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 real-time 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)

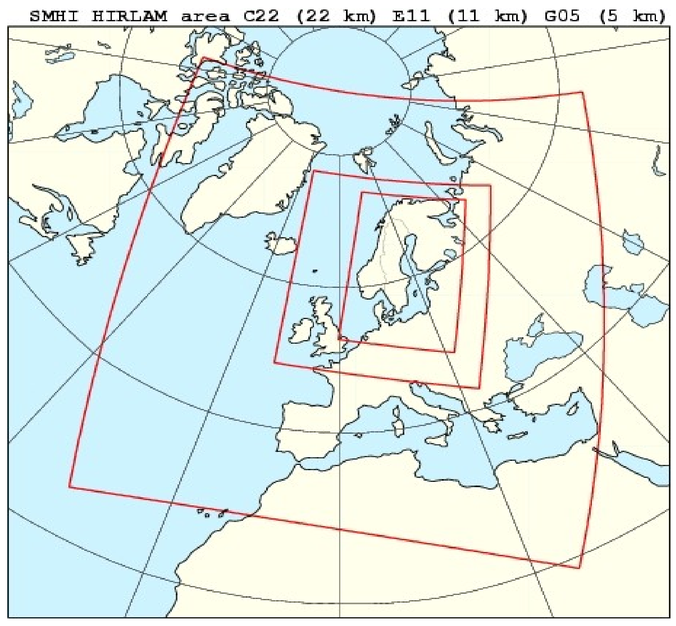
AROME 2.5 km 3D-VAR + 36 hours
G area (for MetCoOp)
CY 37h1.1
3D-VAR (MetCoOp)
Surface data assimilation

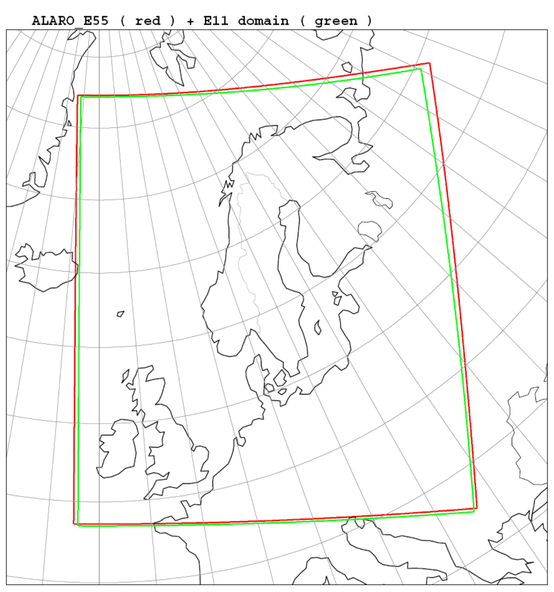
HARMONIE research runs

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

AROME 2.5 km + 36 hours
Sweden – Norway
AROME 1 km + 36 hours

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





MetCoOp proposed operational areas

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

Domains used so far

V1: first setup – daily runs on "byvind"
540x900 gridpoints

V2: second setup – daily runs on "byvind"
750x960 gridpoints

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 (convection)
Rasch-Kristjansson (large scale)

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

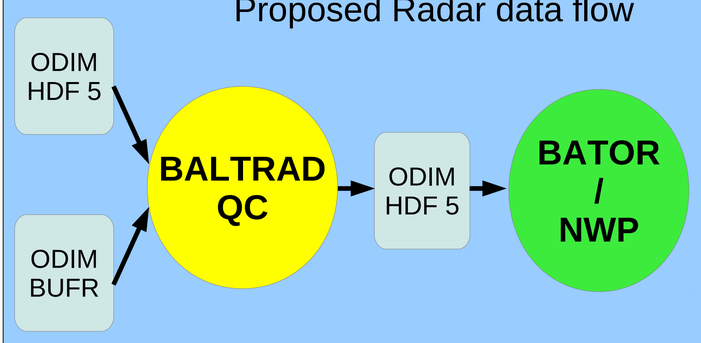
Meso-scale sub scale orography
New snow and soil scheme
RTTOV-8 and more satellites
4D-VAR optimisations
65 levels in 7.4 !

4DVAR
operational since 2008013006

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

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	65	150 s	3D-Var	HIRLAM
ALA 05	real-time	540x600	60	150 s	3D-Var	HIRLAM
ARO 02	New test	750x960	65	60 s	3D-Var	HIRLAM

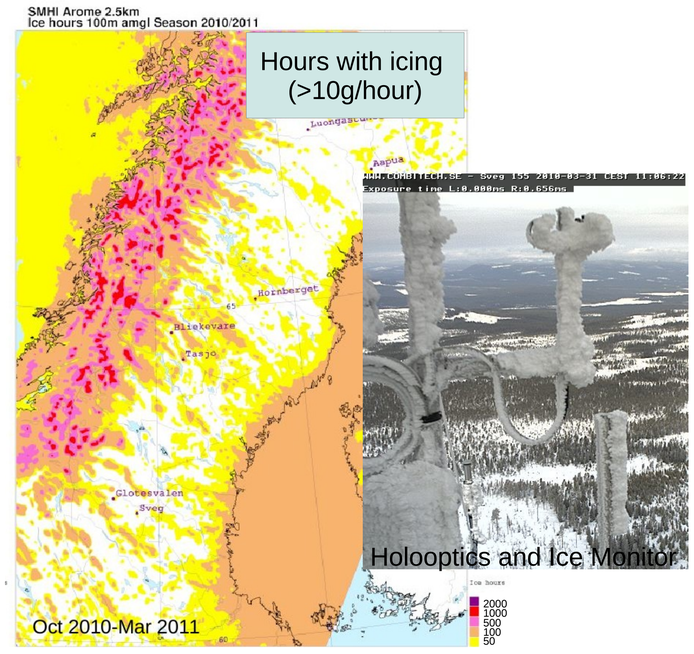
Proposed Radar data flow



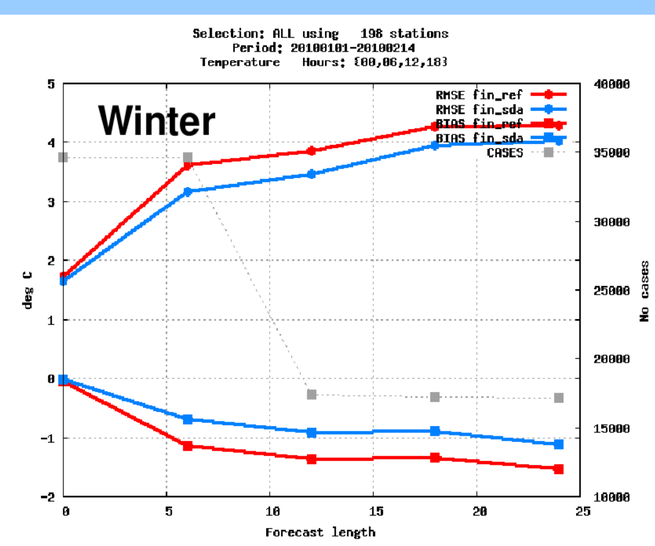
- Harmonie development for Radar pre-processing
- BALTRAD -> OPERA
- simplified data flow and unified pre-processing
- prepare BATOR for multiple Radar sources

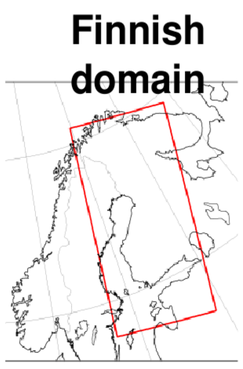
Plans

- Intensive work for common production with met.no
- Attention to highly resolved physiography
- Examine Jk-term and LSMIXBC in AROME 3d-var
- Continue 4D-VAR development and compare with Rapid Update Cycle in HARMONIE
- Coordinated impact study for additional obs data (GNSS, radar, IASI)
- Hybrid assimilation and ETKF in HARMONIE
- ETKF for GLAMEPS
- Stochastic physics in ALARO and AROME, e.g. cloud fraction
- Statistical post-processing



Surface data-assimilation in AROME



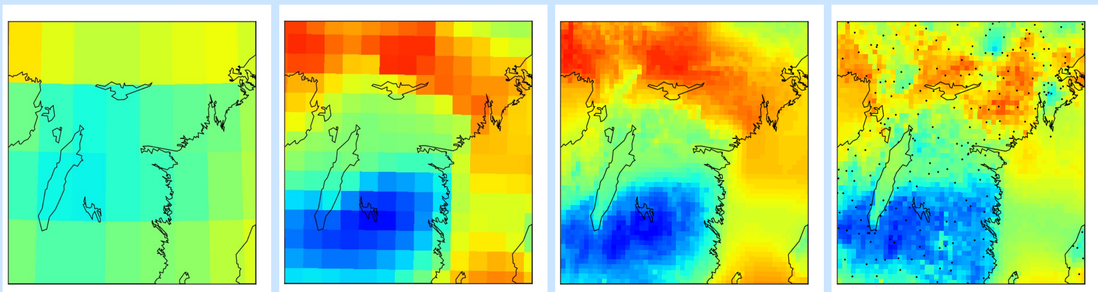


Reference
Tuned

EURO4M

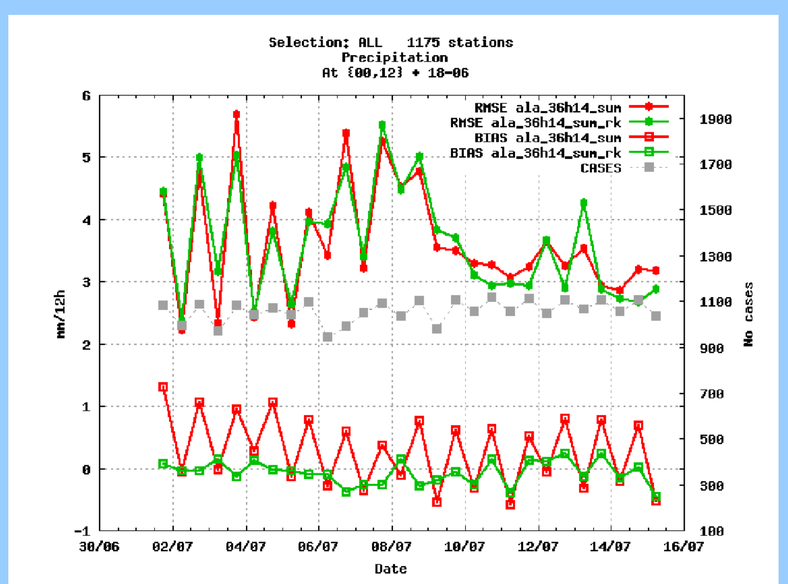
European Reanalysis and Observations for Monitoring

Re-analysis with HIRLAM 3D-Var (60 lev, 22 km) -> MESAN 2D-OI 1961 - 1989 - 2010
Develop (with MF) new spatialization tool based on CANARI and MESAN



SMHI
METEO FRANCE
Toujours un temps d'avance

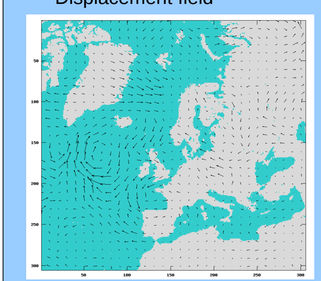
Rasch-Kristjansson condensation scheme in ALARO



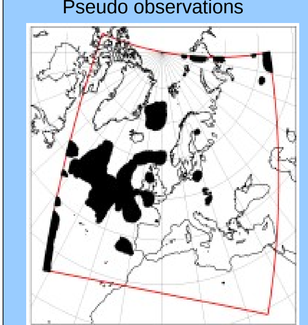
Available from cycle 37h1

Handling of phase errors with Warping and pseudo-observations

Displacement field



Pseudo observations



- use SEVIRI data to calculate displacement field between observations and model background
- Introduce displacement as pseudo-observations in 3D-var to modify background
- Then, standard 3D-var