Annual review of operational HIRLAM/HARMONIE forecasts and status of the Reference System

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with input from all member services

Yearly review of the Reference system

- HIRLAM
    - Different operational setups
    - Changes since last year
    - Experiences
    - Something about quality
    - Present and last(?) version
- HARMONIE
    - Different real time setups
    - Changes since last year
    - Present and coming cycles
- Various about system
    - GRIB2
    - Forum
    - hirlam.org

Operational coarse resolution HIRLAM 2011

Domain	Cycle	Size	DX (deg)	DA
AEMET ONR	7.2	582 x 424 x 40	0.16	3DVAR, LSMIX
DMI M09	7.3beta1	730 x 746 x 40	0.09	3DVAR, LSMIX
EMHI ETA	7.1.2	366 x 280 x 60	0.1	3DVAR
FMI RCR	7.3rc3	582 x 448 x 60	0.15	4DVAR, LSMIX
LHMS L7	7.3	492 x 398 x 60	0.071	3DVAR, LSMIX
KNMI CIS	CIS pre-7.2	726 x 550 x 60	0.1	3DVAR, LSMIX
Met Eirann I10	7.2	654 x 424 x 60	0.1	4DVAR, LSMIX
Met.no 8	7.2	344 x 555 x 60	0.072	4DVAR, LSMIX
SMHI C11	7.1.2	606x606x60	0.1	4DVAR, LSMIX

Operational medium resolution HIRLAM 2011

Domain	Cycle	Size	DX (deg)	DA, BD, MISC
AEMET HNR	7.2	606 x 430 x 40	0.05	3DVAR, LSMIX, HIRLAM BD
DMI S03	7.3rc2	874 x 658 x 65	0.03	3DVAR, LSMIX, ECMWF BD
EMHI ETB	7.1.2	306 x 306 x 60	0.03	3DVAR, HIRLAM BD, **NH**
FMI MB71	7.1.4	482 x 360 x 60	0.068	3DVAR, ECMWF BD
LHMS L4	7.3	658 x 580 x 60	0.036	3DVAR, LSMIX, ECMWF BD
Met Eirann FIN	7.2	438 x 395 x 60	0.05	3DVAR, HIRLAM BD
Met.no 4	7.1.4	300 x 600 x 60	0.036	3DVAR, LSMIX, HIRLAM BD
SMHI G05	7.1.2	294 x 441 x 60	0.05	3DVAR, HIRLAM BD

Operational experiences, stability

- HIRLAM forecast has failed 28 times in total in 2010, the cause is a combination of missing boundary files from ECMWF, missing ob files and computer failures.
- Technical the system is quite stable. If there is a disturbance somewhere, as it is sometimes, there is very seldom anything in the code or the scripts in the NWP system. They normally have been run for months before going operational.
- One concern is the computing time for 4DVAR on the C11 domain and the general bad scalability of the analysis system.
- The HIRLAM system implemented on ICHEC platforms (stokes&stoney) has been extremely reliable over the past year.
- A notable feature for both Hirlam versions (7.2 and 7.3) used during 2010 has been there very good stability: the few problems that we have had have been computer hardware and system software related.

Operational experiences, quality

- Both operational Hirlam versions seem to be having some **problems with winter-time temperatures**, especially during night time (typically the temperature being too low). Several parallel tests of some cases with 7.2 (old snow treatment) have shown better results.

- Winds in the 4 km. set-up tend to get noisy over the sea, typically when more extreme wind speeds occur

- During usually cold spell during December 2010 HIRLAM proved popular for forecasting low temperatures (as low as -18C) and periods of snow the affected different areas. Forecasters particularly noted the usefulness of the HIRLAM snowfall parameters.

- As to user feedback, the previous RCR (V72) received some criticism of a decreased performance as to daily minimum and maximum temperatures during 2010. V72 was constantly outperformed by IFS. Since version 7.3 (updated Nov 2010) the performance of RCR has clearly improved. In the cold conditions during the winter period 2010/11, the V73 has shown even better quality than IFS. This result is also seen in monthly verification scores over Scandinavian domain.

- We included a fix for computing temperatures over sea ice, which were going extremely low otherwise this winter.
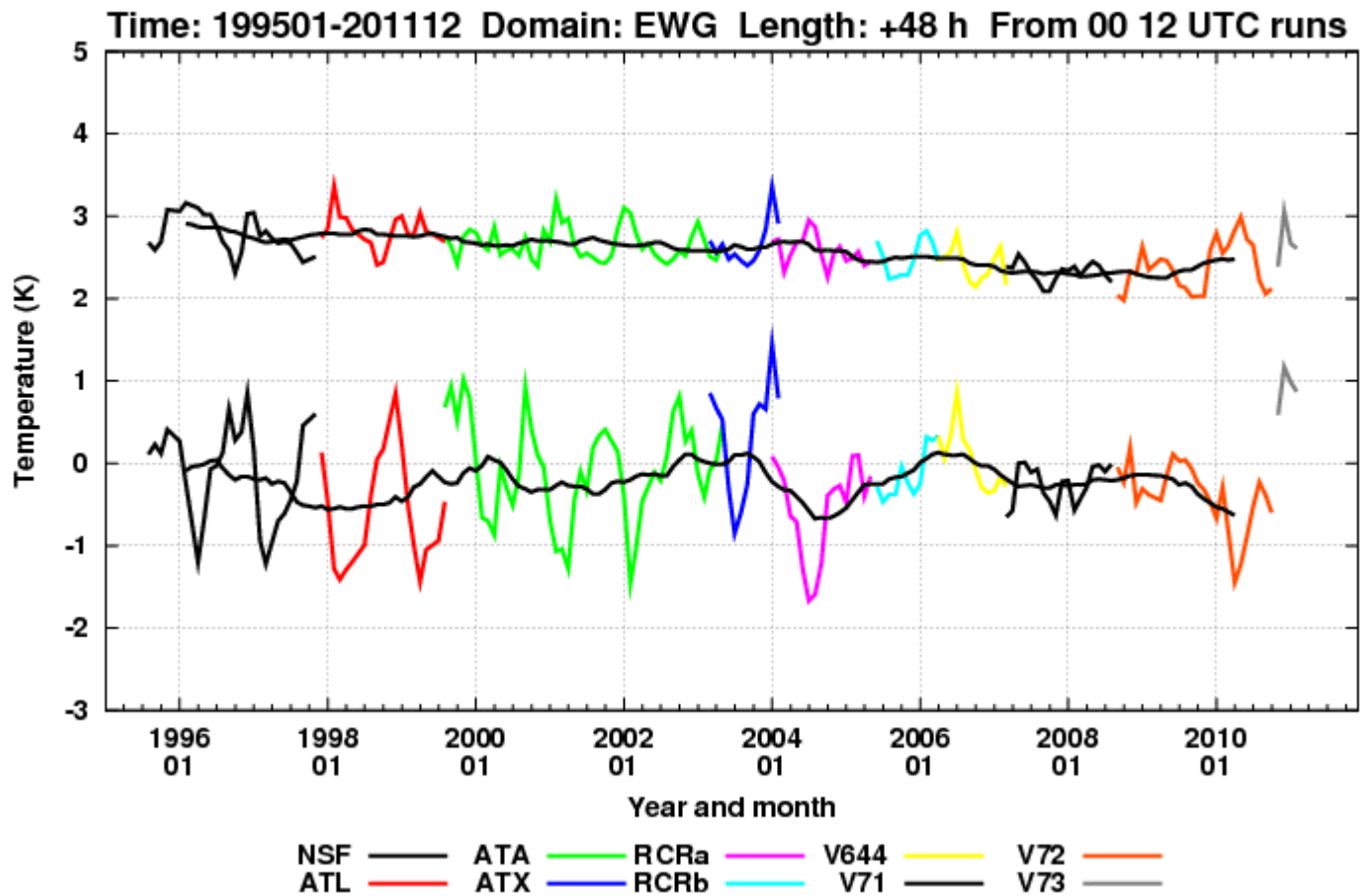
RCR statistics MSLP

Monthly bias and rms of Mean Sea Level Pressure

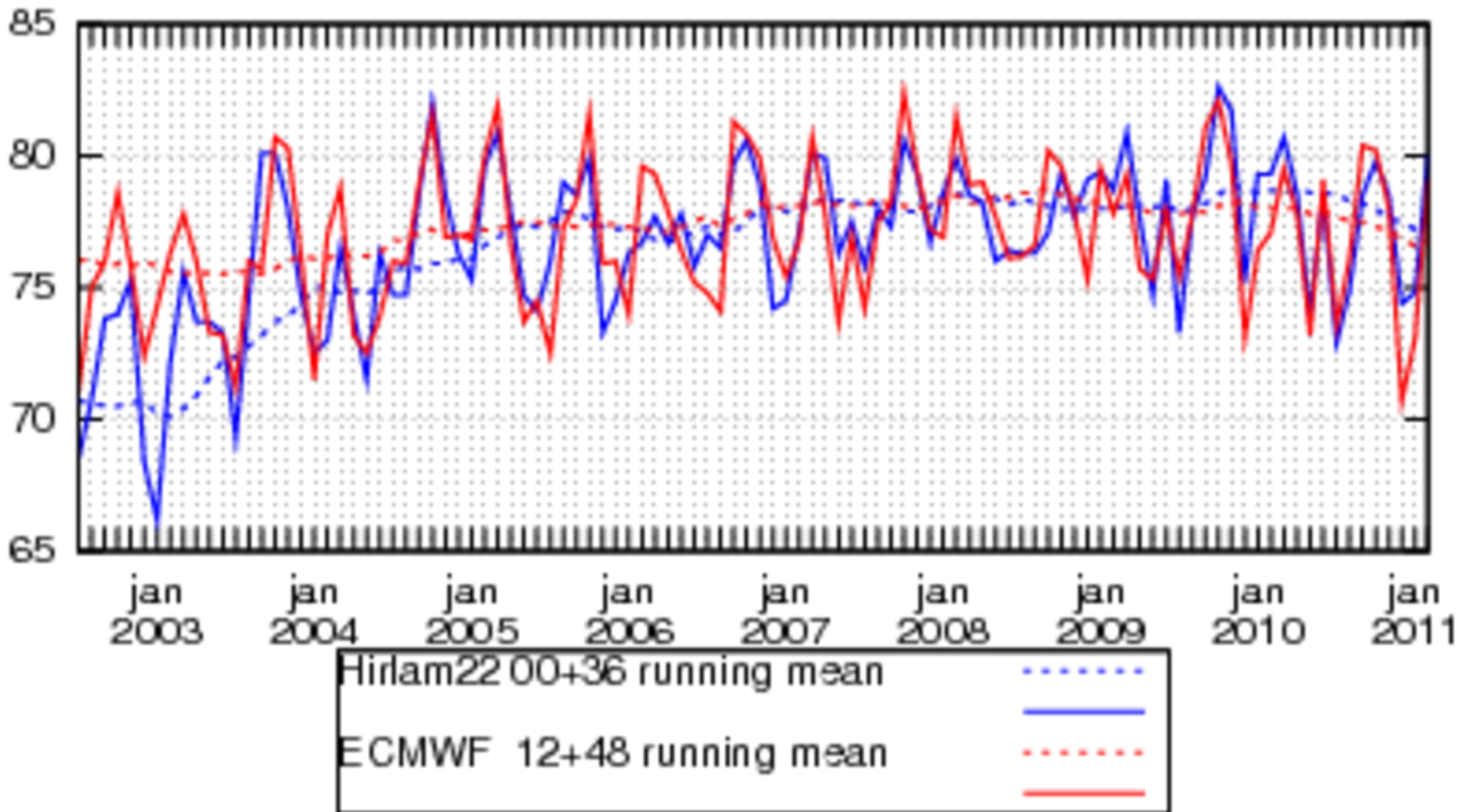Time: 199501-201112 Domain: EWG Length: +48 h From 00 12 UTC runs
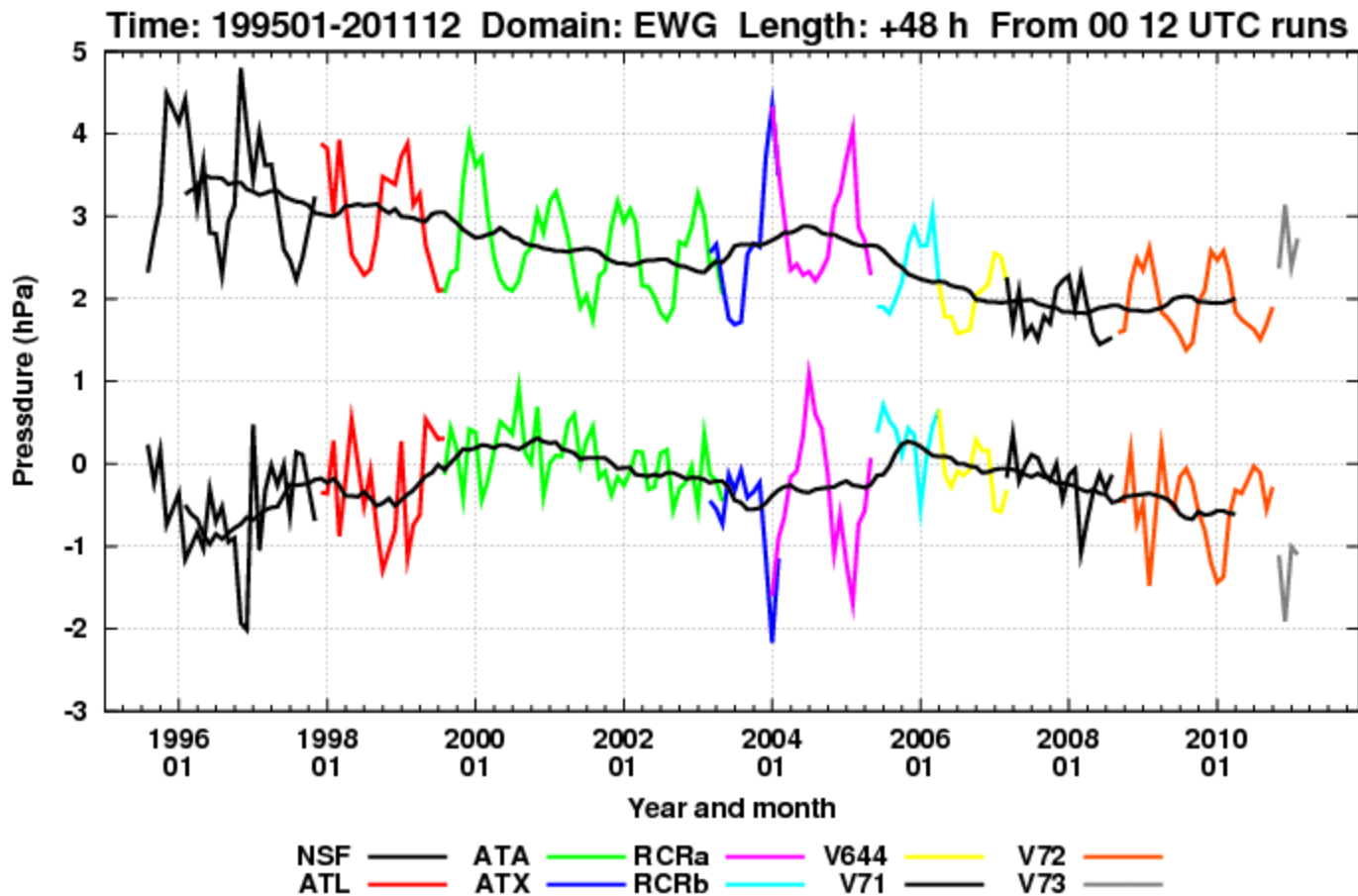
RCR statistics T2M

-

Monthly bias and rms of 2 metre temperature

Time: 199501-201112 Domain: EWG Length: +48 h From 00 12 UTC runs

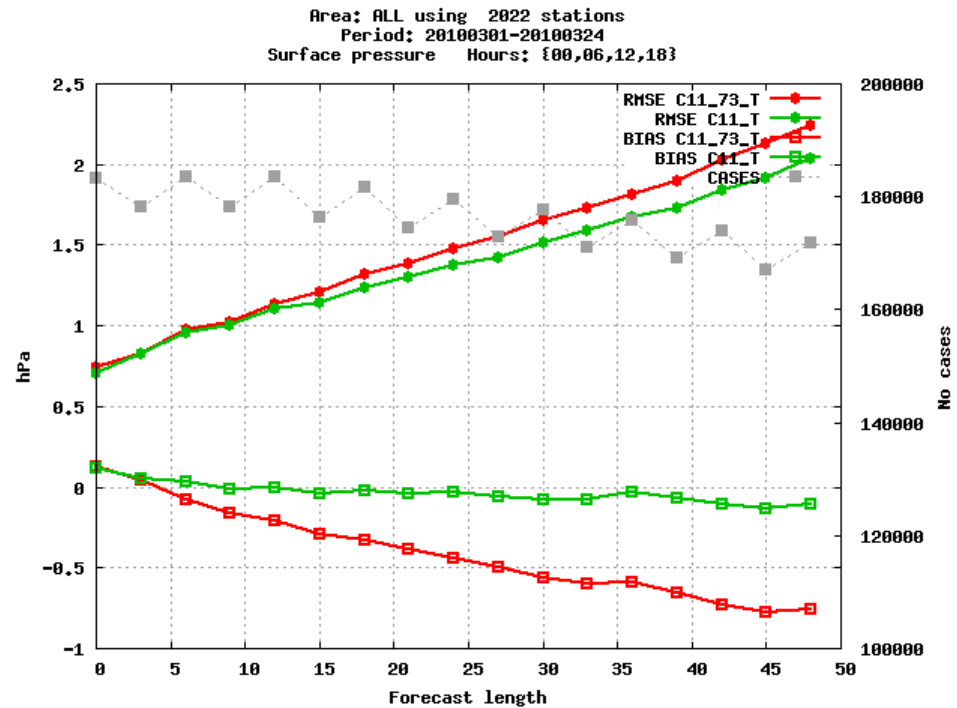# SMHI "forecast index"

ForcastIndex 20020701–20110228

About the quality of HIRLAM-7.3

Reason for SMHI disatisfaction
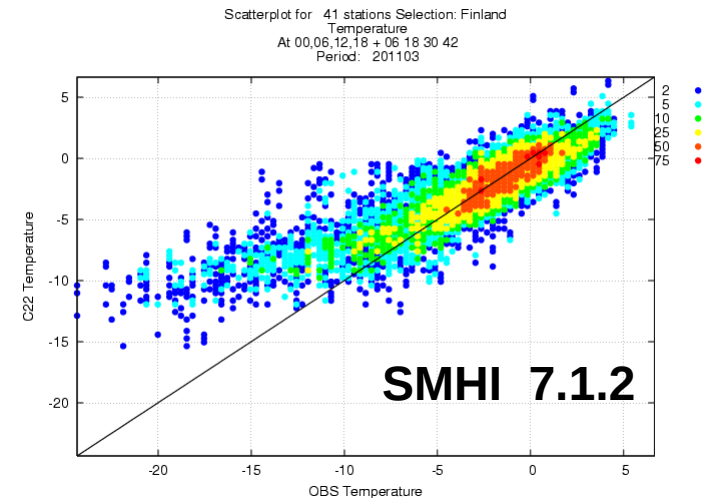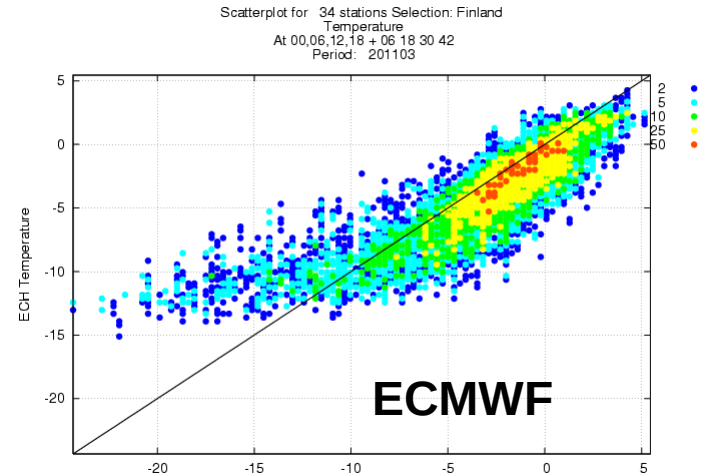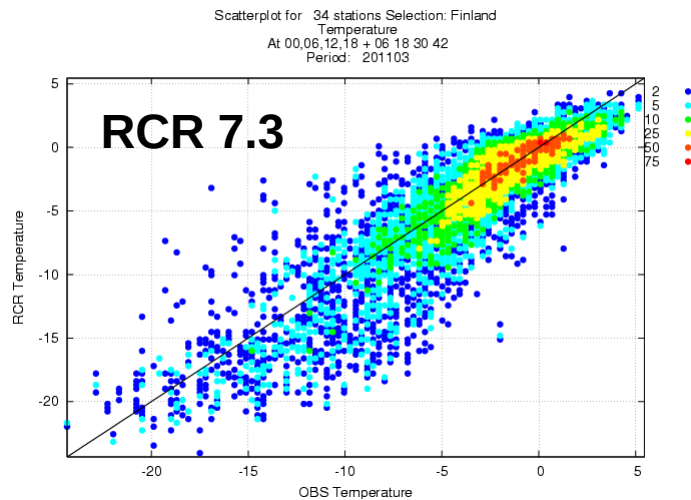
Poor MSLP scores for the relatively large C11 domain

HIRLAM 7.3
HIRLAM 7.1.2

Area: ALL using 2022 stations
Period: 20100301-20100324
Surface pressure   Hours: {00,06,12,18}

RMSE C11_73_T
RMSE C11_T
BIAS C11_73_T
BIAS C11_T
CASES

Reason for FMI satisfaction

T2M comparison between RCR (7.3), ECMWF and SMHI C22 (7.1.2) for March 2011 over Finland

Scatterplot for 34 stations Selection: Finland
Temperature
At 00,06,12,18 + 06 18 30 42
Period: 201103

ECMWF

Scatterplot for 34 stations Selection: Finland
Temperature
At 00,06,12,18 + 06 18 30 42
Period: 201103

RCR 7.3

Scatterplot for 41 stations Selection: Finland
Temperature
At 00,06,12,18 + 06 18 30 42
Period: 201103

SMHI 7.1.2

HIRLAM Releases (Courtesy Xiaohua et.al.)

- 7.3 (2 Nov 2010)
    - Modified surface scheme with improved parameterisation of surface processes, e.g. that of snow and forest
    - Multi-loop multi incremental 4D-VAR minimisation
    - Modified physical parameterisation, such as those for Kain Fritsh Rasch Kristjansson condensation scheme
    - Parameterisation of meso-scale and subgrid scale orographic impacts (MSO-SSO)
    - Extended use of remote sensing data, with AMSU-A from Noaa 15/16/18 (default), from NOAA 19, Metop 2(optional), AMSU-B/MHS from Noaa 16/18, from NOAA 19, metop 2(optional), AMV (Meteosat 8, optional), ASCAT (optional), Radar RadiaWind? (optional), Ground-based GPS (optional), Ocean Sea-Ice SAF data (optional)   * Update in background error statistics, tuning in scaling of background error, observation error and bias correction data for ATOVS
    - Modification related to ensemble forecast, hybrid data assimilation
    - System overhaul, cleaning, new utilities, bug fixes
- 7.4 (still in alpha mode)
    - RCR domain with increased resolution in horizontal and vertical,
    - Parameterisation the fresh lake scheme Flake.

Remember the different(?) HIRLAM domains (figure from 2010)
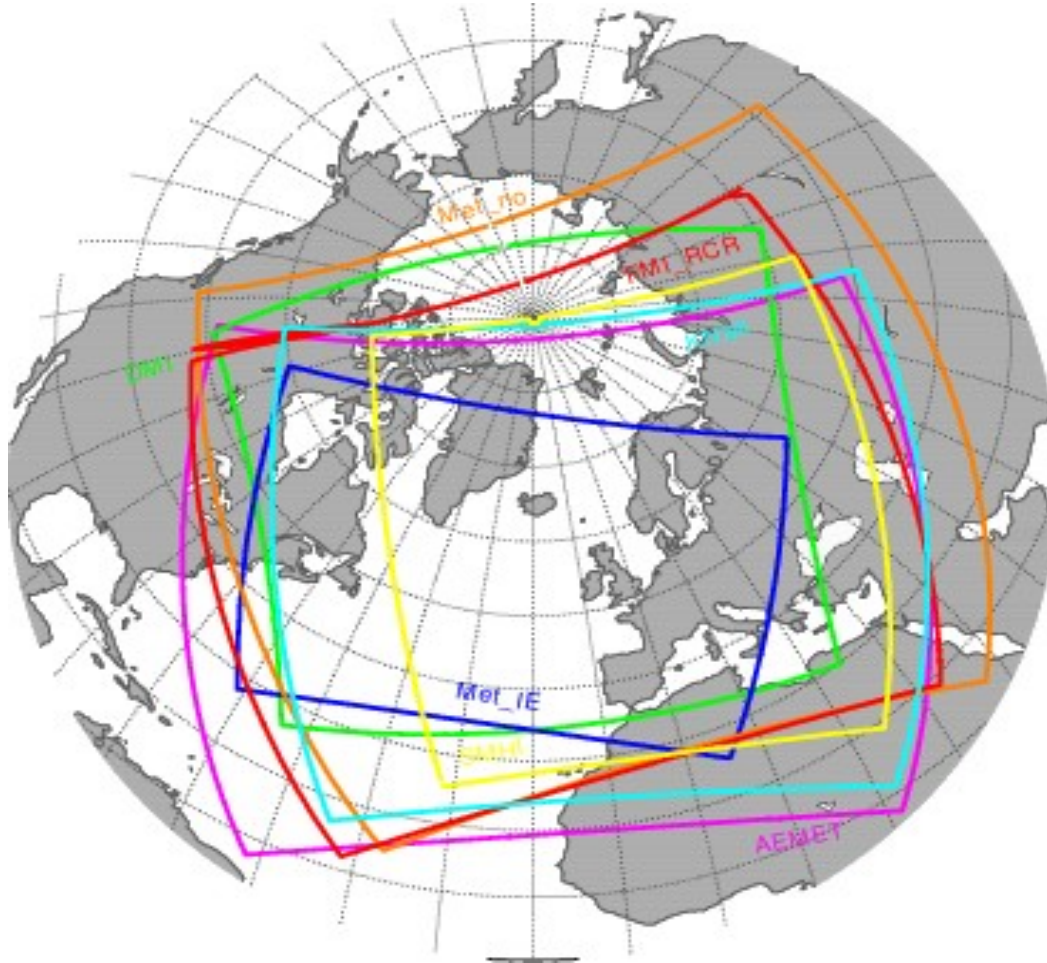
HARMONIE DOMAINS

AEMET
DMI
FMI
KNMI
Met Eirann
met.no
SMHI
Veðurstofa

Pre-operational HARMONIE 2011
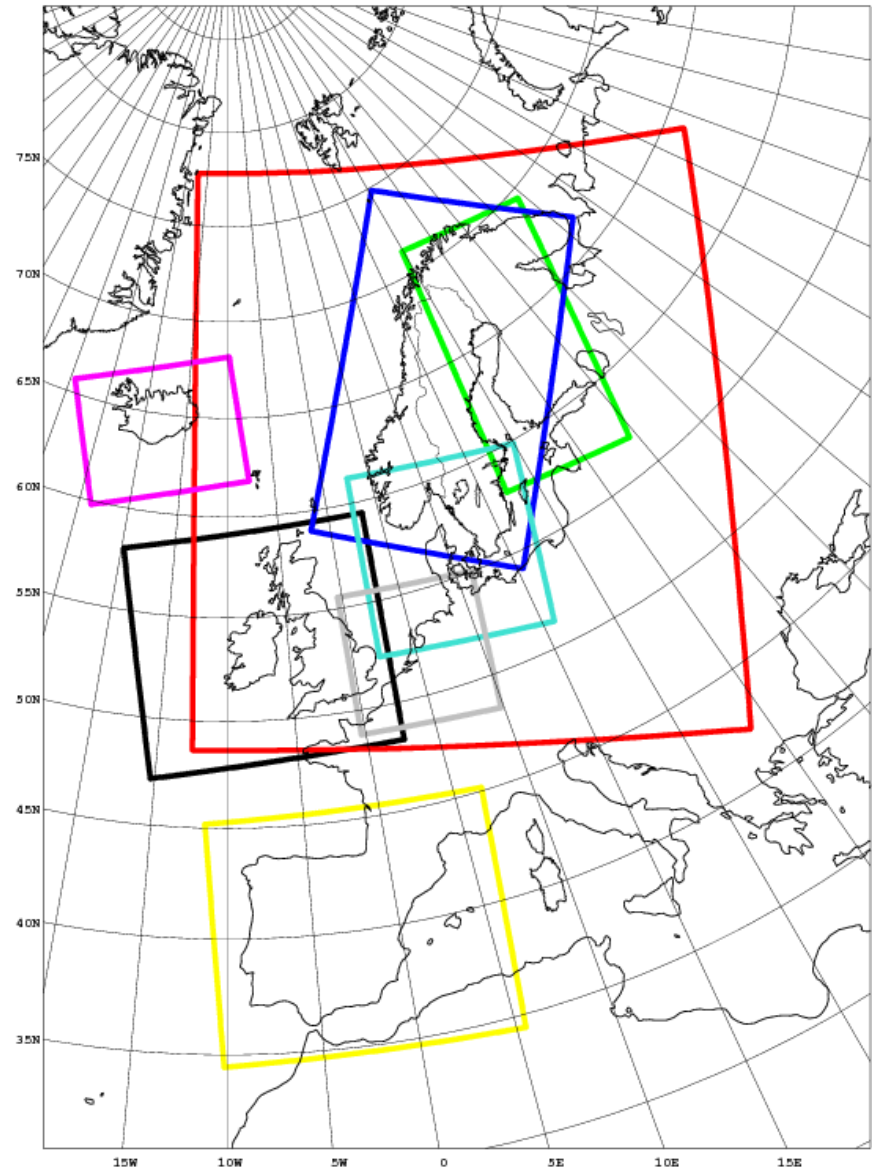
Domain	Cycle	Size	DX	MODEL	DA	COMMENTS
AEMET	36h1.3	384 x 400 x 60	2.5km	AROME	Downscaling or 3DVAR (two suites	3h HIRLAM 16km LBC
DMI	36h1.3	384 x 400 x 65	2.5km	AROME	3DVAR CANARI OI_MAIN	3h ECMWF LBC
FMI	35h1	300 x 600 x 60	2.5km	AROME	Downscaling	1h HIRLAM 7.5km LBC
KNMI	36h1.2	300 x 300 x 60	2.5km	AROME	3DVAR CANARI OI_MAIN	12h cycling Runs at ECMWF
Met Eirann	36h1.3	540 x 500 x 60	2.5km	AROME	BLENDING CANARI OI_MAIN	HIRLAM 10km LBC
Met.no	36h1.1	300 x 500 x 40	4km	ALARO NH SURFEX	BLENDING CANARI OI_MAIN	HIRLAM 8km LBC
SMHI	36h1.3	506 x 574 x 60	5.5km	ALARO SURFEX	3DVAR CANARI OI_MAIN	3h ECMWF LBC
Vedurstofa	36h1.3	360 x 288 x 60	2.5km	AROME	Downscaling	3h ECMWF LBC

Harmonie comments

- One problem with Arome has been that most of its run time is taken by I/O, in spite of high degree of parallelisation.

- Crash due to missing observations

- Crash due to erroneous date in observations (oulan/bator?)

- User feedback is limited, although the HARMONIE run leads to much discussion (mostly among researchers) about effects visible and their relevance for the "real" weather.

- Used by forecasters as guidance but not for products

HARMONIE CYCLES

- 36h1.3 (**23 December 2010**)

- 36h1.4 (before summer)
  - EDMFM bugfixes
  - ECPHY option
  - GRIB2 reading for ECMWF boundaries (gl_grib_api)
  - Correction about surface drag in AROME
  - LNOEXTZ available for testing
  - OI main updates of snow/SST/lakes
  - Various monitor updates
  - Various system updates

- 37h1 (alfa version before summer?)
  - 36h1.4
  - SURFEX v6, Optimized, OpenMP
  - TOUCANS
  - Cellular automata
  - Optimizations, OOPS preparations
  - Arpege simplified physics updates
  - Dyn-phys couplings

- 37t2 (Phasing in May/June, still open
  - SURFEX v7

Adaptation to ECMWF GRIB2 migration

ECMWF will stop dissemination of GRIB1 model level fields in May. For HIRLAM we have three options

grib_set

A grib_api tool that works for both HIRLAM and HARMONIE as long as ECMWF does not increase the number of levels.

gribconv

GRIB2 <-> GRIB2 for HIRLAM. Handles reduction of levels if the number exceeds 126.

gl_grib_api

Rewriting of gl (LBC generator for HARMONIE) using grib_api. Handles both GRIB1 and GRIB2

Wiki page about the progress

https://hirlam.org/trac/wiki/GRIB2
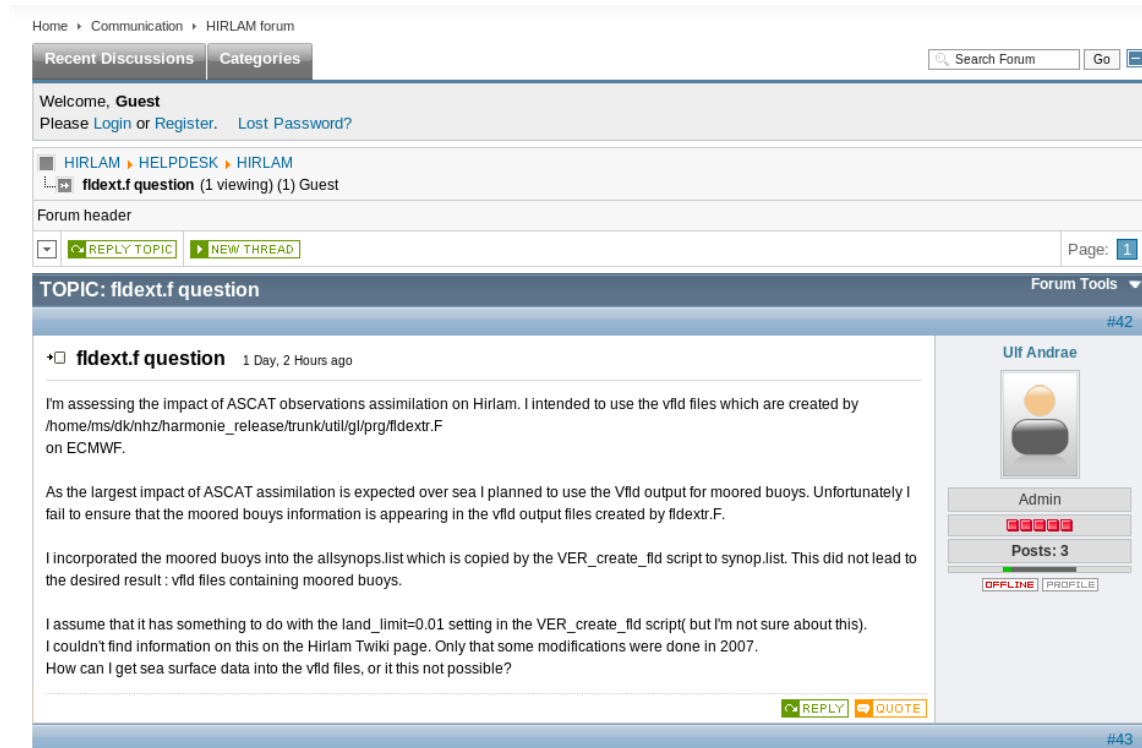
Please update your progress:

Country	Date of switch	Method
Norway	February	grib_set
Ireland	pre-oper testing	grib_set

HIRLAM/HARMONIE HELPDESK

SMHI

- Public open forum
- Monitored by "onduty" team
- Better feedback on your questions!

Please use it!

HIRLAM.ORG updates

- Another try on the bug reporting system

- Multi repository
    - HIRLAM/HARMONIE under subversion
    - GLAMEPS under GIT
    - Why not OOPS?

Thanks for your attention
Questions?