Combination of reprocessed orbit, clock and ERP products

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### Status of IGS Final Products before Reprocessing

- Orbits (with 15-minute clocks) & ERP products since 1994
- SINEX (since 1996; ERP since June 1999)
- Combined Clocks
  - with 5-minute sampling since Oct 2000 (week 1085)
  - with 30-second sampling since Dec 2006 (week 1406)

### ACs:

<table>
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<tr>
<th></th>
<th># in Combi</th>
<th>COD</th>
<th>ESA</th>
<th>EMR</th>
<th>GFZ</th>
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<th>MIT</th>
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: Reprocessing contribution
Reprocessing

Goal
- Generation of RF with consistent ERP (contribution to ITRF)
- Consistent orbits referred to given RF
- Consistent clocks for PPP in given RF (now possible after Oct 2000 only)

Test period
- Jan to Apr 2000, 14 GPS weeks (1042 to 1056)
- Jun to Dec 2007, 30 GPS weeks (1430 to 1459) (Check with latest official products)
  [NGS last 10 weeks → used as interval for all statistics]

<table>
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<th>GFZ*</th>
<th>MIT</th>
<th>NGS</th>
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*not 2000 ~COD
Stability of orbit RF

- Number of stations defining the IGS05

Note: AC’s frame rotation from SINEX combination will be used to align the orbits.

Consistency between orbits and SINEX solution is important, and is degrading in the early years because of the reduced number of RF stations.
Orbits – Differences to combination

- All orbits (including operational IGS Finals) are compared to combined repro orbits.

**AC Orbits compared to Combi**

- **2000** (smoothed): IGF: 29 ± 5 mm
- **2007** (smoothed): IGF: 8 ± 2 mm

**Final Orbits (AC solutions compared to IGS Final)**

- **2000** (smoothed)
- **2007** (smoothed)

**Improvements for 2000**

- Repro quality comparable with operational product in 2007
Orbits – Long Arc Fit

- 7-day long arc fit through all orbits, including the combined ones

**AC Orbits (long arc solutions)**

- 2000: IG1: 51 ± 9 mm (smoothed)
- 2007: IG1: 27 ± 5 mm (smoothed)

**Final AC Orbits (long arc solutions)**

- 2000: IGS: 62 ± 18 mm (smoothed)
- 2007: IGS: 27 ± 4 mm (smoothed)
Clocks – Differences to combination

Repro

- No final answer for 2000

Operational

- Good repro clock quality (official: more ACs, including 30s)
ACs have different scale.

Causing a diff of 0.35 ppb btw 2000 and 2007 in operational time series

Stability per AC and biases are similar to operational solution
Consistency among ACs in 2000 is now comparable to 2007
2000: ACs have smaller scatter, but biases are still there
**Orbit – X-Rotation**

- **Repro**
  - ACs have smaller scatter, but still biases. Problem at SI1 (not in SNX combi).

- **Operational**
  - Large biases at PD1 caused by present inconsistency to SNX

![Graphs showing X-Rotation of AC Orbits minus Combi and X-Rotation of Final Orbits (AC solutions minus IGS Final)]
Orbit – Y-Rotation

Y-Rotation of AC Orbits minus Combi

Y-Rotation of Final Orbits (AC solutions minus IGS Final)
2000: ACs have smaller scatter, but still biases. Problem at ES1.
ACs have better quality.
But not as good as in 2007 (RF!)
Good repeatability at ACs (PD1!)
IGF & IRF small scatter, no bias
**X-Pole**

- ACs have better quality.
- But not as good as in 2007 (RF!)
- Good repeatability at ACs (PD1!)
- IGF & IRF small scatter, no bias
ACs have better quality.
But not as good as in 2007 (RF!)

Good repeatability at ACs (PD1!)
IGF & IRF small scatter, no bias
Y-Pole

2000 AC Y-Pole Differences with Combi 2007

AC Final Y-Pole Differences with IGS Final
ACs have better quality.
But not as good as in 2007 (RF!)

Good repeatability at ACs (better ES1)
IGF & IRF small scatter, no bias
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X-Pole rate

AC X-Pole rate Differences with Combi

AC Final X-Pole rate Differences with IGS Final
Summary

- Reprocessing evaluation
  - 2007: Repro has same quality as latest operational products
  - 2000: Repro quality is better than for the old operational products
    (better, consist. S/W & models result in more consistent submissions)
  - Problem for clocks (still not enough submissions; especially for 30s)

- More ACs shall join the reprocessing; esp. for clocks
- For the clock solutions the unique 4-character ID (RINEX file name) shall be used.
- All reprocessing ACs have to follow the rules for generating IGS Final products, i.e. all products have to be consistent (esp. to SNX)