Impact of Ambiguity Resolution and Orbit Reprocessing on the Global Reference Frame

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Introduction

GPS time series have been processed using three strategies which illustrate the impact of ambiguity resolution and orbit reprocessing on position and velocity estimates. Results were compared to ITRF08 to see how well each strategy was able to realize the global reference frame.

Strategy one used legacy orbits from JPL based on evolving software and models. Point positions were computed without ambiguity resolution and daily free-network estimates were transformed into ITRF05.

Strategy two used improved orbits and clocks from a third round of processing at JPL's IGS Analysis Center in 2011. Upgrades relative to strategy one include use of antenna phase center patterns, the IAU06 precession/nutation model, IERS2010 tides for UTPM, the DE421 planetary ephemeris, the GRS80 reference ellipsoid, and the GSPM10 solar pressure model. Point positions were computed without ambiguity resolution and daily free-network estimates were transformed into IGS08.

Strategy three is identical to strategy two but with ambiguity resolution added to the point positioning (Bertiger et al., 2010). By comparing this strategy to the previous two it is possible to see how much improvement is due to orbit reprocessing and how much is due to ambiguity resolution alone.

Conclusions

Repeatability improvement in mm:
3 N, 4 E, and 9 V ==> 2 N, 2 E, and 7 V
79% of the improvement is from orbit reprocessing
21% of the improvement is from ambiguity resolution

Position improvement in mm:
6 N, 6 E, 11 V ==> 3 N, 5 E, 6 V
91% of the improvement is from orbit reprocessing
9% of the improvement is from ambiguity resolution

Velocity improvement in mm/yr:
0.5 N, 0.6 E, 1.1 V ==> 0.3 N, 0.3 E, and 0.7 V
92% of the improvement is from orbit reprocessing
8% of the improvement is from ambiguity resolution

References

Bertiger, W., S. D. Desai, B. Haines, N. Harvey, A. W. Moore, S. Owen, J. P. Weiss, Single receiver phase ambiguity resolution with GPS data, J. Geod (2010) 84:327–337, DOI10.1007/s00190-010-0371-9.

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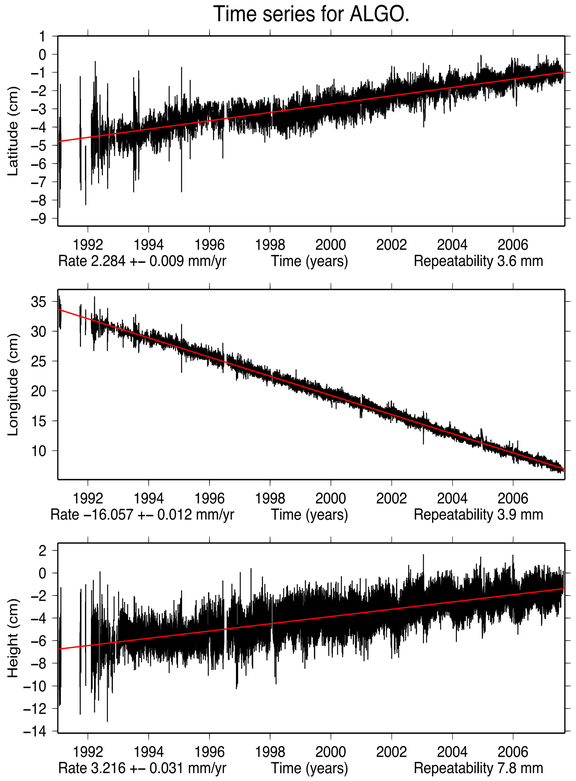
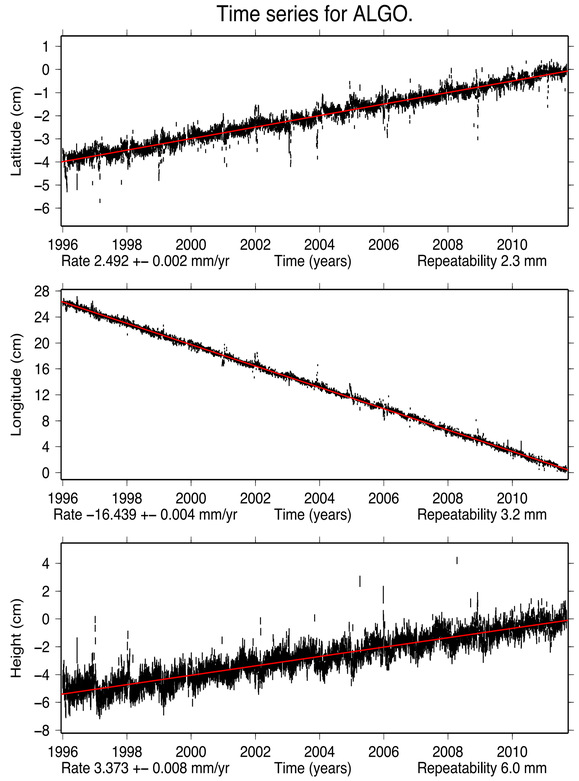
http://sideshow.jpl.nasa.gov/mbh/series.html

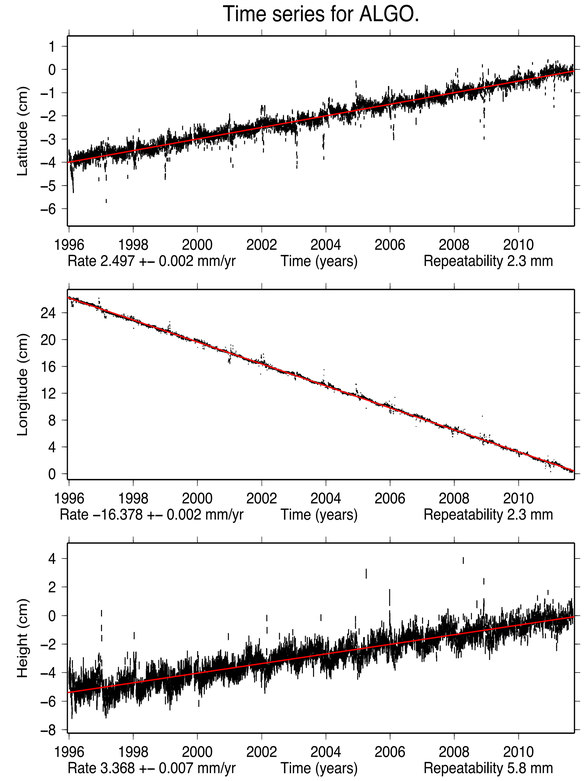
Strategy 1
Orbits: legacy orbits
Span: 1991-2007
Frame: ITRF05
Software: ppp
Ambiguity Resolution: No

Strategy 2
Orbits: 2011 orbits
Span: 1996-2011
Frame: IGS08
Software: a.pl
Ambiguity Resolution: No

Strategy 3
Orbits: 2011 orbits
Span: 1996-2011
Frame: IGS08
Software: a.pl
Ambiguity Resolution: Yes







Strategy 1 - 250 sites	N	E	V	Unit
Repeatability	3.3	4.3	9.1	mm
Position	6.1	5.8	10.9	mm
Velocity	0.5	0.6	1.1	mm/yr

Strategy 2 - 250 sites	N	E	V	Unit
Repeatability	2.4	3.4	7.1	mm
Position	3.3	5.0	6.7	mm
Velocity	0.3	0.4	0.7	mm/yr

Strategy 3 - 250 sites	N	E	V	Unit
Repeatability	2.3	2.3	6.8	mm
Position	3.3	4.5	6.4	mm
Velocity	0.3	0.3	0.7	mm/yr