PBO Velocity Field

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Field generation

• Current velocity field contains 1460 unique stations and 2449 position estimates accounting for offsets from earthquakes and equipment changes.
  – 22 offsets not logged at the time (damaged equipment or partial failure)
  – 28 earthquakes that generate >1 mm offsets at sites with pre-earthquake data. Earthquake catalogs used for initial estimate and then time series checked to see offset (PBO generates earthquake coseismic results for distribution initially 3-days after an event.)
  – 5 earthquakes use log function for postseismic (Hector Mine, San Simeon, Parkfield, El Mayor Cucapah, and a M 7.6 2012/09/05 14:42 off the coast of Costa Rico, lat/long 10.10° -85.31°
  – Remaining offsets are antenna/radome changes
• Daily solutions from 2004-2013 (GPS Week 1723) used plus re-processing test results 1 week every 20 weeks since 1996.
Velocity field files: Full

• Full velocity field solution uses GLOBK to combine full variance-covariance matrix to combine NMT (GAMIT) and CWU (GIPSY PPP) solutions with site specific random walk process noise model.

• Both NMT and CWU PPP solutions have rotation/translation covariance matrices added to allow them to rotate and translate.

• Orbits are fixed in both analyses; clocks are fixed in PPP (in re-processing JPL ITRF2008 products are used in CWU solution to avoid ITRF2005 scale entering solution through clock results when IGS repro1 products used; orbits do not have this problem

• These large velocity analyses are performed annually although due to the recent addition of 500 new sites and all of the SCIGN sites to the PBO analyses; a new combined solution will be generated shortly. As the reprocessing results (1996-date) are added a new updated field will be created at the end of summer.
Velocity field files: Snapshot

- Starting this year, velocity fields are generated once per month based on a time series analysis.
- The reference frame for the time series is based on the latest full velocity solution.
- The snapshot fields allow rapid improvements in the velocity estimates of sites that have been recently installed or added to the PBO analyses.
- The weighted RMS difference between these fields and the full field is $\sim0.4$ mm/yr (3D) with a $\chi^2/f \sim1.0$
  - Differences due to additional data
  - Weighting of data; random walk gives higher weight to start and end of data
  - Both field have correlated noise models but snapshot field has smaller minimum sigmas.
Reference Frames

• PBO Reference frame is now NAM08: North America Fixed based on ITRF2008 North America Euler pole (Altamimi et al., JGR, 2012)

• We do not apply the 0.41±0.54, 0.22±0.64 and 0.41±0.60 mm/yr (2-sigma) XYZ translation rates and hence the NAM08 is a center of figure frame (not center of mass).

• For the NMT/CWU and PBO solutions: Fit to ITRF2008:
  – NMT ENU 0.25 0.51 2.68 mm/yr 18 sites
  – CWU ENU 0.36 0.45 1.92 mm/yr 16 sites
  – PBO ENU 0.30 0.48 2.29 mm/yr 18 sites

• No scale or scale rate estimated; heights down weighted by 1000 when aligning to reference frame values

• Results are also available in IGS08 (NNR), IGS05 (NNR) and SN01 (North America Fixed).
THU3 may be problematic in the future.

Some larger sigma sites not shown (will be improved with reprocessing).

Fit to ITRF2008 Velocities
PBO is adding 500 non-PBO sites to the analysis to densify central/eastern US
The deviation of the Southern California velocities at longitude 244, latitude 34 could be Landers’ postseismic but this is not clear.

Black and Red vectors show velocity estimates with and without Hector and El Mayor Cucapah log estimates: Differences don’t show “Landers deviation”
The error ellipses are non-circular here because of curvature in correlates noise model. Most effects are from the El Mayor Cucapah earthquake.
Conclusions

• Reprocessing underway in PBO (waited for the ITRF2013 standards to be set; although these are not quite ready yet).

• By September we hope to be complete with a new full velocity and time series analysis spanning 1996-2013

• How best to treat postseismic, anthropogenic and natural fluid related effects is still not clear.