SMHI NWP modelling – operations, development and research

Main Operational HIRLAM runs

4 analyses and forecasts per day. 00, 06, 12, 18

HIRLAM C 11km – 4D-VAR 2 loop LSMIX +48 h
2 hours data cut-off
HIRLAM E 11 km – 3D-VAR no LSMIX+72 hours
1 hour 15 min data cut-off
ECMWF rotated HIRLAM grid boundaries for both
ECMWF GTS -> BUFR obs preprocessing
SYNOP,SHIP,TEMP,PILOT,
BUOY,AIREP,AMDAR
BUFR AMDAR
ATOVS AMSU-A radiances – EARS

Other operational and semi-operational HIRLAM

4 analyses and forecasts per day

HIRLAM C 22 km 4D-VAR LSMIX + 48 hours
Still used as optional tool
HIRLAM G 05 km 3D-VAR + 24 hours
Used for certain products
HIRLAM E 05 km + 48 hours
Experimental and HIRLAM 7.3

HARMONIE pre-operational runs

4 analyses and forecasts per day

ALARO E 5.5 km 3D-VAR + 36 hours

Same conventional BUFR observations
More satellite data used (NOAA18, 19, METOP)

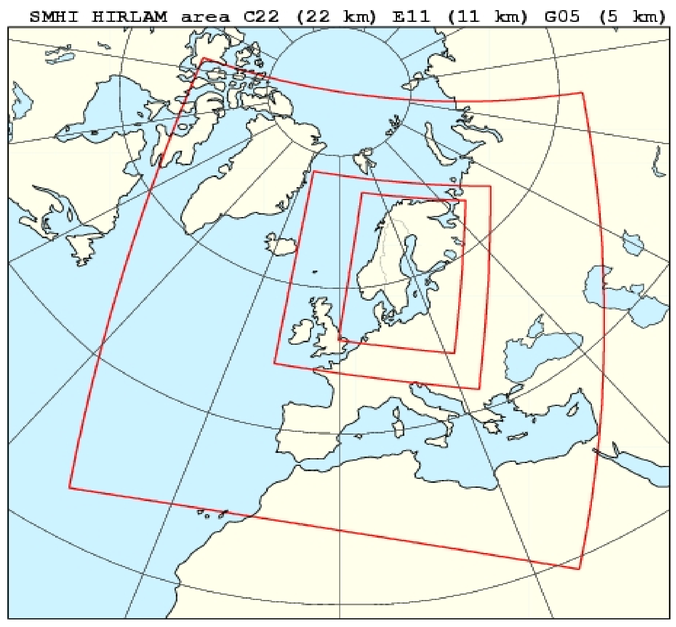
AROME 2.5 km 3D-VAR + 24 hours
G area (for MetCoOp)
CY 36h1.3 -> 36h1.4
3D-VAR (MetCoOp)
Surface data assimilation

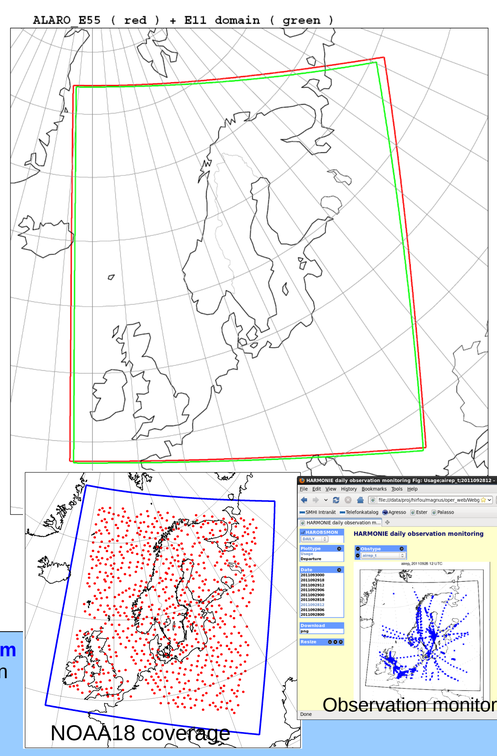
HARMONIE research runs

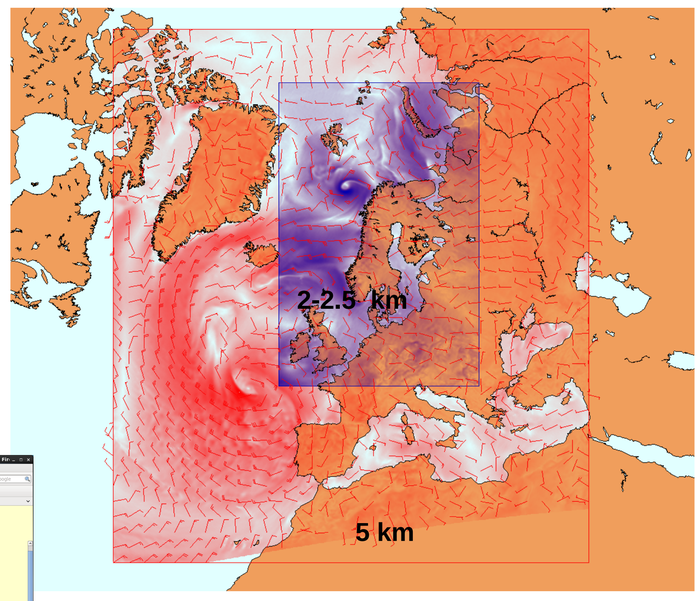
4 analyses and 2 forecasts per day September-April (cold climate potential icing)

AROME 2.5 km + 24 hours twice a day
Sweden – Norway
AROME 1 km + 24 hours twice a day

Interpolated HIRLAM E11 initial conditions
Or 3D-VAR (MetCoOp)
Surface data assimilation

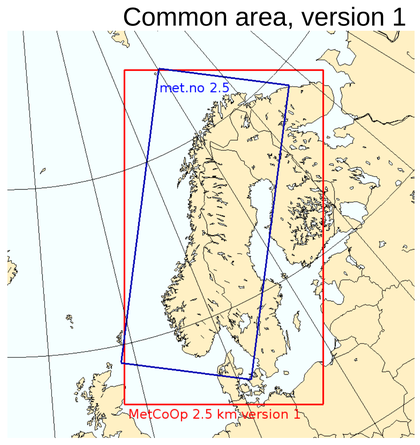






Operational co-operation for common NWP production with met.no - MetCoOp

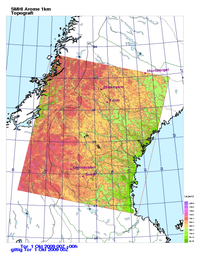
Common area, version 1



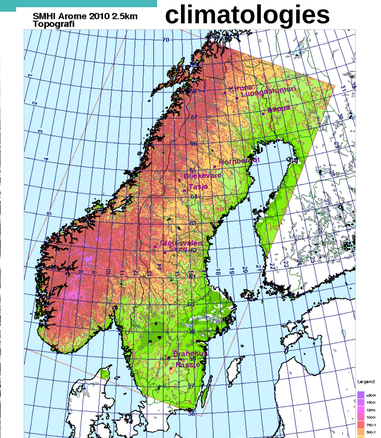
MetCoOp proposed operational areas

Version/res	status	gridpoints	levels	timestep	Assimilation	Boundaries
C22	Old oper	306x306	40	600-450	4D-VAR	ECMWF
C11	New oper	606x606	60	300 s	4D-Var	ECMWF
E11	Oper	256x288	60	150 s	3D-Var	ECMWF
G05	Limit oper	294x441	60	150 s	3D-Var	HIRLAM
E05	pre-oper	506x574	60 (->65)	150 s	3D-Var	HIRLAM
ALA 05	pre-oper	540x600	60	150 s	3D-Var	HIRLAM
ARO 02	New test	540x900	65	60 s	3D-Var	HIRLAM

1 km AROME



2.5 km AROME For local mapping of icing on wind turbines aiming for climatologies



HIRLAM system
Based on HIRLAM version 7.1.2

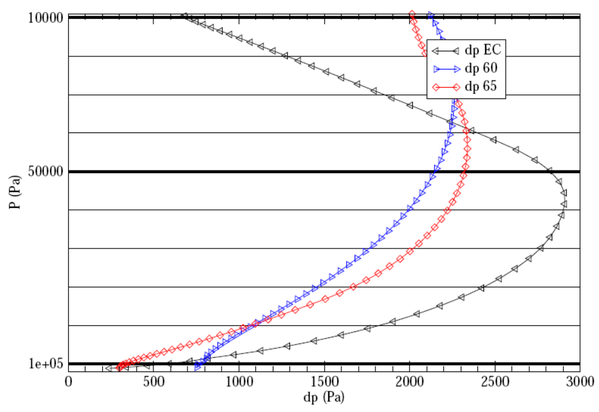
Large Scale Mixing (LSMIX)
4DVAR on C11-domain. 2 outer loops.
3D-VAR FGAT on E05-domain
Incremental DFI (initialisation)
ISBA (surface scheme)
moist CBR (turbulence)
Kain-Fritsch from CAM3 (covnvection)
Rasch-Kristjansson (large scale)

Parallel run next HIRLAM system
Based on HIRLAM 7.3 or 7.4 soon

Meso-scale sub scale orography
New snow and soil scheme
RTTOV-8 and more satellites
4D-VAR optimisations
65 levels in 7.4 !

4DVAR – operational since 2008013006

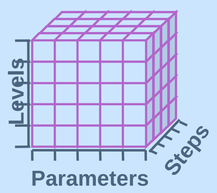
3 (or 2) dx linear grid (66 or 33 km grid)
SL, SETTLS
vert. diff. + large scale cond. Linerised simplified physics
weak digital constraint
linear propagation off assimilation increments
statistical balance background constraints
2 outer loops
NOW developed and performs in ALADIN / ALARO



65 and 60 levels in HIRLAM, 91 for ECMWF
Layer thickness in Pa per level, note good ABL resolution for 65 levels

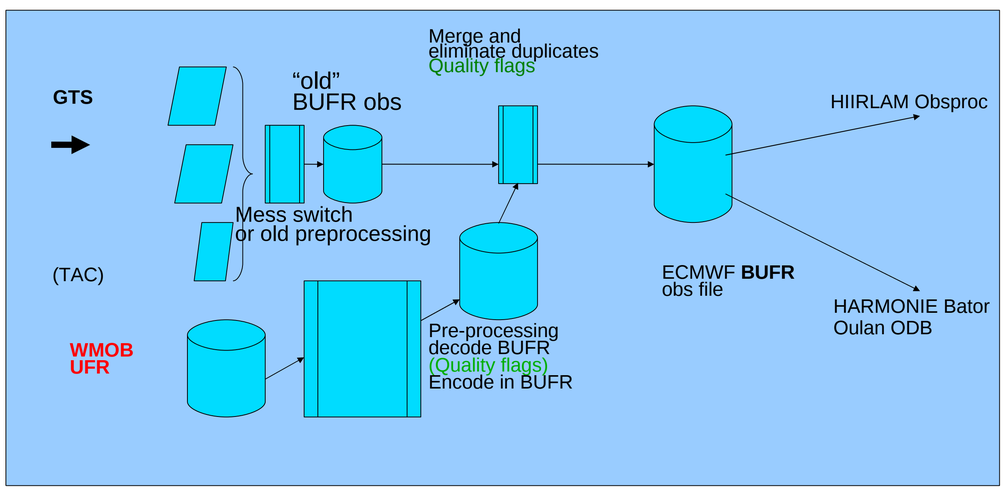
Holooptics and Ice Monitor

Retrieve,
date = 20070901/to/20070915,
parameter = temperature/geopotential,
type = forecast,
step = 0/to/48/by,
levels = 1000/850/500/200,
area = -10/20/10/0



MARS

SMHI implementation of ECMWF MARS @NSC.liu.se
Linux servers, discs and tape robots
Co-operation and merge with ECMWF



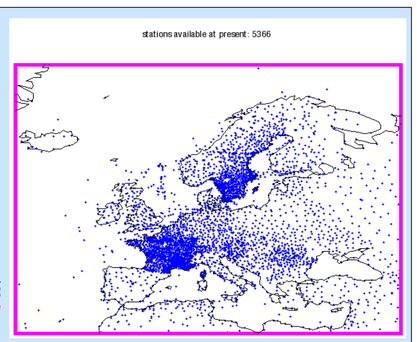
EURO4M

Re-analysis with HIRLAM 3D-Var (60 lev, 22 km) 1989-2010, 1961– 1989

Re-analysis with MESAN 2D-OI (5 km) 1961 – 1989 – 2010

Develop (with MF) new spatialization tool based on CANARI and MESAN

SMHI METEO FRANCE Toujours un temps d'avance

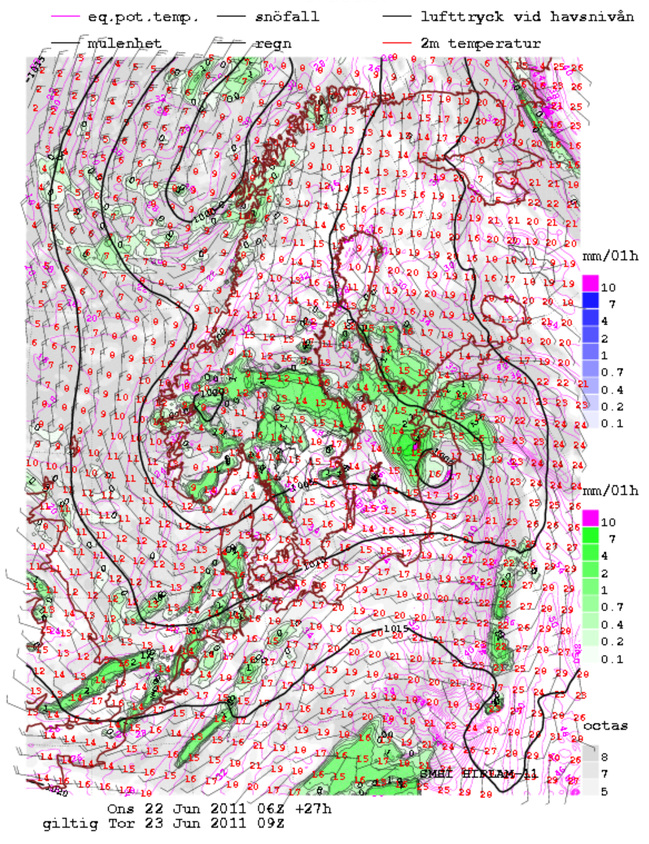


Plans:

- Intensive work for common production with met.no, MetCoOp
- Upgrading HIRLAM models to 7.4 with 65 levels (gives better ABL performance) and introduce more AMSU-A data and AMSU-B, MHS
- Trials of new pre-processing system with HIRLAM
- Corrections and upgrade of ALARO to 36h1.4
- Attention to snow and lake issues with ALARO – soil assimilation improvements even before EKF is in place
- Blending to be introduced
- HARMONIE ensemble assimilation background error statistics , seasonal dependence
- Introduce ALARO-1
- Continue 4D-VAR development and compare Rapid Update Cycle
- Hybrid assimilation and ETKF in HARMONIE
- Making ALARO real operational (until 2012, 2013 until MetCoOp 2014)
- Work on AROME for the common area
- AND: Co-ordination with met.no research throughout the period

BYVIND cabinets

Example of ALARO 5.5 km real time forecast



Computer systems at SMHI (Norrköping) and NSC(Linköping) www.nsc.liu.se

NSC

BYVIND – dedicated to operational models NWP, oceanograhic and dispersion models

- Linux
- 2 system nodes
- 140 computing nodes
  1 node – 2 INTEL X5550 processors
  each with 4 cores. 2.66 GHz and 3GB memory
- 1120 cores
- InfiniBand QDR
- IntelMPI, OpenMPI, OpenMP
- Intel compilers

BORE for backup and research

- Linux
- 70 nodes
- Intel Harpertown 2.8 GHz, each with 8 cores
  16 GB memory
- InfiniBand interconnect
- ScaMPI, OpemMP
- Intel compilers
- CentOS 5
- **25 nodes available to met.no for backup**