

Operational HIRLAM at DNMI

Ole Vignes, May 2001

Model version

The model used is still the norwegian parallel version of HIRLAM 2.7, with semi-Lagrangian advection, 6th order implicit horizontal diffusion and Sundqvist condensation. The model grids are listed in Table 1, and the areas covered are shown in Fig. 1.

Name	Resolution	Grid	Boundaries
HIRLAM 50	0.5°	188x152x31	EC/UK 1.5° surface/2.5° upper air
HIRLAM 10	0.1°	224x324x31	HIRLAM 50
HIRLAM 5	0.05°	152x150x31	HIRLAM 10

Table 1: Operational HIRLAM model grids

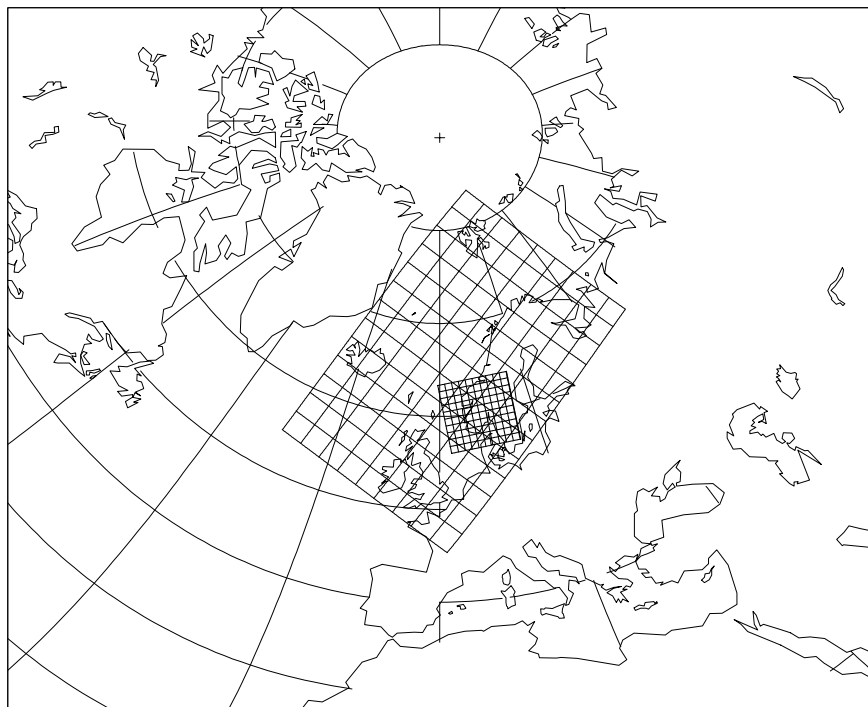


Figure 1: Areas covered by HIRLAM 50, HIRLAM 10 and HIRLAM 5

Analysis

The NORANA SC/OI code was replaced by 3D-Var (HIRVDA 4.3.1) on December 7, 2000, after a parallel test period of 6 weeks. During the test period 3D-Var verified equally good or better for all variables. We use analytical nonseparable structure functions with statistics generated at SMHI, but without seasonal scaling.

Analysis is only done on the 0.5° grid. Initial conditions for HIRLAM 10 are interpolated from HIRLAM 50, and initial conditions for HIRLAM 5 are interpolated from HIRLAM 10. Only conventional data are assimilated in the operational run. In a parallel experiment run, ATOVS data from NOAA-15 are also assimilated, so far with neutral impact.

Model output

The 0.5° model is now run up to +60h. The increase from +48 to +60h is mainly in order to produce input to a nuclear accident program (SNAP). HIRLAM 10 and HIRLAM 5 are run up to +48h as before. MSLP, T2m, precipitation and 10m winds are written out each hour. 6 fields on 15 pressure levels, and 8 fields on 31 model levels are written out at 0, +3, +6, +9, +12, +18, +24, +30, +36, +42, +48h (+54 +60h).

Hardware

All the operational code is run on the Cray T3E located at NTNU, Trondheim. 84 nodes with 128Mb each are utilized for the operational runs. Work is in progress to move to a new SGI Origin 3800 at NTNU with 220 nodes and 220 Gb shared memory. This is urgent, since the T3E will go out of maintenance only 3 months after the Origin 3800 is accepted as “stable”.

Operational schedule, T3E

The operational schedule is as given in Table 2. Note that HIRLAM data are also used to force various ocean and wave models.

UTC	Model	Min.	Comment
00	HIRLAM 50km	11	+60h
	WAM 75km	5	Wave model, HIRLAM+EC forcing
	ECOM3D 20km	8	Ocean model, HIRLAM forcing
	HIRLAM 10km	35	+48h
	MM5, 3+1 km	105	City air quality (winter)
	HIRLAM 5km	25	+48h
	HIRLAM 50 EXP	30	12r*+6h,18+6h,00+48h: ATOVS assim. in 3D-Var
	WAM 8km	6	HIRLAM forcing
	ECOM3D 4km	70	HIRLAM forcing
06	HIRLAM 50	25	00r+9h, 06+60h
12	HIRLAM 50	11	+60h
	WAM 50km	2	
	ECOM3D 20km	6	
	HIRLAM 10	35	+48h
	HIRLAM 5	25	+48h
	HIRLAM 50 EXP	22	00r+6h, 06+6h: ATOVS assimilation in 3D-Var
18	HIRLAM 50	22	12r*+6h, 18+60h

Table 2: Operational schedule winter 2000/2001

The “r” runs are reruns with more observations (longer cut-off) in the assimilation. The * on the 12r runs means that these runs use EC 12 as background field in 3D-Var. While not entirely satisfactory from a theoretical point of view, this was shown to give better verification scores in a parallel run in December/January.

Plans

The most urgent task is to move the operational schedule to the new SGI Origin 3800. At the same time we will upgrade to version 5.0 of the reference system, and start to use frames for boundaries. With so many simultaneous changes it is hard to measure the impact of the new version (5.0 vs. 2.7) compared to the impact of boundaries with better resolution in space and time. This is unfortunate, but the strategic decision has been made to move to the reference system, and there is little reason to delay the use of frames now that they are available.

Plans in more detail:

- Introduce 3D-Var in HIRLAM 5.0, set up quasi-operational schedule and compare with operational 0.5° model.
- Test “FRAMES” as boundaries in HIRLAM 5.0 (OK).
- Implement DNMI improved parameter fields (SST, snow, ice in GRIB).
- Test ISBA when it is available in HIRLAM 5.1.
- Replace preliminary version of 3D-Var with the reference version when available in HIRLAM 5.3.
- Move all operational models from T3E to SGI (urgent).
- Work on computational efficiency on SGI, look at I/O issues, ...
- Try out 0.2° horizontal resolution and 40 levels on the same area as the current 0.5° grid.
- Test a 0.05°-0.1° HIRLAM nested into the new 0.2° model. Test further nesting of “some suitable model” on a 0.03° grid covering all of Norway. [2002]
- Operational models on the new resolutions? [2003]