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Use of radar radial winds from the OPERA network

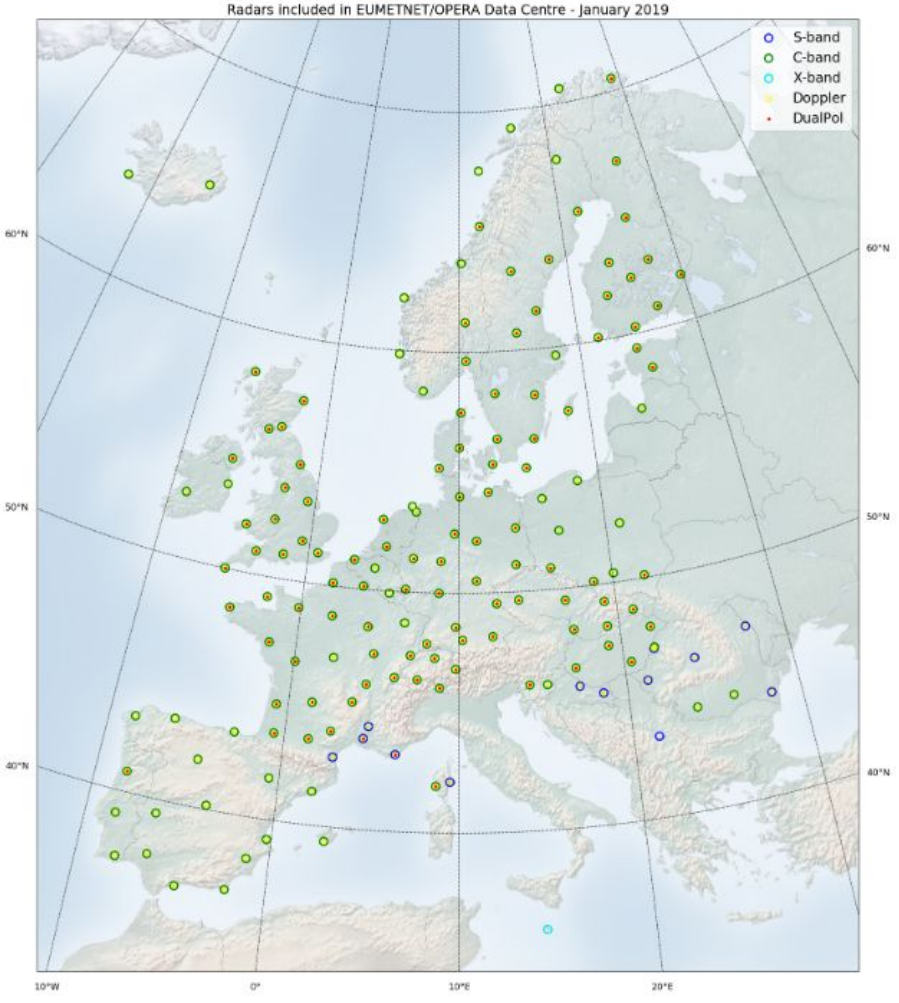
Martin Ridal, Jana Sanchez and Mats Dahlbom

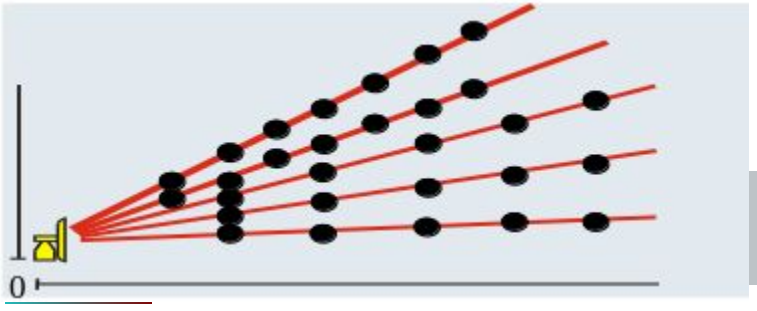
Outline

- Introduction
  - OPERA data
  - Pre-processing
- Doppler wind assimilation
  - Challenges
- Sources of data
  - OIFS
  - ODE
- Examples of results
- Concluding remarks

OPERA radar data

- EUMETNET radar programme
  - Data format is well specified and documented
  - OPERA Information Data Model (ODIM)
- Data amount and content still differ
  - Different volume sizes
  - Reflectivity, radial velocity, raw data…
- Different scan strategies
  - Can be different for different elevations
  - Can be different for reflectivity and radial velocity
- Quality control
  - All reflectivity observations comes with a quality index
  - Radial wind is not quality controlled





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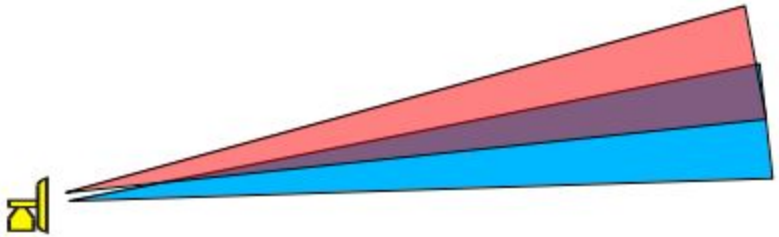
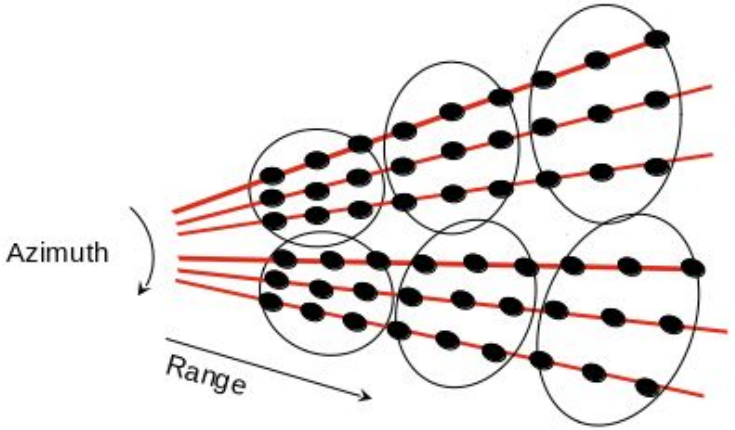
Preprocessing of OPERA radar data

- Data sanity check
  - Checks that all attributes needed are present and have correct units
  - Checks for overlapping elevations
- Large data amounts - Thinning is needed
  - Super observations are created
  - The quality information is used
  - Both clear and rainy SOs are created
  - Size, thresholds and conditions can be different for reflectivity and winds
- Data usage
  - All scan strategies can be handled
  - No observations used for elevations below one degree
  - For wind an upper limit is set too





Radial winds - challenges

- Not mandatory in OPERA
  - Reporting practice differ
  - Wind optimized volumes, wind optimized scans, a compromise…
- Quality control difficult
  - Needs co-located reflectivity observations
  - The QC index can then be applied to the Doppler winds
- Aliasing effects
  - De-aliasing algorithms does not seem fully reliable
  - Only winds with NI higher that 30 m/s are used
- Super observations
  - Only rainy pixels used
  - Variability within the SO cannot be too large

Sources of OPERA data

Two sources of OPERA data:

OIFS - OPERA Internet File Server

ODE - OPERA Development Environment

Sources of OPERA data

OIFS

- OPERA Internet File Server
- One file contain all scans within 15 minutes
- Data is quality controlled using the bropo and beamb packages
  - Includes a satellite cloud filter precipitating clouds from NWCSAF
- Long latency, file available 15 minutes after the last observation
- NIMBUS
  - New processing/dissemination server will be operational in 2023
  - Will replace the current ODC (odyssey)

Sources of OPERA data

ODE

- OPERA Development Environment
- Set up originally to share volumes for NWP before OIFS was available
- Data available as single volumes
- Data is quality controlled using the bropo and beamb packages
  - Does not include the satellite cloud filter
- Short latency, files available within 15 minutes
- Not an operational service – can lead to long data outages

Evaluation

- Evaluation of the two data sources
  - Do we get the same information?
  - Does one perform better than the other?
  - Which one would be the primary source and could the other serve as backup?

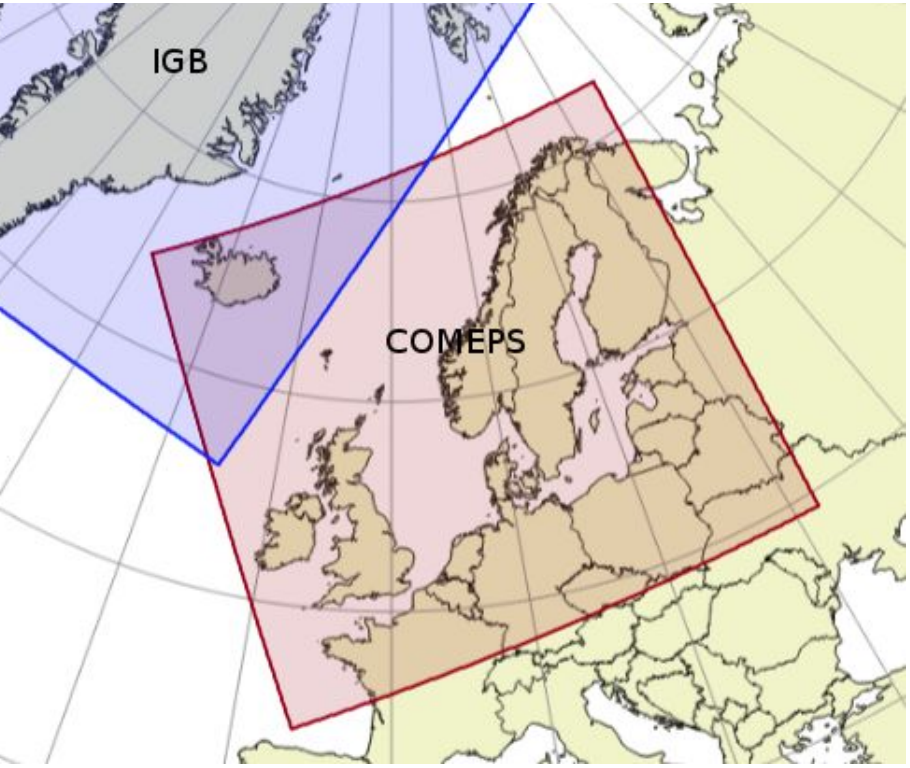
- Modifying the preprocessing
  - Resulted in a new version of the preprocessing
  - Additional checks were put in to sort out wind scans with no co-located reflectivity

- New data assimilation experiments
  - Reference - no radar information
  - Reflectivity and winds from OIFS
  - Reflectivity and winds from ODE

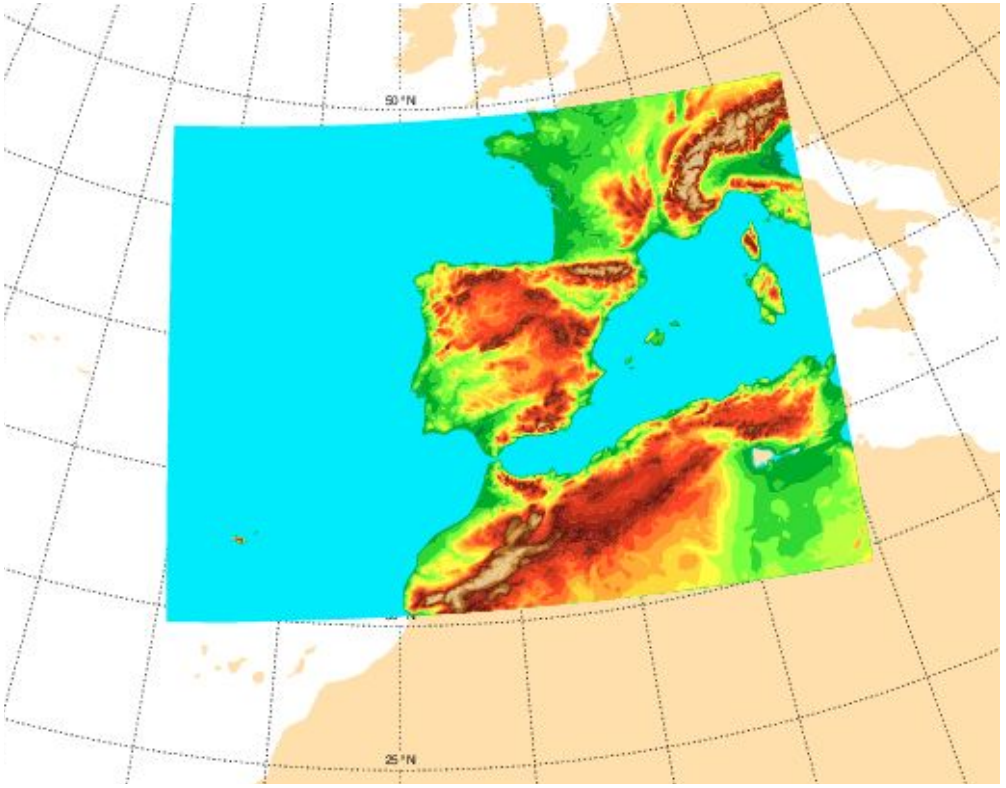
- Two domains
  - Danish NEA. Includes ~70 radars from 12 countries
  - Iberian peninsula. Includes 42 radars from 3 countries

The two domains

Danish NEA domain

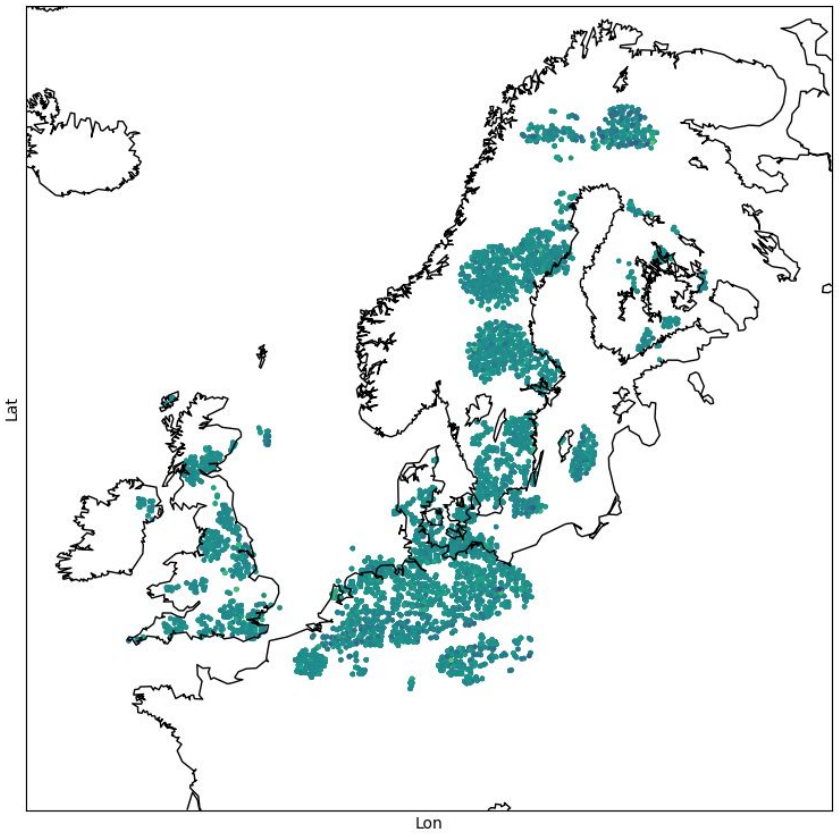


Spanish Ibearian Peninsula domain

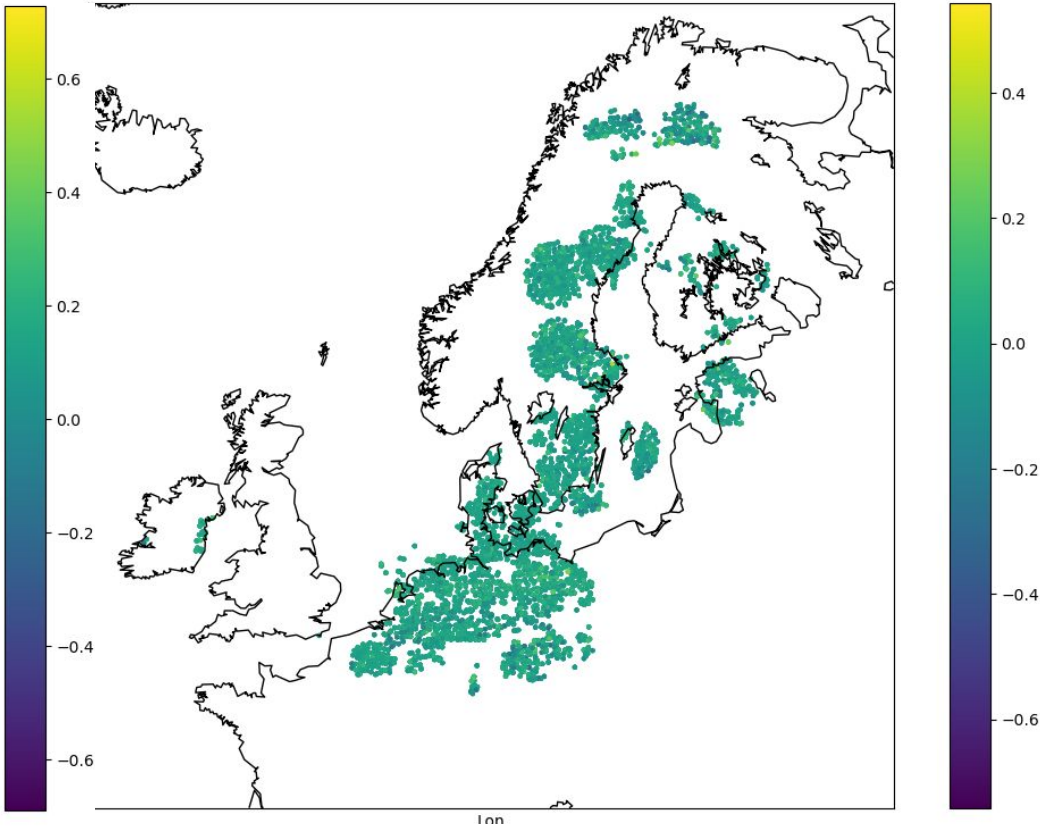


Preliminary results from the Danish NEA domain

RH from OIFS

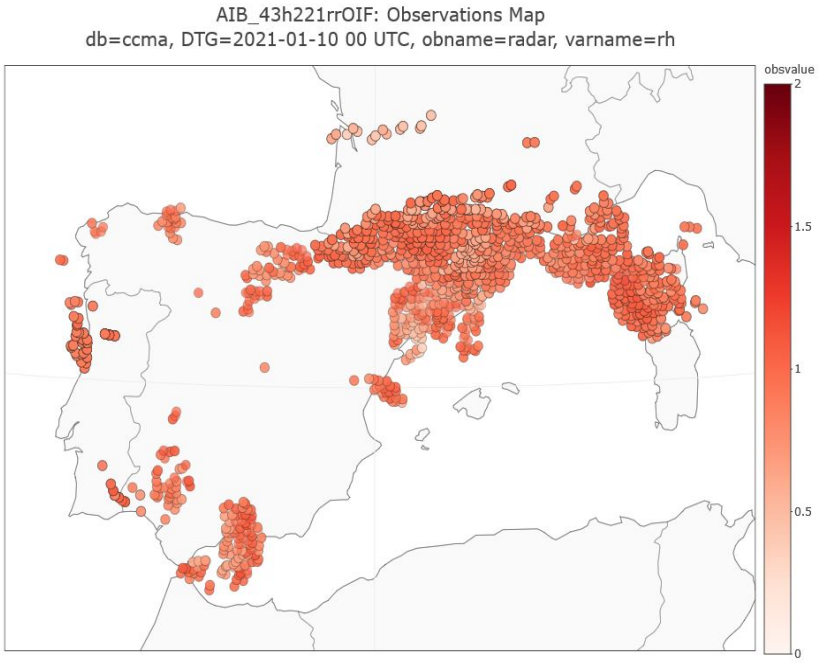


RH from ODE

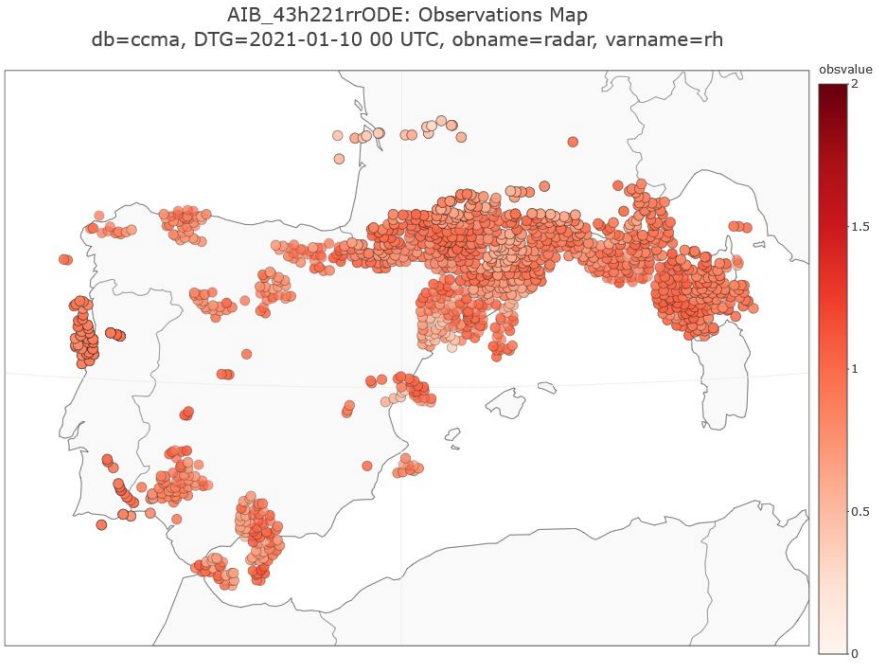


Preliminary results from the Ibearian Peninsula domain

RH from OIFS

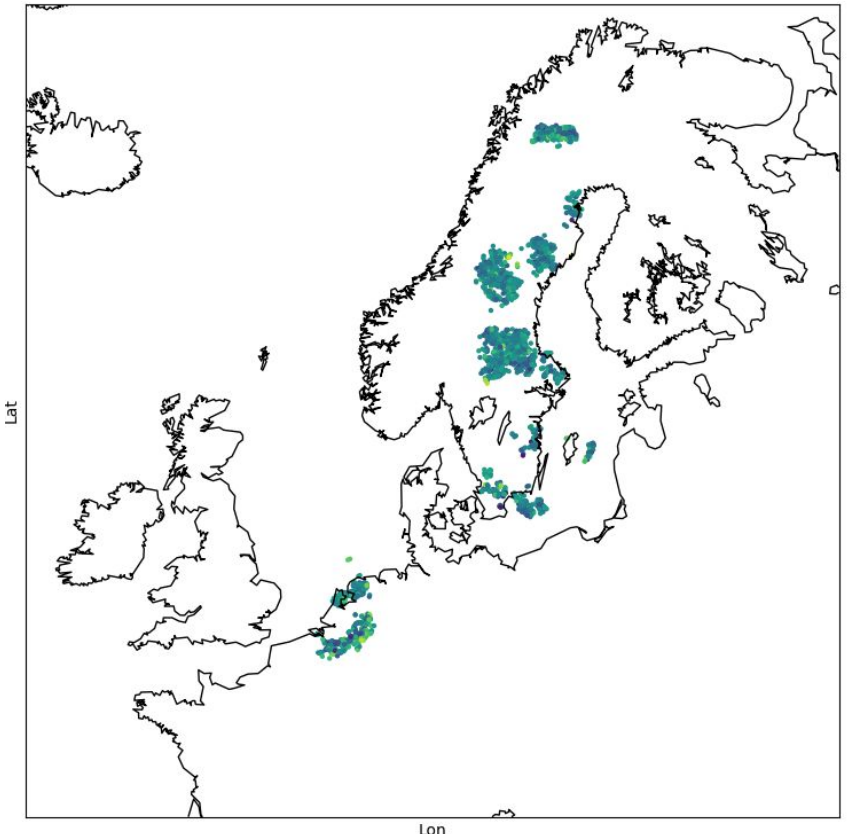


RH from ODE

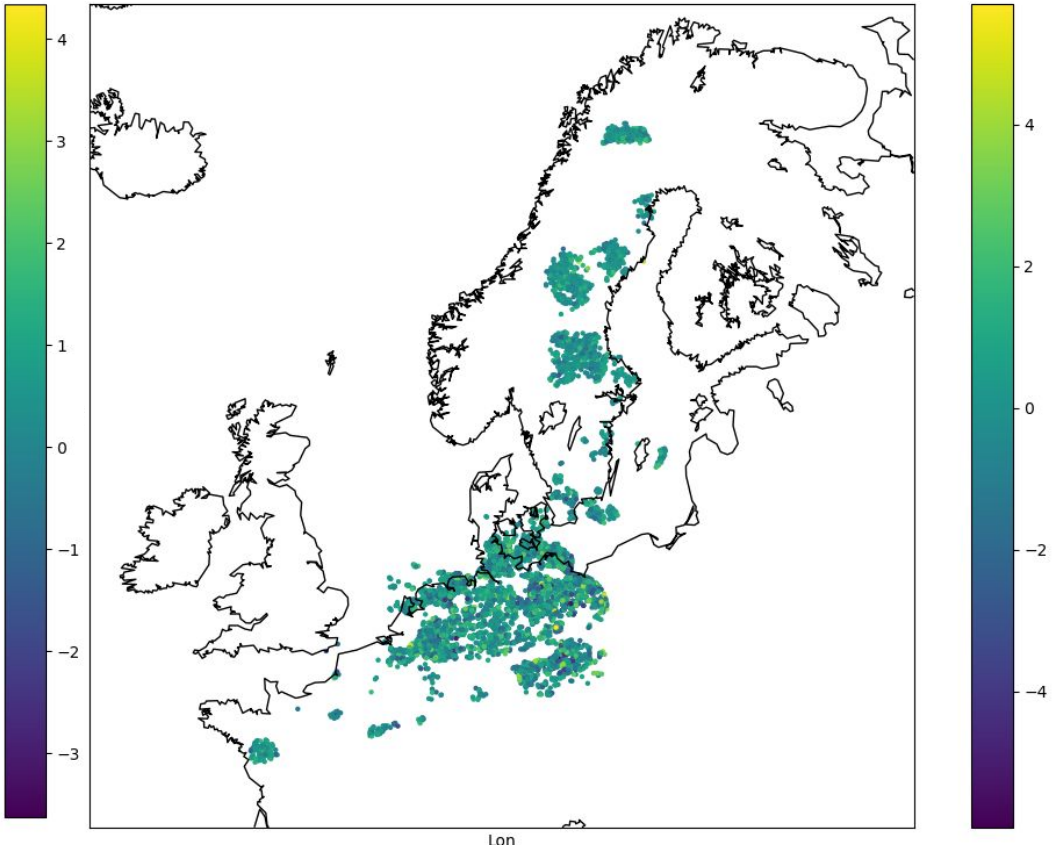


Preliminary results from the Danish NEA domain

Doppler winds from OIFS

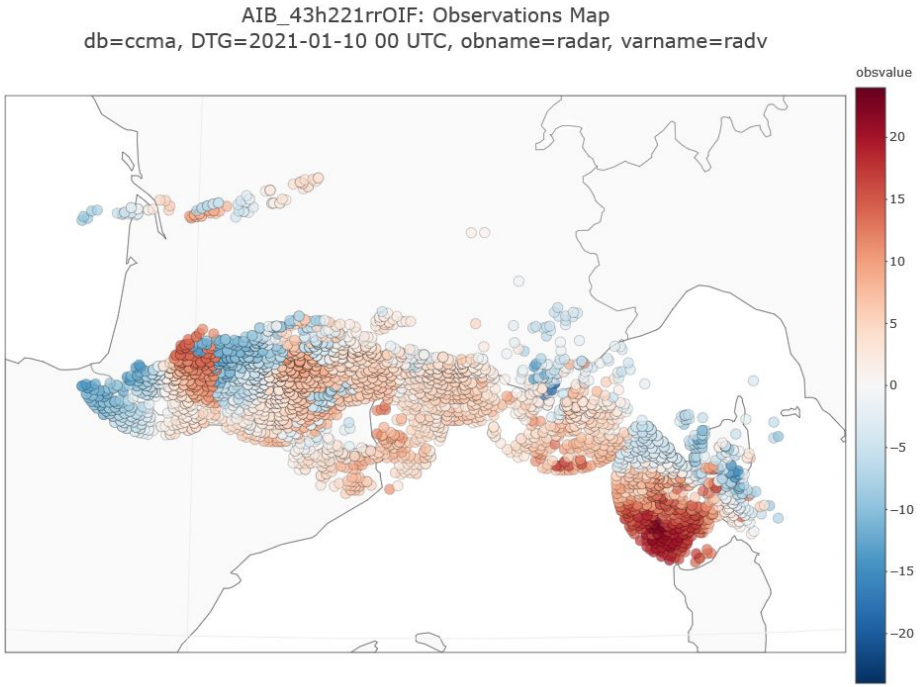


Doppler winds from ODE

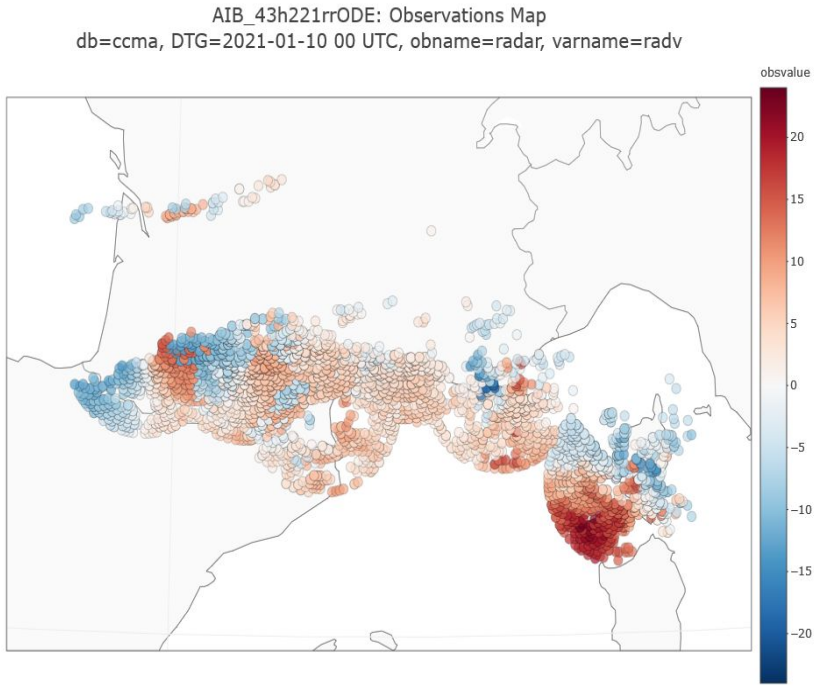


Preliminary results from the Ibearian Peninsula domain

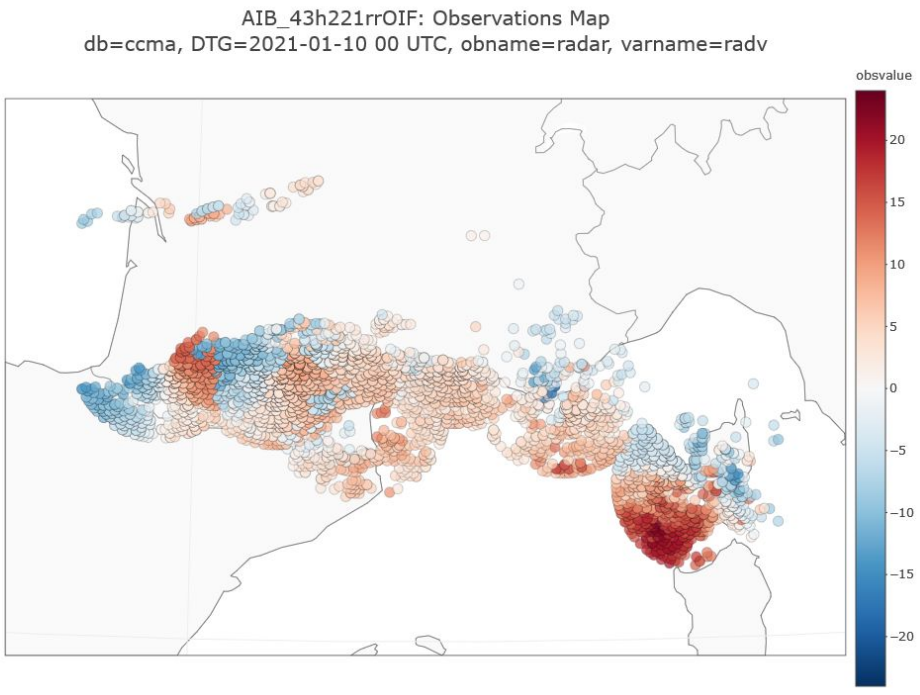
Doppler winds from OIFS

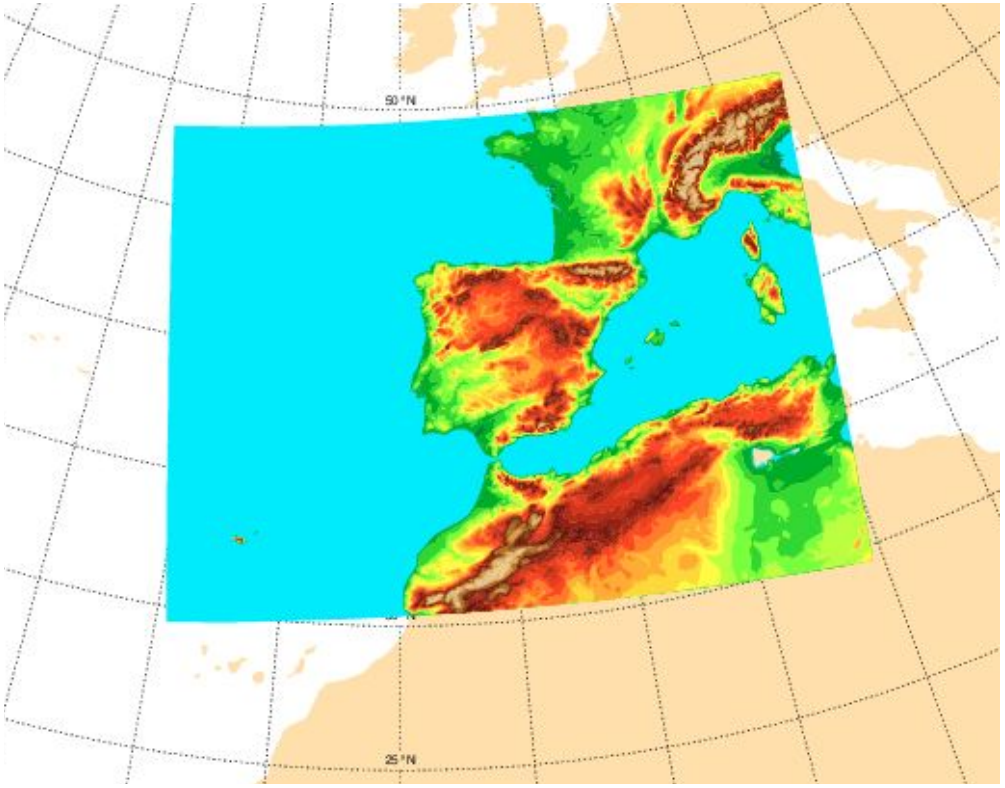


Doppler winds from ODE



Preliminary results from the Ibearian Peninsula domain





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Preliminary results

- UK is missing from ODE
  - Only one elevation of DBZH present
  - Why is not known. Under investigation

- Missing winds in OIFS
  - Wind scans are sent separately
  - At ODE these are put together before disseminated

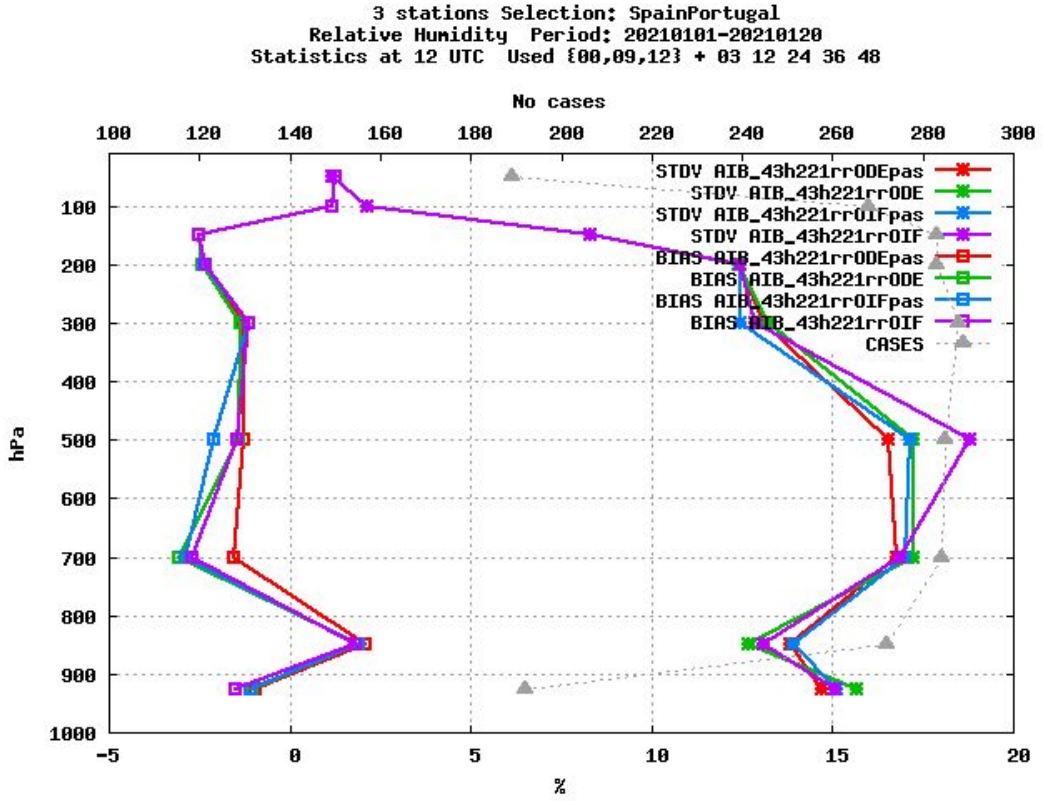
- Preliminary results from the NEA domain
  - Impact of adding radar data is positive
  - OIFS vs ODE is more or less neutral
  - However, difficult to draw too many conclusions since input data differ

- Preliminary results from the Iberian peninsula domain
  - Very little wind data in the domain, only from France
  - Results more or less neutral

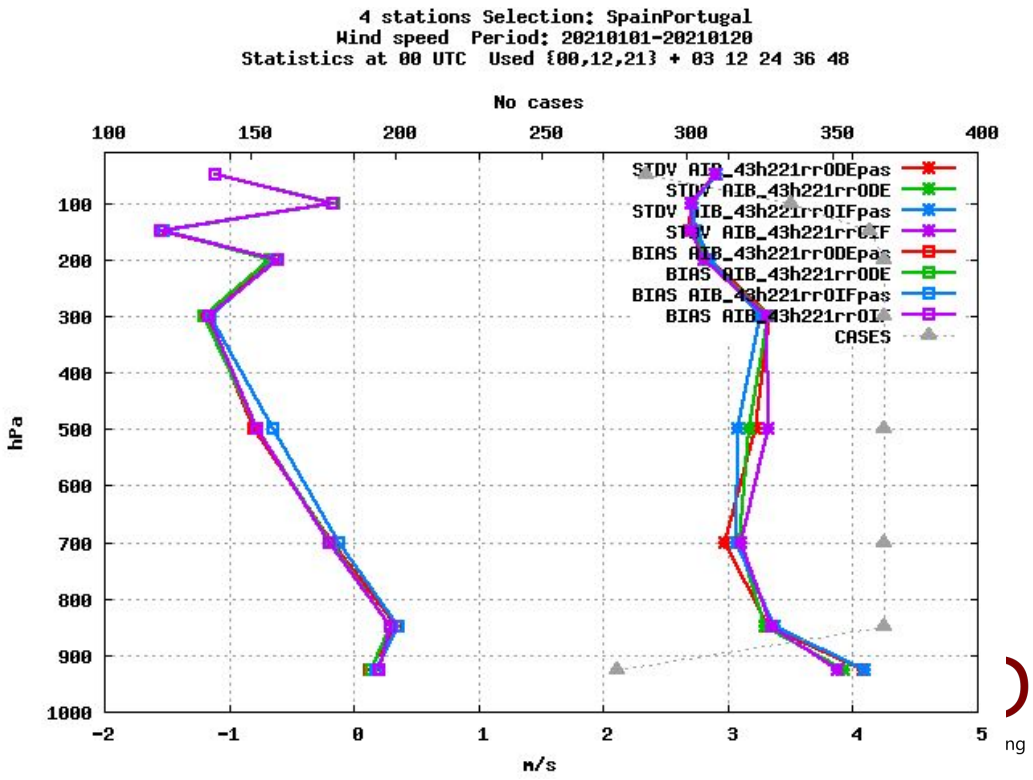
Preliminary results from the Ibearian Peninsula domain

Refl ODE
Refl+DOW ODE
Refl OIFS
Refl+DOW OIFS

Relative humidity



Wind speed



Conclusions from radial wind experiments

- Quality of the observations
  - Need to use wind optimized scans (high NI)
  - Need to use the quality index from co-located reflectivity
  - Need to monitor the input data
- Super observation construction
  - The internal variability is important (less important for smaller SO)
  - No need to treat the reflectivity and winds equal, e.g. the size of the SO can differ
- OPERA data
  - Two different data sources
  - Content/usability can differ, especially for the winds
  - Investigations ongoing
  - Constant communication with OPERA

The end

Thank you for your attention!