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IVS Tropospheric Parameters - Comparison with DORIS and GPS for CONT02

Harald Schuh [1], *Kristyna Snajdrova* [1], *Johannes Boehm* [1], *Pascal Willis* [2], *Gerald Engelhardt* [3], *Roberto Lanotte* [4], *Paolo Tomasi* [5], *Monia Negusini* [5], *Daniel MacMillan* [6], *Iraida Vereshchagina* [7], *Vadim Gubanov* [7], *Rüdiger Haas* [8]

[1] *IGG, Vienna University of Technology*
[2] *Jet Propulsion Laboratory, California Institute of Technology*
[3] *Federal Agency for Cartography and Geodesy*
[4] *Centro di Geodesia Spaziale*
[5] *Istituto di Radioastronomia*
[6] *NASA Goddard Space Flight Center*
[7] *Institute of Applied Astronomy*
[8] *Onsala Space Observatory, Chalmers University of Technology*

Contact author: Harald Schuh, e-mail: harald.schuh@tuwien.ac.at

Abstract

In April 2002 the IVS (International VLBI Service for Geodesy and Astrometry) set up the Pilot Project - Tropospheric Parameters, and the Institute of Geodesy and Geophysics (IGG), Vienna, was put in charge of coordinating the project. Seven IVS Analysis Centers have joined the project and regularly submitted their estimates of tropospheric parameters (wet and total zenith delays, horizontal gradients) for all IVS-R1 and IVS-R4 sessions since January 1st, 2002. The individual submissions are combined by a two-step procedure to obtain stable, robust and highly accurate tropospheric parameter time series with one hour resolution (internal accuracy: 2-4 mm). Starting with July 2003, the combined tropospheric estimates became operational IVS products.

In the second half of October 2002 the VLBI campaign CONT02 was observed with 8 stations participating around the globe. At four of them (Gilmore Creek, U.S.A.; Hartebeesthoek, South Africa; Kokee Park, U.S.A.; Ny-Ålesund, Norway) also total zenith delays from DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite) are available and these estimates are compared with those from the IGS (International GPS Service) and the IVS. The distance from the DORIS beacons to the co-located GPS and VLBI stations is around 2 km or less for the four sites mentioned above.

1. Comparison

Fig. 1 shows the total zenith delays derived from VLBI (see Schuh and Boehm, 2003, [1]), GPS and DORIS at the station Hartebeesthoek (South Africa) during CONT02. Fig. 2 then focuses on a detail of Fig. 1 to illustrate the different variations of the time series. Similarily, Figures 3 and 4 show the total zenith delays and a detail for the station Ny-Ålesund in Norway. The total delays for Gilmore Creek (Alaska, U.S.A.) and Kokee Park (Hawaii, U.S.A.) are plotted in Fig. 5 and Fig. 6. The figures show that the variation of the time series is larger for DORIS than for GPS and VLBI, which might be due to looser constraints in the DORIS analysis.

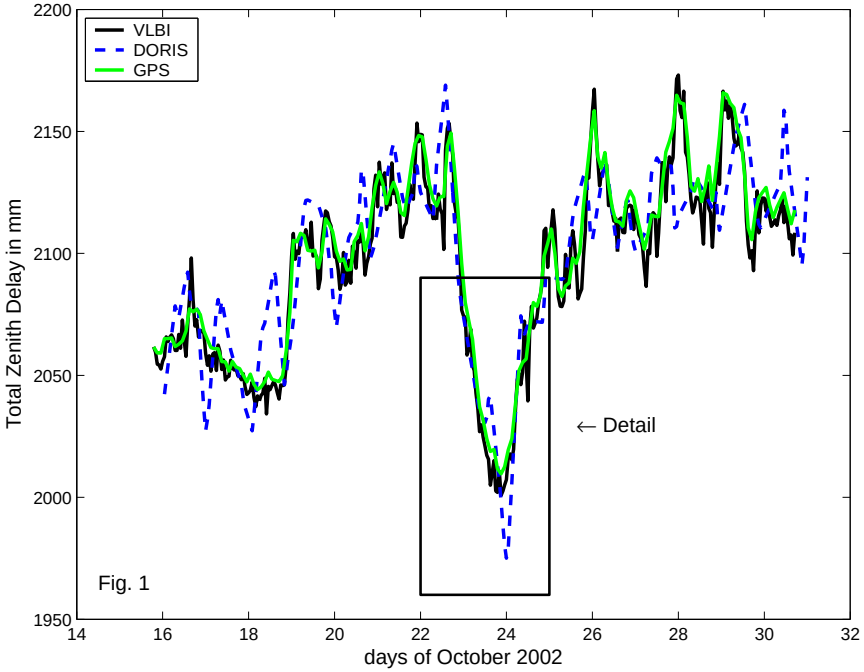

Figure 1. Total zenith delays at Hartebeesthoek during CONT02.

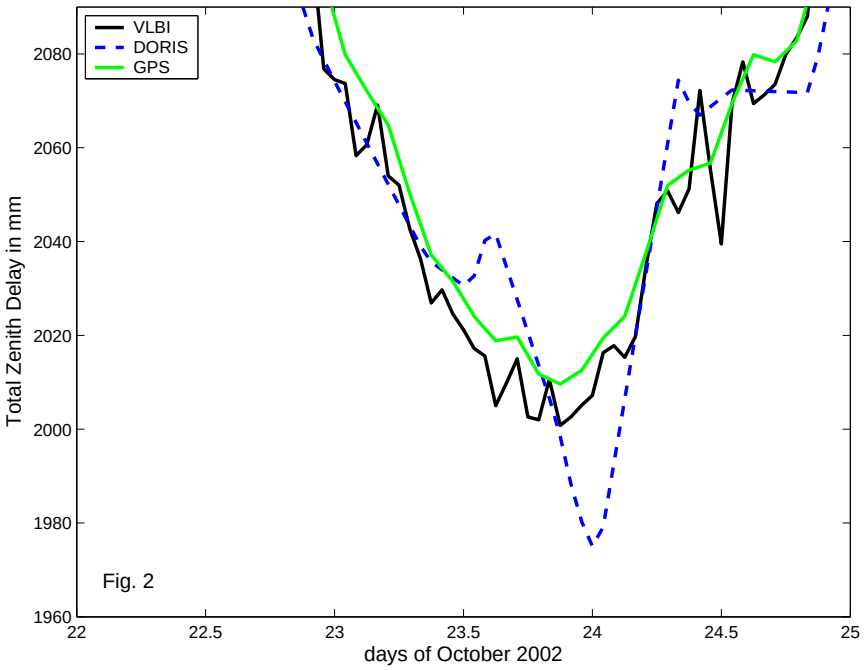

Figure 2. Total zenith delays at Hartebeesthoek, (48h detail).

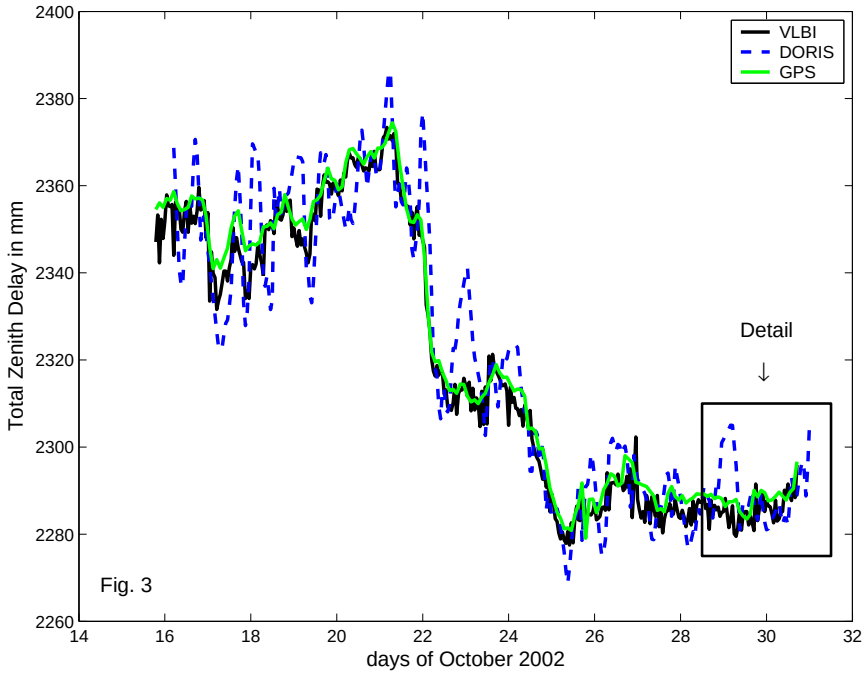

Figure 3. Total zenith delays at Ny-Ålesund during CONT02.

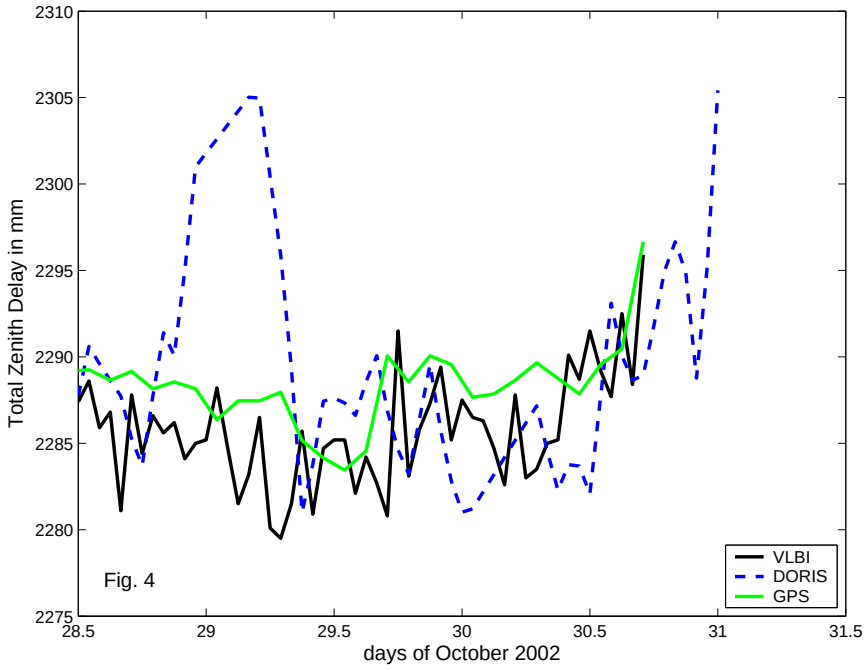

Figure 4. Total zenith delays at Ny-Ålesund, (48h detail).

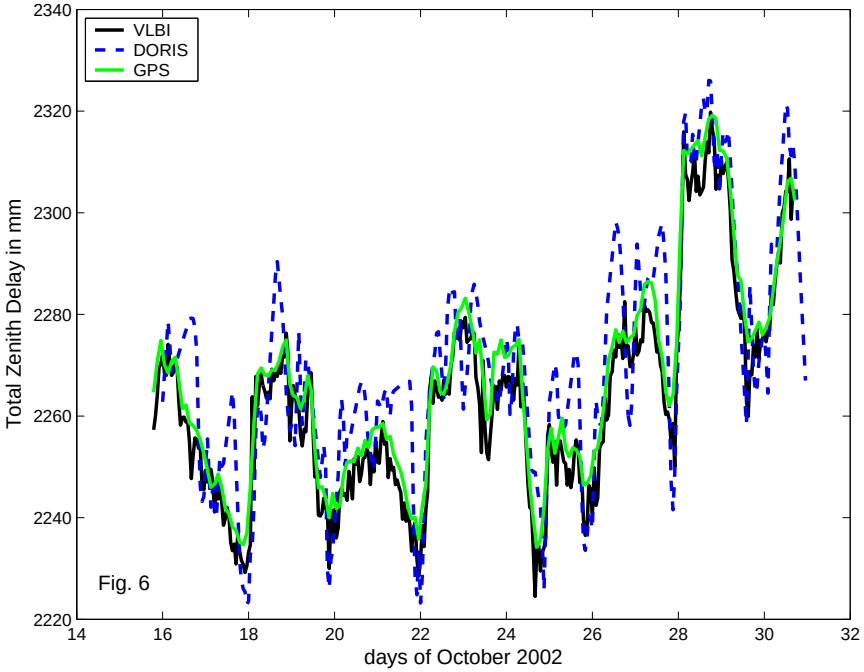

Figure 5. Total zenith delays at Gilmore Creek during CONT02.

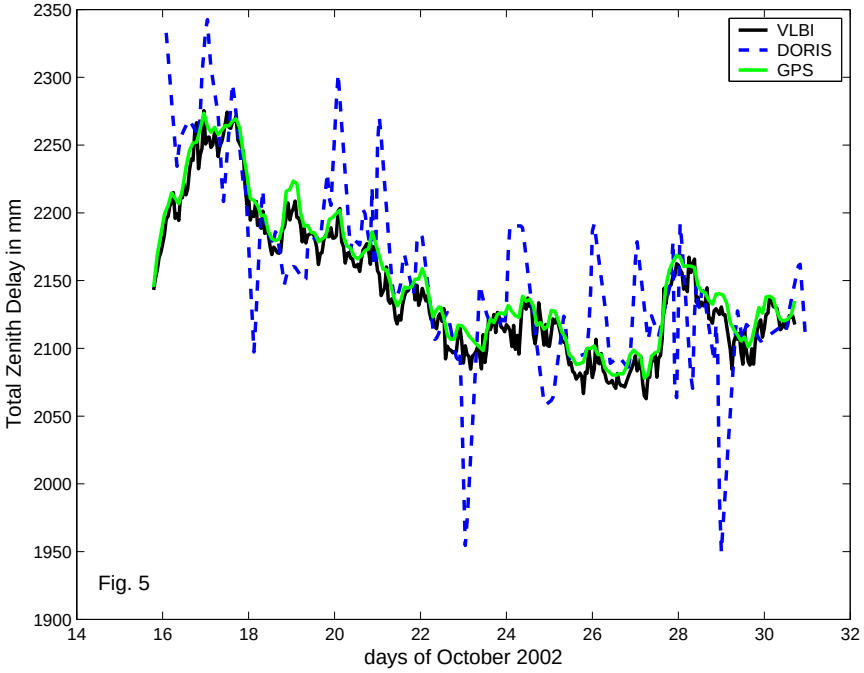

Figure 6. Total zenith delays at Kokee Park during CONT02.

Table 1. Offsets and standard deviations (in mm) for the sites Gilcreek, Hartebeesthoek, Kokee Park, and Ny-Ålesund between VLBI, GPS, and DORIS total zenith delays for CONT02. Before the data were compared, height corrections were applied (10 m height difference corresponds to ∼3 mm in total zenith delay). No outlier elimination was carried out for this comparison. The offsets between the time series do not close to zero because of interpolation and rounding errors.

	DORIS - VLBI	DORIS - GPS	GPS - VLBI
Gilmore Creek	6.9 ± 10.6	3.1 ± 10.2	3.9 ± 3.5
Hartebeesthoek	2.6 ± 20.1	-1.6 ± 18.9	4.2 ± 6.3
Kokee Park	9.7 ± 45.1	0.3 ± 44.8	8.9 ± 7.2
Ny-Ålesund	2.5 ± 9.7	-0.1 ± 9.8	2.6 ± 3.5

Tab. 1 summarizes the offsets and the standard deviations of the differences between the time series after removing the offsets between VLBI, GPS, and DORIS. The big standard deviations between DORIS and the other techniques at Kokee Park might result from DORIS as non-continuous tool using loose constraints for the total zenith delays in the estimation.

2. Conclusions

- There are positive biases of ∼5 mm between the total zenith delays from GPS and VLBI although height corrections are applied. The biases between DORIS and GPS are close to zero.
- VLBI and GPS agree better (∼5 mm) than VLBI or GPS with DORIS.
- There are some outliers in the DORIS data, which might be due to the fact that DORIS is a non-continuous tool for a specific ground station (compare Fig. 6: rapid variations with few DORIS passes).

3. Acknowledgements

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References

[1] H. Schuh and J. Boehm, Status Report of the IVS Pilot Project - Tropospheric Parameters, in International VLBI Service for Geodesy and Astrometry 2002 Annual Report, edited by N. R. Vandenberg and K. D. Baver, NASA/TP-2003-211619, 13-21, 2003.