SMHI

Assimilation of radar data in HARMONIE Activities and plans

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High Resolution Limited Area Model

HIRLAM

ALADIN

SMHI

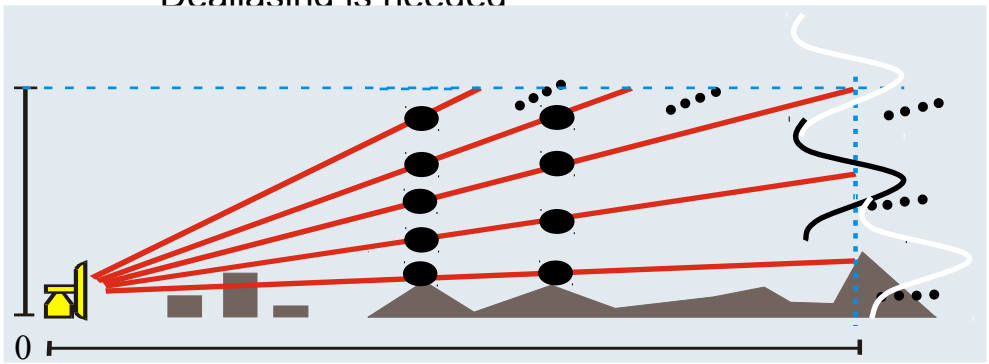
Radar assimilation working week 1-3 March 2011

- HIRLAM members that plan to use radar data in HARMONIE
  - Sweden, Norway, Denmark, Ireland, Spain, (Finland)
  - The Netherlands
  - LACE countries
  - Telephone conference with Meteo France representatives

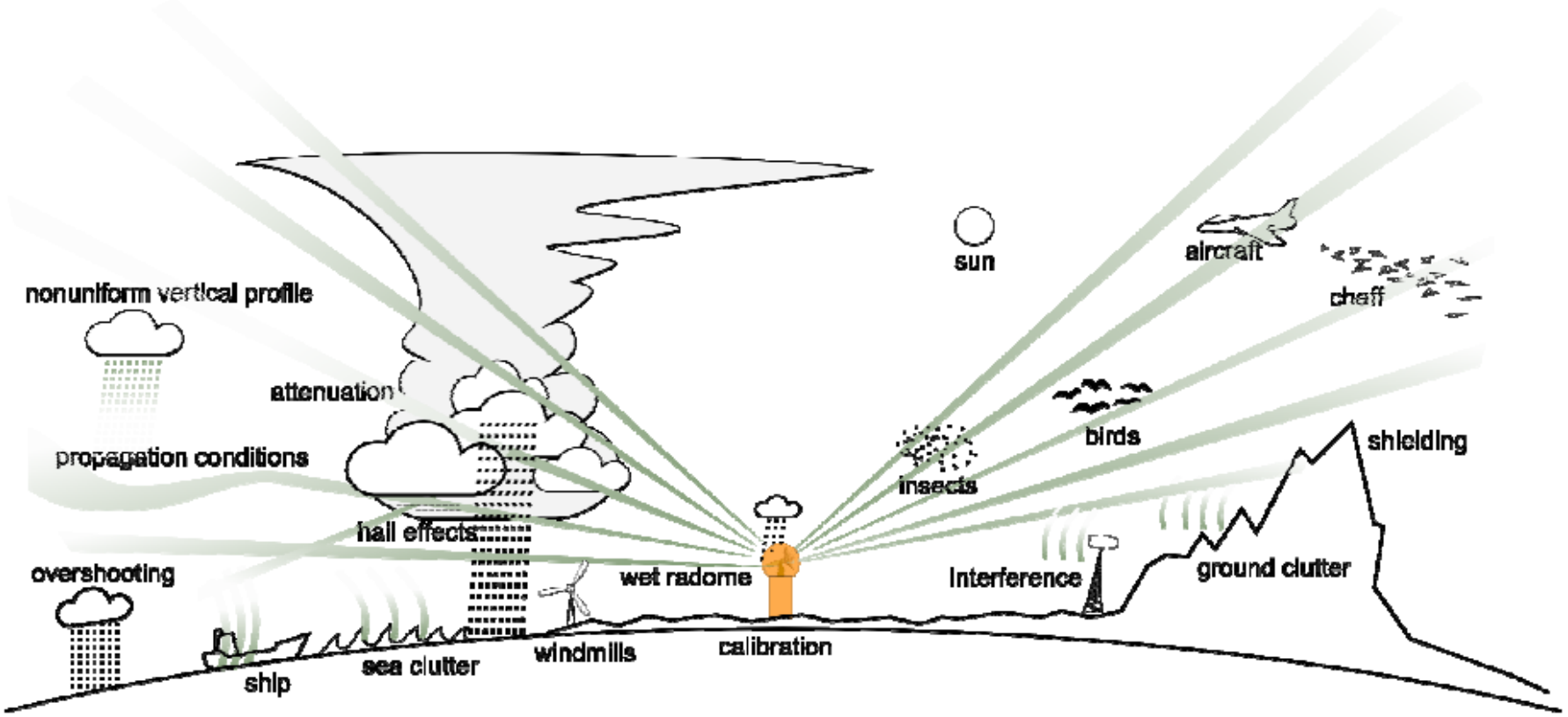
- This presentation
  - Introduction to radar data assimilation
  - Status for each country
  - Challenges we are facing
  - Most important outcome of the week
  - Current work

Radar assimilation

- Radar data
  - Volume scans from each radar
- Reflectivities
  - Difficult to do direct assimilation (complicated relation between control variables and reflectivity, including microphysics)
  - 1D + 3DVar
  - Assimilation of a humidity pseudo observation
  - Assimilation of “no humidity” to dry the model
- Radial velocities
  - Easier and more straight forward
  - Dealiasing is needed



Quality control

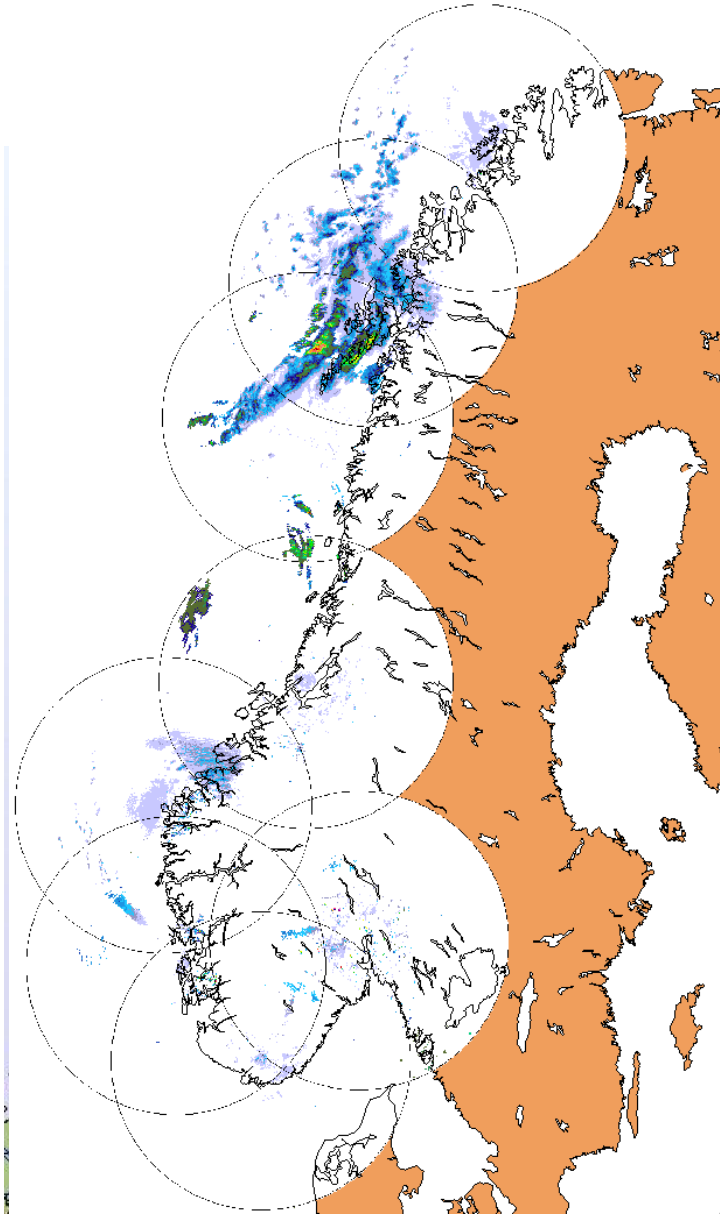


Thanks: M. Peura (FMI)

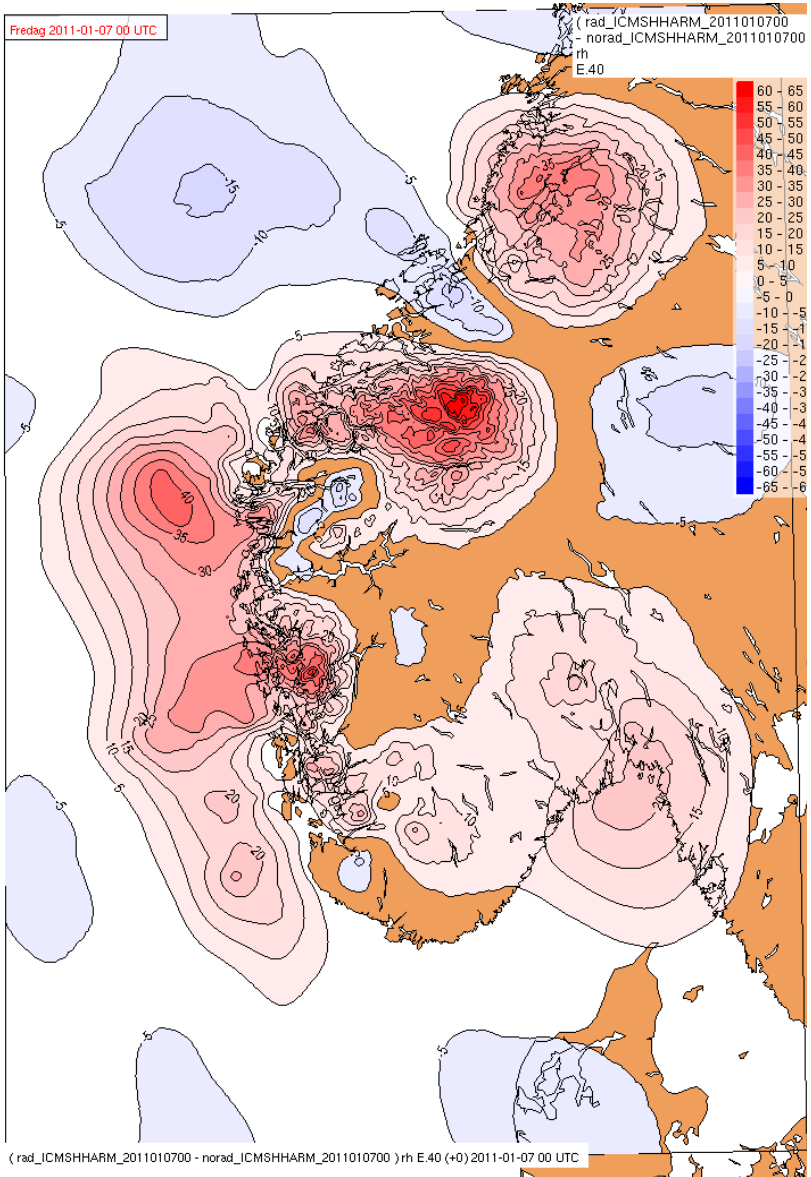
Status for each country

- Sweden
  - Radar data from 12 Swedish radars in HDF5 format
  - Polar coordinates
  - 10 elevation angles
  - 2 km bin size for the lower and 1 km for the higher
  - First experiments with assimilation of radial velocities

- Norway
  - 8 radars in PRORAD XML format
  - Polar coordinates
  - 12 elevation angles for reflectivity
  - 10 different elevation angles for radial velocity
  - First experiments with assimilation of reflectivities



Relative humidity at model level 40

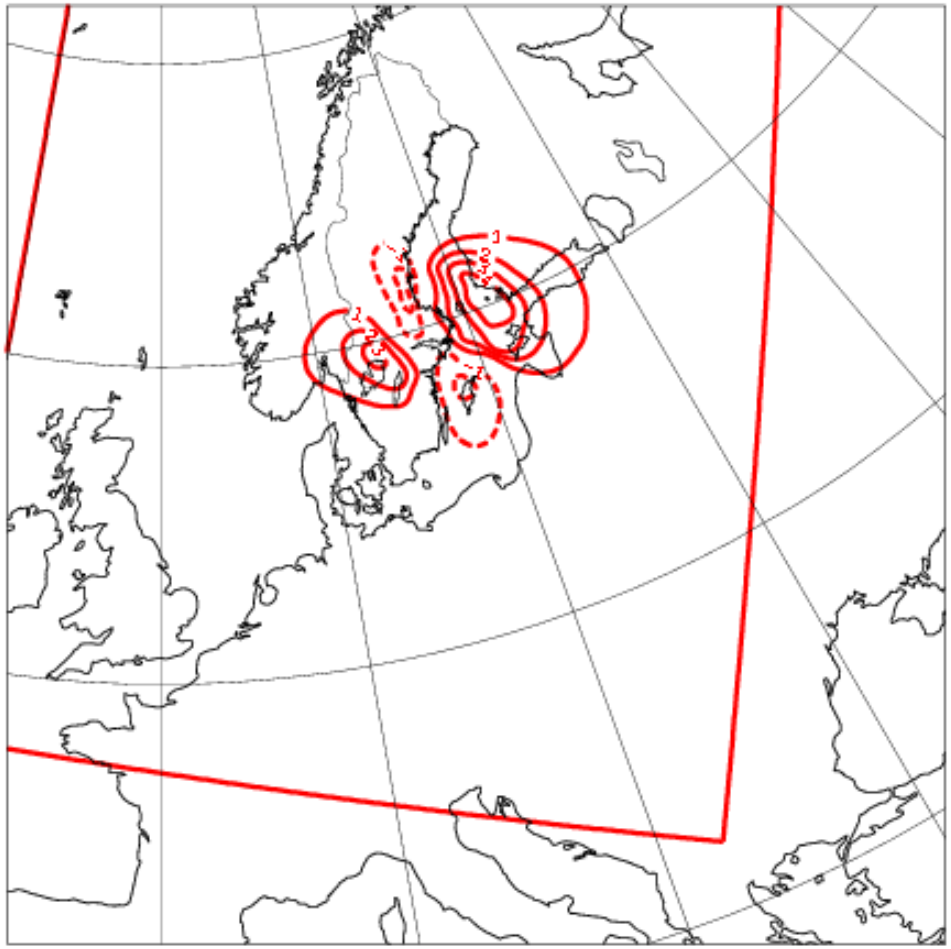


First example:

Difference between an analysis including radar reflectivities and the same analysis without reflectivities.

For further details see poster: "Assimilation of radar observations in Harmonie/Norway“ by Martin Grønsleth

First example of radial velocity assimilation at SMHI.
Radar data from the radar at Arlanda airport. No other observations.



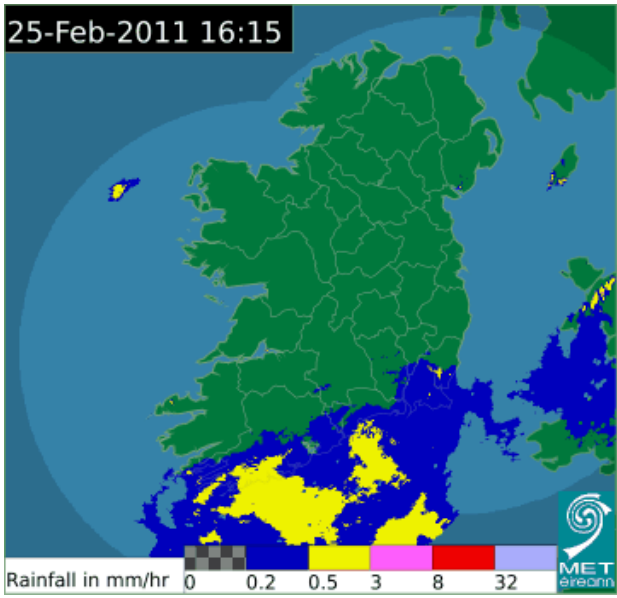
u-wind increment (an-fg) at model level 50

Status for each country cont.

- Denmark
  - 5 radars in internal format (HDF5 will be available)
  - Polar coordinates
  - Two different scan strategies
  - “Long range” for reflectivity
  - “Short range” for radial velocity
  - No assimilation experiments yet

- Spain
  - 15 radars in BUFR and/or HDF5 format
  - Polar coordinates
  - Two different scan strategies
  - “Long range”: 1 km bin size, only reflectivity
  - “Short range”: 500 m bin size, reflectivity and radial velocity
  - No assimilation experiments yet

Status for each country cont.



- Ireland
  - 2 radars in multiple formats
  - Multiple grid types available
  - The two radars have different elevation angles and scan strategies
  - No assimilation experiments yet
- Hungary
  - 3 radars
  - 9 elevation angles for reflectivity and 5 for radial velocity
  - No assimilation experiments yet
- Lace countries
  - Austria, Czech Republic, Croatia, Hungary, Slovakia, Slovenia and Romania
  - Model version ALARO
  - Adjustment of the observation operator for reflectivity to ALARO microphysics is needed
  - No assimilation experiments yet

Status for each country cont.

- The Netherlands
  - 2 radars
  - Successful experiments of radial velocity assimilation in HIRLAM (positive impact)
  - Hourly update cycle with up to 6 hours forecasts
  - Close to operational

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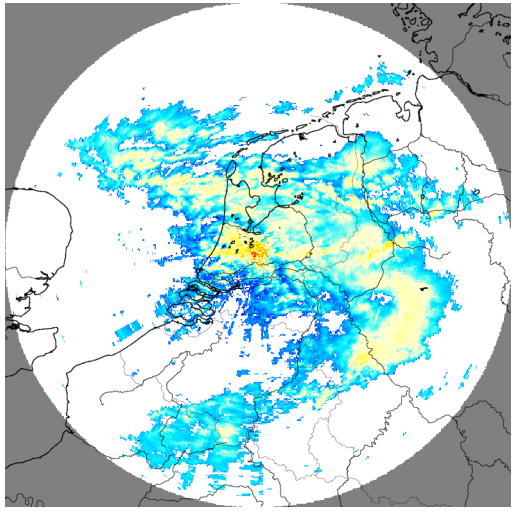
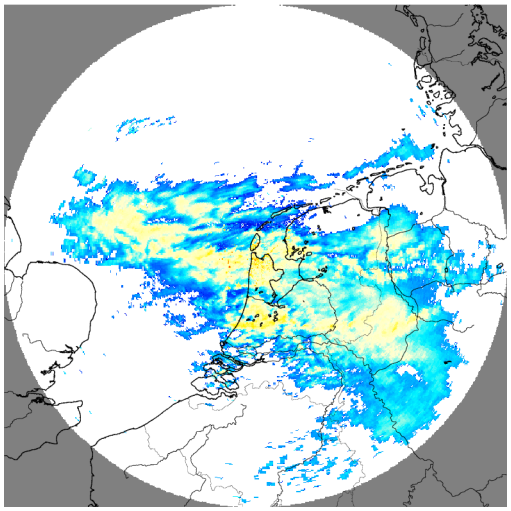


DenHelder

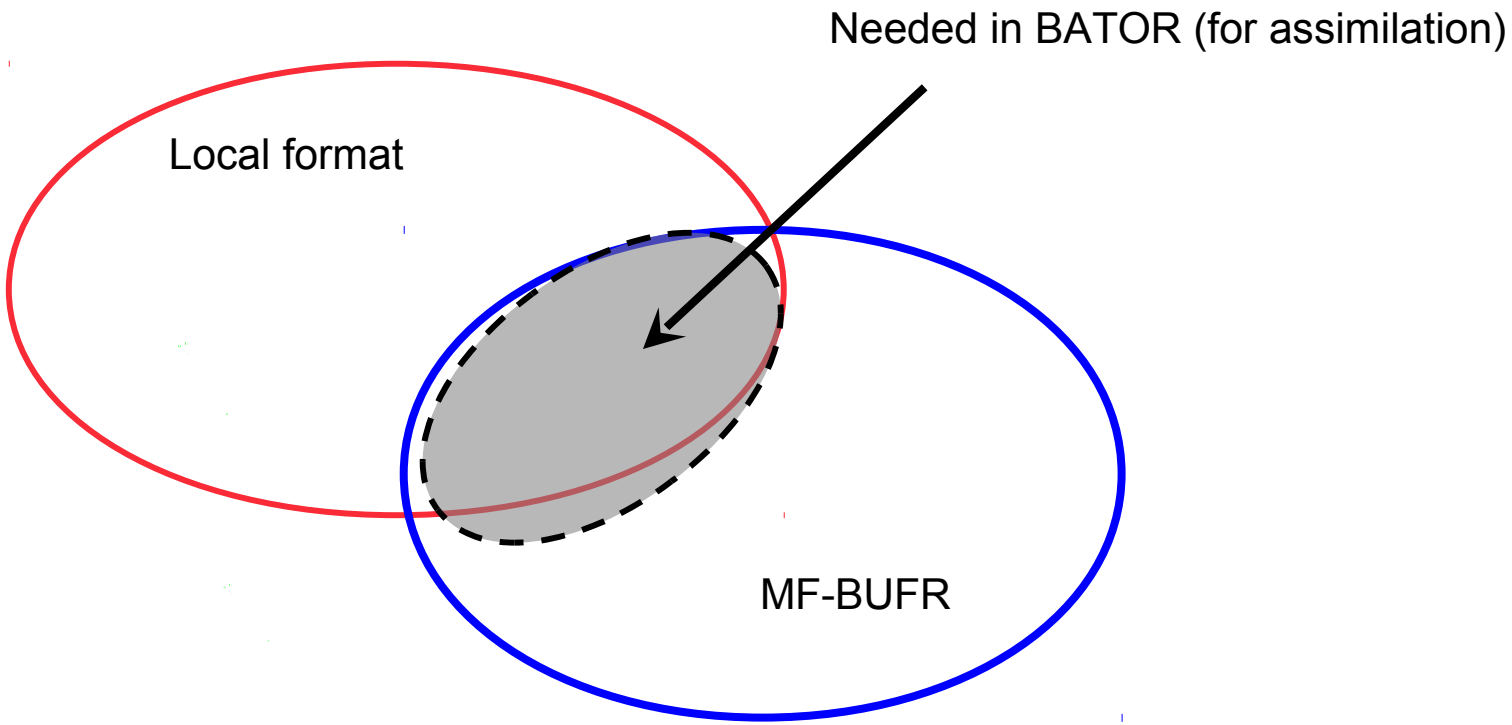


Challenges

- Different data formats
  - HDF5, BUFR, internal formats…
  - Many countries are aiming for the OPERA Information Data Model (ODIM) in HDF5 or BUFR file format
- Different grid types
  - Most countries use polar coordinates (azimuth angle and range)
  - Different volume sizes
- Different scan strategies
  - Different for different elevations
  - Different for reflectivity and radial velocity
- Different quality of the data
  - Different levels of quality control in each country

Outcome from the radar working week

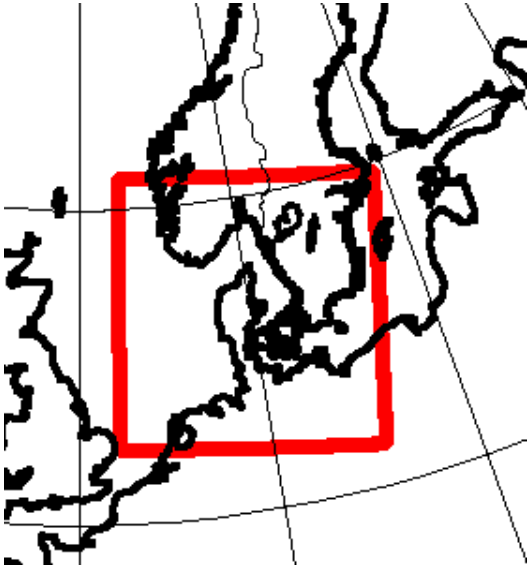
- Common preprocessing: CONRAD
  - CONversion of RADar data to MF-BUFR
  - Local part: Reads the local format into CONRAD structs
  - Common part: Creates the BUFR-file from the CONRAD structs
    Common quality control?
  - “Missing” parameters should be handled



Outcome from the radar working week

- BATOR must be able to handle…
  - polar coordinates
  - different scan strategies
  - different volume sizes
  - data thinning for different grid types

  - Common quality control?



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Current work

- Radar data
  - Communication with the data providers (QC, data format, content…)
- CONRAD
  - Preparing the preprocessing to be useful for all
- BATOR
  - Adding code to handle polar coordinates and different scan strategies
- Quality control
  - Inventory of what is done today
  - What can we do in a common preprocessing or in BATOR?
- Next meeting in autumn
  - Planning of coordinated impact studies