Combination and long term stability of the IGS Reprocessing campaign

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1. Introduction

- The International GNSS Service (IGS) reprocessing campaign uses the latest operational models and techniques to reprocess the back catalogue of GPS data to produce a homogeneous time series of station coordinates and Earth rotation parameters (ERPs).
- Weekly station coordinates and daily ERP solutions from up to 11 reprocessing analysis centers (ACs) have been aligned to the ITRF2005 and combined using the TANYA software.

2. TANYA

- The TANYA program has been developed over several years since its creation in 1997, [Davies, 1997]. Most recently it has been developed by the authors to include:
  - Fully loosened solution, using minimal rotation constraints.
  - Ability to process normal equations.
  - Combined solution of station coordinates and ERPs.

3. Preliminary Results

- For this study a subset of 8 ACs were used over a period of 6 years, (1147 – 1459), processing station coordinates and 5 ERPs, pole position, pole position rate and length of day, which appear in a minimum of 3 SINEX solutions.
- Closer inspection of the timeseries shows close agreement to solutions of ig1 (Ferland and Piraszewski, 2009) for both stations and ERPs.
- A 7 parameter Helmert Transformation is used to compare AC station solutions to the TANYA combined solution, nc1, and to ig1. Helmert transformation parameters for ERPs are calculated using formulae from (Altamimi et al 2007).

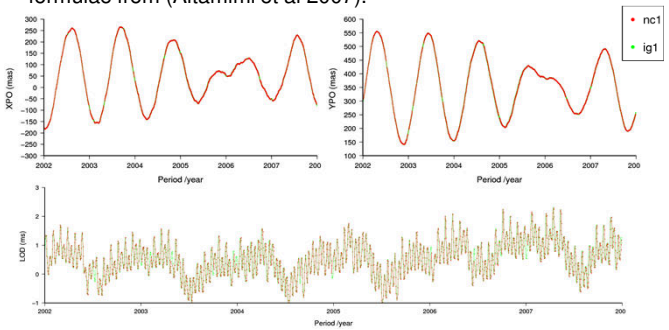

Figure 1: Comparison of XPO, YPO and LOD parameters over the period 2002 – 2007 between nc1 and ig1.

4. Spectral Analysis

- Spectral analysis of the 7 Helmert parameters to IGS05 and weighted residuals, of both the 8 AC solutions and the combined solution will help to provide an insight into any periodic signals present in the data.
- Notable signals should appear at annual and semi annual periods but short and longer term signals may become apparent.

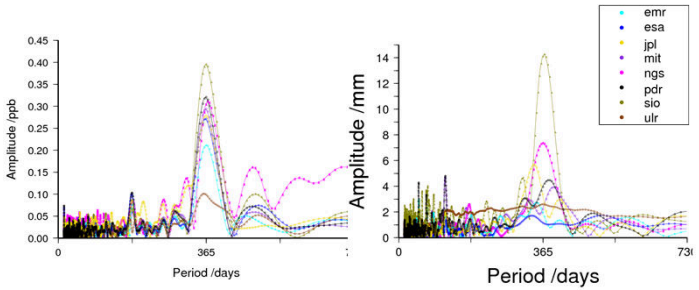

Figure 2: Left Scale, Right Translation in Z

- What figure two shows is a very clear annual signal in both the scale and Z axis translation. Also present is a longer than annual signal that is not as well defined in the Z axis. There are potentially peaks at shorter periods 1/4 and 1/5 which if are true signals pose some interesting questions.

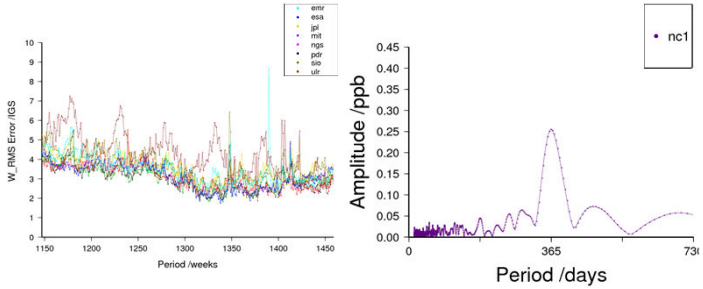

Figure 3: Analysis Center weighted residuals

Figure 4: Scale with respect to IGS05

- Figure 3 shows the long term reduction of the weighted residuals of the reprocessed solutions, this is a significant decrease to the legacy values which on average were ~10mm until week 1400. On closer inspection of figure 4, the nc1 spectral signature displays a strong annual signal with a much smaller semi annual spike, again the shorter period spikes appear in the combined solution.

5. Conclusions

- Preliminary testing of changes made to TANYA shows good agreement to both station coordinates and Earth rotation parameters to the IGS release IG1.
- Spectral analysis of different parameters show expected regular signals, but also some potentially shorter period signals which are best defined in the combined series scale.

6. Future Work

- For secular deformation it is possible to distinguish between surface mass loading and deformation caused by tectonics and Glacial Isostatic Adjustment, (GIA).
- Current models of GIA will be tested and the best model or combination of models will be used.
- The development of a new tectonic plate model to remove signals from station timeseries
- Removal of these signals should allow for the detection of any secular signals remaining due to surface mass loading of the solid Earth.

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References

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