

# Basics of processing workflow for GAMIT/GLOBK

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and track

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

# GAMIT/GLOBK

GAMIT ("GNSS at MIT") is collection of programs to process:

- phase data to estimate three-dimensional relative positions of ground stations and satellite orbits,
- atmospheric zenith delays, and
- Earth orientation parameters.

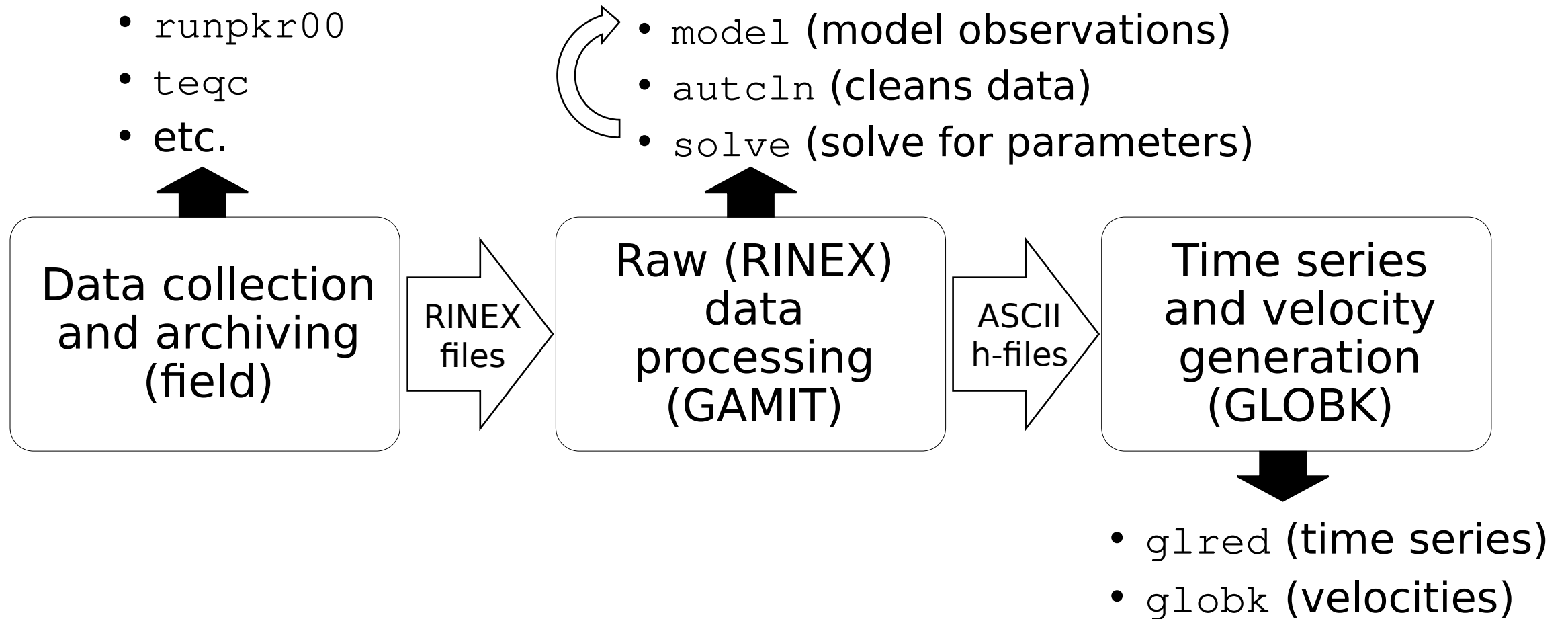
The software is designed to run under any UNIX operating system.

GLOBK ("Global Kalman filter") is a Kalman filter whose primary purpose is to combine various geodetic solutions such as GPS, VLBI, and SLR experiments. It accepts as data, or "quasi-observations", the estimates and covariance matrices for station coordinates, Earth orientation parameters, orbital parameters, and source positions generated from the analysis of the primary observations. The input solutions are generally performed with loose a priori uncertainties assigned to all global parameters, so that constraints can be uniformly applied in the combined solution.

# Structure

- The scripts that control GAMIT and GLOBK all have a built-in help page which can be evoked by entering command name only
  - `~/gg/com/` contains all of the scripts used
  - `~/gg/gamit/bin/` and `~/gg/kf/bin/` contain the program executables
  - (gg is a link in your home directory that points to the directory with the GAMIT/GLOBK software installed and should not be removed)
- Once the software is installed, user selects data to be processed over some interval of time and uses `sh_gamit` for the processing
- GLOBK is used after the daily processing to combine results and set the reference frame
- Everyone should have completed the installation of the software at this point
- Running the example case is a good idea to make sure installation was successful

# Basic stages of GAMIT/GLOBK for geoscience



# Basic inputs and outputs

- RINEX data must be prepared for input to GAMIT
- Output from GAMIT are ASCII (text) “h”-files
  - Loosely constrained solutions with a priori parameter information, parameters adjustments and full covariance matrices
- Input to GLOBK are binary version of h-files
  - Convert from ASCII to binary h-files using `htoglb` (or “-opt H” option in `sh_glred`)
- Final output of GLOBK is “.org”-file, which contains all information for
  - Time series (“.pos”-files)
  - and/or
  - Velocities (“.vel”-files)

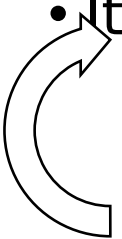
# GAMIT

- Run `sh_setup`
  - Check all links, especially to grid files (`otl.grid`, `atl.grid`, `map.grid`, `met.grid`; see `sestbl`. for what is “switched on”)
- Place RINEX data to be processed in `rinex/` directory
  - Except any publicly-available RINEX files one has set to be downloaded in `sites.defaults`
- Prepare *and verify* `station.info`, e.g. `sh_upd_stnfo`
- Prepare *and verify* `apr-file`, e.g. `sh_rx2apr`
- Run `sh_gamit`

# sh\_gamit

- `sh_gamit` is the main script for running GAMIT
- The following files are important to verify and/or edit (e.g. after `sh_setup`)
  - `autcln.cmd` (probably unnecessary to edit)
  - `process.defaults` (not necessary to edit much, if anything)
  - `sestbl.` (controls experiment observations and models; defaults OK but may want to edit)
  - `sites.defaults` (list of sites to process in experiment)
  - `sittbl.` (controls a priori constraints on sites; probably unnecessary to edit)
  - `station.info` (very important file to get right)
  - `.apr-file` (very important file to get right)
- More detail in following lecture

# Phase data processing: GAMIT

- Preprocessing
  - Download (`sh_get_orbits`) and prepare (`sh_sp3fit`) orbits
  - Make clock files (`makej`)
  - Download publicly available sites (`sh_get_rinex`) and convert RINEX files to GAMIT internal format for phase-and-pseudorange observations (`makex`)
  - Write batch (“b”) files
- Iterative solution (run b-files)
  - Calculate synthetic observations from a priori parameters and models (`model`)
  - Create observables (LC, L1+L2, etc.), clean data (`autcln`)
  - Fit calculated to observed by solving for parameter estimates (`solve`)
  - Update a priori information if large adjustments
- All the above command steps are run for the user by `sh_gamit`
  - Although preparation of orbits (`sh_get_orbits/sh_sp3fit`) and RINEX files (`sh_get_rinex`) often done manually, depending on resources



# Post-processing: GLOBK

- Convert ASCII h-files to binary h-files (`htoglb` in `glbf/`)
- Generate and chronological list of binary h-files (`glist` in `gsoln/`)
- At this point, diverge in approach depending on solution sought
  - More details about `glred`, `globk` and `glorg` in following lectures
- Similarly to `sh_gamit`, the batch script `sh_glred` will run all of the above command steps (and more, introduced in next slides)
  - User may just need to edit `globk` and/or `glorg` command files to achieve most desired types of solution

# GLOBK short-term combinations

- Combine days from a period over which velocities are negligible, e.g. a 10-day survey, bi-weekly or monthly combinations for continuous GNSS
  - Reduces short-term scatter
  - Reduces number of files to be carried forward to velocity solution
- Run `glred` to generate time series
- Plot time series (`sh_plot_pos`)
- Inspect time series to identify (and remove) outliers
- Run `globk` to form one solution file for survey (".org"-file) *without velocity estimation*, e.g. in `globk` command file:  
    `apr_site all 10 10 10 0 0 0`  
or  
    `apr_neu all 10 10 10 0 0 0`

# GLOBK long-term velocities

- Combine daily (continuous) or short-term combined h-files (e.g. surveys; see last slide)
- Plot long-term time series from short-term combination “.org”-file(s) (`sh_plot_pos`)
- Inspect time series to identify (and remove) outliers
- Run `globk` to form final solution file for all data (another “.org”-file) *with velocity estimation*, e.g. in `globk` command file

```
apr_site all 10 10 10 1 1 1
```

or

```
apr_neu all 10 10 10 1 1 1
```
- `sh_glred` capable of running all these individual commands to produce time series, short-term combinations and long-term velocity solutions