



2011 EVGA Meeting – Bonn, Germany



Strategy to Improve the Homogeneity of Meteorological Data in CALC/SOLVE Database

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Contents

- State-of-the-art: Pressure, temperature.
 - Importance of those data.
 - What is in the database?
- Impact of:
 - A 10mbar pressure offset in the processing;
 - Using the smoothed 6-hours meteorological data series from ECMWF;
 - Using the default value in CALC/SOLVE.
- Study case: R1 and R4 sessions in which Westford participated from Jan. 2002 – Apr. 2010.
- Strategy to obtain a homogeneous database.



What is in the CALC/SOLVE data base? Temperature and pressure

2008 VLBI sessions (167)

- Met data in VLBI database
- ✗ Missing met data
- Session in which station did not participate

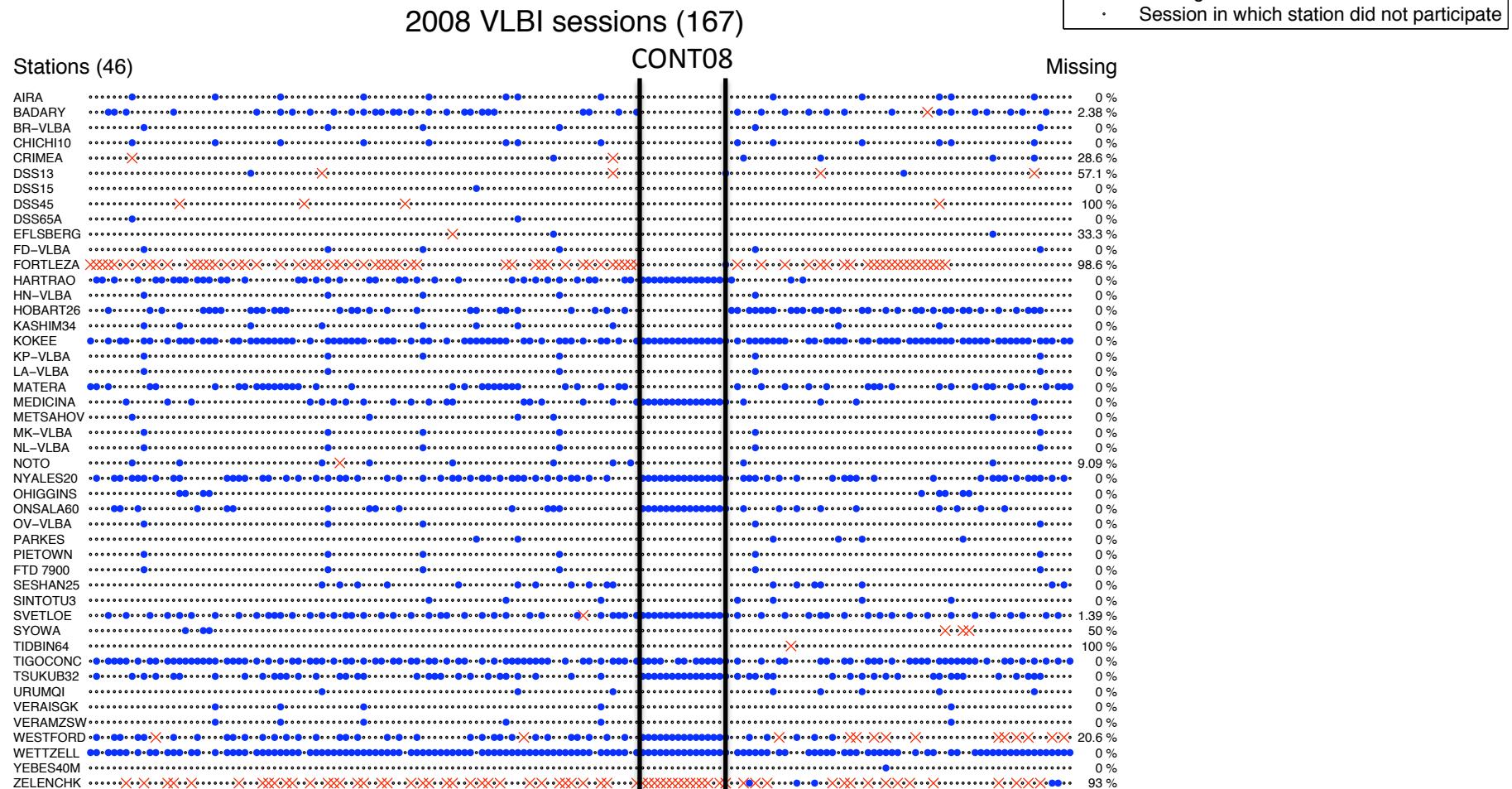
Stations (46)

Missing

| | | |
|----------|-------|--------|
| AIRA | ..... | 0 % |
| BADARY | ..... | 2.38 % |
| BR-VLBA | ..... | 0 % |
| CHICH10 | ..... | 0 % |
| CRIMEA | ✗ | 28.6 % |
| DSS13 | ..... | 57.1 % |
| DSS15 | ..... | 0 % |
| DSS45 | ✗ | 100 % |
| DSS65A | ..... | 0 % |
| EFLSBERG | ..... | 33.3 % |
| FD-VLBA | ..... | 0 % |
| FORTLEZA | ✗✗✗✗ | 98.6 % |
| HARTRAO | ..... | 0 % |
| HN-VLBA | ..... | 0 % |
| HOBART26 | ..... | 0 % |
| KASHIM34 | ..... | 0 % |
| KOKEE | ..... | 0 % |
| KP-VLBA | ..... | 0 % |
| LA-VLBA | ..... | 0 % |
| MATERA | ..... | 0 % |
| MEDICINA | ..... | 0 % |
| METSAHOV | ..... | 0 % |
| MK-VLBA | ..... | 0 % |
| NL-VLBA | ..... | 0 % |
| NOTO | ..... | 9.09 % |
| NYALES20 | ..... | 0 % |
| OHIGGINS | ..... | 0 % |
| ONSALA60 | ..... | 0 % |
| OV-VLBA | ..... | 0 % |
| PARKES | ..... | 0 % |
| PIETOWN | ..... | 0 % |
| FTD 7900 | ..... | 0 % |
| SESHAN25 | ..... | 0 % |
| SINTOTU3 | ..... | 0 % |
| SVETLOE | ..... | 1.39 % |
| SYOWA | ..... | 50 % |
| TIDBIN64 | ..... | 100 % |
| TIGOCONC | ..... | 0 % |
| TSUKUB32 | ..... | 0 % |
| URUMQI | | 0 % |
| VERAISGK | | 0 % |
| VERAMZSW | | 0 % |
| WESTFORD | | 20.6 % |
| WETTZELL | | 0 % |
| YEBES40M | | 0 % |
| ZELENCHK | ✗✗ | 93 % |



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More than 90% of missing data:
Fortleza and Zelenchuk



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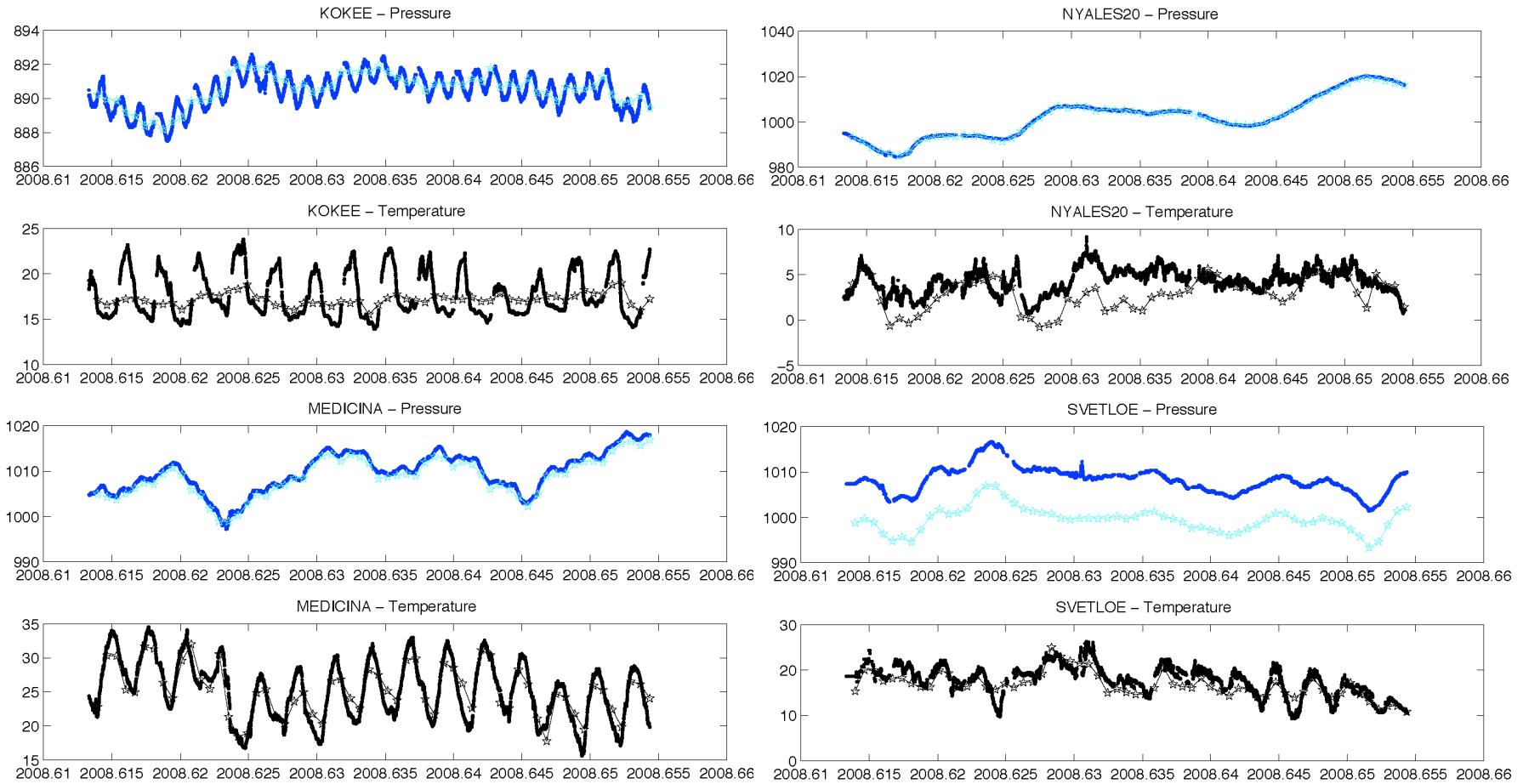
Westford:
Met sensor provided
by NOAA onsite
Then, from July 2001,
met data from SA01
(GPS sensor –
Suominet network)





What is in the CALC/SOLVE data base?

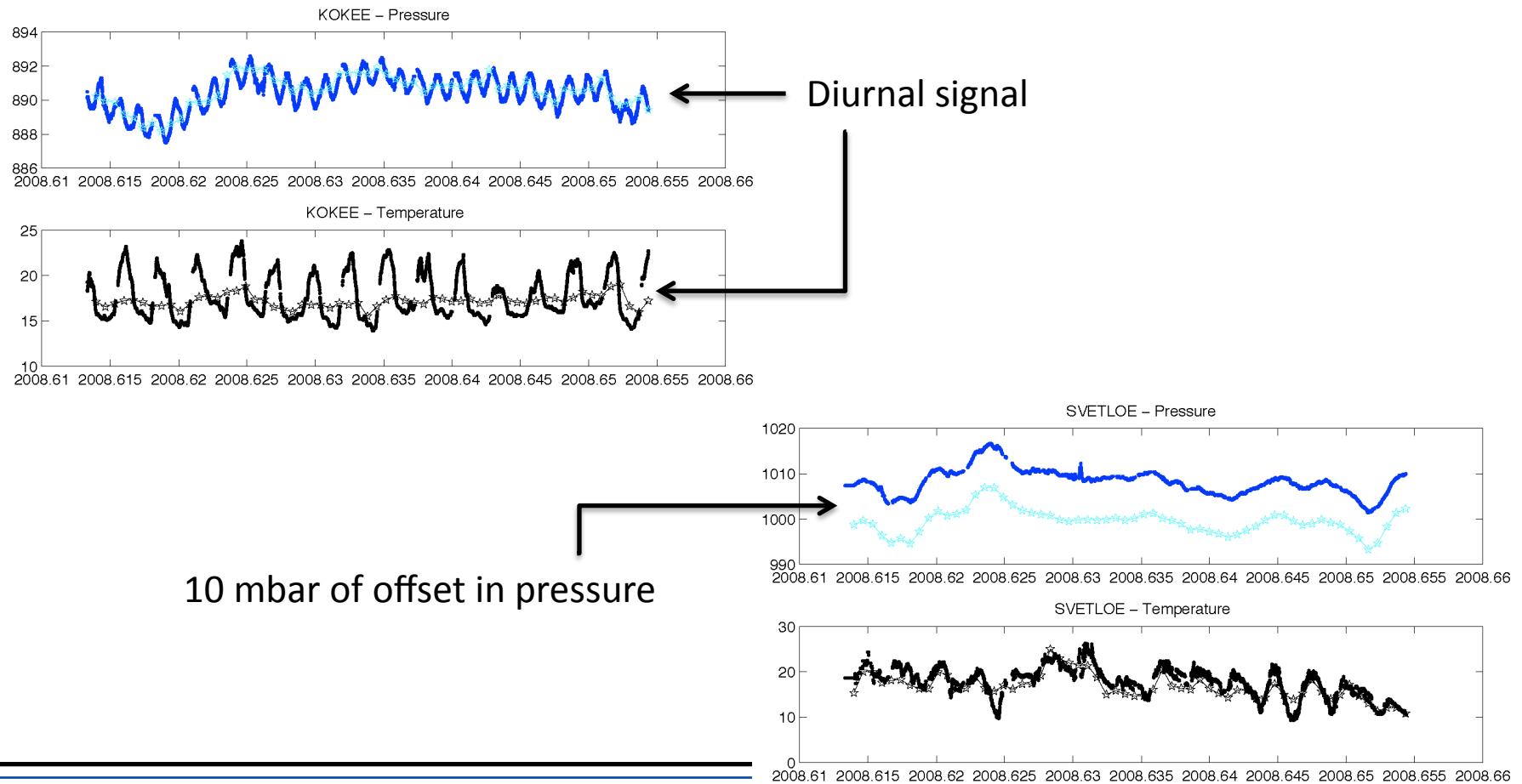
- Quality of the met data in the data base?
 - Comparaison with ECMWF on CONT08 period.





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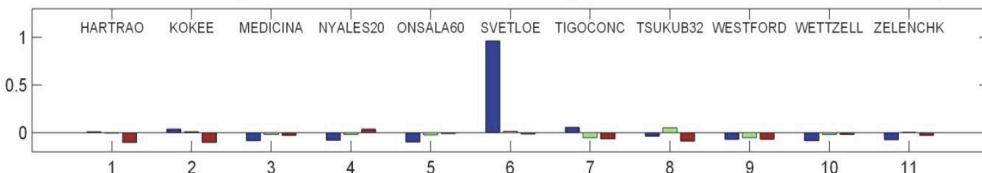




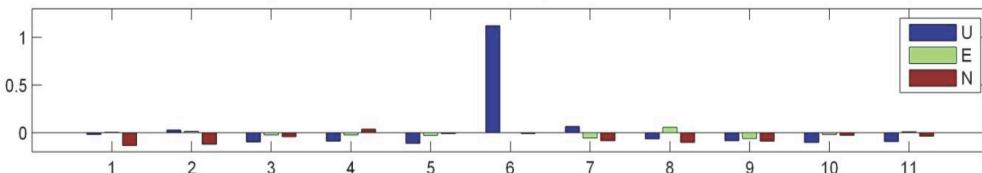
Impact of an offset in pressure

SVETLOE analyzed on CONT08 period

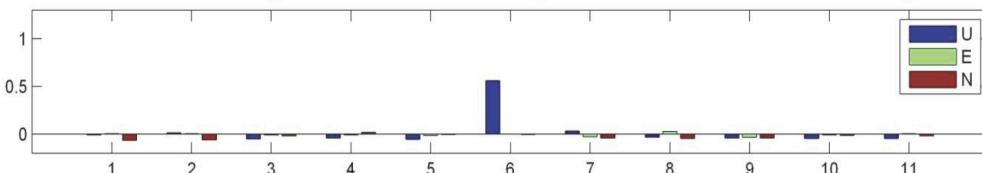
Differences (pressure from ECMWF / pressure from the data base)



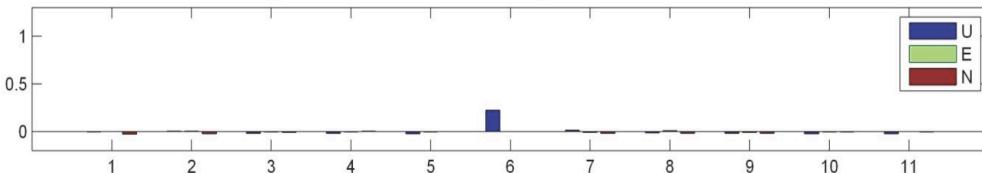
Differences (pressure – 10mbar / pressure from the data base)



Differences (pressure – 5mbar / pressure from the data base)



Differences (pressure – 2mbar / pressure from the data base)

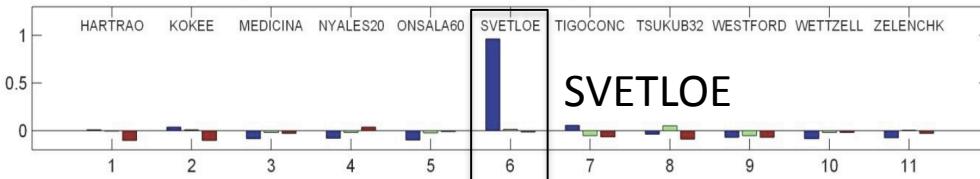




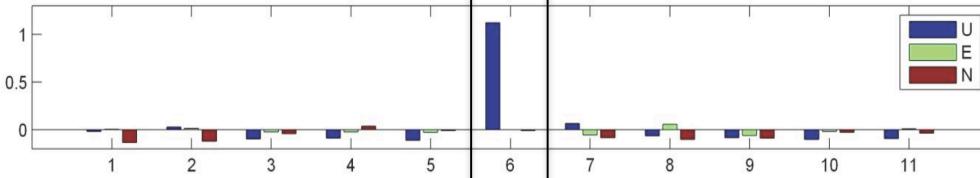
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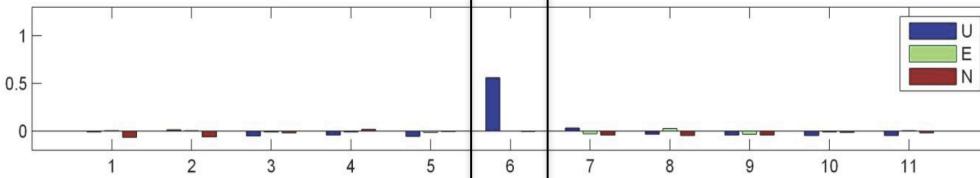
Differences (pressure from ECMWF / pressure from the data base)



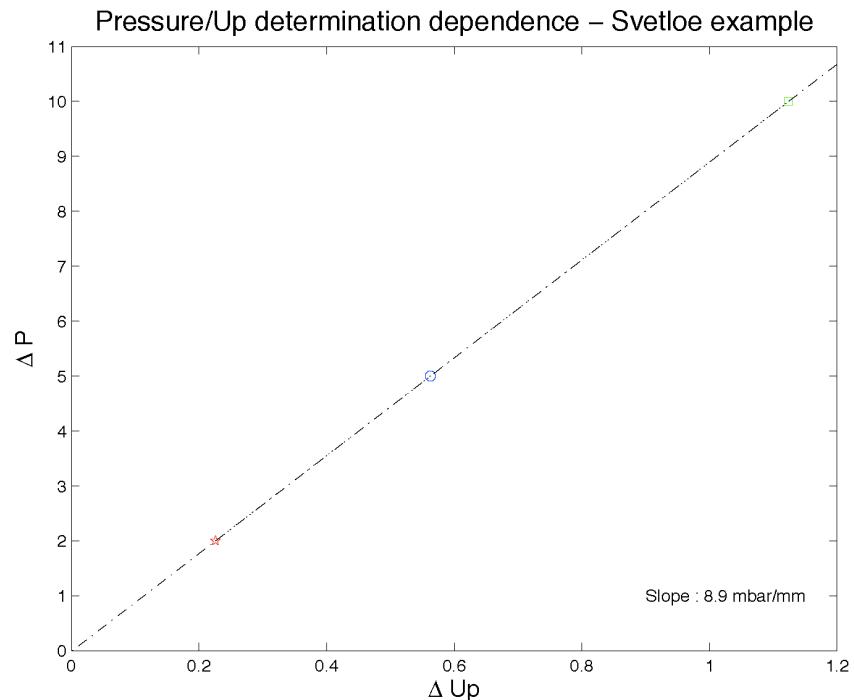
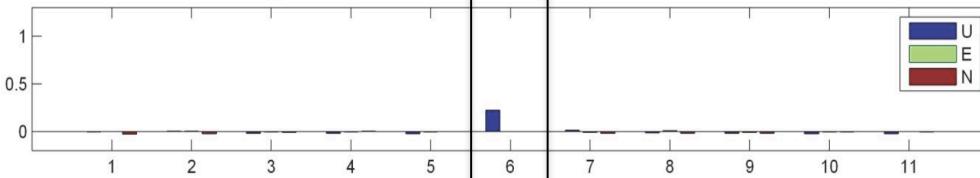
Differences (pressure - 10mbar / pressure from the data base)



Differences (pressure - 5mbar / pressure from the data base)



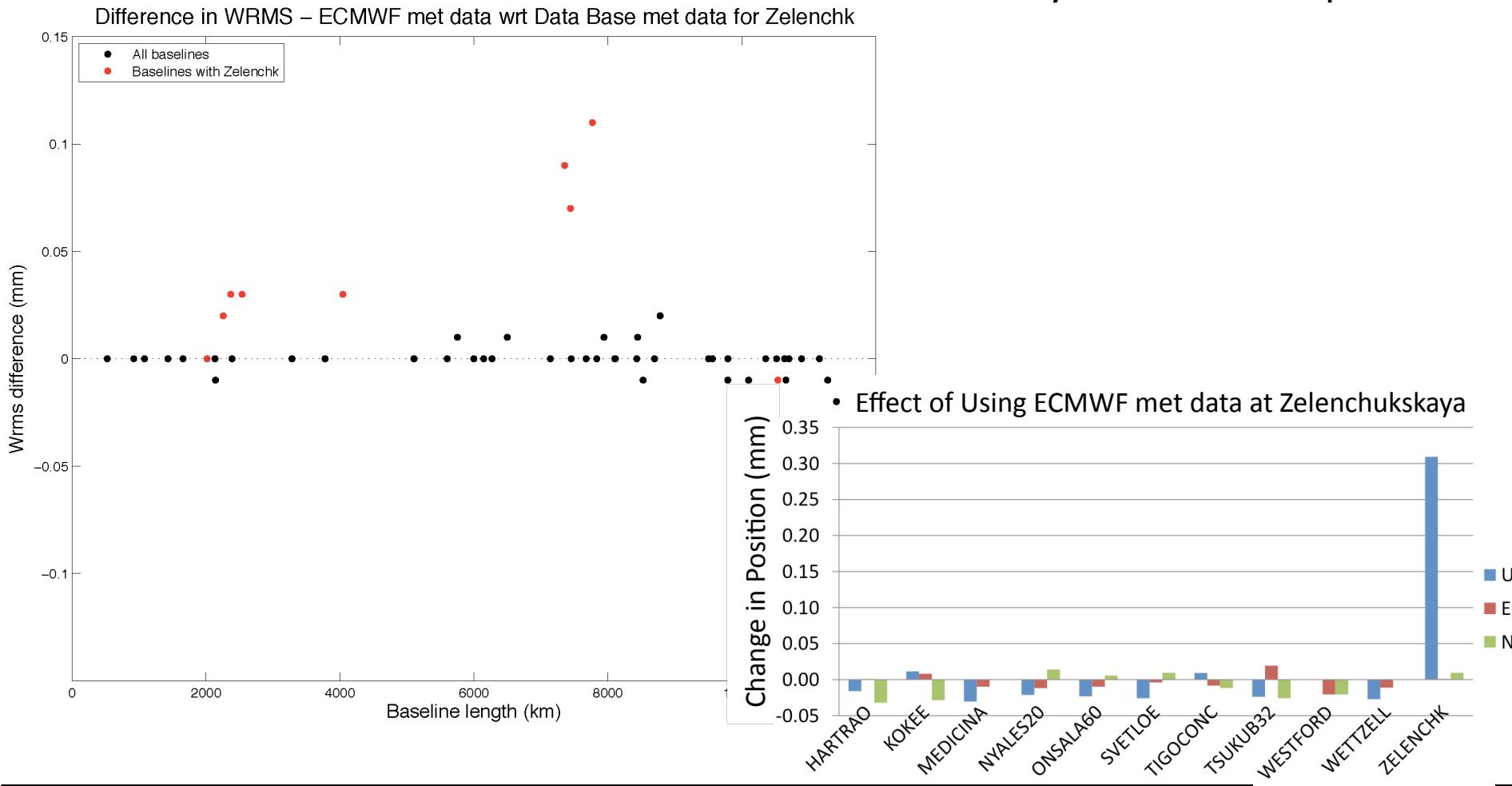
Differences (pressure - 2mbar / pressure from the data base)





CALC/SOLVE default value vs ECMWF

Zelenchukskaya on CONT08 period





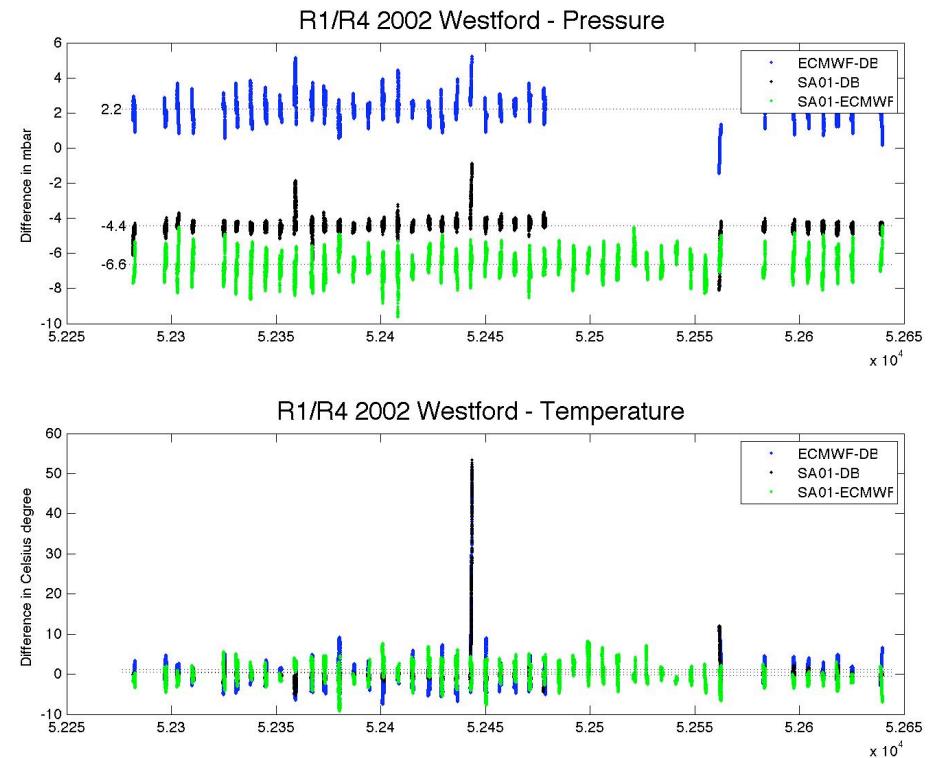
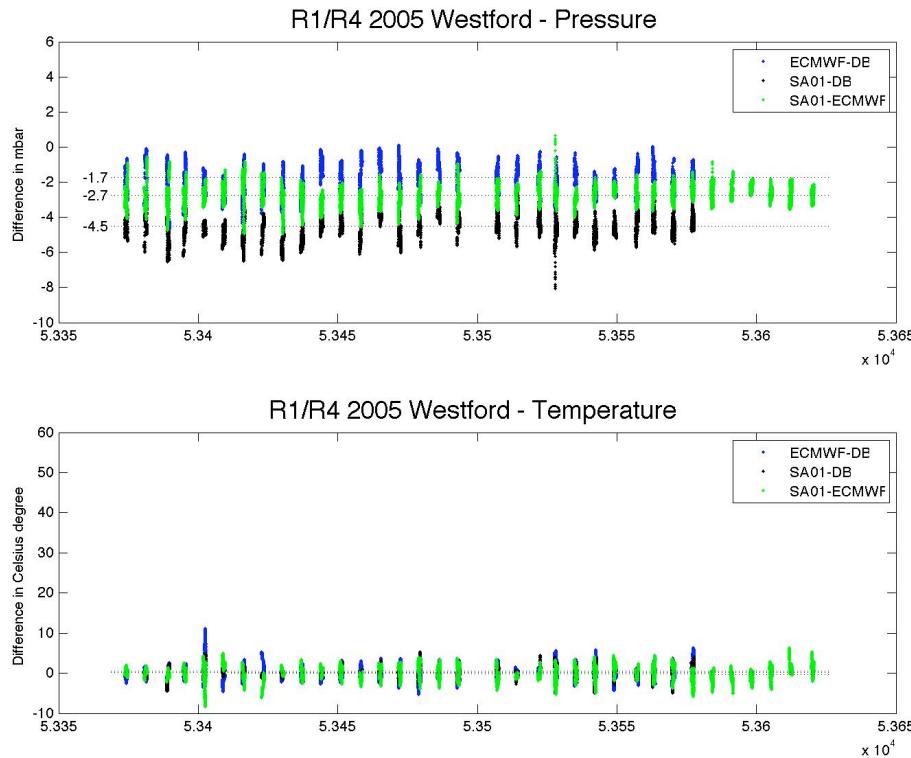
Westford: Jan. 2002 – Apr. 2010

- Jan. 2002 – Apr. 2010:
Westford participated in 351 R1/R4 sessions.
- Met data available for Westford:
 - CALC/SOLVE database;
 - ECMWF (every 6 hours);
 - Suominet data / GPS sensor (**Haystack website:** <ftp://web.haystack.mit.edu> or **UNAVCO website:** <ftp://data-out.unavco.org>).
- Experiences: For Westford only
 - 1/ Using met data from the CALC/SOLVE database if it exists, default value otherwise;
 - 2/ Using met data from the CALC/SOLVE database if it exists, ECMWF value otherwise;
 - 3/ Using only ECMWF value as met data;
 - 4/ Using met data from the Suominet sensor SA01.



Westford: Jan. 2002 – Apr. 2010

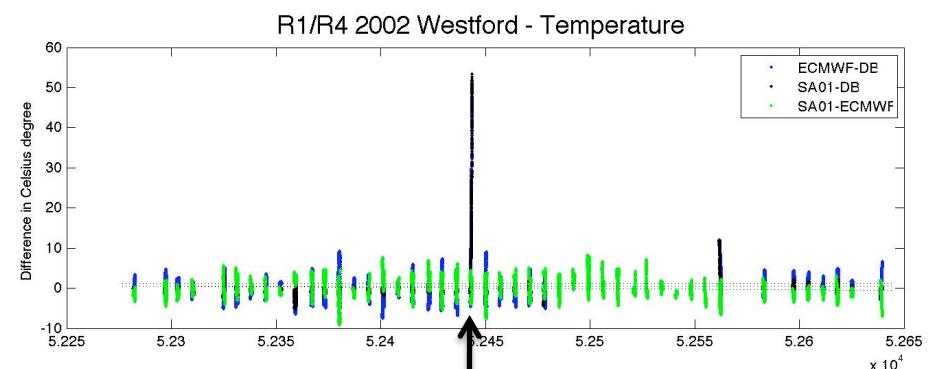
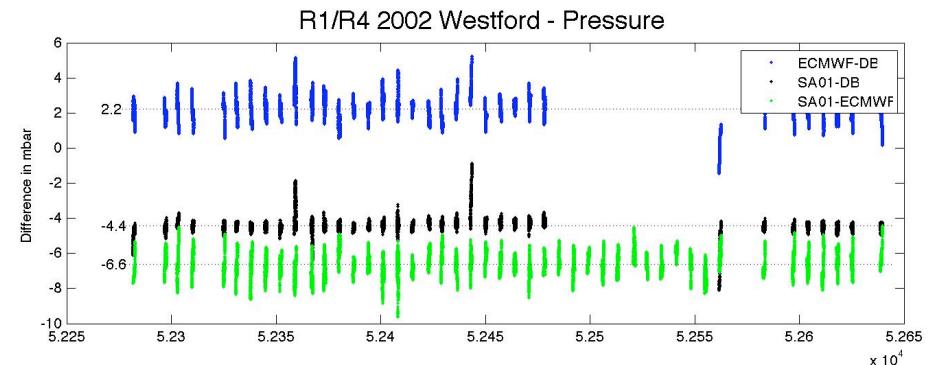
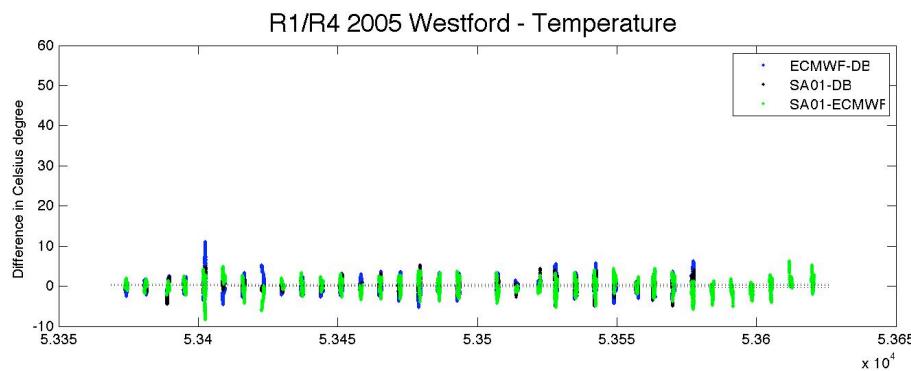
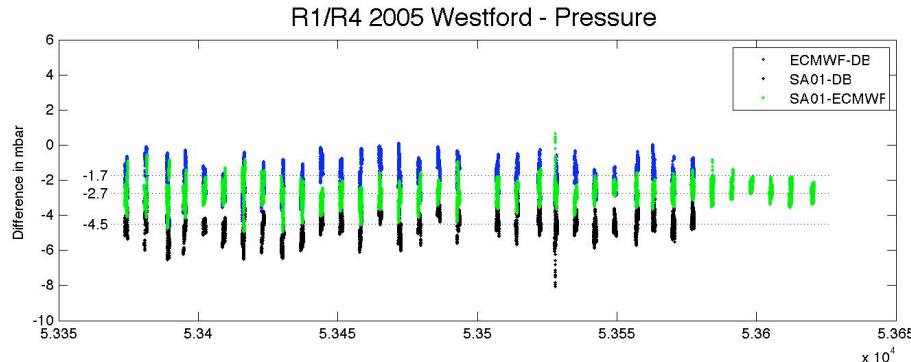
- Differences in temperature and pressure of the three sets of met data.





Westford: Jan. 2002 – Apr. 2010

- Differences in temperature and pressure of the three sets of met data.



02JUN17

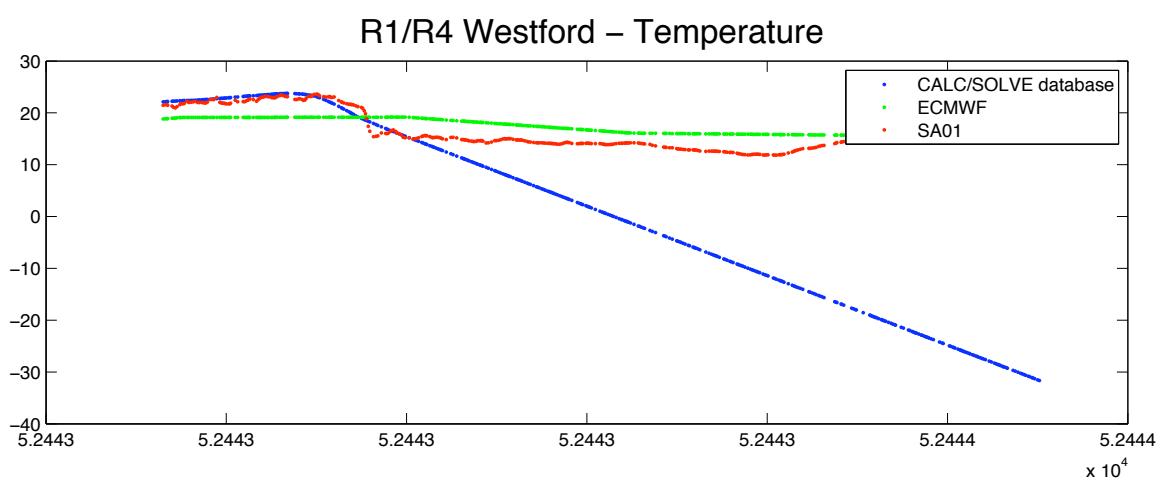
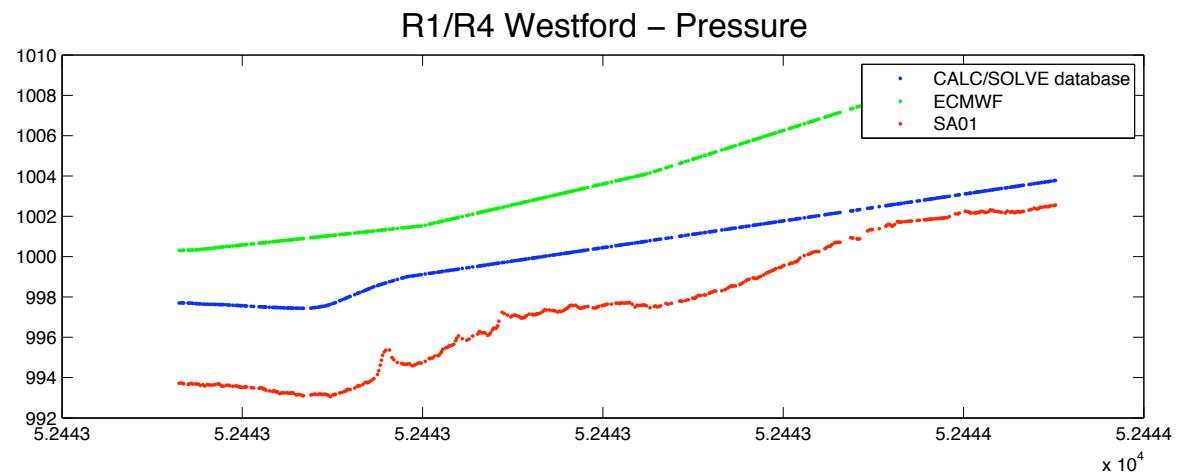


Westford: Jan. 2002 – Apr. 2010

- Quality of the met data in the data base?

- Detection of abnormal behavior in pressure and temperature time series

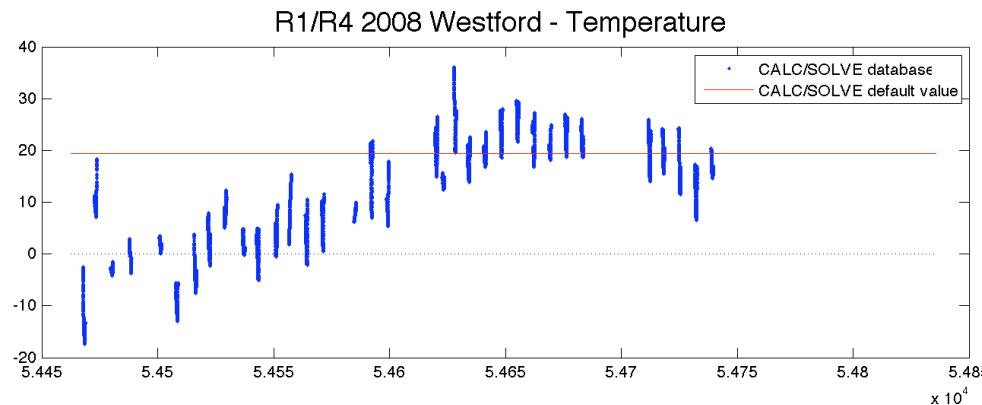
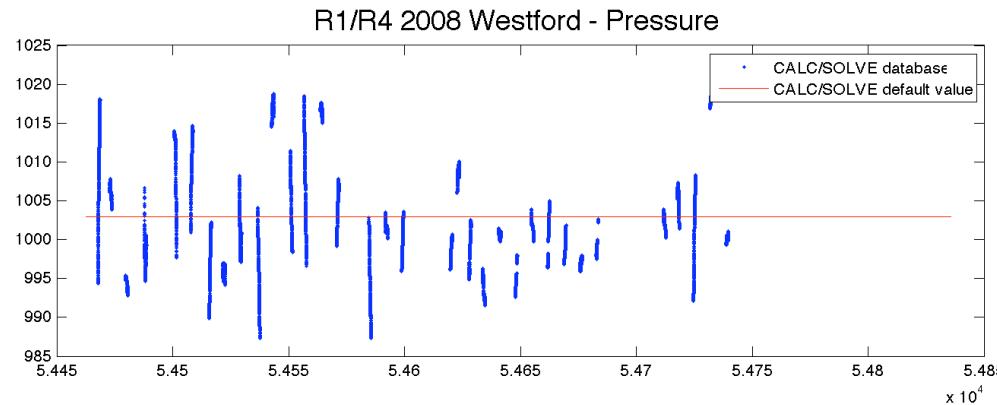
Example of the
02JUN17
session in 2002.





Westford: Jan. 2002 – Apr. 2010

- Pressure and temperature default values allocated to Westford in CALC/SOLVE.

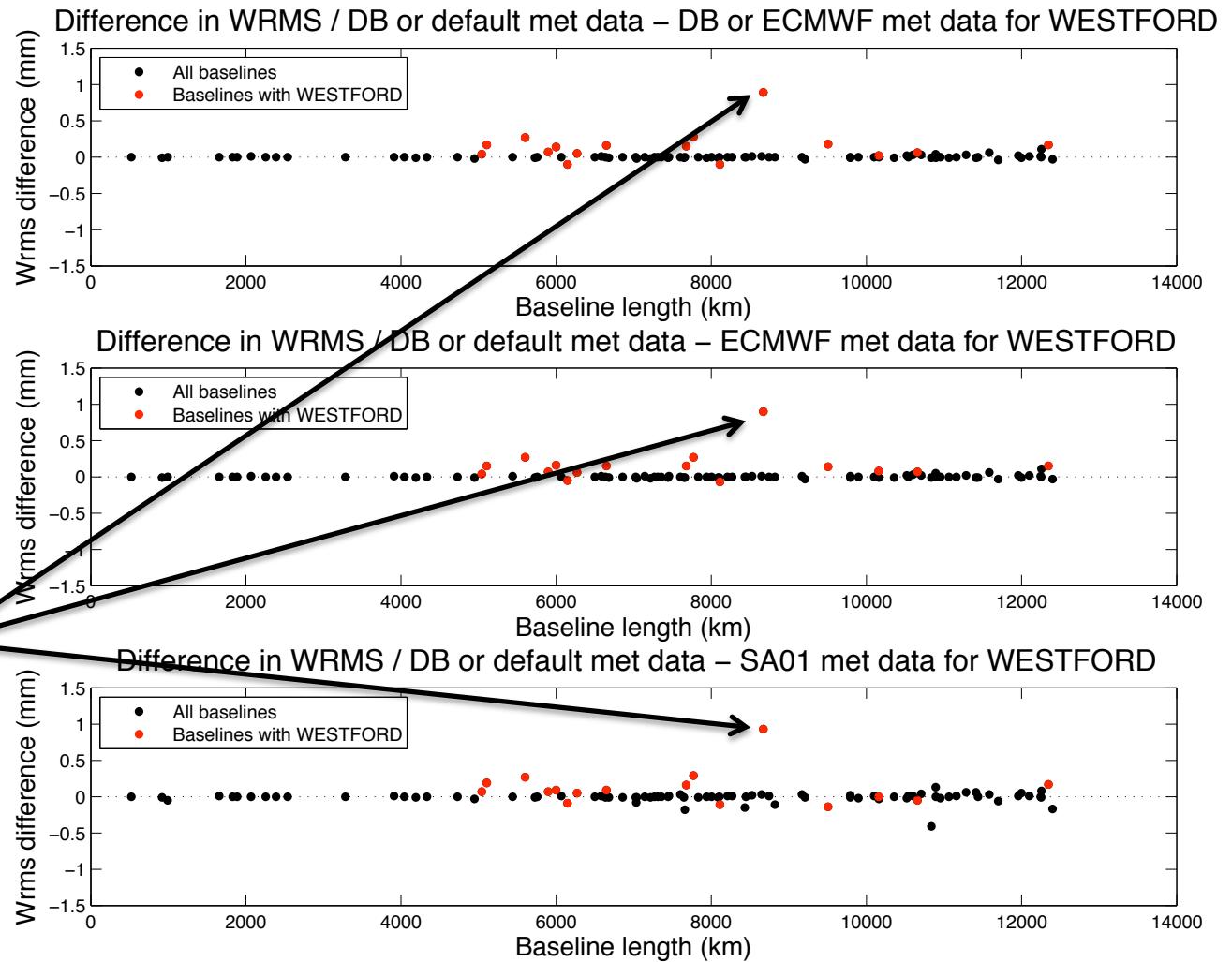




Westford: Jan. 2002 – Apr. 2010

Differences in WRMS

The WRMS difference is of up to 0.93 mm for the baseline BADARY – WESTFORD.

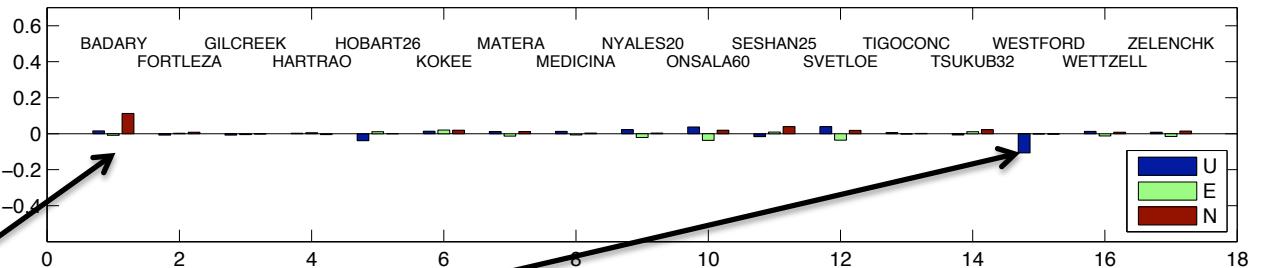




Westford: Jan. 2002 – Apr. 2010

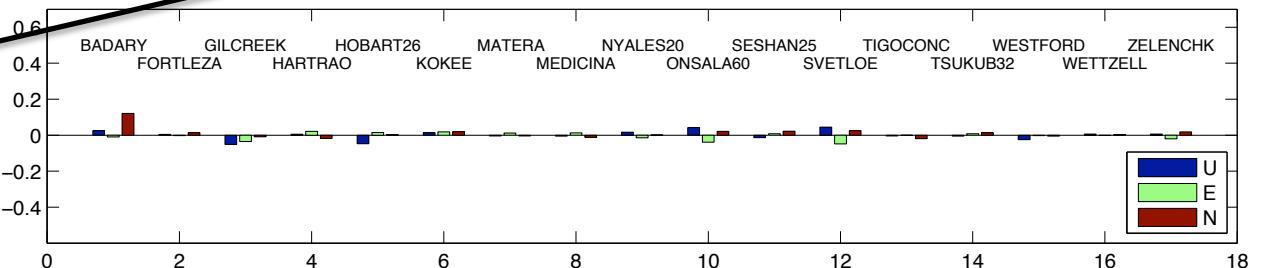
Differences in
UEN
determination

Differences (pressure from the data base or default / the data base or ECMWF)

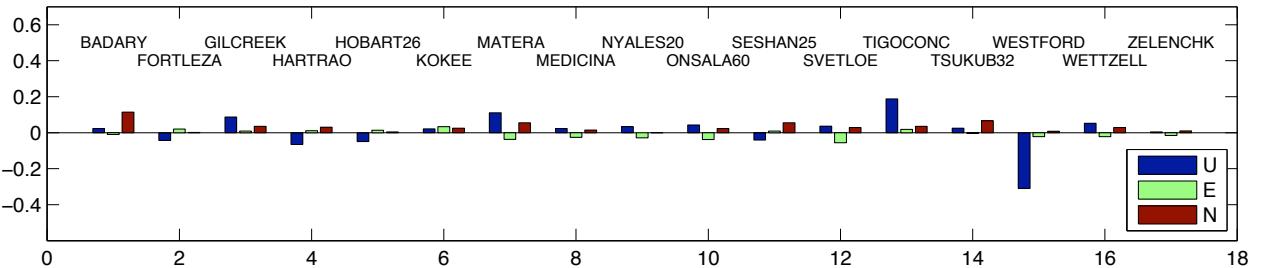


Note: Badary / Westford
baseline

Differences (pressure from the data base or default / ECMWF)



Differences (pressure from the data base or default / SA01)





Conclusions

- The CALC/SOLVE data base is not homogeneous in terms of met data. It contains missing, biased and inaccurate data.
- That impacts directly the quality of the VLBI processing:
 - The WRMS is affected (for example, by using CALC/SOLVE default value: 0.12mm for 2 weeks in the case of Zelenchukskaya and 1mm for 9.5 years in the case of Westford);
 - The determination of the Up component varies within a significant level (8.9mbar/mm for Svetloe).
- Using a constant default value to replace missing data is not a satisfying solution.
- It is necessary to have a homogeneous data base for the met data:
 - Homogeneous meteorological sensors in the global network (VLBI2010 specification);
 - GSFC strategy to obtain a homogeneous database for pressure/temperature: 1/ detect bad data and correct them; 2/ fill the gaps with accurate data.