USNO Analysis Center Progress 2010-2

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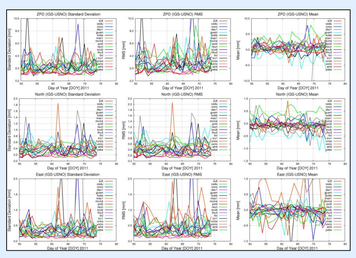
NEW (SINCE 2010)

IGS FINAL TROPOSPHERE ESTIMATES (FTEs)

- USNO now produces IGS FTEs
- Operations transferred from JPL July 2011
- IGS FTEs dated 17 April 2011 and after generated by USNO
- Dr. Sharyl Byram, project manager
- mm-level RMS agreement in total delay/N gradient/E gradient achieved for 18 station/25 d test prior to operations transfer
- 300+ stations processed daily
- More info: Poster 06-01, Byram & Hackman



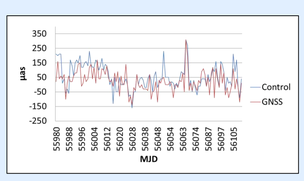
Pre-transfer comparison. *USNO test troposphere solutions WRT existing IGS Final estimates, 28 Feb – 14 Mar 2011. (Byram et al., 2011).*

CHAIR IGS TROPOSPHERE WORKING GROUP

- Dr. C. Hackman, chair
- WG goal: improve accuracy, usability of IGS tropo estimates
- 40 members recruited Fall 2011
- Charter revised Fall 2011
- Survey distributed Winter 2012

GLONASS PROCESSING

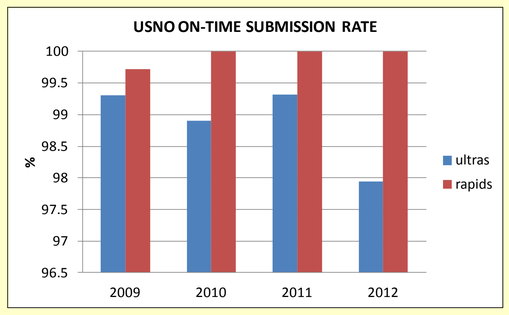
- Test adding GLONASS data to network processing
- Dr. S. Byram, project manager
- Rapid products generated/tested since Winter 2012
- One result: adding GLONASS data reduces z-axis rotation wrt IGR
- Findings presented at ION PLANS 2012 (Byram & Hackman, 2012c)
- Ultra-rapid products to be completed Summer 2012
- See Poster 10-02, Byram & Hackman, for more details



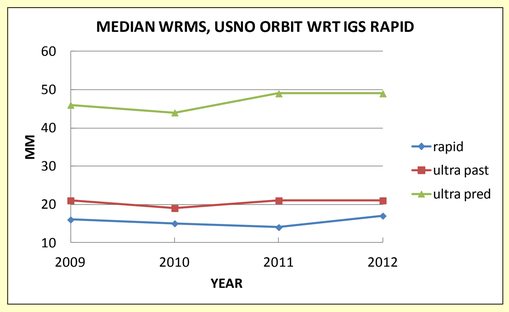
Improved z-axis orientation. *Z-axis rotation wrt IGR orbit. Control = GPS only; RMS = 104 µas. GNSS = GPS+ GLONASS; RMS = 76 µas. 23 Feb – 7 Jul 2012.*

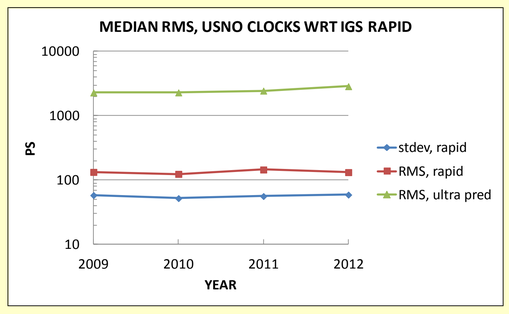
AC HISTORY AND PRODUCTS

- AC since 1997
- Contribute rapid and ultra-rapid solutions
- NEW: Produce IGS Final Troposphere Estimates
- NEW: Testing GLONASS processing
- Products generated using *Bernese GPS Software*
- Statistics below: 6 Jan 2009 – 30 Jun 2012; 5-σ filtered

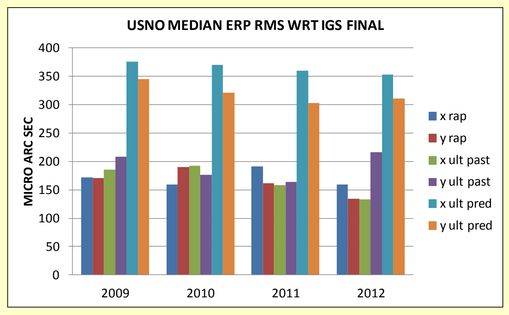


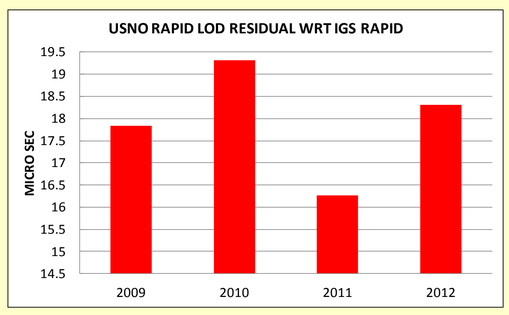
On-time rate. ***Rapids****: 100% on-time rate maintained.* ***Ultras****: ~99% on-time. 2012: missed 11 submissions 3-6 Jun due to unscheduled network outage. Offsite backup operations would have mitigated.* ***Note:*** *Dr. V. Slabinski has made numerous improvements to automation.*





Orbits & clocks. ***Orbits (left):*** Rapids*: Median WRMS 14-17 mm wrt IGR.* Ultras*: Median WRMS 19-21 mm wrt IGR, post-processed portion; 44-49 mm for 6-h predict.* ***Clocks (right):*** Rapids*: Median standard deviation/RMS of 52-59/124-145 ps wrt IGR.* Ultras*: 6-h predict has 2286-2862 ps median standard deviation wrt IGR. Internal studies indicate difficulty predicting Block IIA clocks (Hackman et al. 2012b).*





Polar motion & LOD. ***PM (left):*** Rapids*: Median RMS 134-191 µarc sec wrt IGS* Final*; note 2012 improvement.* Ultras*: Median RMS 134-217 mm wrt IGS Final, post-processed portion; 304-376 mm for 24-h predict.* ***LOD (right):*** Rapids*: Annual RMS residual 16-19 µs wrt IGR.*

FUTURE PLANS

- **Improve PM, no. stations, rapid clocks.**
- **Develop off-site backup operation.**
- **Incorporate GLONASS into IGS submissions.**
- **Troposphere: perform Repro 2; incorporate WG recommendations.**

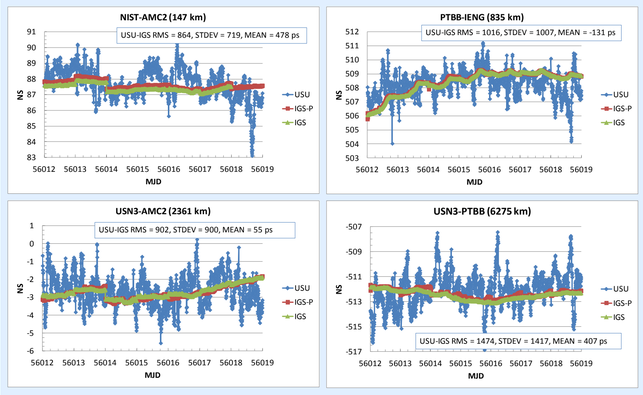
NEW (Cont'd)

SUB-DAILY UTGPS (2011)

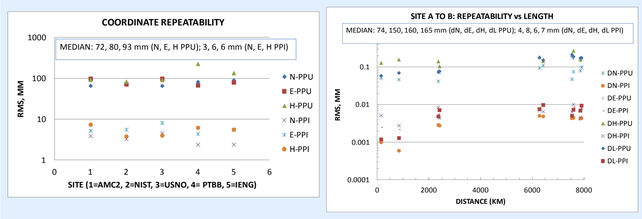
- Mr. J. Tracey, project manager
- UTGPS: GPS-based extrapolator of VLBI UT1-UTC measurements used to predict UT1-UTC
- Was generated daily using IGR
- Now generated 4*/d using IGU
- Enables USNO Earth Orientation Dept to predict UT1-UTC 4*/day

NEW STUDY: PPP WITH USU PREDICTS

- Predictions suitable for RT applications
- Initial study: concatenate predicted orbits, clocks, EOPs (no filtering)
- Do PPP with these, IGS Finals
- Sites: AMC2, NIST, USN3 (all USA), PTBB (DE), IENG (IT)
- 26 Mar - 1 Apr 2012 (MJD 56012-8)
- Obtain 7-9 cm position repeatability
- ~ 1 ns RMS time transfer wrt IGSF
- More info: Hackman *et al*. (2012b)



Timing results. *USU = PPP results obtained using USNO predicted values; IGS-P = PPP results using IGSF; IGS = IGS Final Clock values*



Coordinate precision. *PPU, PPI = PPP results obtained using USNO predicts or IGS Finals. PPU coordinate precision is 7-9 cm; no cancellation of errors with subtraction. (Not shown: PPI, PPU agree well within RMS).*

2010-2 IGS-Related Bibliography

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S. Byram, C. Hackman & J. Tracey, Computation of a High-Precision GPS-Based Troposphere Product by the USNO, *Proc. ION GNSS 2011*, 572-578, 2011.

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