Time Series of Site Positions and Datum Parameters

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Abstract: This paper is a summary of the poster presented at the IERS Workshop in Munich. It focusses on the analysis of time series of site positions and datum parameters obtained from VLBI, SLR, GPS and DORIS solutions. We analysed the time series with respect to non-linear effects, periodic signals and systematic differences and compared the results obtained by different techniques at co-location sites.

Motivation

Technique- and/or solution-related systematic effects (biases) are often poorly characterised or quantified, and can be considered as one major limiting factor for the accuracy of space geodetic observations and combination results. The analysis of time series is important to get further insight into the solution characteristics and to identify possible problems. One major goal is to study the existing differences of techniques and to understand their origin in order to achieve further improvements.

Data

The characteristics of the individual solutions are summarised in Table 1. We applied 7-parameter similarity transformations to align the individual VLBI, SLR, GPS and DORIS solutions into the ITRF2000 datum.

Results

The results of this study include time series of station positions and datum parameters (origin and scale) obtained from the various technique solutions (Angermann et al., 2003). In this poster summary we present one example for the scale variations (see Figure 1).

Conclusion

The time series of the datum parameters have evidenced that VLBI and SLR are the major techniques to realize the TRF scale, whereas SLR provides the most stable results for the origin. The observed non-linear effects in the position time series (e.g. due to earthquakes, instrumental changes, deficiencies in the models) are in conflict with the assumption of constant velocities. This may degrade the accuracy and consistency of the ITRF. Hence a better monitoring of the terrestrial reference frame may require non-linear components in site positions.

Acknowledgements

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References

Angermann, D., M. Krügel, B. Meisel, H. Müller, V. Tesmer: Time Evolution of the Terrestrial Reference Frame, presented at IUGG General Assembly, Sapporo, submitted for publication in IAG Proceedings, 2003.

Table 1   Summary of solutions used for this study

Techn.	Analysis Center	Software	Data Time Span	Stat. #	Station Coord. Solutions
DORIS	IGN/JPL	GIPSY/OASIS	1992.8–2002.0	80	weekly SINEX files
GPS	CODE	Bernese	1996.0–2002.2	163	weekly SINEX files
GPS	JPL	GIPSY	1996.0–2002.2	180	weekly SINEX files
GPS	SIO	GAMIT	1995.0–2002.2	157	weekly SINEX files
SLR	DGFI	DOGS	1992.9–2002.2	75	weekly comb. solut., Lag1&2
VLBI	DGFI	OCCAM	1984.0–2002.0	56	2227 daily session solutions

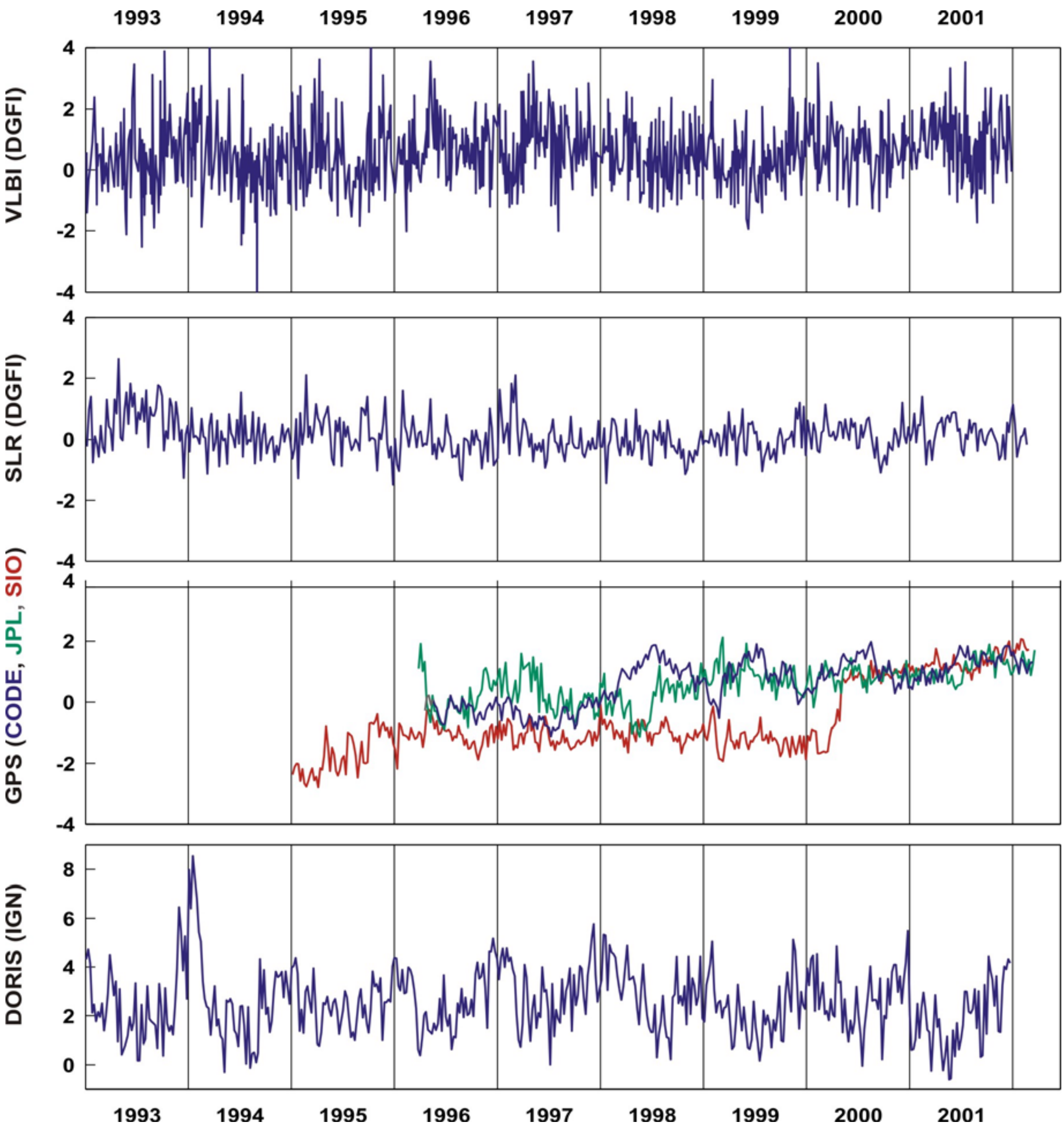

Fig. 1   Time series of scale variations [ppb]. Note that the VLBI results are based on single day session solutions, whereas the time resolution for the other techniques is one week. In case of VLBI typically only 4–7 stations observe simultaneously with changing network configuration from one to the other session, which is a second reason for the higher noise level of the VLBI series.

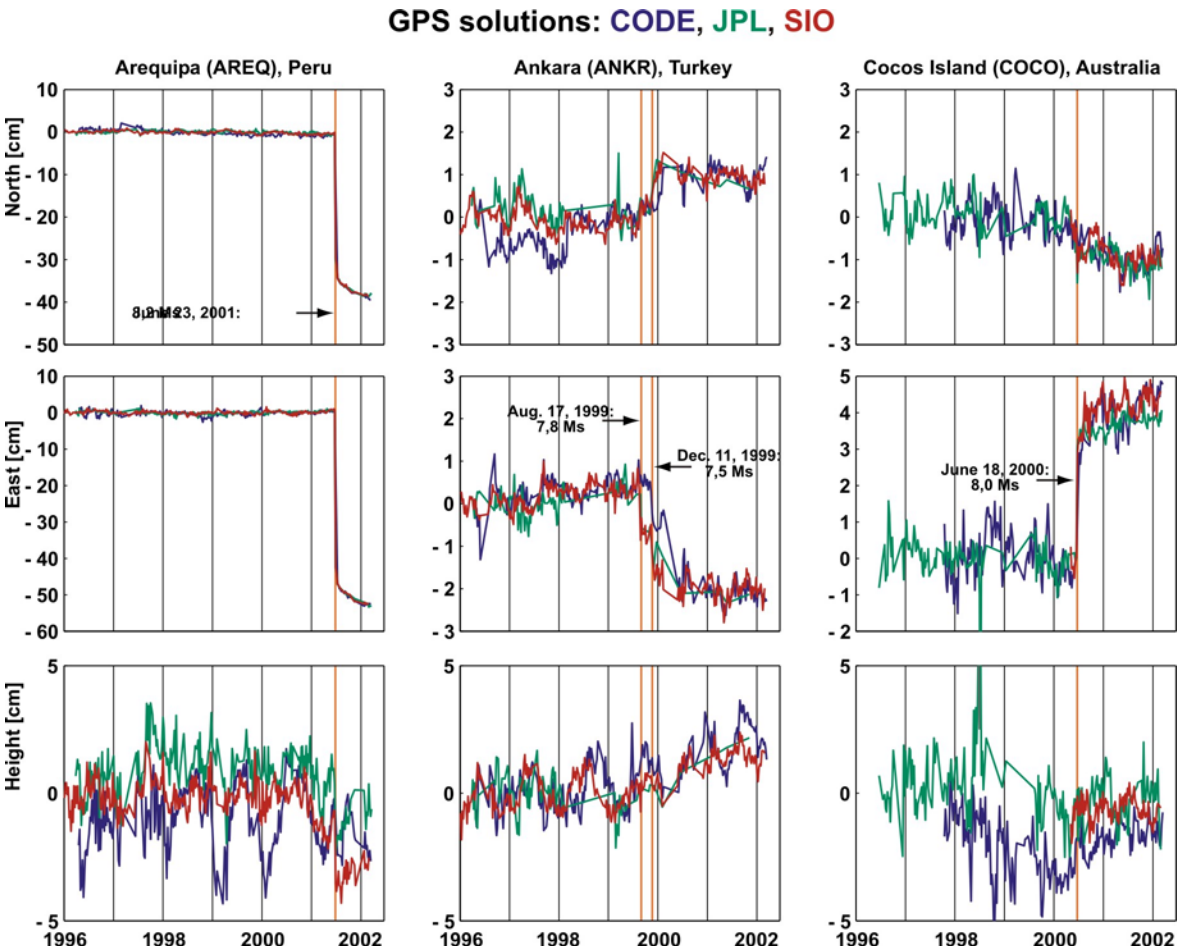

Fig. 2 Stations that are located in or close to plate boundary zones may be influenced by transient effects (e.g. due to earthquakes). The effect of large earthquakes is shown for three stations located at Arequipa (Peru), Ankara (Turkey) and Cocos Island (Australia). The co-seismic displacements of several centimeters up to half a meter in case of station Arequipa are often accompanied by time dependent or episodic motions after the event, which are difficult to be correctly modeled.