuning
  - Extended direct model output lists
    - visibility, gust wind, CAPE index, surface temperature maxima,etc.

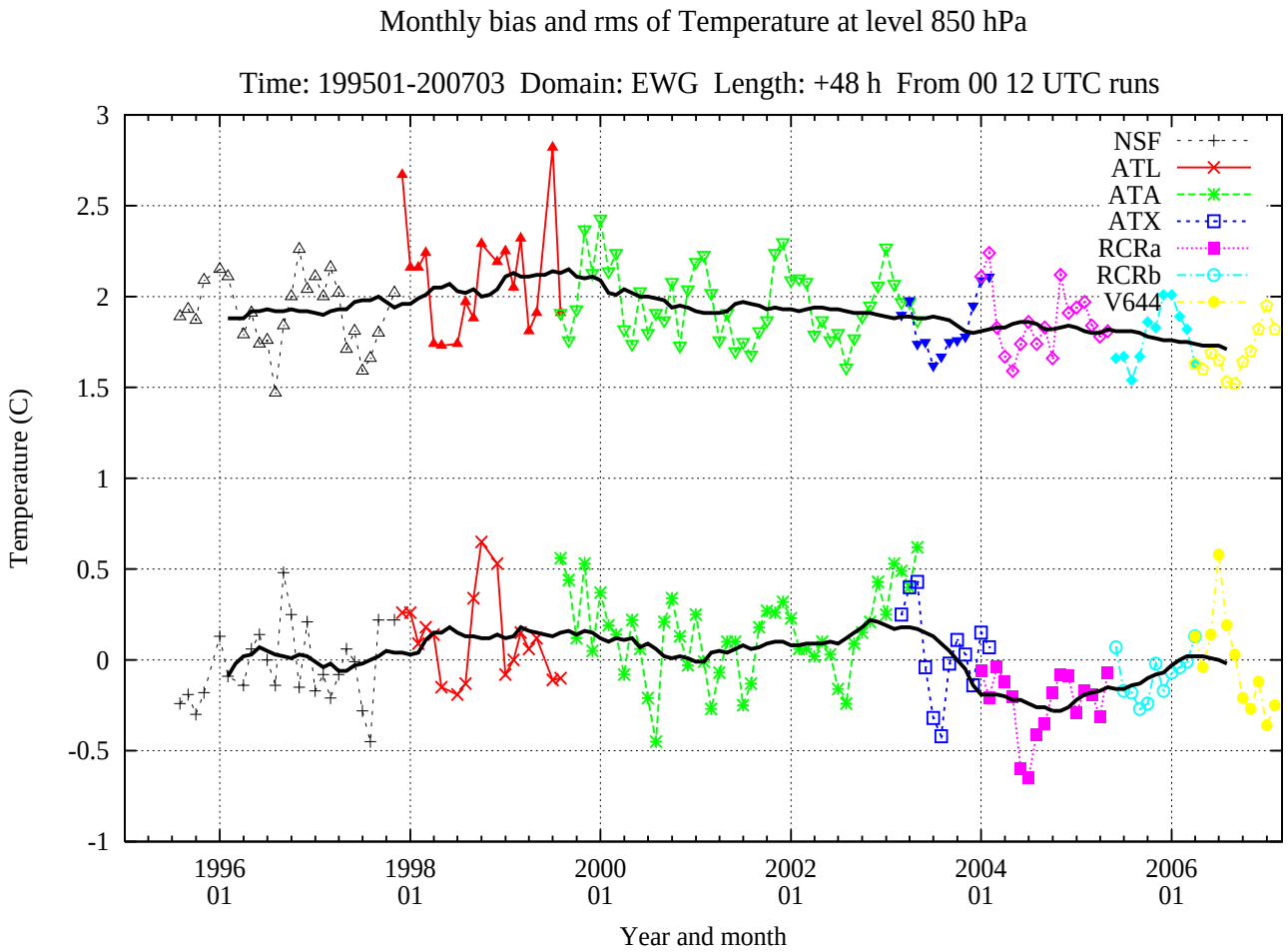
FMI operational activities

- FMI runs operationally Regular Cycle of Reference HIRLAM (RCR) since 2004
- Only minimum deviation applied
  - in surface analysis, inclusion of Baltic SST/ice observations from FMRI
  - climatological lake observations in Finnish area
  - full SMS instead of mini-SMS
- In addition, MBE at 0.08d with DA is run daily
- FMI runs twice daily AROME for southern Finland at 2.5 km resolution (Niemela talk)

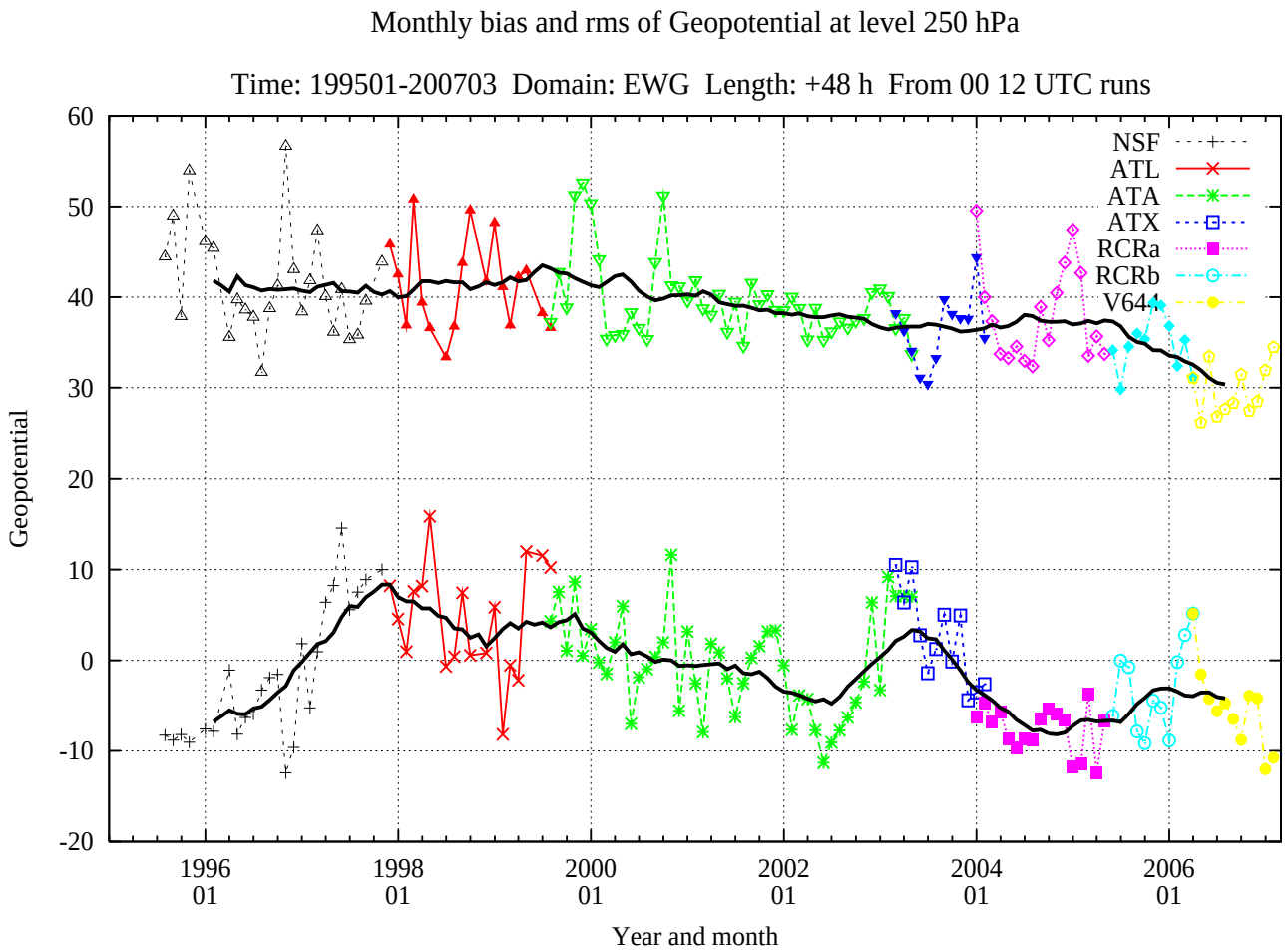
FMI forecast quality: MSLP



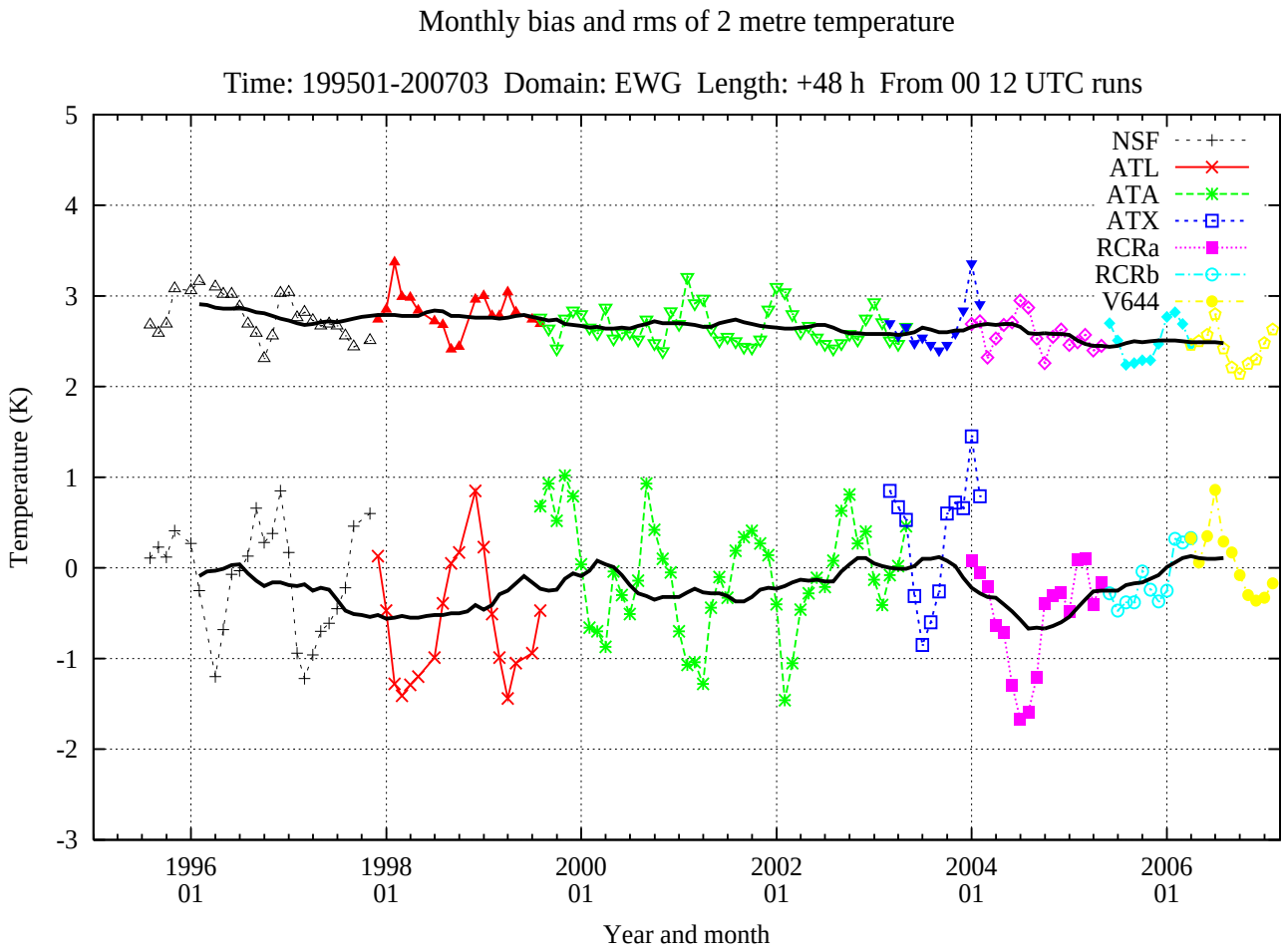
FMI forecast quality: 850 hPa T



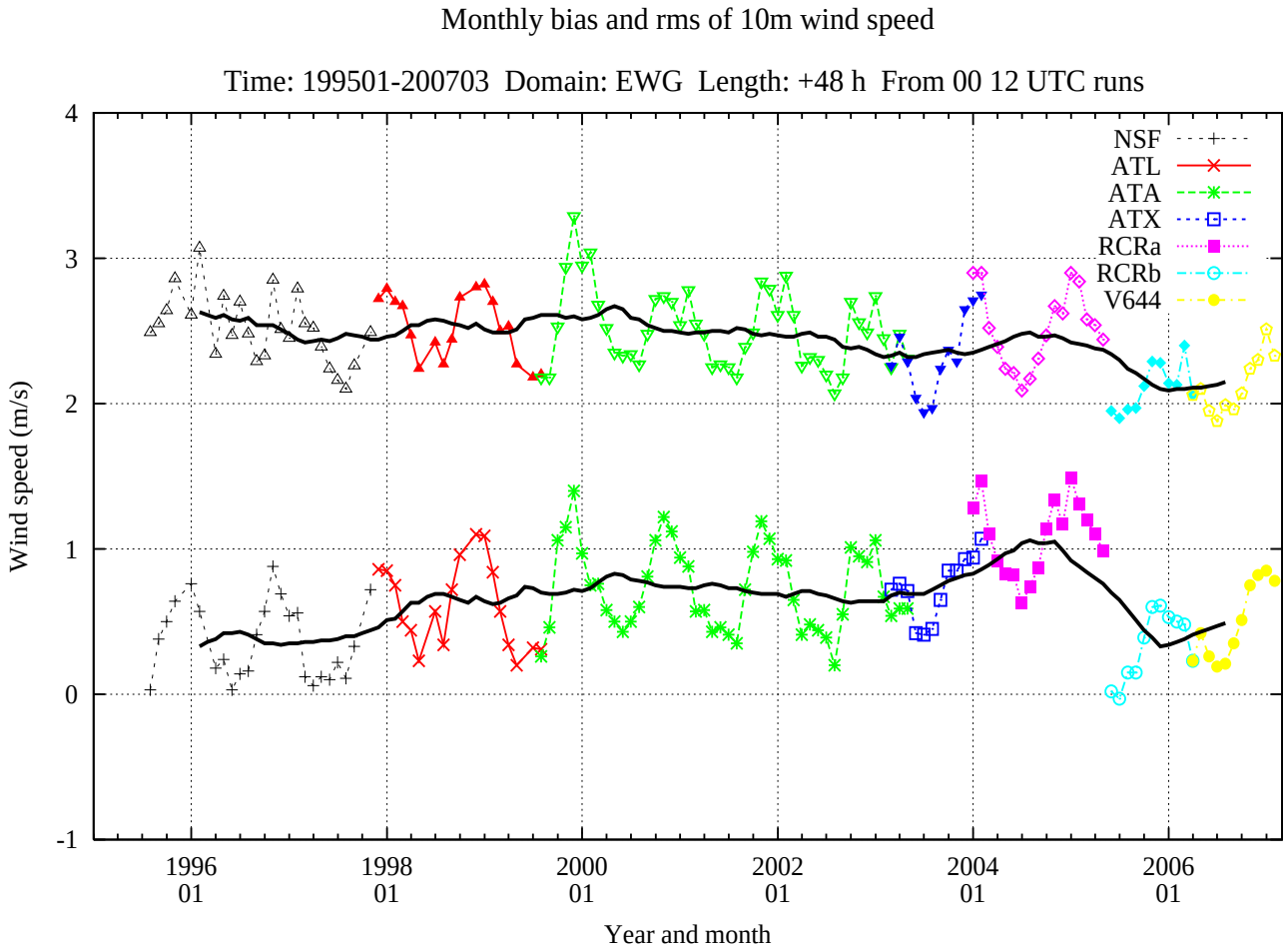
FMI forecast quality: 250 hPa T



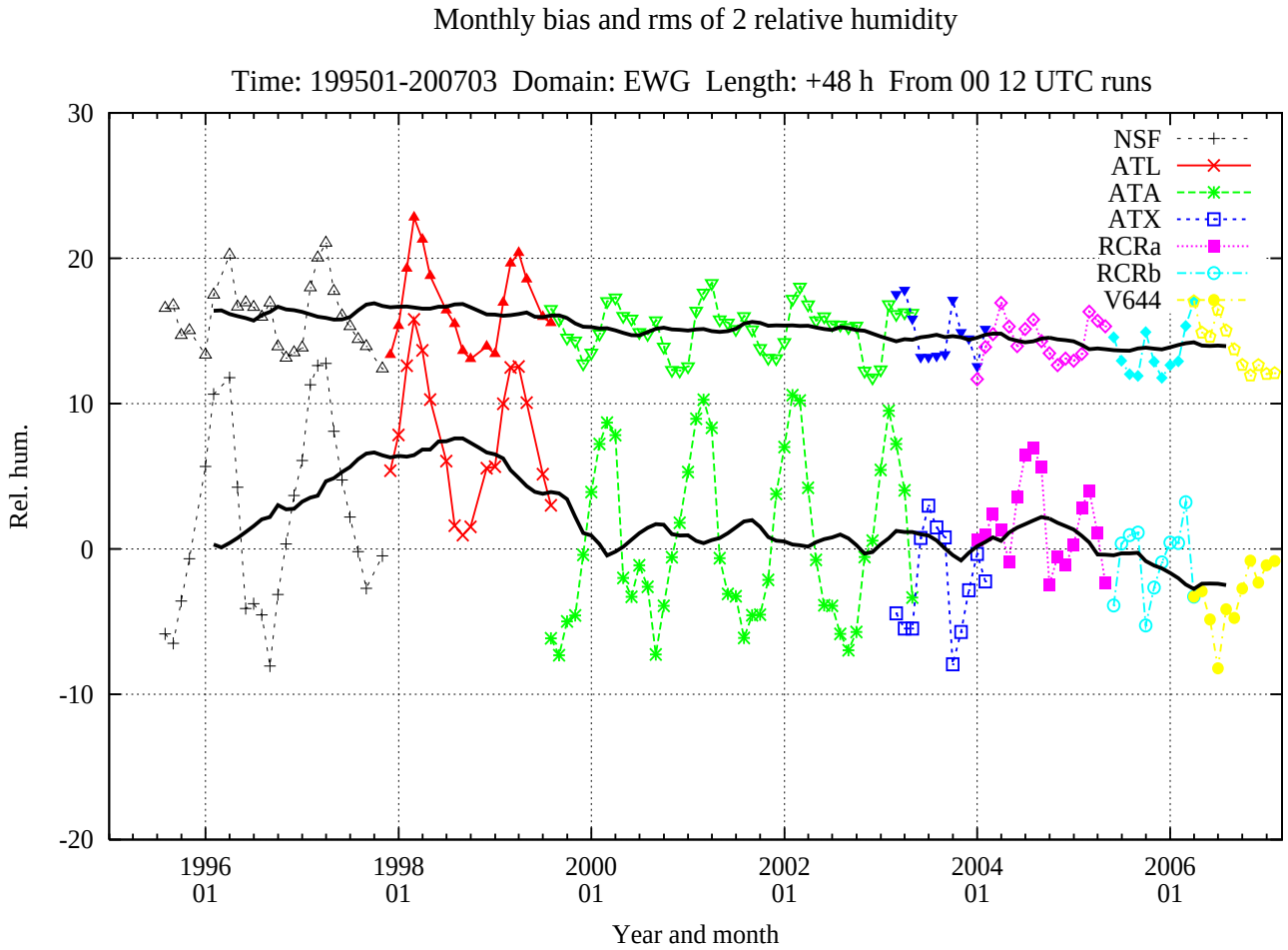
FMI forecast quality: T2m



FMI forecast quality: W10m



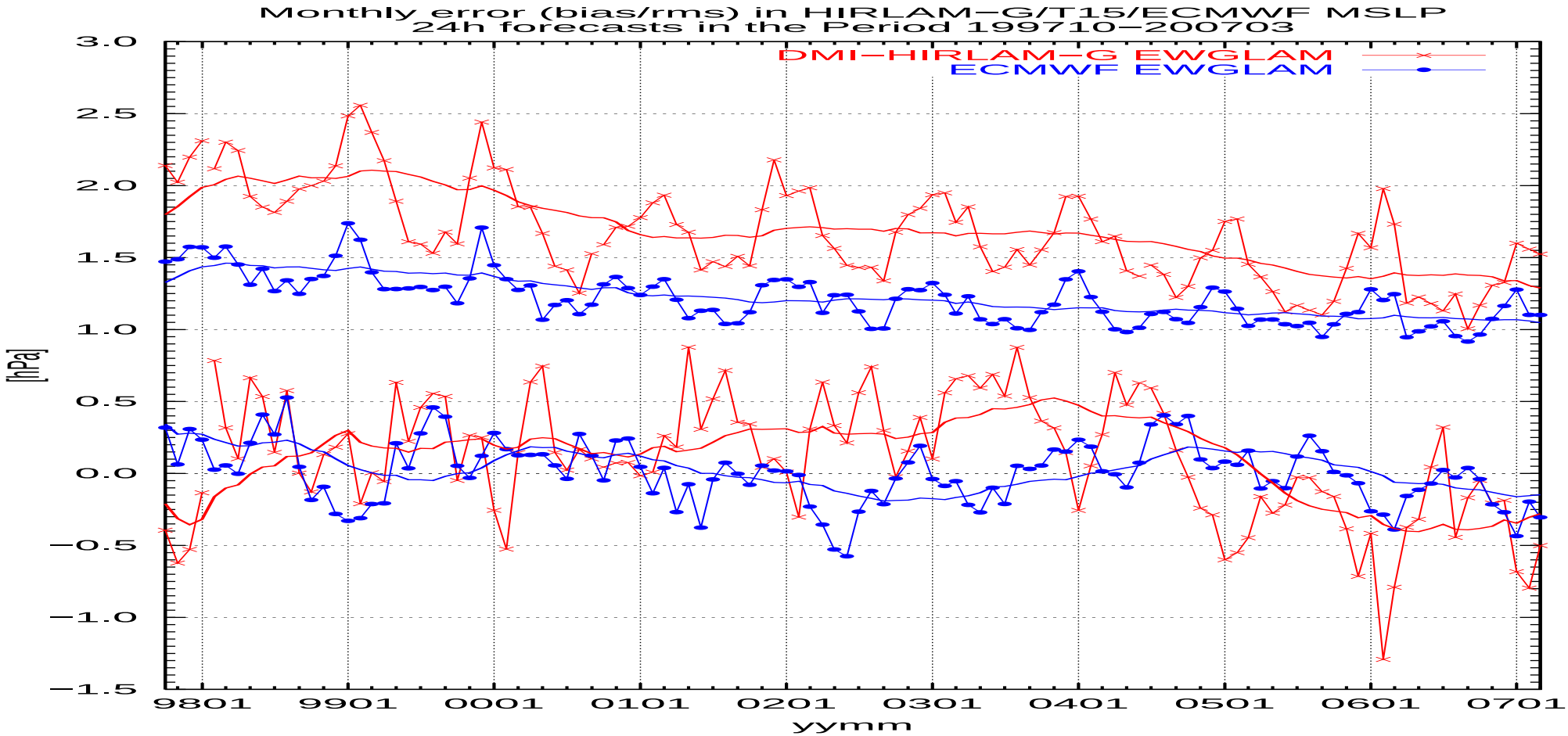
FMI forecast quality: RH2m



DMI operational activities

- Minor upgrade Feb 2007: introduction of NOAA 18 AMSU-A assimilation
- Minor upgrade May 2007:
  - STRACO update in phase with 7.1
  - statistical balance structure function
  - cloud water initialisation correction
  - correction on model top maximum wind
- Multiple test suits on M-domain

Quality improvement: PMSL

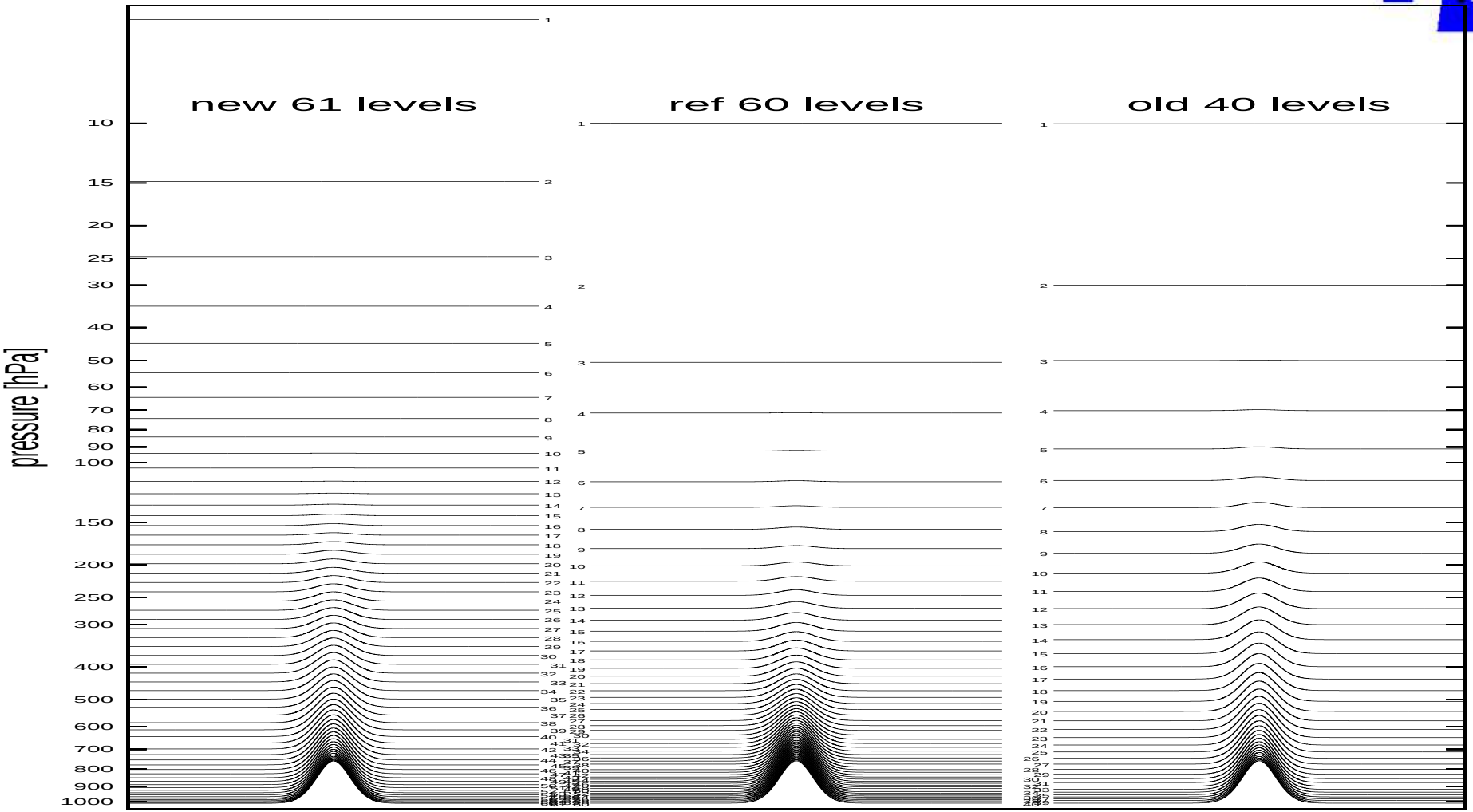


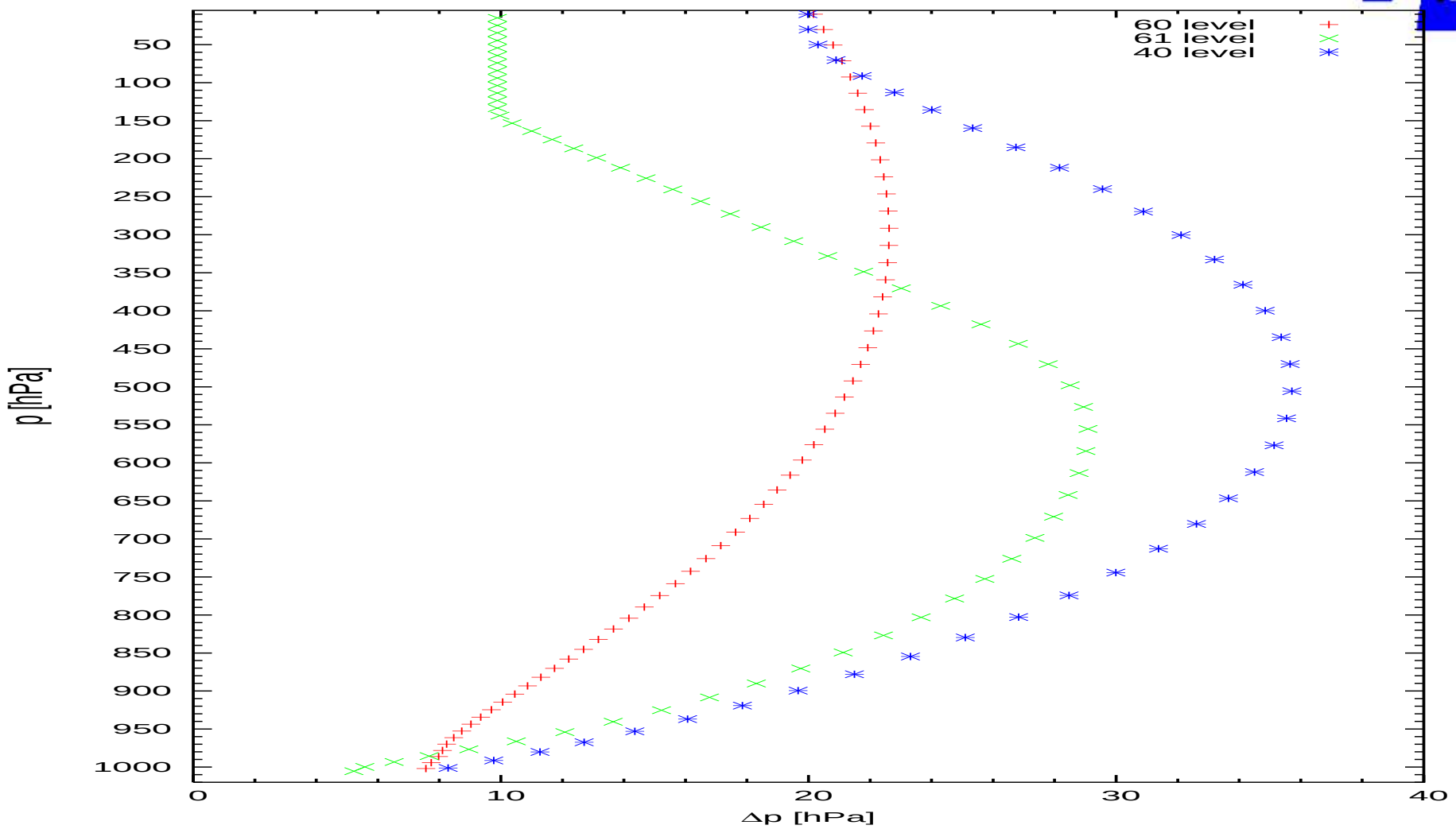
Related DMI activities

- real-time HARMONIE runs with AROME and hirlam physics (Andersen's talk)
- preparation for next HPC (late 2007/early 2008): benchmark suite
- preparation for resolution/domain/schedule changes
- preparation for upgrade to 7.1/7.2
- DMI HIRLAM forecast data in hirlam.org data portal
- preparation for 4DVAR, vertical resolution upgrade

DMI 61-level tests

- basically a copy of the ECMWF EPS leveling (L62)
- exception for the lowest model level to avoid too low model level
- main desire is to reduce needs for vertical interpolation


new 61 levels
ref 60 levels
old 40 levels
pressure [hPa]
10
15
20
25
30
40
50
60
70
80
90
100
150
200
250
300
400
500
600
700
800
900
1000


60 level
61 level
40 level
p [hPa]
Δp [hPa]
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
0
10
20
30
40

INM operational activities

- Three operational suites based on v6.1.2 from last upgrade in May 2005
  - ONR at 0.16d, UA+SPan, 72h fcst, delivery +3h05m
  - HNR at 0.05d for Spain, UA+Span, 36h fcst, delivery +3h40m
  - CNN at 0.05d for Canary Islands, UA+Span, 36h fcst, delivery +3h40m
- Operational suites on INM Cray X1E with 2.3TF peak performance
- SREPS suite quasi-operational (see talks by Garcia-Moya, Santos et al)

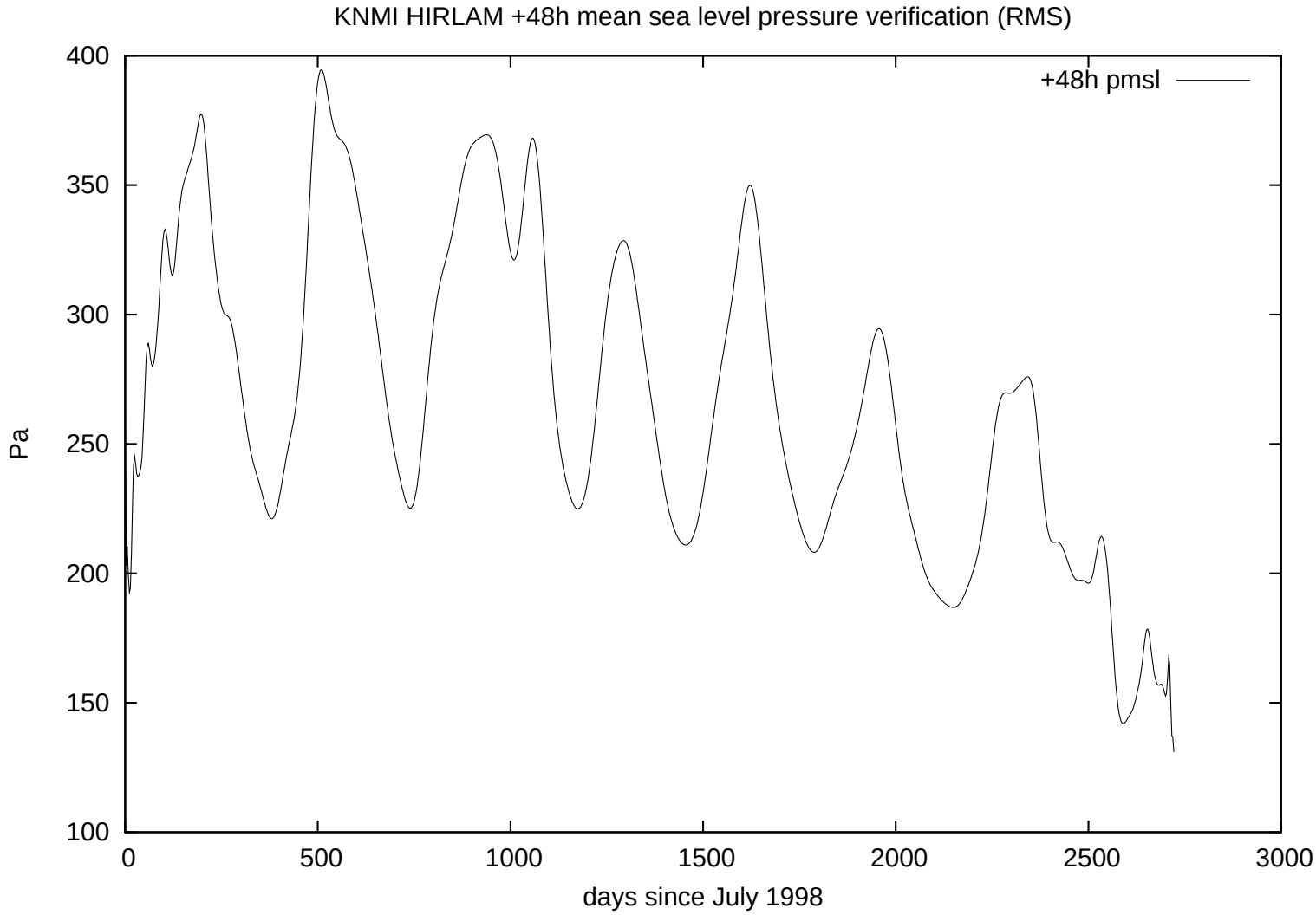
KNMI operational events

- KNMI receives 100+ PE SGI ALTIX in may 2006
- D11 upgrade in Oct 2006 with HIRLAM 7.0 and resolution upgrade
  - 0.1 degree, 60 levels, DT=240s, 48h fcst, delivery +3h
  - with 816x650x60, D11 has 6x more grid-point than previous model
- Supplementary faster-delivery H11 run 8 times/day
- Planed parallel suite with 7.1
- Planed introduction of HARMONIE test cycle

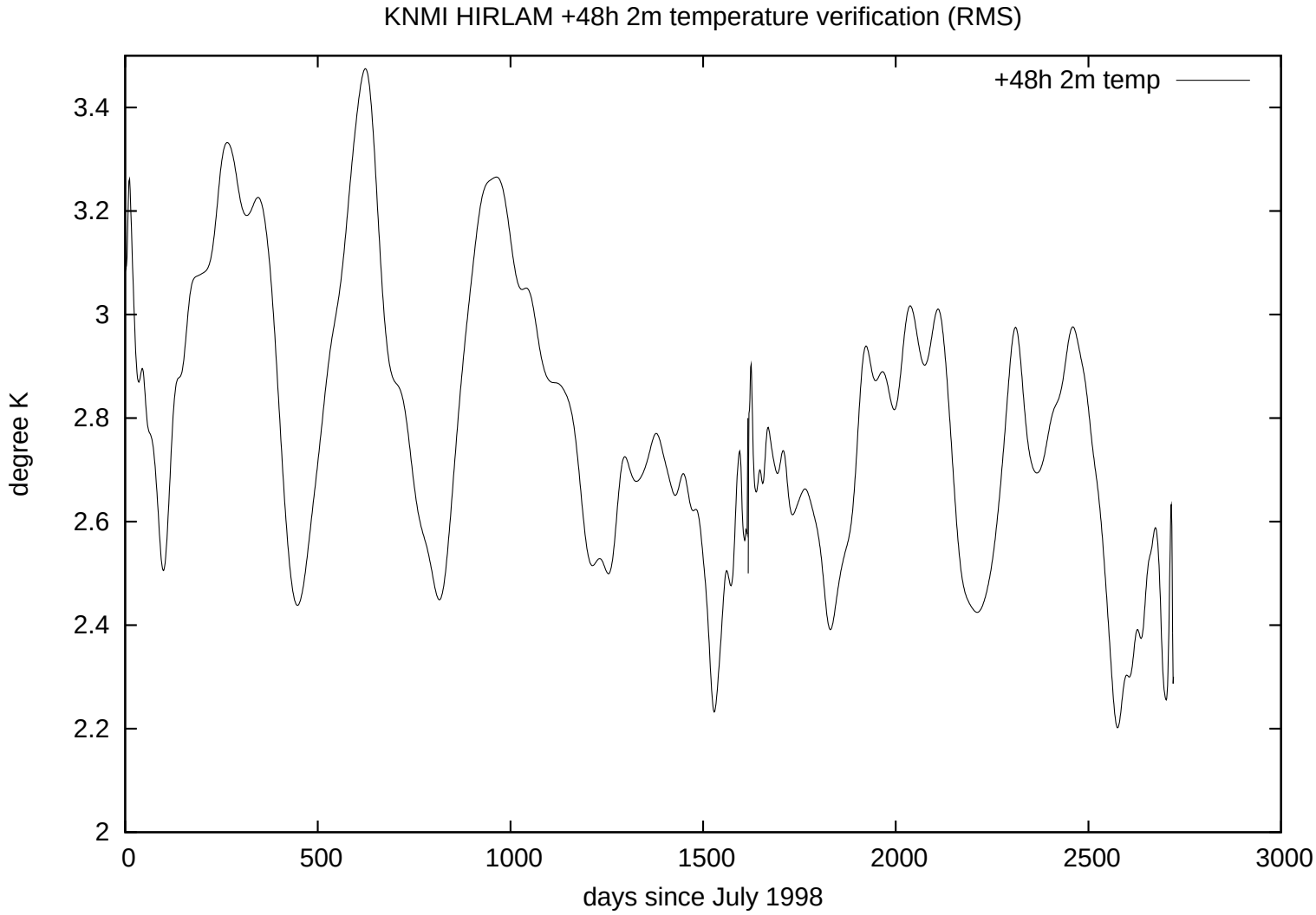
KNMI deviations from reference 7.0

- explicit ECMWF upper air + HIRLAM surface fields mixing in re-forecast
- no remote sensing data in data assimilation
- higher horizontal diffusion coefficients to mitigate model top resonances
- some features from 7.1
  - corrections for soil ice treatment
  - extended post-processing
- offline-mode for verification

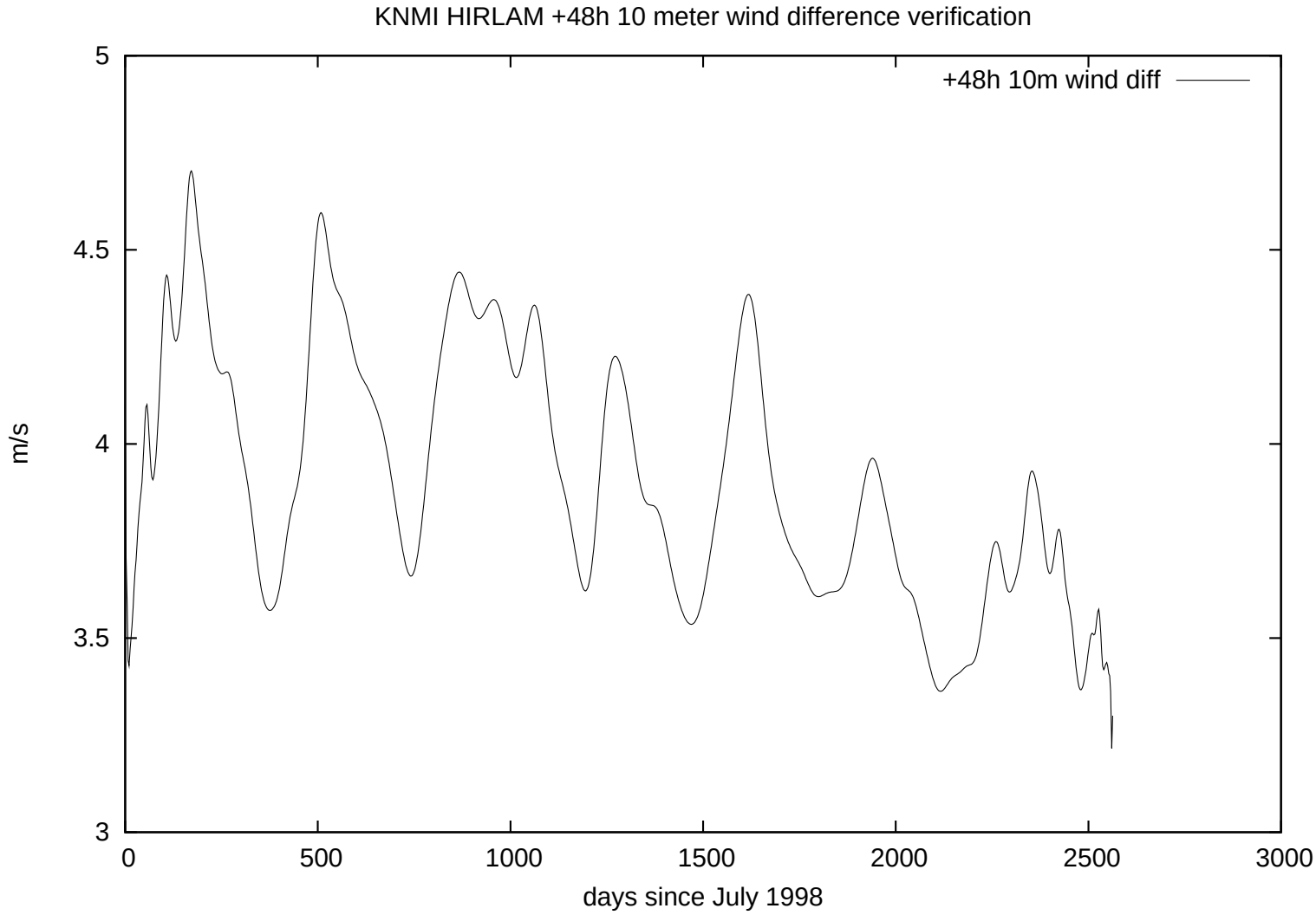
KNMI forecast quality evolution: PMSL



KNMI forecast quality evolution: t2m



KNMI forecast quality evolution: W10m



Met Eireann operational activities

- Met Eireann outsources operational HIRLAM runs to ICHEC
- New operational HIRLAM with 7.0.1 to be operational shortly
  - OPR: 0.1 d, L60, no LSMIX, DFI, 54h fcst, delivery +2h50m
  - FIN: 0.05 d, L60, DFI, no surface analysis, 30h, delivery +3h40m
- Some direct contribution from ICHEC to HIRLAM-A system project
- Considering on meso-scale NWP

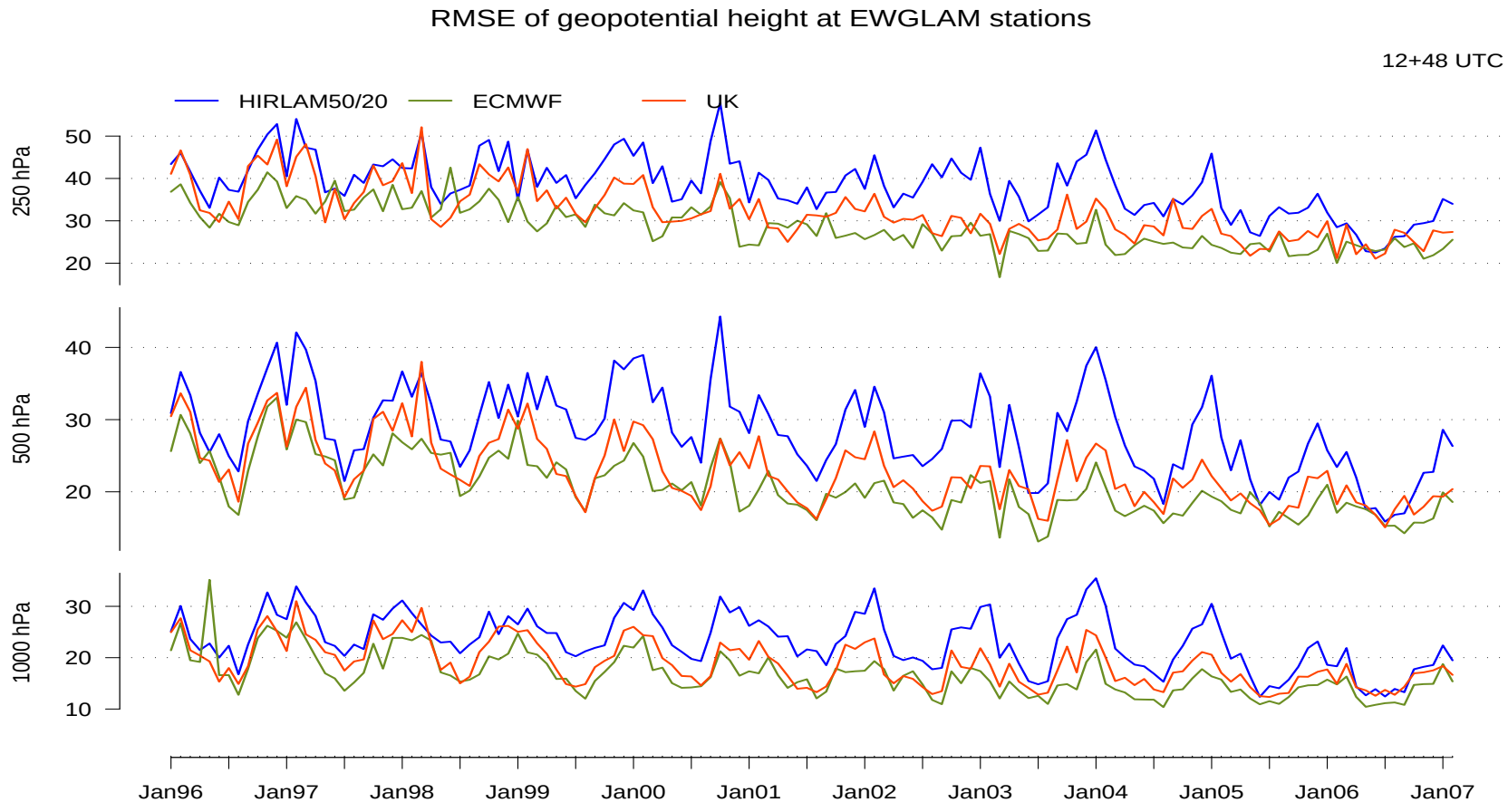
Met Eireann operational experiences

- Substantial efforts to port recent reference HIRLAM
- Model top wind maxima and solution
- Problems with soil freezing
- Positive impact on PMSL bias with increased LBC resolution
- Problem with 7.0 reproduciability?

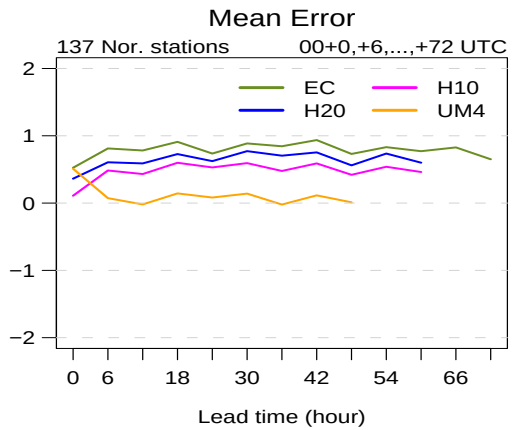
met.no operational activities

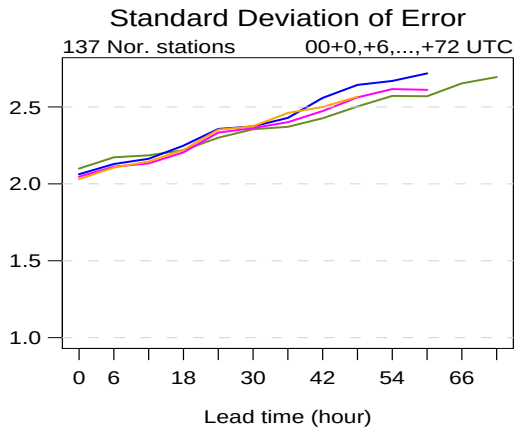
- Migration to new IBM Power 4+ HPC platform in early 2007
- Operational suits with double nesting
  - H20: 22 km
  - H10: 11 km, no DA
  - H04: 4 km
- Coming operational suite in 2007
  - upgrade to 7.1
  - merged H22 and H11 runs with a resolution of about 12 km, 60 or 61 levels
- real-time test of 4D-VAR
- HARMONIE cycling

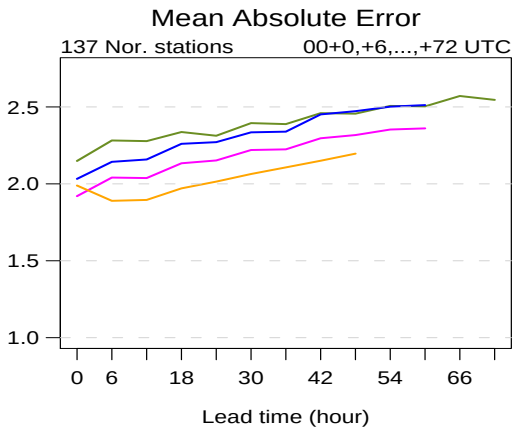
Quality improvement: Geopotential Height

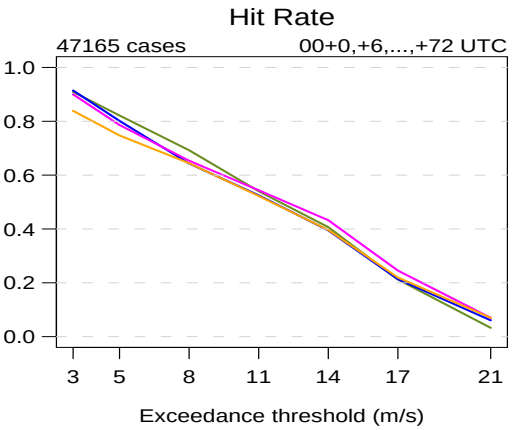


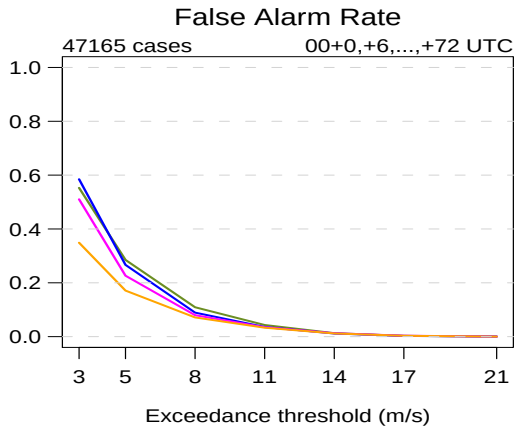
Quality improvement: W10m

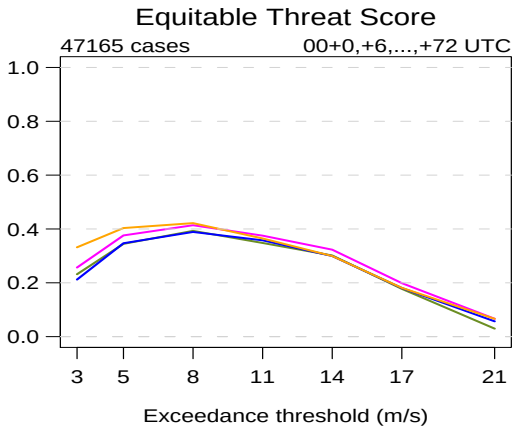












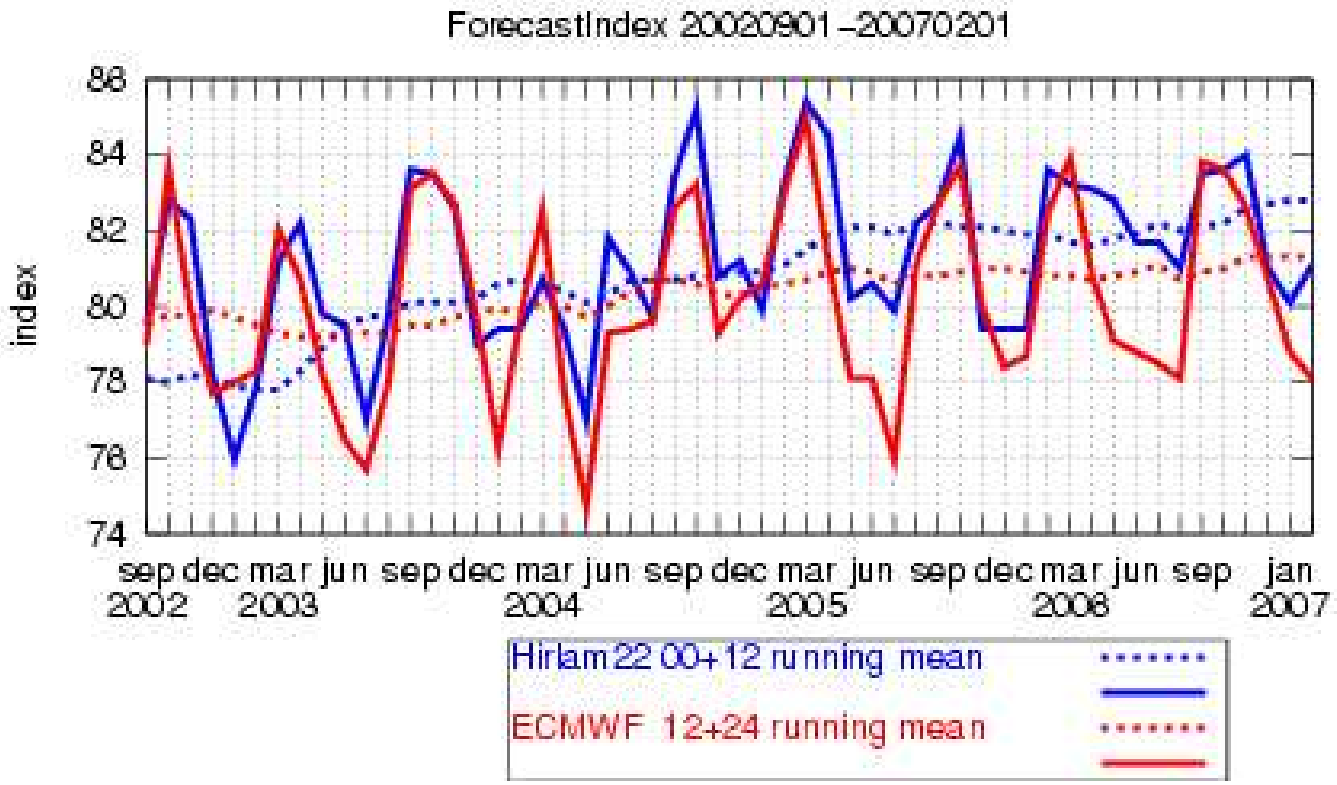
SMHI operational activities

- No major upgrade since last ASM. System based on 6.3.5+ with HIRVDA 6.2.1
- C22, E11 and G05 each run own DA cycles
  - C22: 2h OBS cut off; 48 h fcst; delivery at 2h20m
  - E11: BC from ECMWF; 1h15m OBS cut-off; 72h fcst; delivery 1h50m
  - G05: BC from E11; 48h forecast. delivery 3h30m?
- Real-time C22-4DVAR since Dec 2006: good synoptic scores seen
- Planed system upgrade in 2007: HIRLAM 7.1; C22 4DVAR
- Planed system upgrade in 2008: 0.1d, L60 on C (606x606x60) with 4D-VAR
- ITT out for a new super computer for NSC/SMHI by the end of 2007

SMHI deviations from reference HIRLAM

- SST and SEA-ICE over the Baltic Sea taken from HIROMB
- Lake-ice as a function of deep soil temperature in forest.
- KF/RK instead of STRACO
- Moist CBR
- Minor modifications in physics
  - heat conduction in ice
  - reduced snow fraction in forest
  - soil freezing calculation removed
  - max random calculation of cloud types

SMHI: Forecast quality indicator



SMHI efforts on HARMONIE

- two real-time Cycle 31t1 AROME suites at 2.5 km nexted under ALADIN 11 km
- monitoring information available on hirlam.org
- test ongoing for cycle 32t0
- possibility to setup daily cycle with ALADIN 3D-VAR in discussion
- more from Andrae's talk

Operational domains: coarse resolution

		model version	grid-mesh	resolution	vertical level
DMI	T15	6.3+/7.1+	610x568	0.15d	40
EMHI	ETA	6.1+	114x100	0.10d	40
FMI	RCR	7.1	582x448	0.15d	60
INM	ONR	6.1.2	582x424	0.16d	40
KNMI	D11	7.0	816x650	0.10d	60
ME	OPR	7.0.1	438x284	0.147d	60
METNO	N22	6.4.2	468x378	0.20d	40
SMHI	C22	6.3.5+/6.2.1	306x306	0.20d	40

Operational domains: fine resolution

		model version	grid-mesh	resolution	vertical level
DMI	Q05	6.3+	550x378	0.05d	40
DMI	S05	6.3+	496x372	0.05d	40
EMHI	ETB	6.1+	196x170	0.03d	40
FMI	MBE	6.2.1	582x448	0.08d	40
INM	HNR	6.1.2	606x430	0.05d	40
INM	CNN	6.1.2	606x430	0.05d	40
ME	FIN	7.0	438x395	0.05d	60
METNO	N04	6.4.2	300x500	0.036	40
SMHI	G05	6.3.5+	294x441	0.05d	60

EMHI operational activities

- EMHI officially joins HIRLAM in 2007
- real-time test suite since 2004
- current quasi-operational suite ETA
  - hydrostatic, 0.1 d, L40, dt=400 s, 54 h fcst
  - LBC from FMI
  - hirvda 6.4 and Span
  - delivery +5h 30m
  - probably operational late 2007 with installation of new computer
- Experimental suite ETB
  - nonhydrostatic, 0.03 d, L40, dt=120s, 36h fcst, LBC from ETA
  - delivery +9h 45m

LHMS experiment with HIRLAM and plans

- LHMS runs real-time 0.1d, L40 resolution HIRLAM 7.0.1
  - LBC from FMI
  - 3DVAR, Span
  - runs on Linux-cluster
  - plan to upgrade to 7.1 source code
- Mainly two staffs are involved
- Wish to promote NWP studies at Vilnius University

Summary: recent hot operational issues

- Winter time extreme wind maxima at model top
- Problems of soil freezing
- Unexplained model crash, probably associated with surface scheme
- Bugs and data holes in previous climate generation
- Sensitivity to vertical resolution in boundary data (DMI,INM,met.ie)
- Surface fields initialisation in case of nesting without surface analyses
- Inconsistency in diagnostic/post-processing quantities
- Reproducibility (platform, re-start, diagnostic quantities etc.)
- E-AMDAR data in BUFR format not entirely resolved
- PLEN setting in UA

Summary: Highlights of operational HIRLAM

- Release of reference 7.0 and 7.1
- Improved operational resolution (0.1d to 0.03d, L60)
- More evidences of quality improvement with operational HIRLAM
- Further harmonisation of operational suites
- Several newcomers with real-time HIRLAM suites
- Extensive real-time tests of 4D-VAR and HARMONIE
- More active exchange of operational experiences