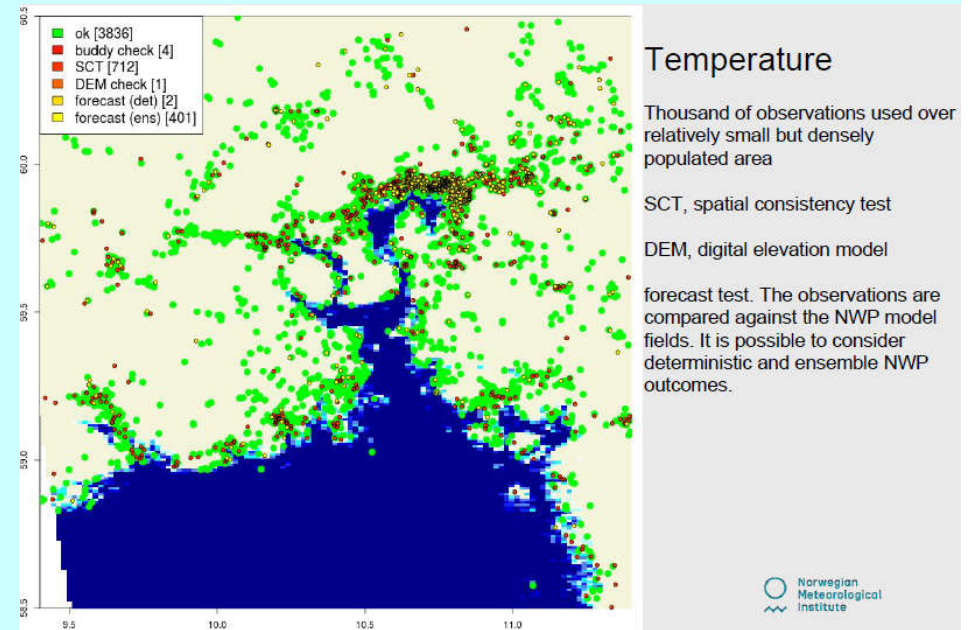# HIRLAM activities; an overview

Jeanette Onvlee

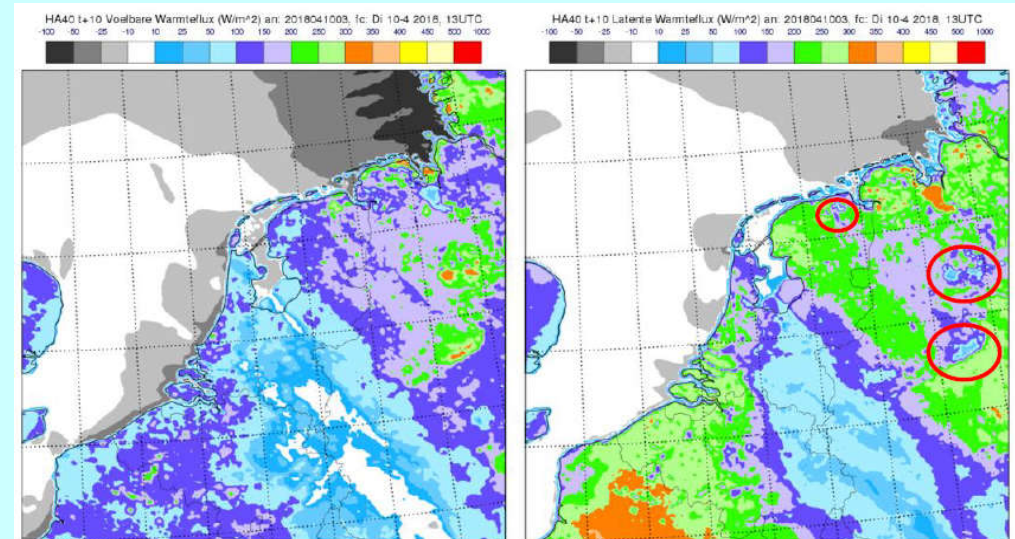EWGLAM Meeting, Salzburg, 01/10/2018

Towards optimal use of high-resolution observations and flow-dependent assimilation, also in nowcasting range

- 4D-Var multiple outer loop version, coupled to full range of "operational"observations, optimizing computational performance

- Implementation and sensitivity/validation studies with LETKF and hybrid 3/4D EnVar

- Assimilation setups for nowcasting

- New observations: GNSS slant delays, cloudy radiances, amateur weather stations, smartphones, preparations for next generation satellites

- Re-analysis activities (e.g. CARRA)

- Testing observation preprocessing with SAPP

Legend:
- ok [3836]
- buddy check [4]
- SCT [712]
- DEM check [1]
- forecast (det) [2]
- forecast (ens) [401]

Temperature

Thousand of observations used over relatively small but densely populated area

SCT, spatial consistency test

DEM, digital elevation model

forecast test. The observations are compared against the NWP model fields. It is possible to consider deterministic and ensemble NWP outcomes.

Norwegian Meteorological Institute

Forecast model

- Convection-related problems

  - Problems with severe convection due to several causes

  - Short-term corrective actions in Cy40h1.1

    - surface evaporation/ assimilation

    - activeness shallow convection, turbulence

    - cloud microphysics.

- Aerosol: Sea salt, sulphate implemented in radiation parametrization; Impact small but positive when significant aerosol are present

HA40 t+10 Voelbare Warmteflux (W/m^2) an: 2018041003, fc: Di 10-4 2018, 13UTC

HA40 t+10 Latente Warmteflux (W/m^2) an: 2018041003, fc: Di 10-4 2018, 13UTC

- Too early increase in LAI and too strong evaporation/evapotranspiration seems to be cause, surface DA reacts to too low T2m and too high Td2m
- Tests in 40h1.2.tg2 (crude):
  - Reduced LAI (*0.5)
  - Increased Stomatal Resistance (*1.25)
  - Reduced soil moisture increments in OI (*0.33)

Towards the hectometric scale

Very high resolution Harmonie-Arome
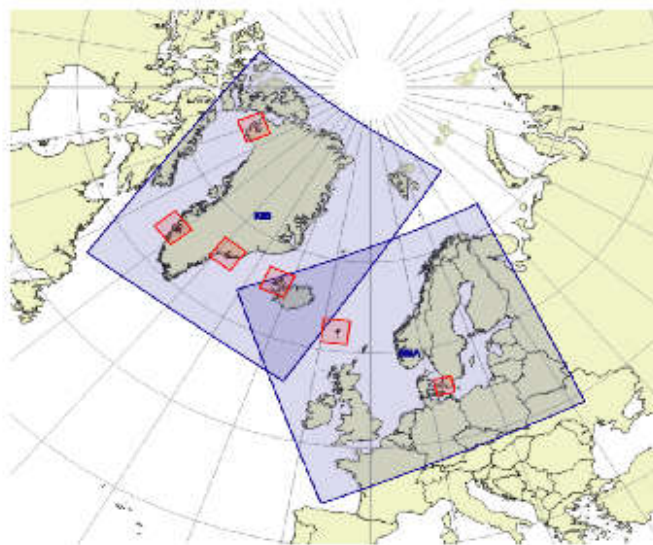
- Working group on very high resolution modeling

- Towards increased operational resolution (1km, 90L?), first in deterministic mode and then as EPS (1km) Hectometric scales, on the longer term.

- Scientific (dynamics (stability, level definition, ...), parametrizations, DA, surface, EPS) including urban aspects and the use of VHR local network observations

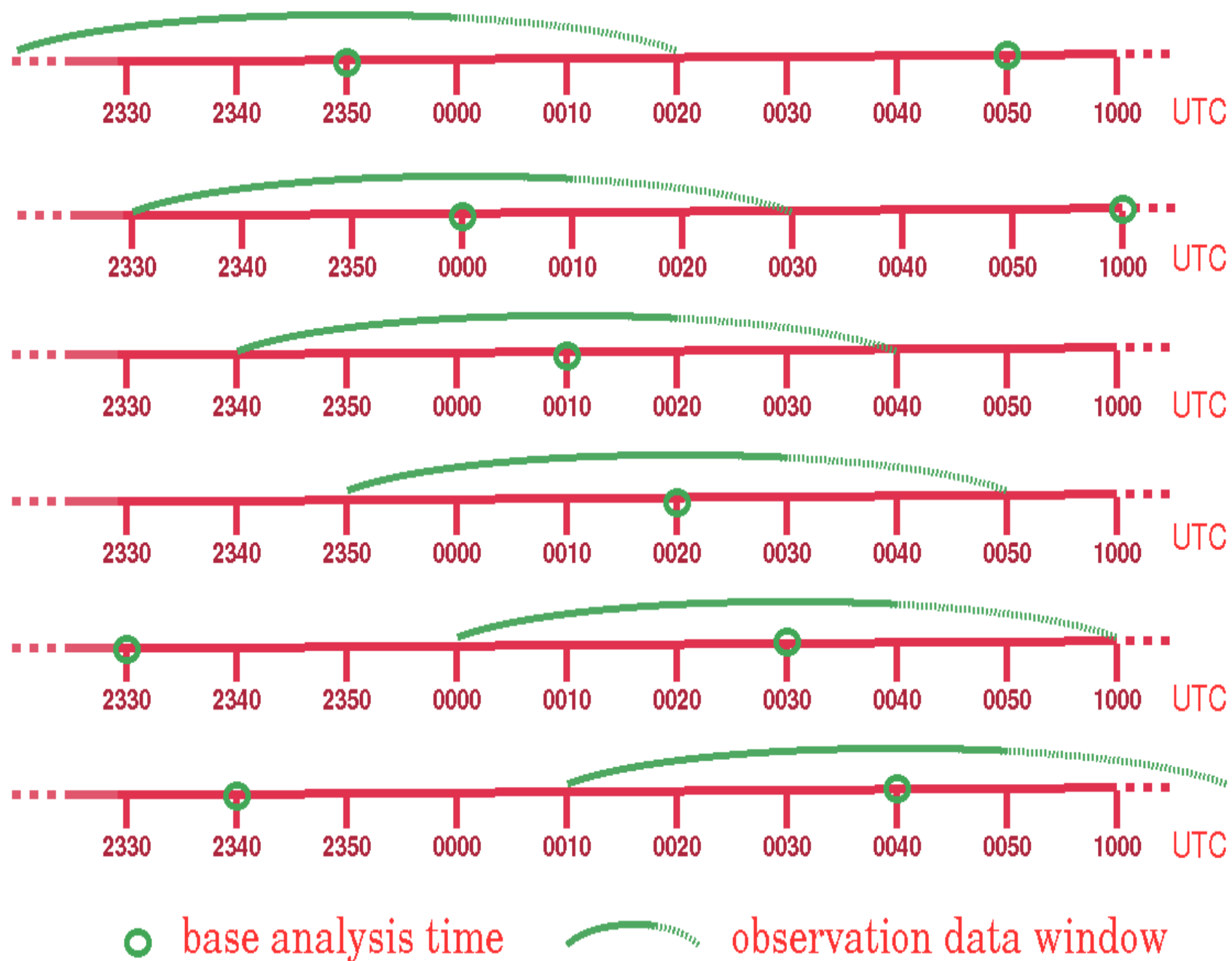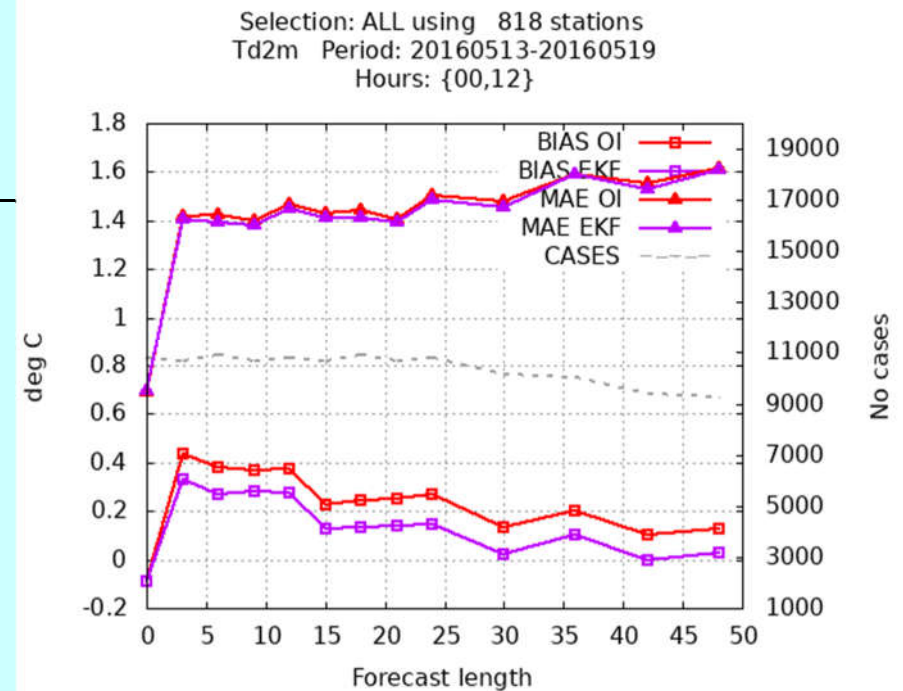- Computational efficiency aspects.

https://hirlam.org/trac/wiki/Meetings/HR/
HR_2017_CPH

DK750   Copenhagen 500

Including ensemble nowcasting setups ...

base analysis time observation data window

Surface analysis and modelling

Selection: ALL using 818 stations
Td2m   Period: 20160513-20160519
Hours: {00,12}
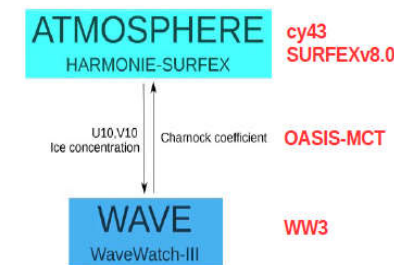
- Preparations to replace OI with SEKF

- Experimentation with SEKF and satellite surface observations

- Explore alternatives to (parts of) CANARI horizontal interpolation: Gridpp

- Surfex v8.1: upgrade of soil, snow, urban modules. Also improved versions of sea ice and lake modules introduced. Proposed combination of new/upgraded schemes to be tested in coming year.

- Coupled atmosphere- ocean wave and coupled surface – hydrology modelling


Sea wave modelling by Lichuan Wu, SMHI

ATMOSPHERE   cy43
HARMONIE-SURFEX   SURFEXv8.0

U10,V10
Ice concentration   Charnock coefficient   OASIS-MCT

WAVE   WW3
WaveWatch-III

- HARMONIE-AROME and WW3 has the same domain with same grid information. The boundary data for WW3 are from the WAM global run in ECMWF.
- HARMONIE-AROME and WW3 exchange information every 10 min through OASIS-MCT.

Experiment	Physical package	Air-sea scheme	Wave feedback
CTL	ST4	NO	No
ST4-FLD2	ST4	FLD2	Yes
ST3-FLD2	ST3	FLD2	Yes

Comparison the measurements from two buoy sites in Baltic Sea with simulation results concerning SWH. 3 December days in 2016:
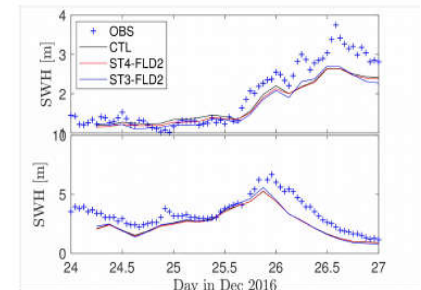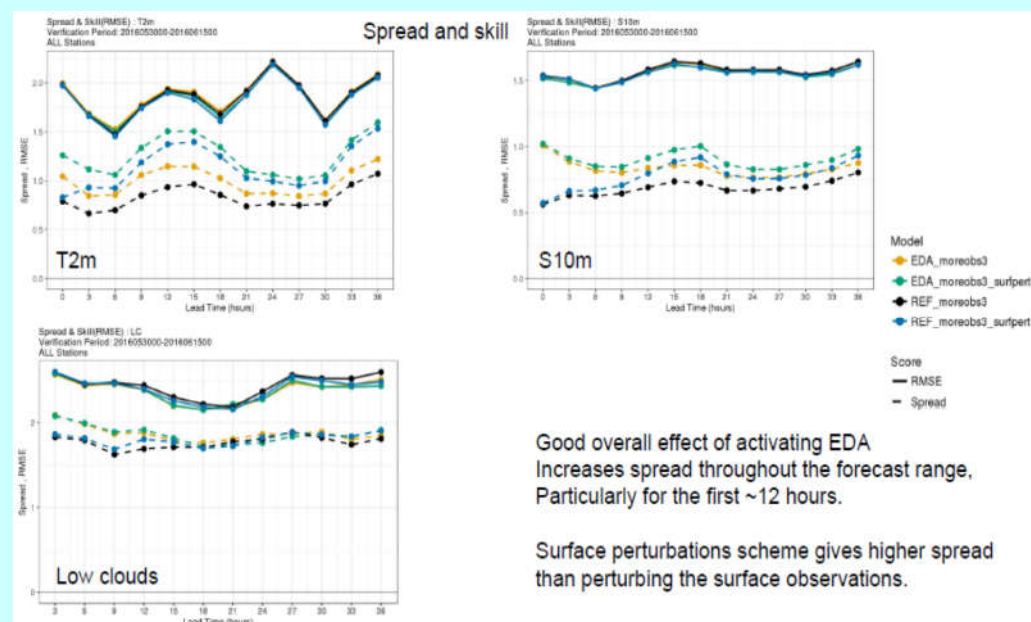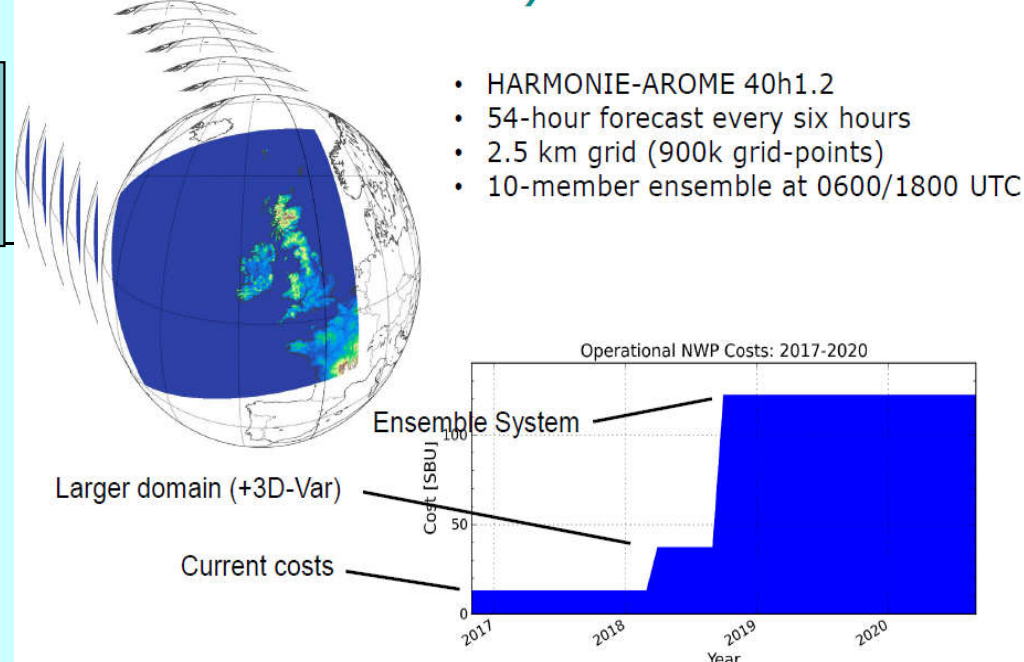
All three experiments give similar results since the sites represent coastal areas with limited wave-atmosphere feedback.

With support from Slovenia team, Météo-France team, Norwegian team

Hirlam
High Resolution Limited Area Model

Probabilistic forecasting

- Operational or pre-operational HarmonEPS suites in Dk, Ir, Nl, No-Sw-Fi, Sp (typically 10-20 members, 2.5km)

- Stopping hydrostatic GLAMEPS production by mid-July 2019

- Making ensembles suitable in nowcasting range through e.g. overlapping windows cycling strategy

- EDA perturbations and surface field perturbations clearly beneficial for spread/skill ratio.

- Experimenting with SPPT, SPP and different pattern generators

- Intercomparison of different LBC perturbations: SLAF, 1h ENS comparable

- HARMONIE-AROME 40h1.2
- 54-hour forecast every six hours
- 2.5 km grid (900k grid-points)
- 10-member ensemble at 0600/1800 UTC

Operational NWP Costs: 2017-2020

Ensemble System

Larger domain (+3D-Var)

Current costs

Spread and skill

T2m

S10m

Low clouds

Model
EDA_moreobs3
EDA_moreobs3_surfpert
REF_moreobs3
REF_moreobs3_surfpert

Score
— RMSE
– Spread

Good overall effect of activating EDA
Increases spread throughout the forecast range,
Particularly for the first ~12 hours.

Surface perturbations scheme gives higher spread
than perturbing the surface observations.

Hir Lam — High Resolution Limited Area Model

Verification, system

Aim for single common verification package: HARP
- HARP-v1: probabilistic verification
- HARP-v2: spatial verification included
- ~End 2018: beta-release of HARP-v3: integration of in-situ and conditional verification, more user-friendly interface

Optimizing code/modernizing scripts and repository:
- * Overhaul of parts of scripting system
- * Move to git repository
- * Optimization of microphysics/EDMF code, improve parallellization of 4D-Var
- * Next: single vs double precision (Cy43)
- * Engaging in longer-term collaboration with computational science institutes (BSC) on code optimization

Operational cooperation between HIRLAM services increasing swiftly
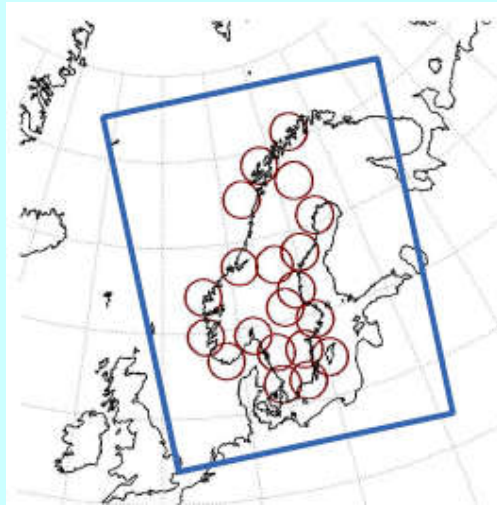
MetCoop
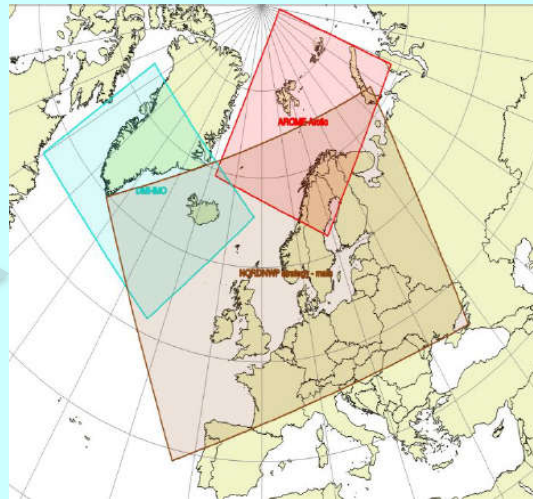
NordNWP (orig)

UWC East (MetCoop +Baltic) and West (Dk, Ic, Ir, Nl)

Have a fruitful meeting and enjoy your time in Salzburg!