

Optimal use of radar radial winds

Martin Ridal

Jana Sanchez, Mats Dahlbom

- Not mandatory in OPERA
 - Reporting practice differ
 - Wind optimized volumes, wind optimized scans, a compromise...

- Quality control difficult
 - No quality index for winds
 - Needs co-located reflectivity observations
 - The reflectivity quality index can then be applied to the Doppler winds

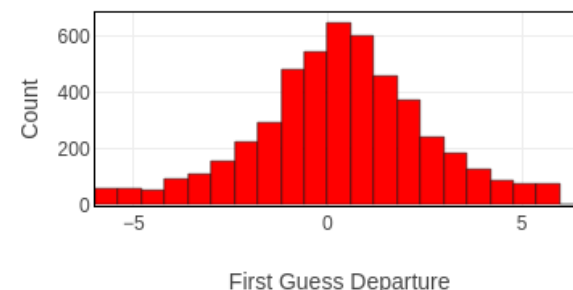
- Aliasing effects
 - De-aliasing algorithms does not seem reliable
 - Only winds with NI higher than 30 m/s are used

- Super observations
 - Only rainy pixels used
 - Variability within the SO cannot be too large

- Recent investigation show that we have not been using wind optimally
 - Observation error, thinning distance, size of the SO...
 - Optimization needed!
 - Careful monitoring is needed

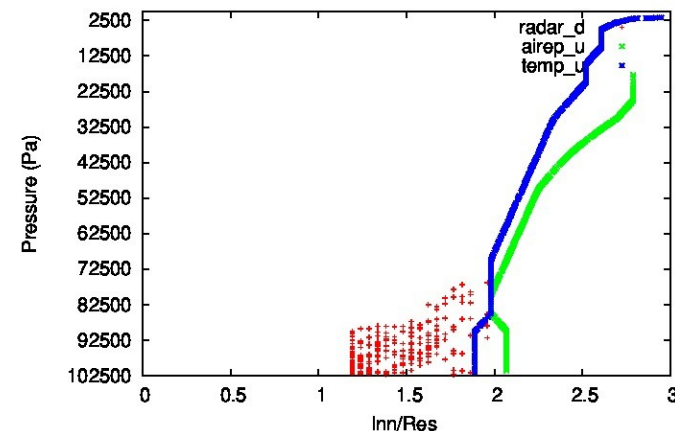
Findings from recent and ongoing experiments

- First guess check limit is too generous
 - 5-6 m/s seems reasonable
- Higher observation error
 - Default is lower than radiosondes and air crafts
 - For radar winds it increases with distance

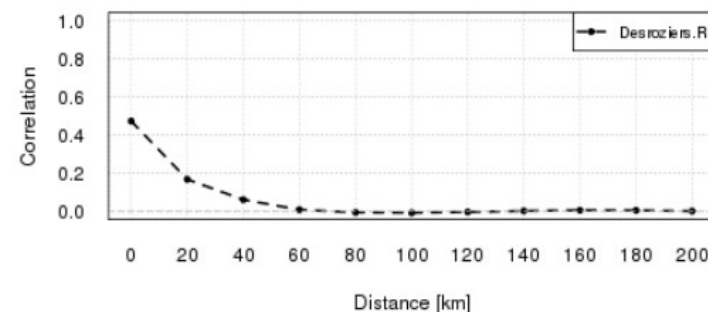


- Thinning distance and size of SO
 - More thinning to avoid correlated errors
 - Or smaller SO, less thinning and even higher observation error

DOW1 | Vertical sigmao ACT 20190904 at 12

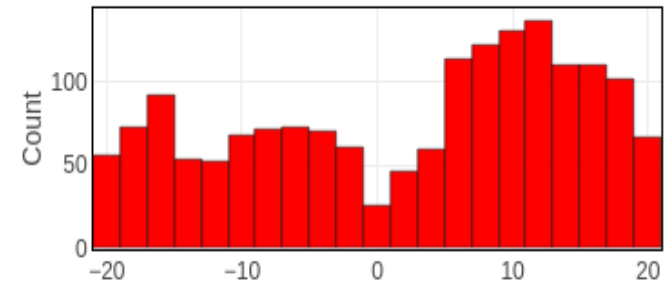


RADAR DOW

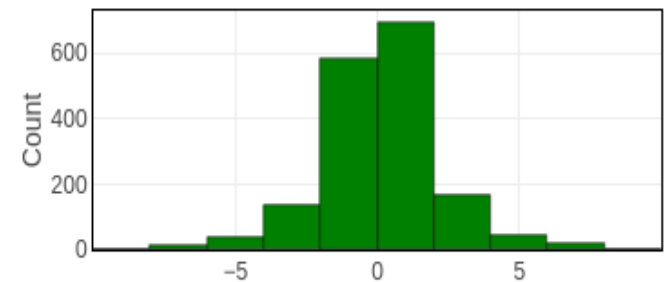


First guess and analysis departures from Danish station **Bornholm**

Despite the bad FG-departures it still provides good analyses. Indicates that we have too low observation error.



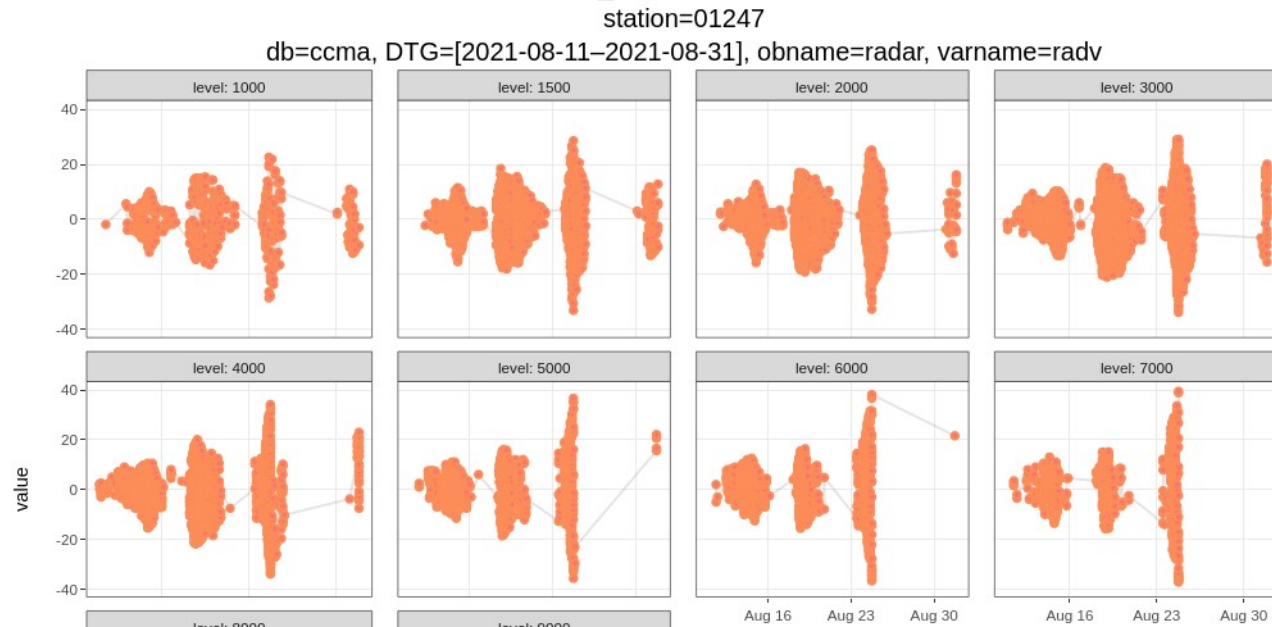
First Guess Departure



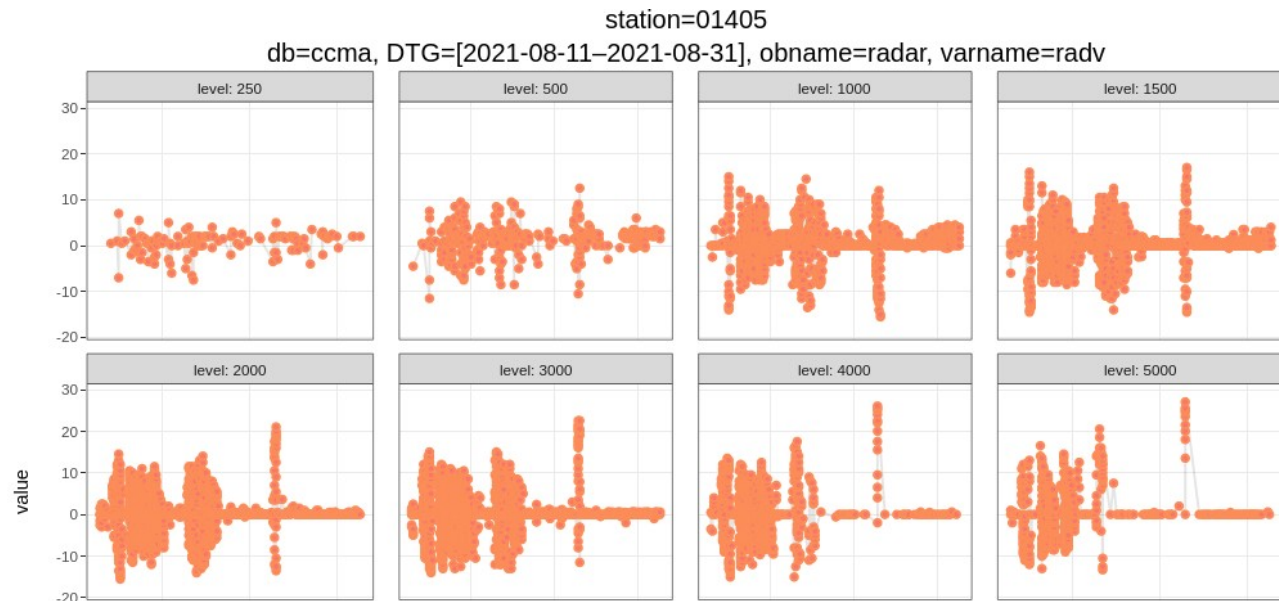
Analysis Departure

Importance of monitoring – examples of bad stations

Timseries of observations
from Norwegian station
Rissa



Timseries of observations
from Norwegian station
Bömlo



- Common for all
 - Bad stations blacklisted
 - No winds below 1 m/s used
 - First guess check limit 6 m/s

- Candidate #1
 - SO 6 km for both reflectivity and winds
 - Thinning in Screening 15 km
 - Observation error 2-2.5 m/s for winds

- Candidate #2
 - SO 3 km for both reflectivity and winds
 - Thinning in Screening 7.5 km
 - Observation error around 3 m/s for winds
 - Observation error increased also for reflectivity

- Candidate #3
 - SO 6 km for reflectivity
 - SO 3 km for winds
 - Thinning 15 km for reflectivity and 7.5 km for winds
 - Observation error around 3 m/s for winds and default for reflectivity

- Experiments run for three weeks in August 2021 (with 2 weeks warmup)
 - Reference run – same as operational
 - Candidate #1
 - Candidate #3

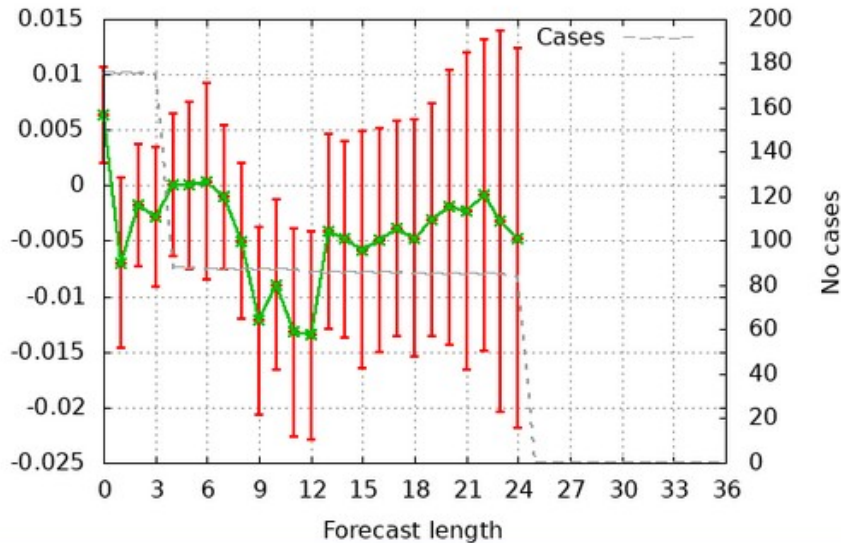
Mean sea level pressure

Ref compared to same size of SO

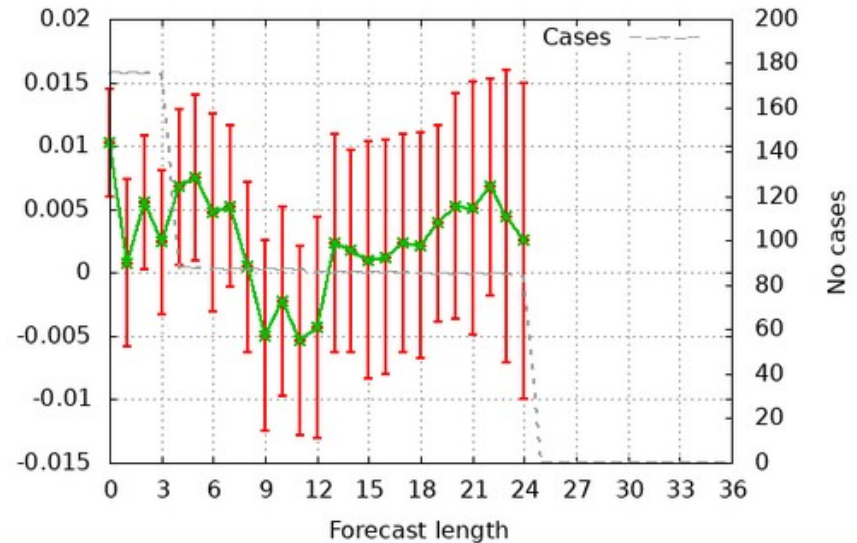
Ref compared to mixed size of SO

Observation verification comparison

Normalized mean RMSE diff (90% conf) dow_ref - dow_so6km_newBfg6nolow
Selection: ALL using 849 stations
Period: 20210810-20210831
Mslp Hours: {00,03,...,21}



Normalized mean RMSE diff (90% conf) dow_ref - dow_somix
Selection: ALL using 849 stations
Period: 20210810-20210831
Mslp Hours: {00,03,...,21}



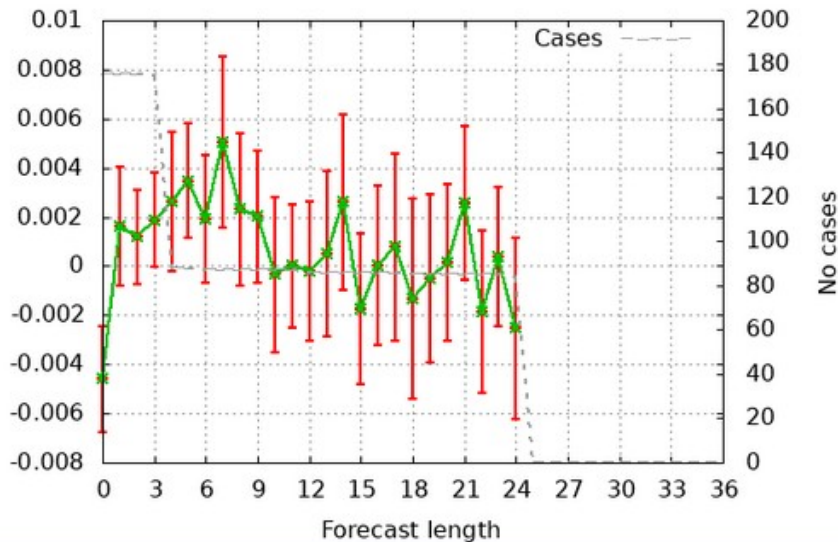
Wind at 10 m height

Ref compared to same size of SO

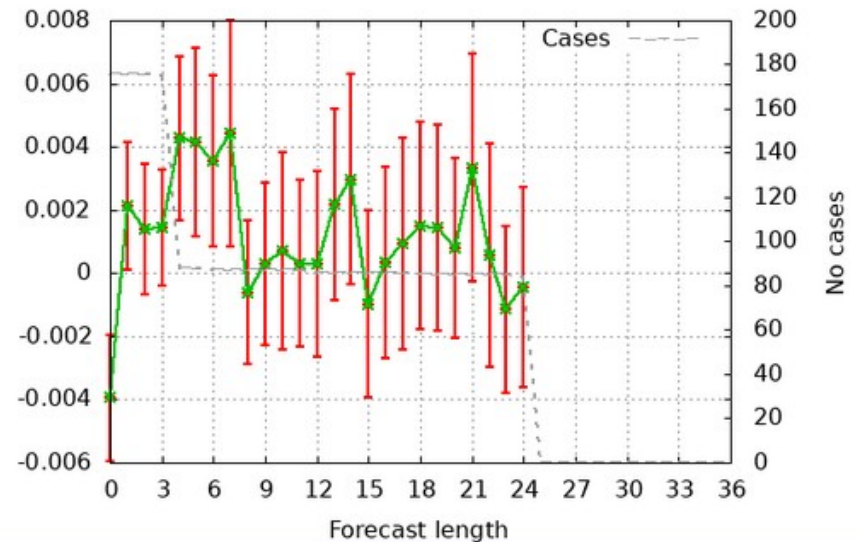
Ref compared to mixed size of SO

Observation verification comparison

Normalized mean RMSE diff (90% conf) dow_ref - dow_so6km_newBfg6nolow
Selection: ALL using 1009 stations
Period: 20210810-20210831
U10m Hours: {00,03,...,21}



Normalized mean RMSE diff (90% conf) dow_ref - dow_somix
Selection: ALL using 1009 stations
Period: 20210810-20210831
U10m Hours: {00,03,...,21}



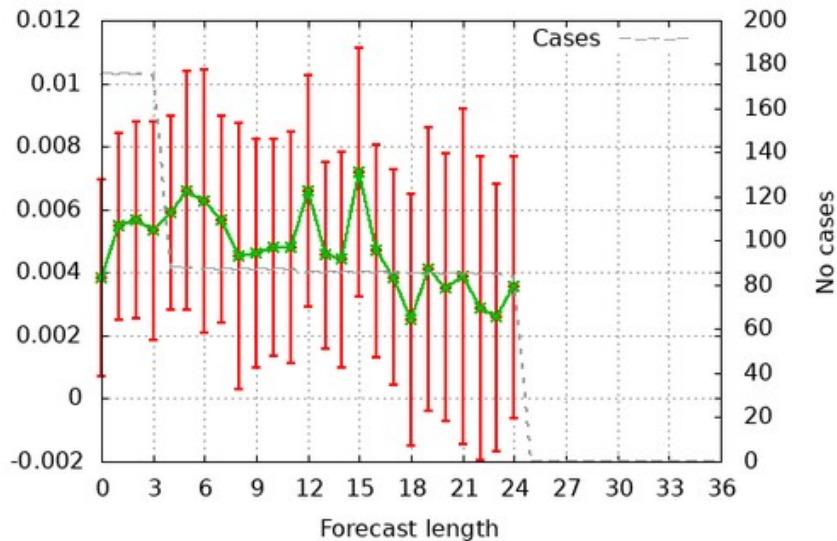
Temperature at 2 m height

Ref compared to same size of SO

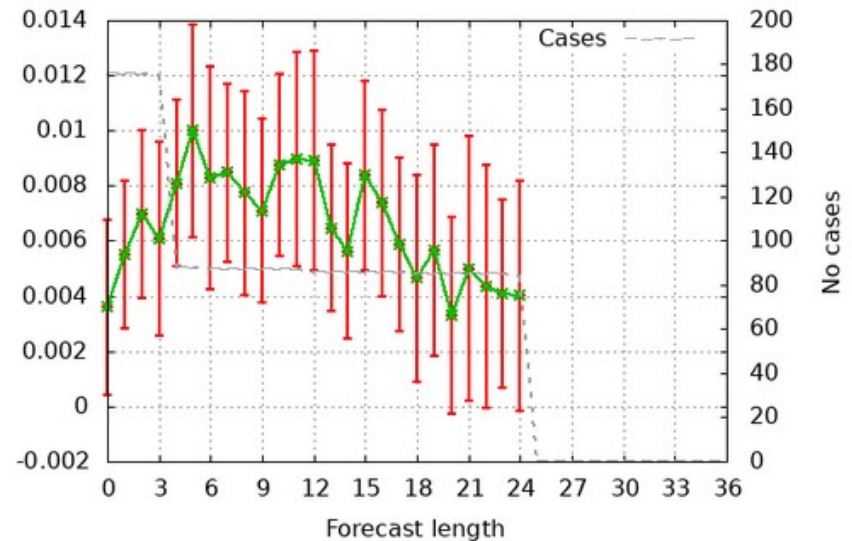
Ref compared to mixed size of SO

Observation verification comparison

Normalized mean RMSE diff (90% conf) dow_ref - dow_so6km_newBfg6nolow
Selection: ALL using 1064 stations
Period: 20210810-20210831
T2m Hours: {00,03,...,21}



Normalized mean RMSE diff (90% conf) dow_ref - dow_somix
Selection: ALL using 1064 stations
Period: 20210810-20210831
T2m Hours: {00,03,...,21}



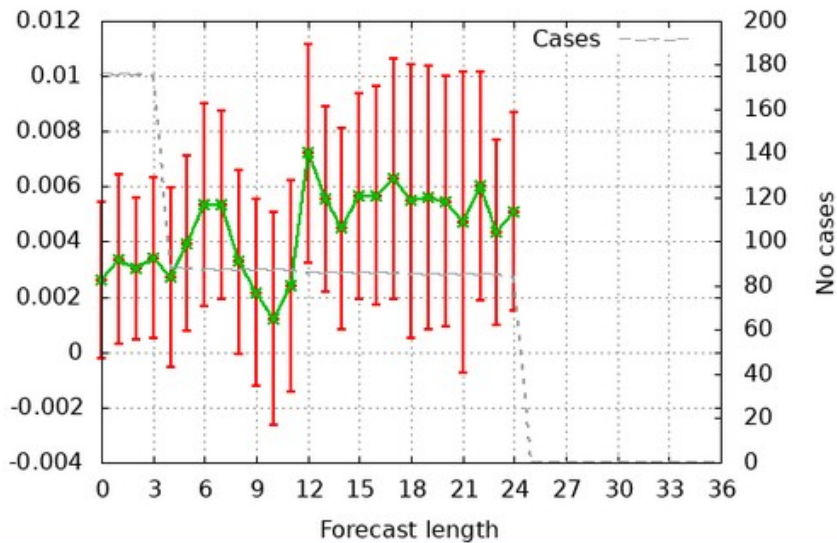
Relative humidity at 2 m height

Ref compared to same size of SO

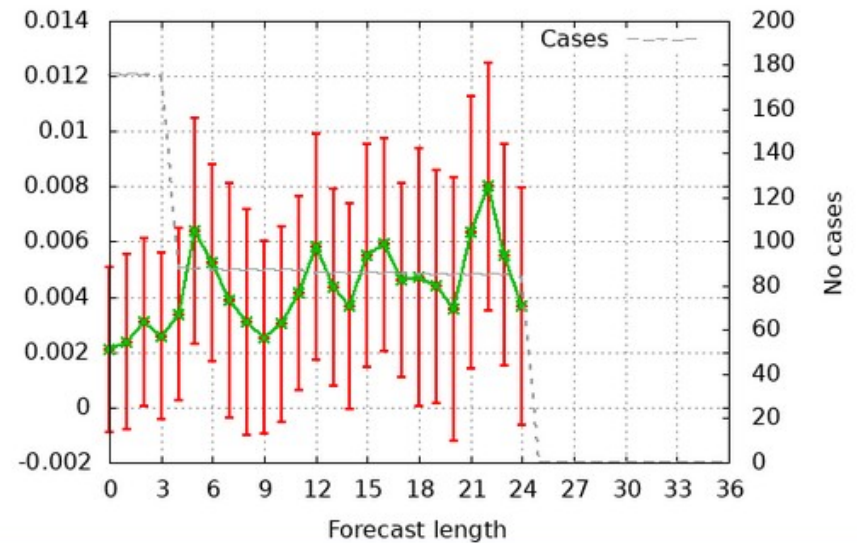
Ref compared to mixed size of SO

Observation verification comparison

Normalized mean RMSE diff (90% conf) dow_ref - dow_so6km_newBfg6nolow
Selection: ALL using 1046 stations
Period: 20210810-20210831
Rh2m Hours: {00,03,...,21}



Normalized mean RMSE diff (90% conf) dow_ref - dow_somix
Selection: ALL using 1046 stations
Period: 20210810-20210831
Rh2m Hours: {00,03,...,21}

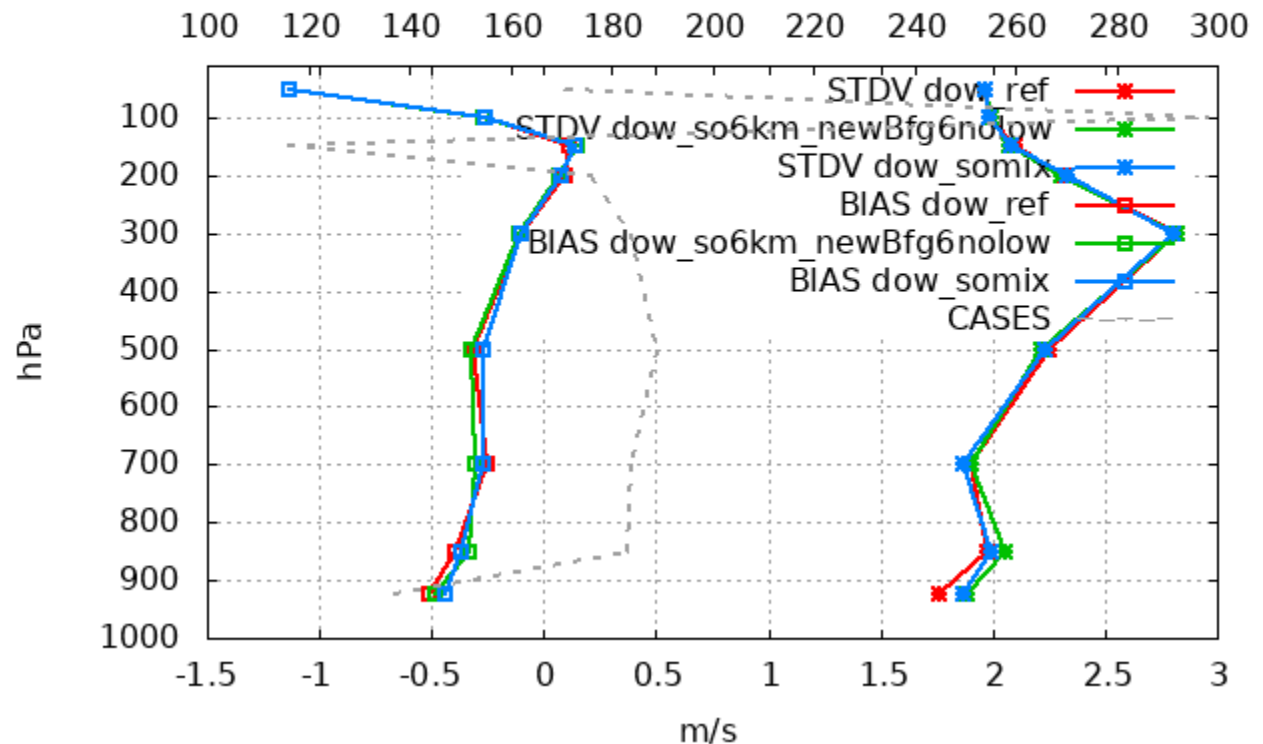


Vertical profiles of wind speed

22 stations Selection: ALL
 Wind speed Period: 20210810-20210831
 Used {00} + 12

No cases

Reference
 SO 6 km
 SO 6 and 3 km



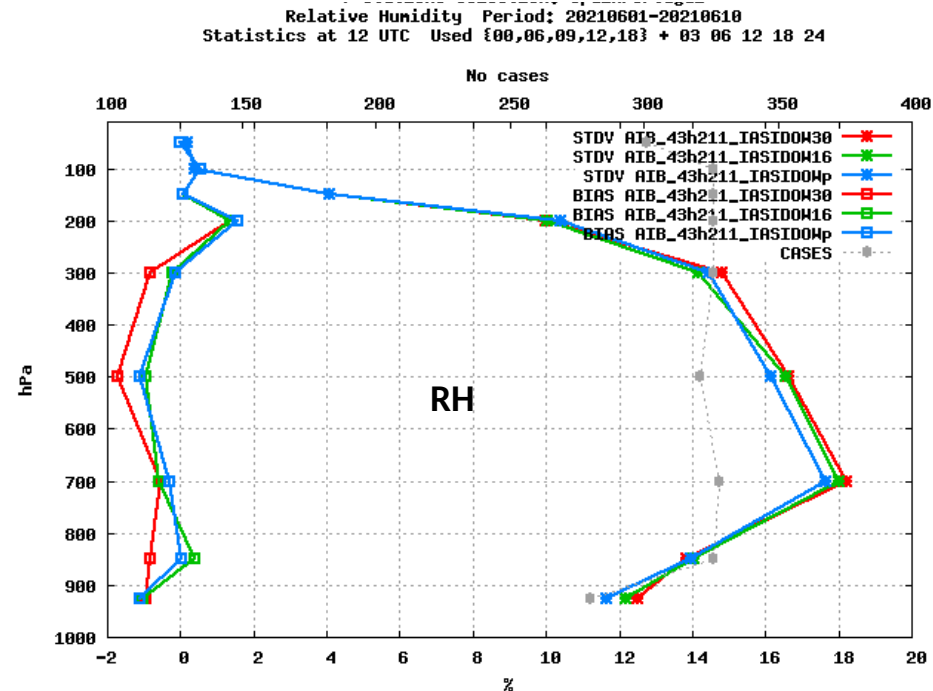
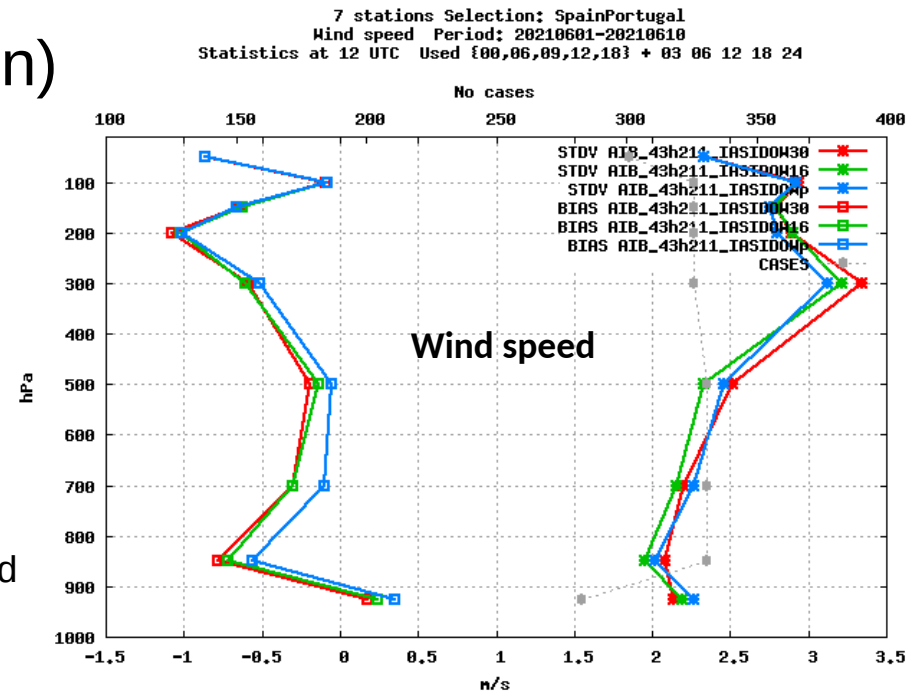
Experiences from AEMET (Spain)

- Same settings required
 - Reduced first guess check limit
 - Increased observation error
 - Increased thinning distance
- Problems with high elevations
 - Better results when high elevations are removed
- Test run with “optimal wind settings”
 - No good results (only 10 days so far)
 - Memory problems due to the amount of data

Reference

SO 6 km, no high elevations

SO 6 and 3 km



- Quality of the observations
 - Need to use wind optimized scans
 - 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)
 - Best results are seen when the size of the SO is smaller for winds
 - Preprocessing need to run twice
 - The amount of data will be more than doubled

- Use of the data
 - Important to tune the observation error
 - Important to tune the thinning distances