

# Generating velocity solutions with `g1obk`

M. Floyd

*Massachusetts Institute of Technology*

K. Palamartchouk

*Newcastle University*

GAMIT-GLOBK course  
University of Bristol, UK  
12–16 January 2015

Material from R. King, T. Herring, M. Floyd (MIT) and S. McClusky (now ANU)

# GLOBK Velocity Solutions

- The aim of these solutions is to combined many years of data to generate position, velocity, offset, and postseismic parameter estimates. Not uncommon to have 10000 parameters in these solutions.
- Input requirements for these solutions:
  - Apriori coordinate and velocity file. Used as a check on positions in daily solutions (for editing of bad solutions) and adjustments are apriori values (apriori sigmas are for these values)
  - Earthquake file which specifies when earthquakes, discontinuities, and mis-named stations affect solution. Critical that this file correctly describe data.
  - Process noise parameters for each station. Critical for generating realistic standard deviations for the velocity estimates.

# Velocity Solution Strategies

- In general careful setup (i.e., correct apriori coordinate, earthquake file and process noise files) is needed since each run that corrects a problem can take several days. In correct solutions may not complete correctly.
- Previous methods for constructing these solutions:
  - Define a core-set of sites (usually 20-200 sites) where the solution runs quickly. Test files on this solutions and use the coordinate/velocity estimates to form the reference frame for time series generation.
  - Time series using these reference frame sites and then test (RMS scatter, discontinuity tests) to form a more complete earthquake and apriori coordinate/velocity files.
  - Steps above are repeated, usually increasing number of stations until solution is complete. As new stations are added missed discontinuities and bad process noise models can cause problems.

# Velocity strategies

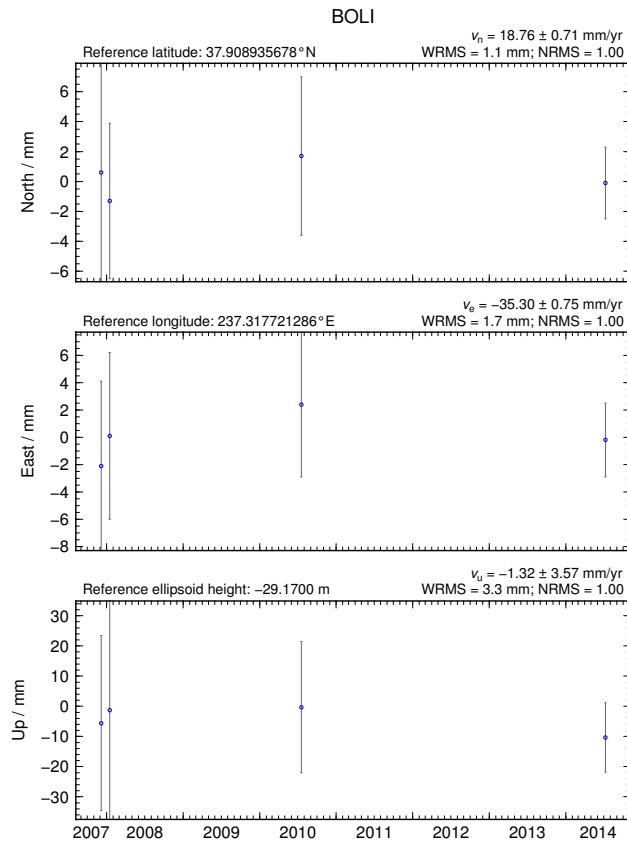
- Other methods that are used to increase speed are:
  - Pre-combine daily solutions into weekly to monthly solutions and use these combined solutions in the velocity solutions. There are many advantages to this approach:
    - Runs are much faster. Each processing step takes about the same time with the monthly as a daily file but there are 30 fewer files so 30 times faster.
    - Numerical rounding errors are much better when monthlies are used
    - New MIDP output option refers the solutions to the middle of the month. (Earlier versions used last day of month as reference time, natural time for a sequential Kalman filter.
    - Random walk process noise models correct when velocity NOT estimated in combinations
  - Run decimated solutions (e.g., one day per week). Works fine and changing start day does not have large effect due to correlated noise models. Care needed when different start day results are combined to avoid white noise sigma reduction.

# Before velocity runs

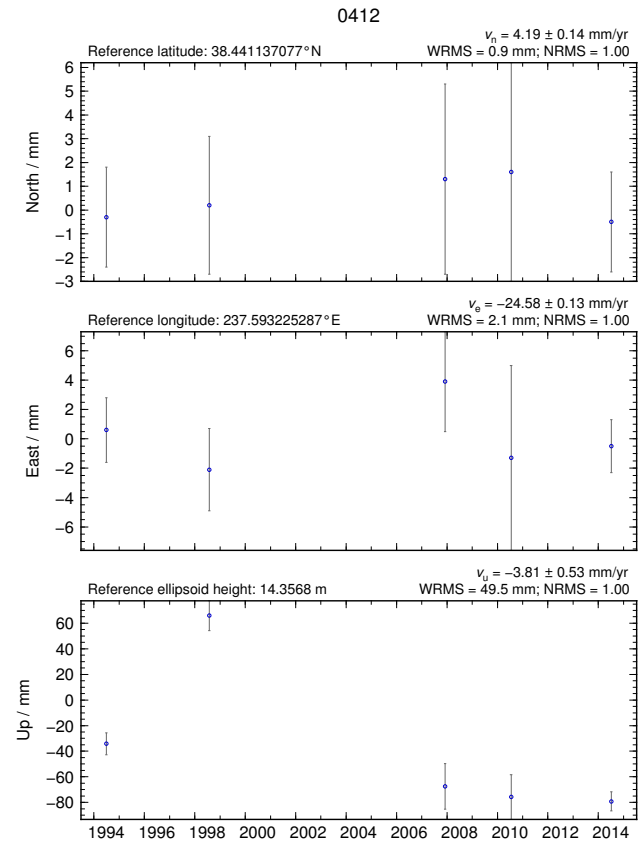
- Surveys may be combined into one solution per survey
- No need to re-run glred again to see long-term time series
- Multiple “.org”-files may be read by tssum or sh\_plot\_pos
  - `tssum pos mit.final_igb08 -R survey1_comb.org survey2_comb.org ...`
  - `sh_plot_pos -f survey1_comb.org survey2_comb.org -k ...`

# Long-term time series

## Reasonable repeatability



## Outlier in vertical



# Excluding outliers or segments of data

- Create “rename” file records and add to GLOBK command file’s “eq\_file” option, e.g.
  - rename PTRB PTRB\_XPS h1407080610\_nb4a
  - rename PTRB PTRB\_XPS 2014 07 07 18 00 2014 07 08 18 30
  - rename ABCD ABCD\_XCL 2013 07 08 00 00
- “XPS” will not exclude data from glred (so still visible in time series) but will exclude data from globk (combination or velocity solution)
- “XCL” will exclude data from all glred or globk runs

# Run globk

- Create new “.gdl”-file with *combined* binary h-files, e.g. from vsoln/, assuming standard directory hierarchy
  - `ls ../*/gsoln/*.GLX > vsoln.glx.gdl`
- Optionally run glist again
  - Recommended to prevent problems during long globk run
- Run globk
  - This may take many hours for very large/long velocity solutions



# glorg for different reference frames

- No need to re-run globk every time you want
- glorg is usually called from globk command file (“org\_cmd” option) but glorg may be run separately
- `globk 6 globk_vel.prt globk_vel.log globk_vel.gdl globk_vel.cmd`
- `glorg globk_vel_noam.org ERAS:... glorg_vel.cmd vel.com`
- Must have saved the “.com”-file!
  - e.g. “com\_file @.com”
  - Do not use “del\_scra yes” in globk command file