Estimating DORIS tropospheric corrections with GIPSY/OASIS, possible IDS recommendations

Pascal Willis (IGN/IPGP),
Johannes Boehm (TU Vienna)

SUMMARY

- A priori hydrostatic zenith delay
- Mapping functions
- Estimation strategy
- Low elevation data
- IGS recommendations (Miami meeting)
- Discussion (IDS recommendations?)

A priori dry zenith delay

- Current = standard = 1.013*2.27 exp(-0.000116 h)

- Planned = GPT (Global Pressure Temperature)

  (in GIPSY/OASIS but not in official release)

See : Boehm, J; Heinkelmann, R; Schuh, H, Short Note: A global model of pressure and temperature for geodetic applications, JOURNAL OF GEODESY, 81 (10): 679-683 OCT 2007

Mapping functions

- Estimating wet zenith delay

  Mapping functions:

  LANYI

  NIELL (current)

  GMF (implemented but not in official release), see Boehm, J; Niell, A; Tregoning, P; et al., Global Mapping Function (GMF): A new empirical mapping function based on numerical weather model data, GEOPHYSICAL RESEARCH LETTERS, 33 (7): Art. No. L07304 APR 4 2006

  VMF-1 (being implemented), see J. Boehm, B. Werl, and H. Schuh, Troposphere mapping functions for GPS and very long baseline interferometry from European Centre for Medium-Range Weather Forecasts operational analysis data, J. Geophys. Res., 111, B02406, doi:10.1029/2005JB003629, 2006.

- Other options: horizontal tropospheric gradients (1 per day), for DORIS study, see Snajdrova, K; Boehm, J; Willis, P; Haas, R; Schuh H. 2006. Multi-technique comparison of tropospheric zenith delays derived during the CONT02 campaign, *JOURNAL OF GEODESY* 79(10-11):613-623, DOI: 10.1007/s00190-005-0010-z

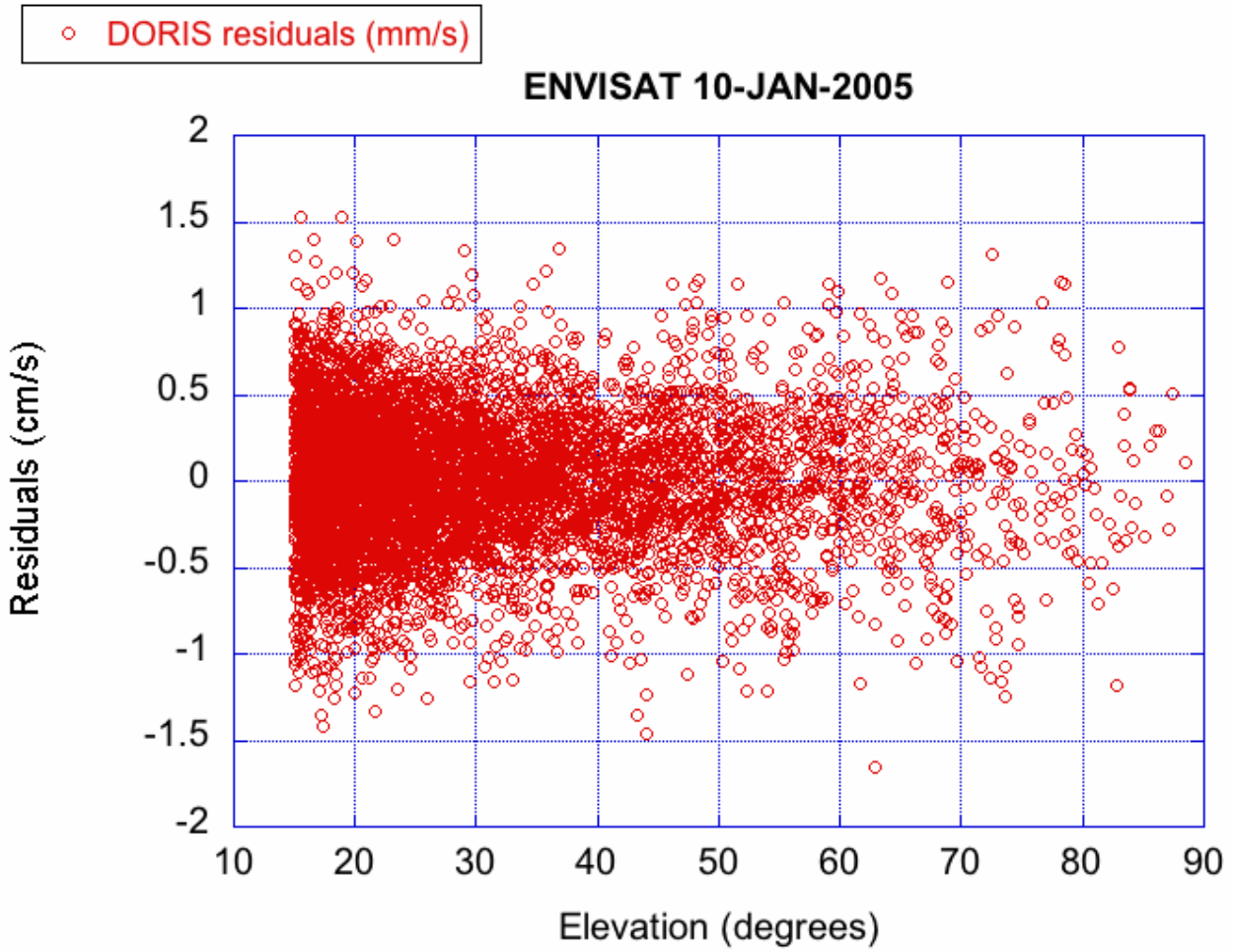
Estimation strategy

- Current filter options:
  - Time of reset : every start of pass (if more than 20 minutes from previous)
    - (station dependent but not satellite dependent)
  - Constrains = 2.5 cm / sqrt(1 day)

Other options: white noise or random walk noise process

See: Snajdrova, K; Boehm, J; Willis, P; Haas, R; Schuh H. 2006. Multi-technique comparison of tropospheric zenith delays derived during the CONT02 campaign, *JOURNAL OF GEODESY* 79(10-11):613-623, DOI: 10.1007/s00190-005-0010-z

Tropospheric errors in DORIS residuals



Low elevation data

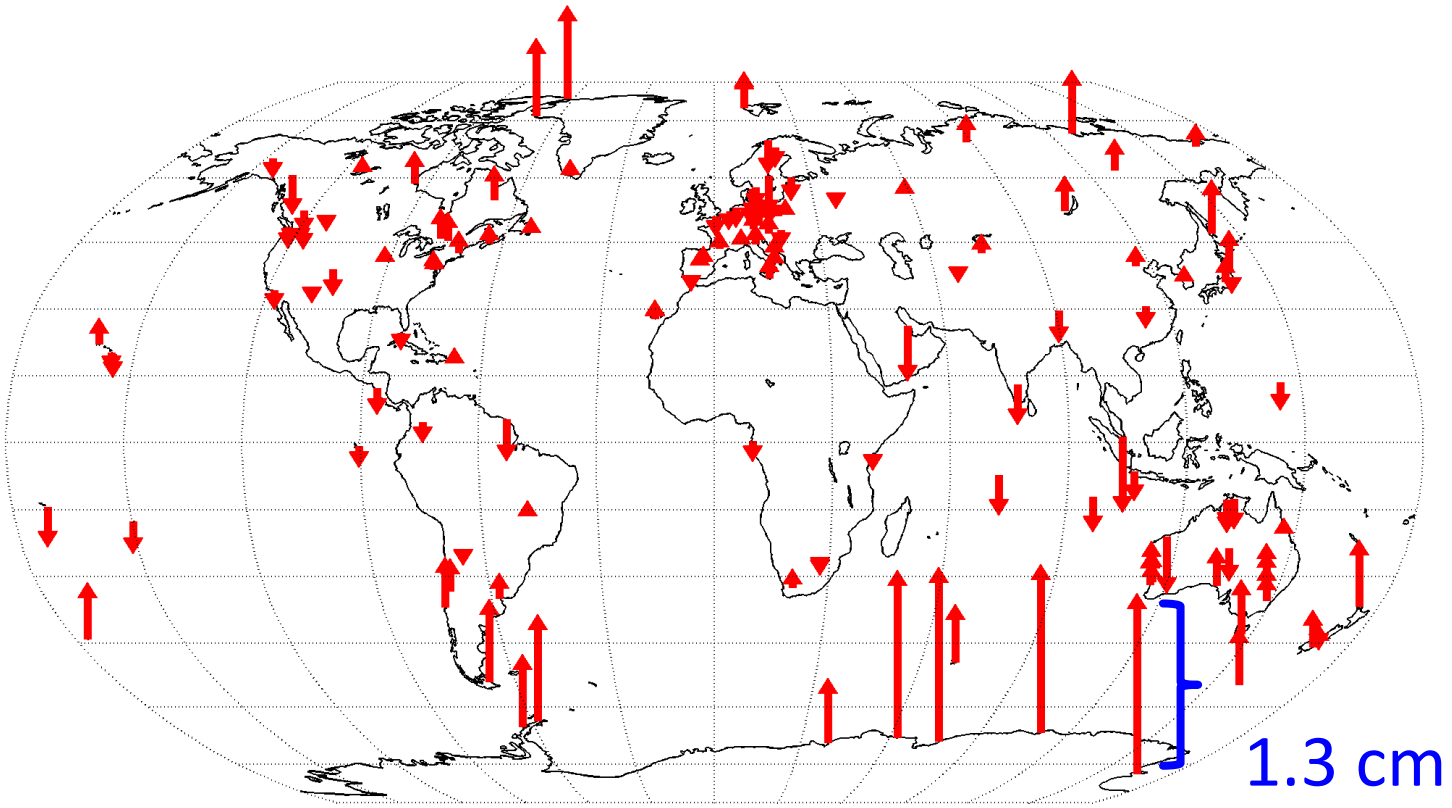
- Cutoff angle
  - For the complete data set (not by satellite)
  - 15 degrees (current)
  - Need to be used after changes in CNES data preprocessing / low elevation
- Data down-weighting (not used anymore)
  - WGHT = WGHT * (EL+1)**2 / ((EL+1)**2 + ELREF)

Recommendations at the IGS Analysis Workshop in Miami

- **Troposphere mapping functions**: Use **at least GMF** (Global Mapping Functions, GMF hyd for the mapping of the a priori hydrostatic zenith delay and GMF wet for the estimation of the residual wet zenith delays), but **preferably VMF1** (Vienna Mapping Functions 1) or any other mapping function based on data from numerical weather models.
- Use **at least GPT** (Global Pressure and Temperature) for the determination of the pressure. The pressure is input for the determination of the **hydrostatic zenith delay** (see Appendix of Davis et al 1985). **Preferable** to GPT would be the use of pressure values recorded at the sites if available or **pressure** values at six hour intervals from **numerical weather models**.

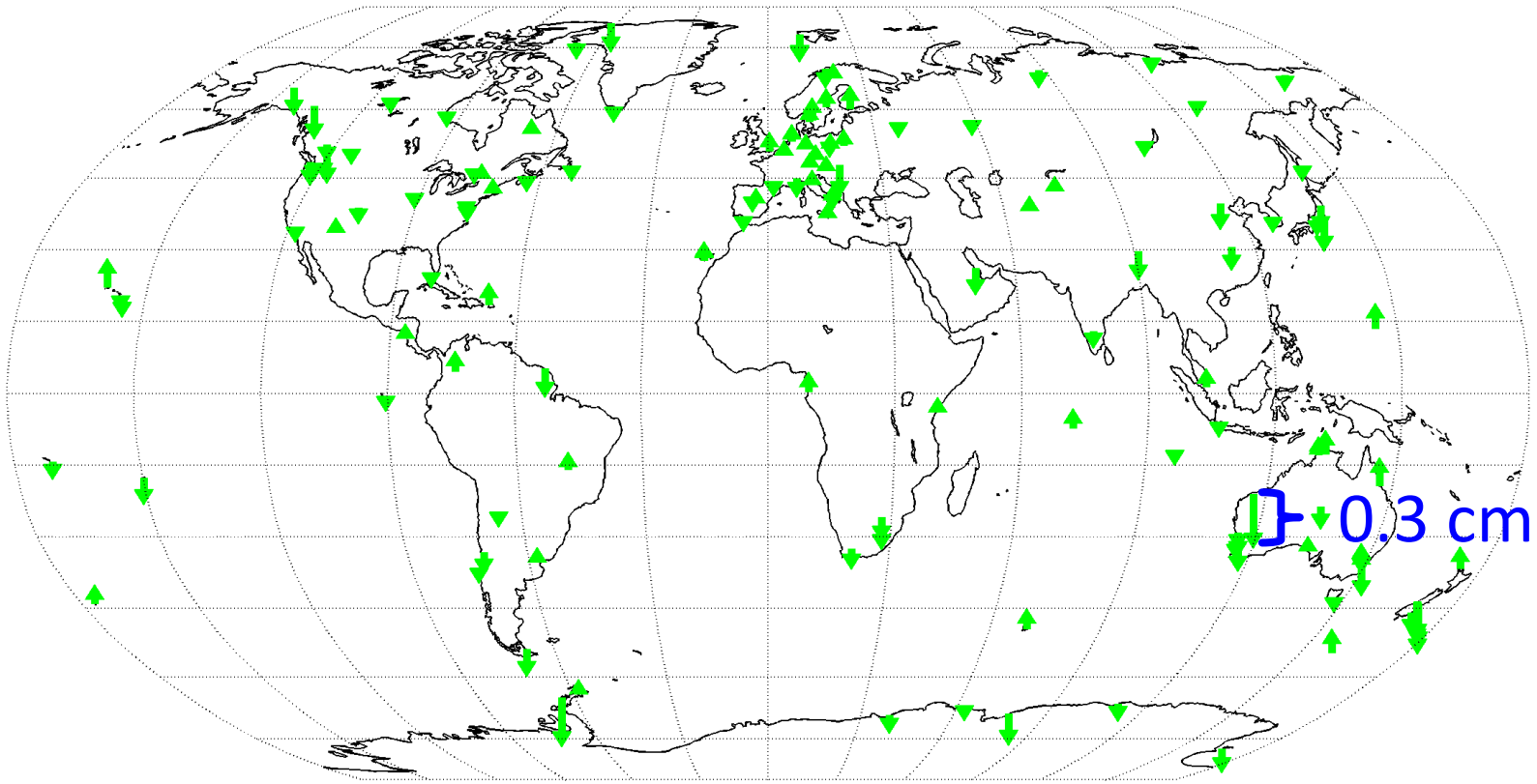
(Action Items 12a and 12b of the GGOS Unified Analysis Workshop)

GPS: VMF1 - NMF Heights



Difference in GPS heights between VMF1 and NMF. Gamit/Globk (Paull Tregoning), 1 year (June 2004 to July 2005), 7 degree cutoff, no downweighting.

GPS: VMF1 - GMF Heights



Difference in GPS heights between VMF1 and GMF. Gamit/Globk (Paull Tregoning), 1 year (June 2004 to July 2005), 7 degree cutoff, no downweighting.

- **Long-term differences** between GMF/GPT and VMF1/ECMWF are in general

  -on the sub-millimeter level for the horizontal component

  -below 1 millimeter for the station heights (up to 2 mm for a few stations)

- There is a clear **connection** between the modeling of **troposphere delays** and **atmospheric loading**

- Therefore, **VMF1** and **a priori hydrostatic zenith delays** with a 6 hours time resolution from **numerical weather models** have to be used to **reveal atmosphere loading signals** in the coordinate time series.

- **VMF1** and **a priori hydrostatic zenith delays** from data of the ECMWF are available starting with 1992.0 (also April to June in 1990 is available), i.e. for the complete history of DORIS observations

- VMF1 and a priori hydrostatic zenith delays are also available from **forecast data** for real-time analysis (can be used without loss of accuracy)

- Everything (gridded files for VMF1 with a time resolution of 6 hours, Fortran routines, literature, etc.) is available at

  - **http://www.hg.tuwien.ac.at/~ecmwf1**

Discussion
IDS recommendations

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