Windprofiler impact studies with the Hirlam model

Outline:

- **Use of wind profilers in HIRLAM 3/4D-VAR**
- **Experimental set-up**
- **Data quality**
- **Observation verification and case study**
- **Conclusions and outlook**

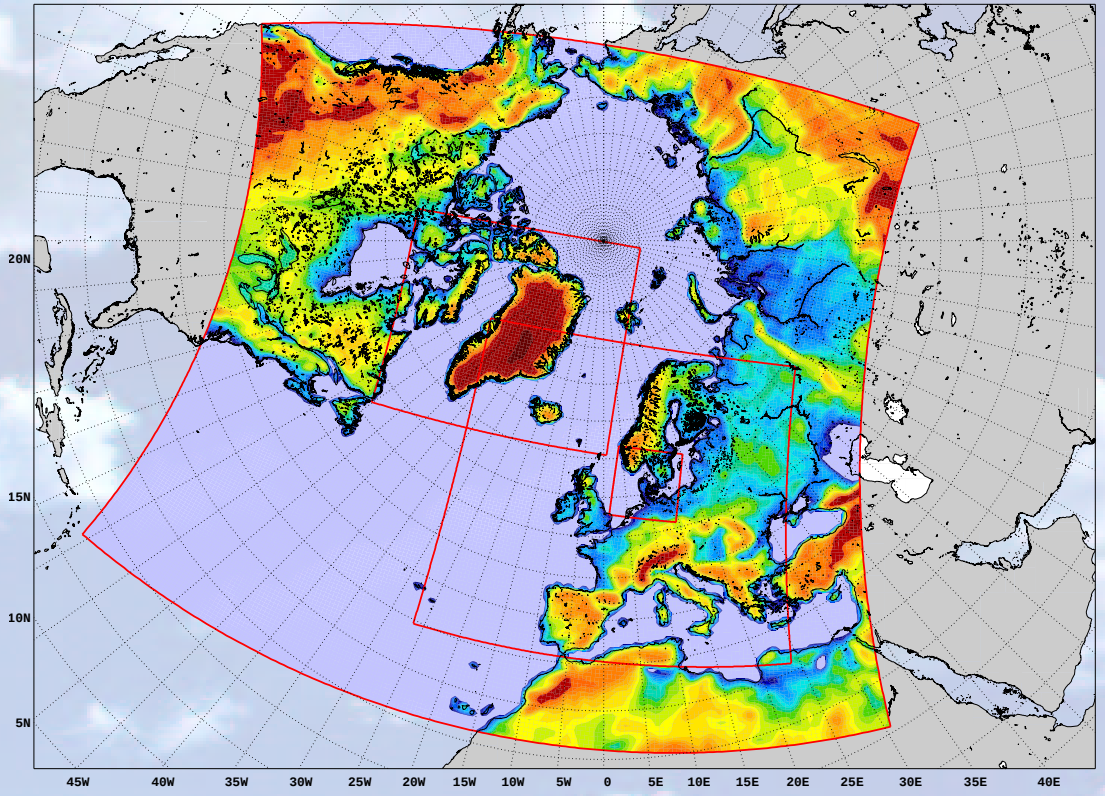
Kristian S. Mogensen, Xiang-Yu Huang and Magnus Lindskog
ksm@dmi.dk, xyh@dmi.dk and magnus.lindskog@smhi.se

Use of wind profilers in HIRLAM 3/4D-VAR :

1. The data are converted from BUFR til CMA by OBSPROC
2. CMA data are read by the analysis program
3. The innovation ($Hx_b - y$) is calculated
4. A whitelist is applied (Optionally).
5. The data is checked by the following screening checks:
   a) First-guess check
   b) Multi-level check
   c) Redundancy check where only 1 observation per station per time window is selected
6. The data is used in the minimization alongside all the other observations
7. Observations statistics and screening decisions are stored for monitoring

Experimental set-up :

- DMI-HIRLAM-G with DMI-HIRLAM-E nested inside
- Operational like settings for the forecast model
- 3 hour assmilation cycling with ECMWF large scale increments twice a day
- 3D-VAR FGAT
- Conventional + NOAA16 AMSU-A data
- Test run with GTS received (at DMI) EWP
- $\sigma_{o,windprof} = \sigma_{o,pilot}$

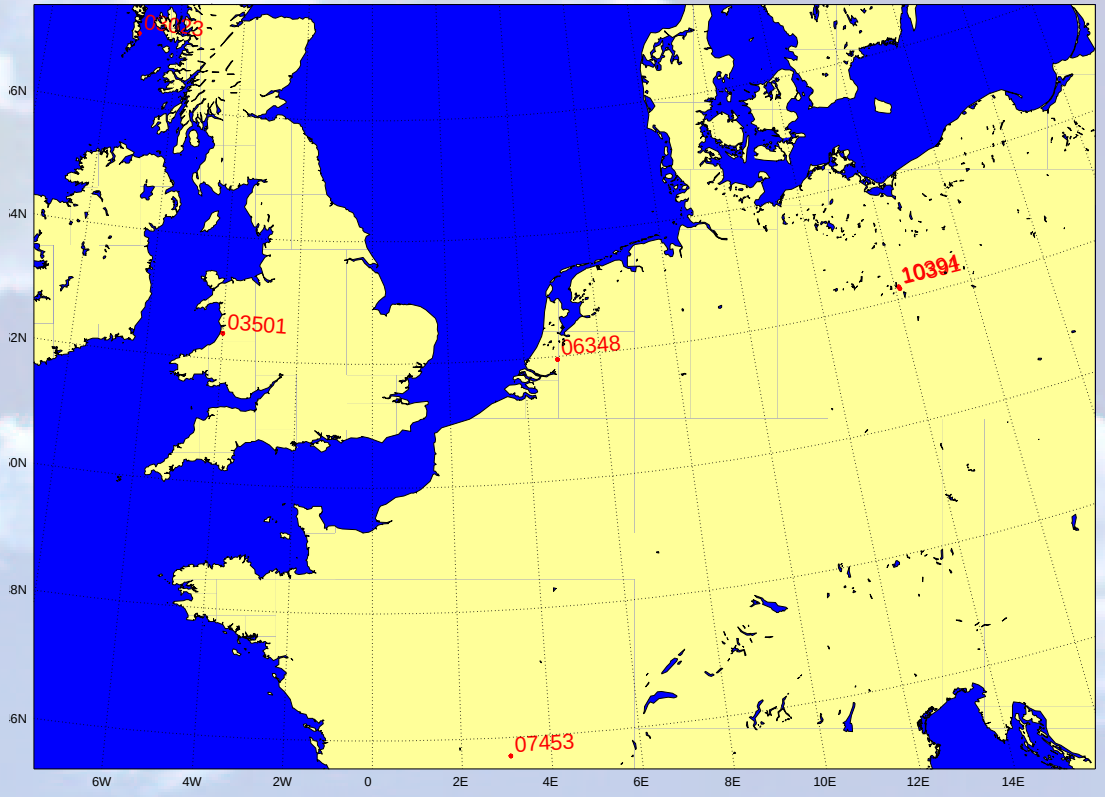


Data coverage :

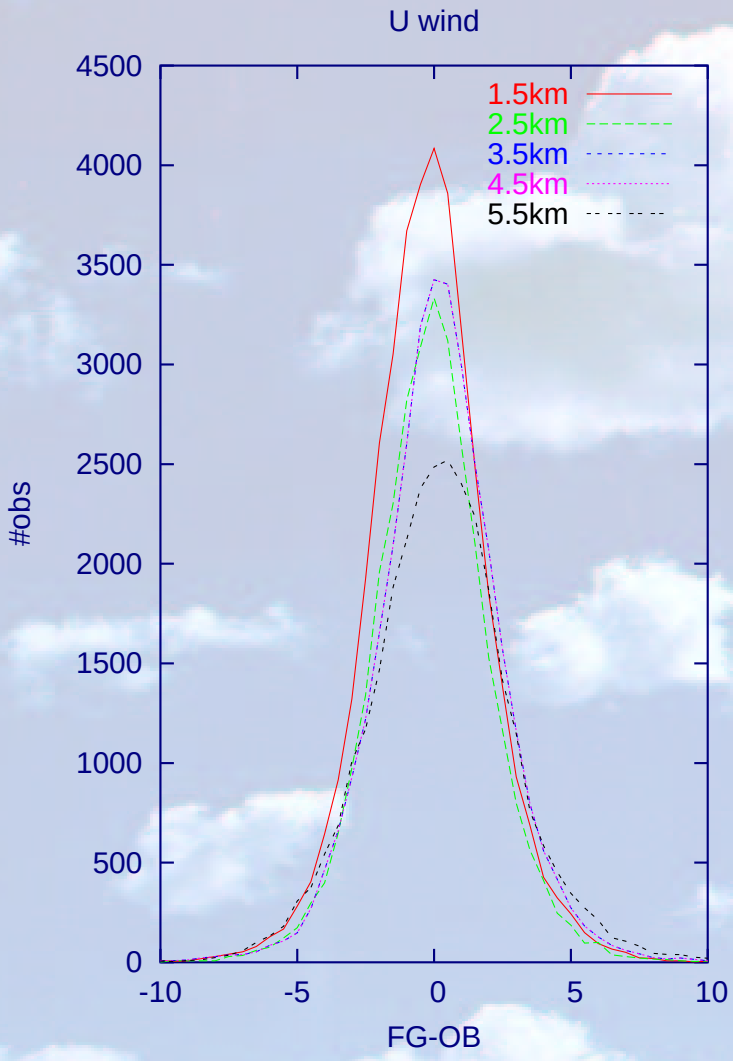
- Data received from GTS by DMI
- Totally 6 stations are received:

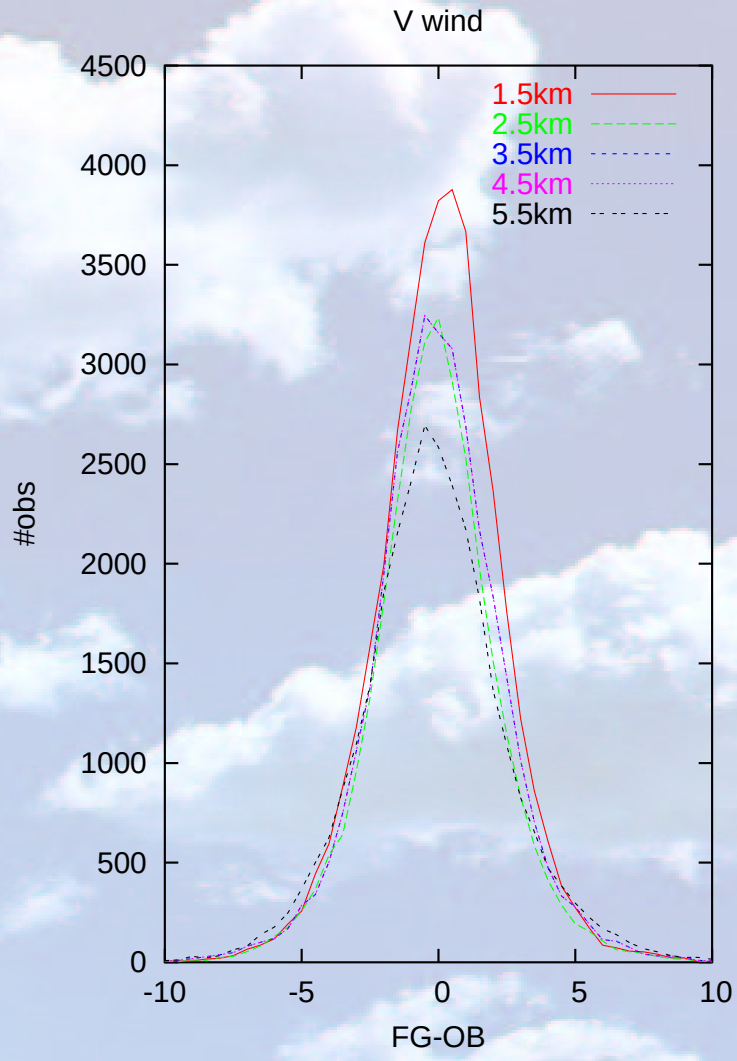
ID	Country
03023	UK
03501	UK
06348	Netherlands
07453	France
10391	Germany
10394	Germany

- Why don't we receive more?



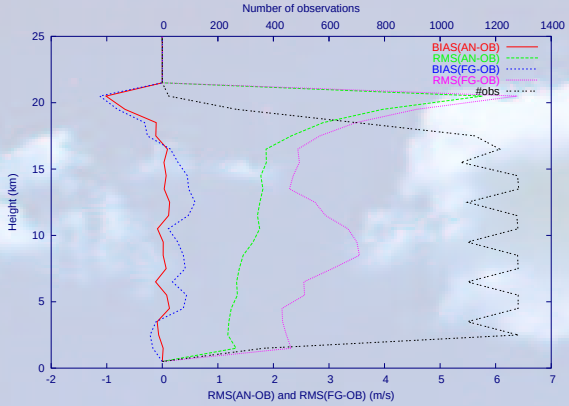
Data quality :



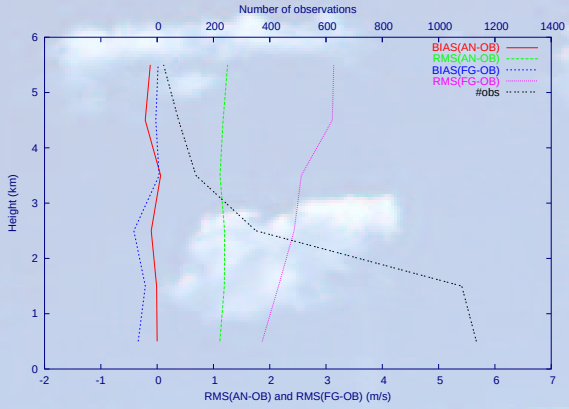


RMS and bias for individual stations :

U-wind

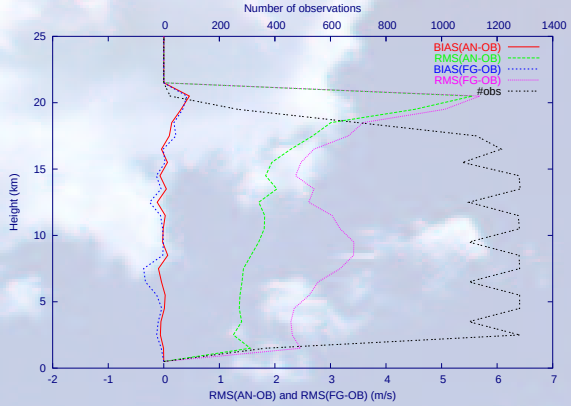


03501

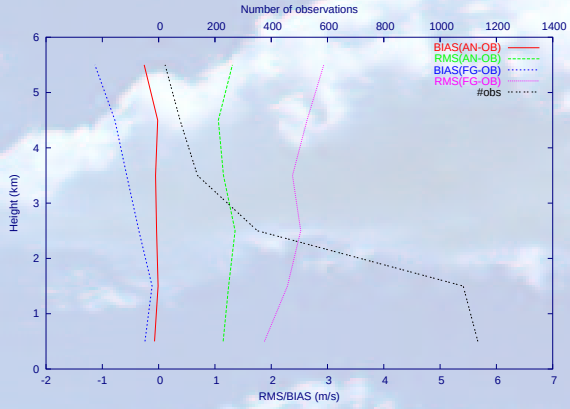


06348

V-wind

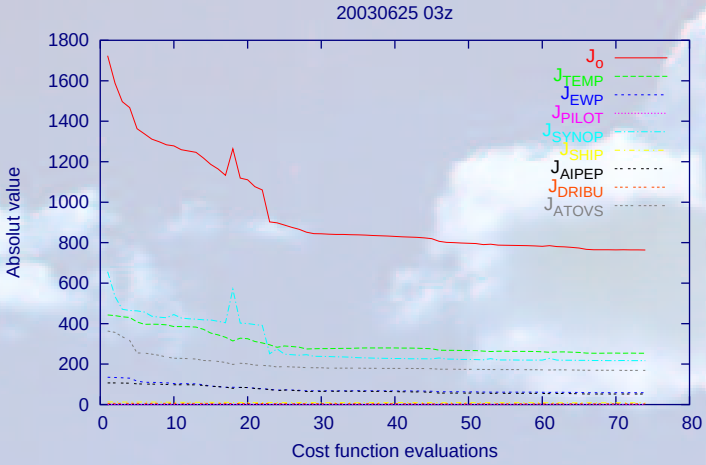


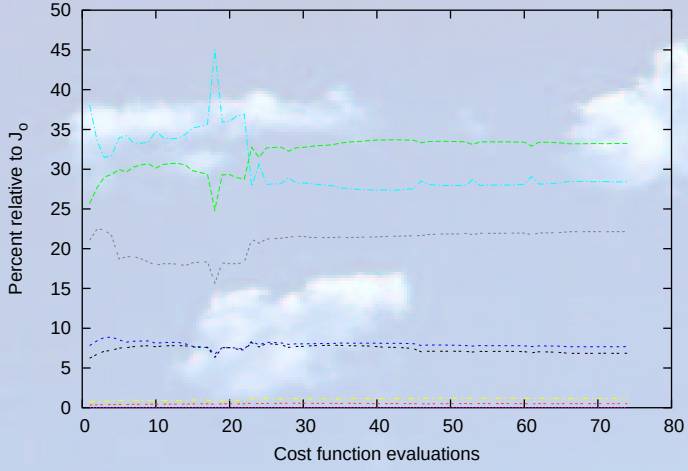
03501

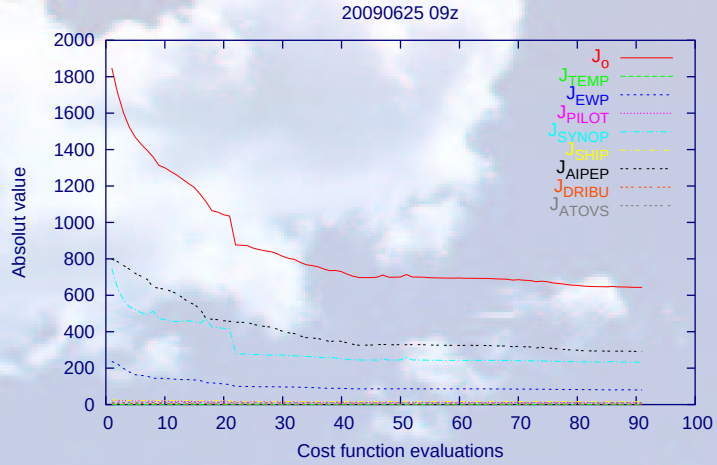


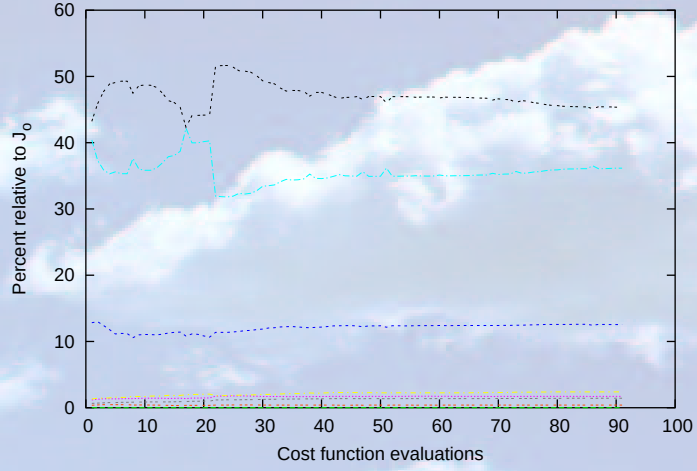
06348

Analysis influence of EWP : 03 and 09 runs

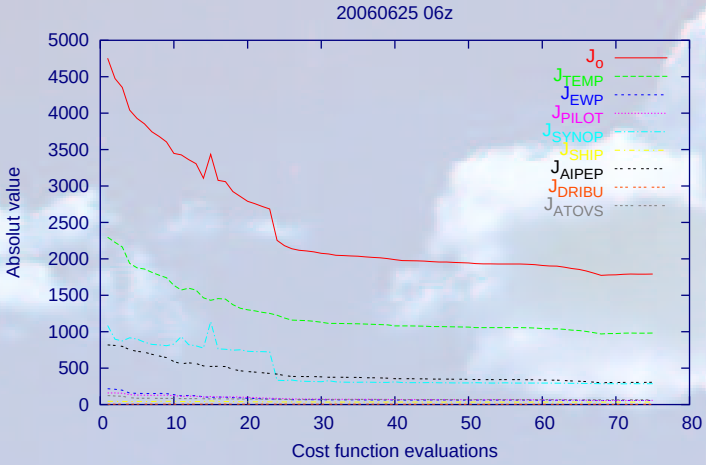


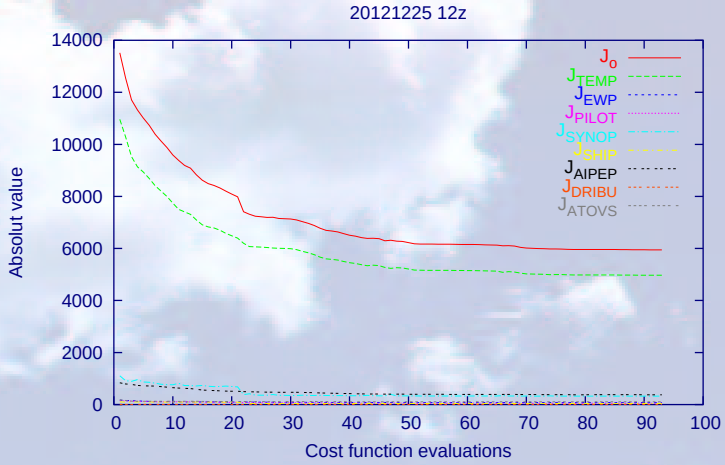


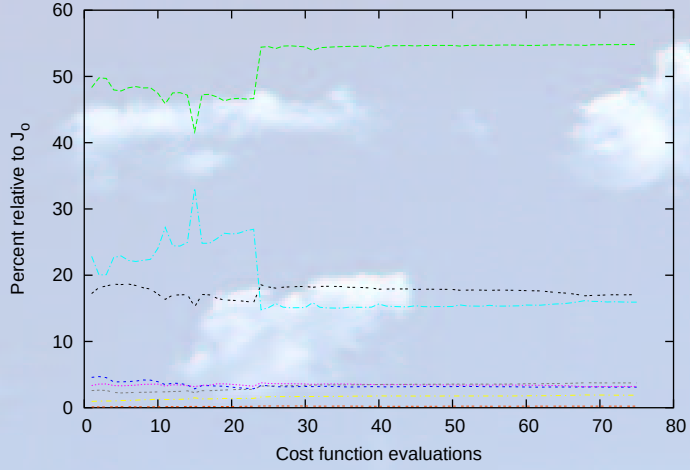


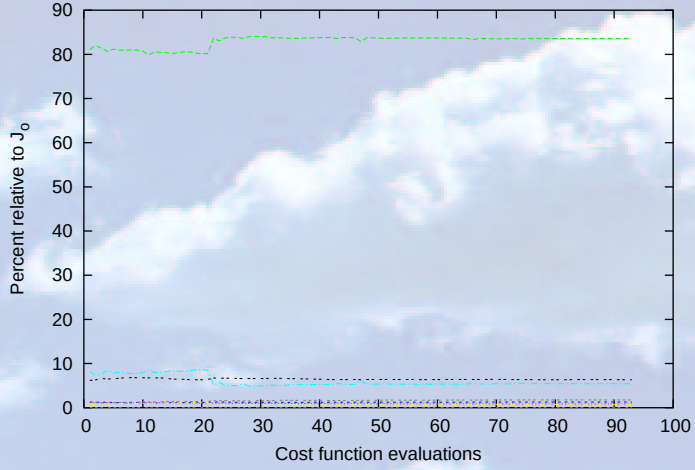


Analysis influence of EWP : 06 and 12 runs

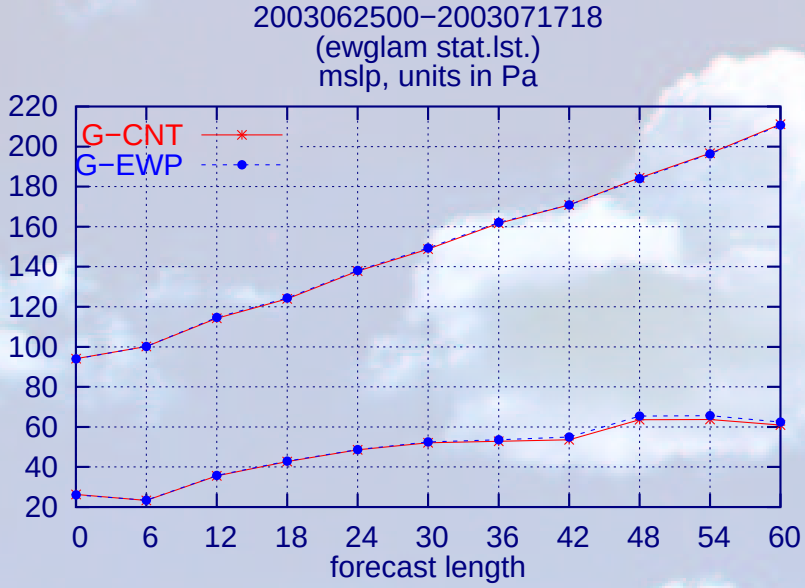


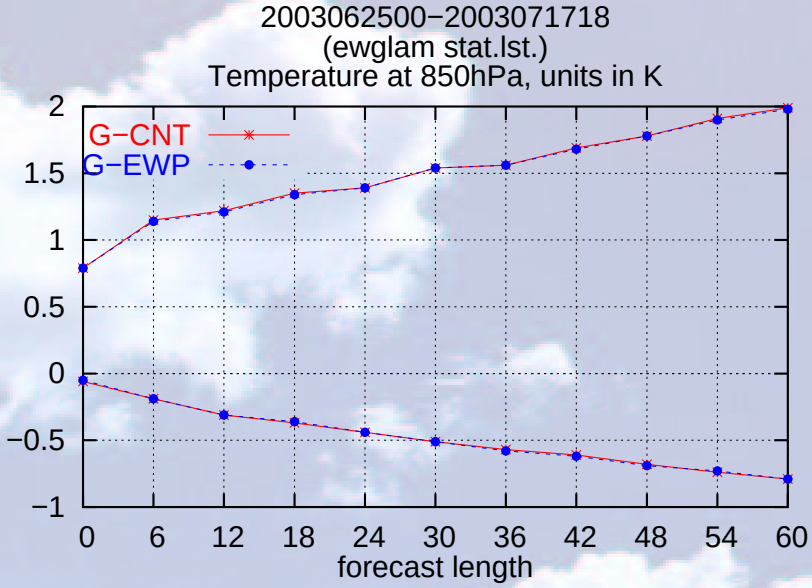


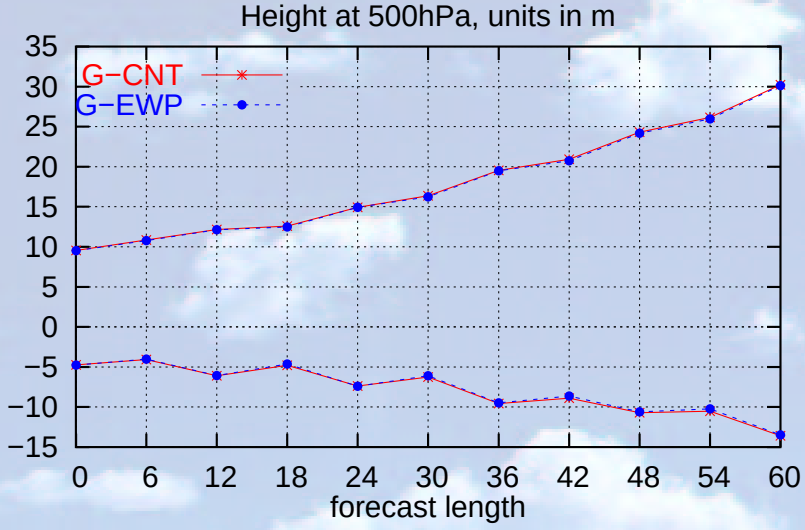


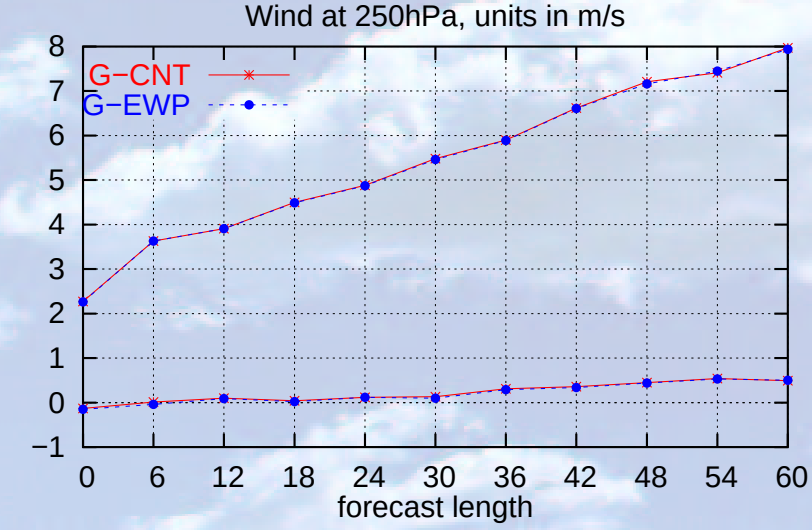


Verification against EWGLAM stations : G area

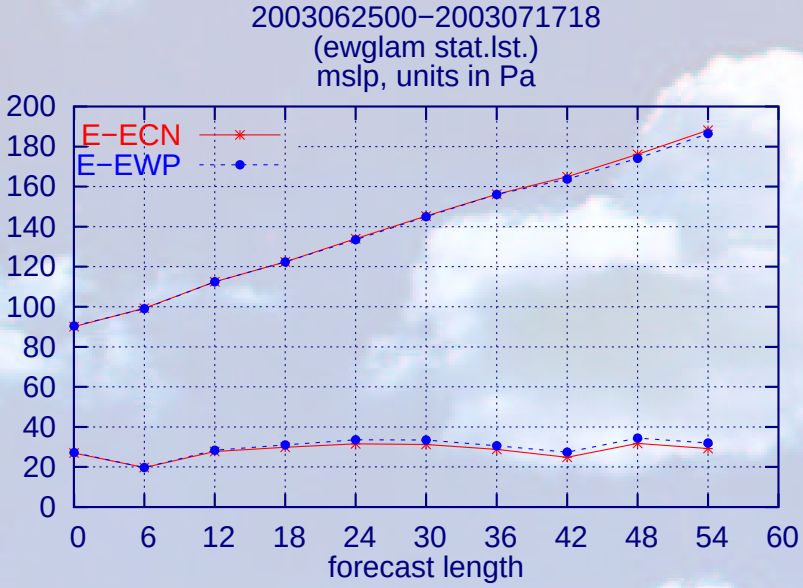


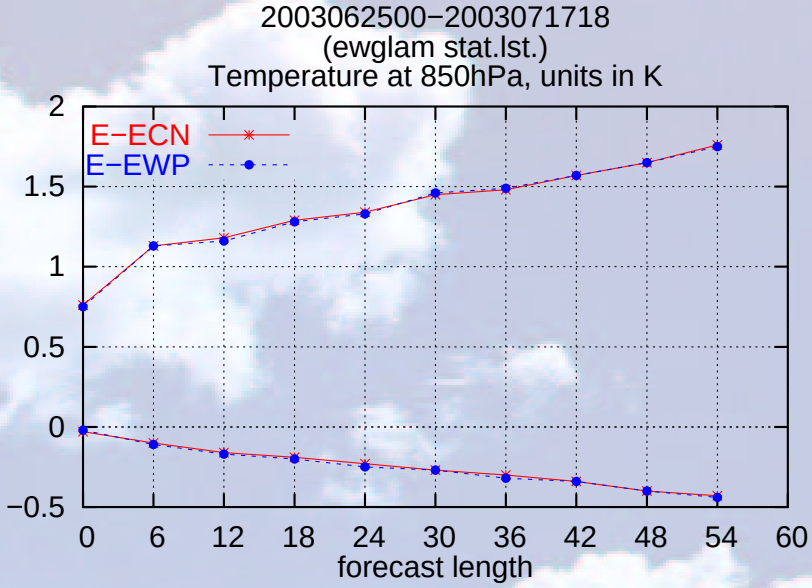


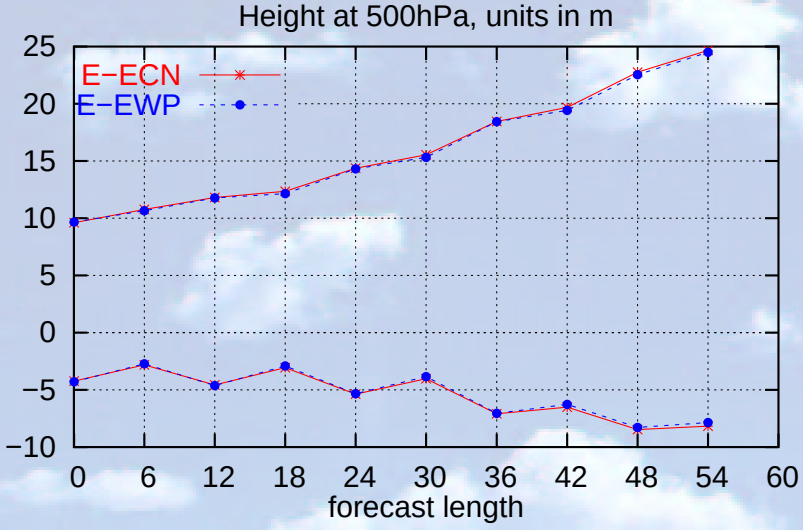


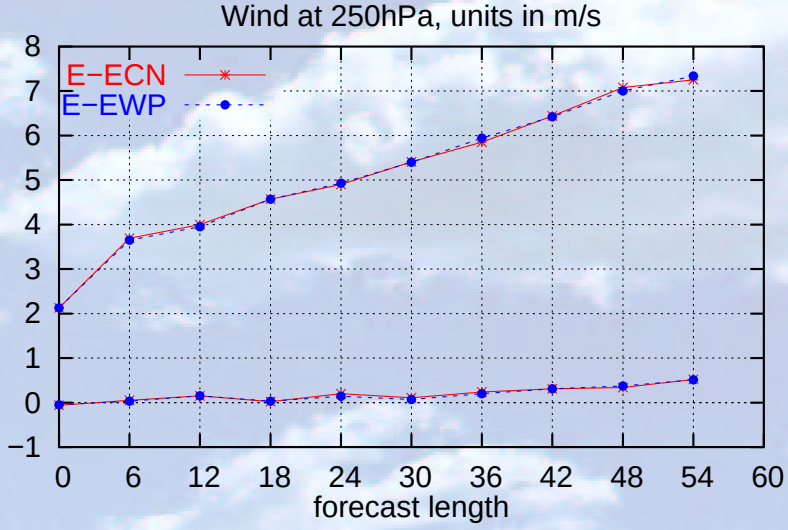


Verification against EWGLAM stations : E area



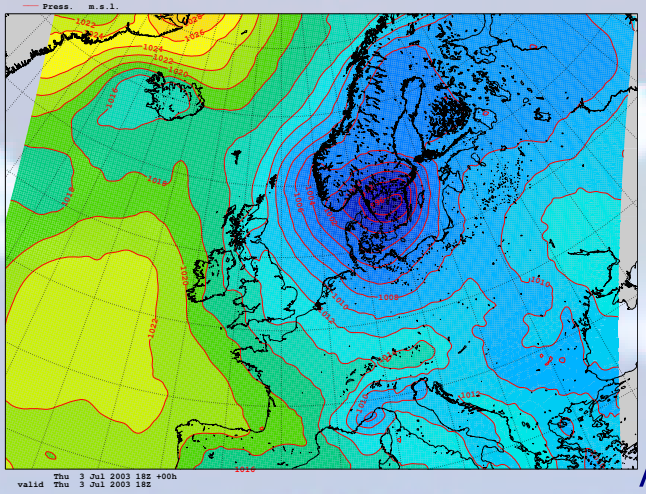




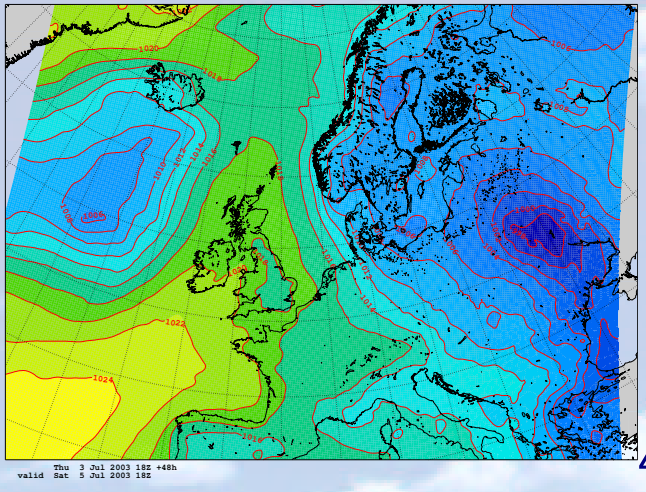


Case study 20030705 18z :

Without EWP

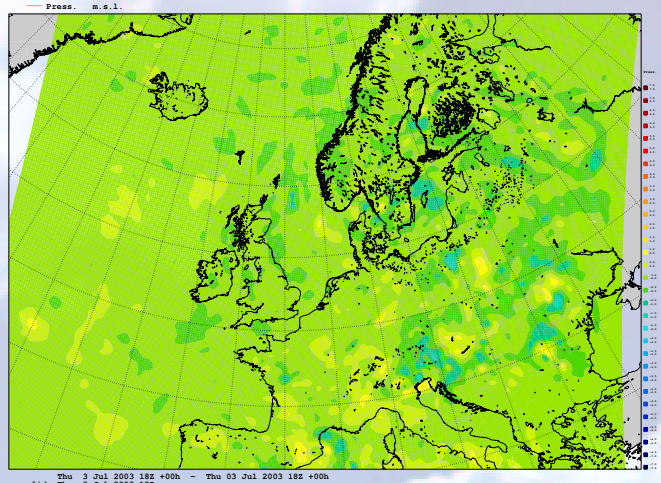


Analysis

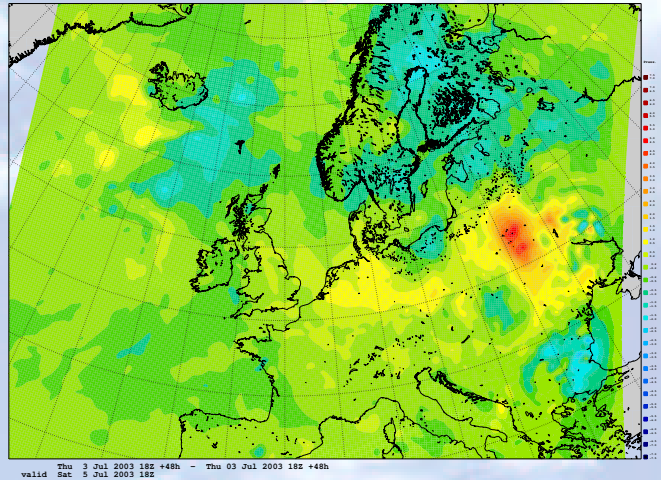


48 FCST

With EWP (difference)



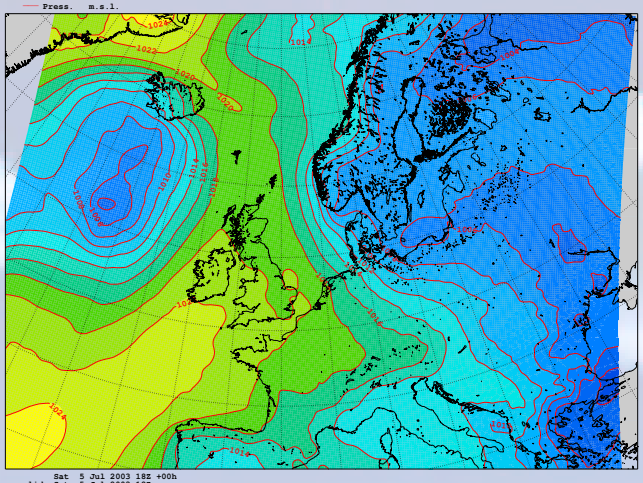
Analysis



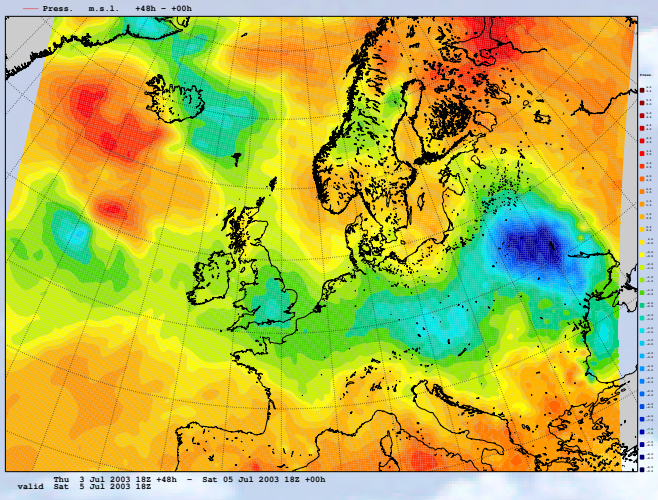
48 FCST

Case study 20030705 18z : analysis

Without EWP

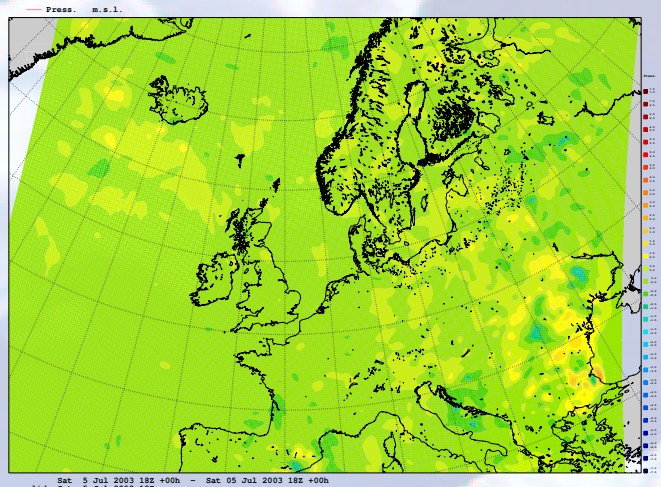


Analysis

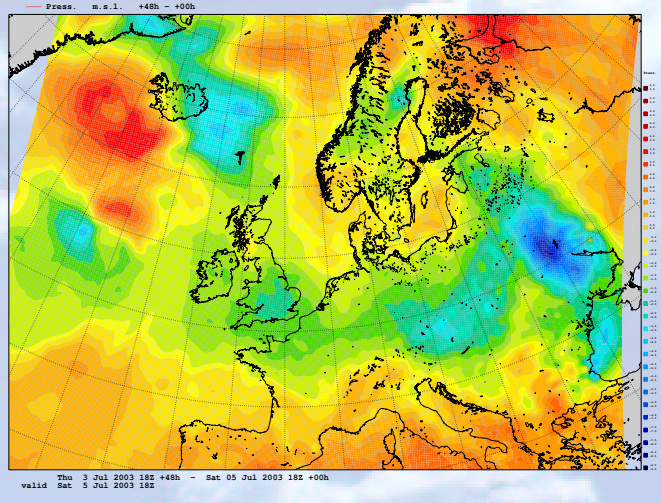


FCST error

With EWP



Ana. diff



FCST error

Conclusions :

- Most of the observations used in this study are of high quality
- A few observations are clearly wrong (e.g. vertical level < 0 and wind > 200 m/s) but those are rejected by the screening
- The data are most useful for RUC/4D-VAR, but 3 hour cycle can still benefit from them
- Even with few observations the observational information content increases significant for the 03z, 09z, 15z and 21z cycles
- In the present study neutral to (very) slightly positive impact is found
- A few forecast failures are less severe when including wind-profilers

Outlook :

- More data should be received on GTS (under investigation)
- Operational monitoring will be set-up