SURVIVAL GUIDE FOR THE GEODESY LAB

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CHAPTER 1: SETTING UP A GPS STATION

A ground GPS station consists of several different components: the mount, the antenna, the receiver, the connectors, and the power supply. In this chapter, we will discuss how to setup and use these parts.

In order to get statistically good data, the system need to run for at least three day, and one UTC day should not have less than 8 hours of data. Be sure to arrange for the instruments to be run for at least this amount of time.

There are many different ways to set up a GPS station because it would be way too simple to just have one standard way. This manual will explain several ways to set up an antenna.

1. ANTENNA SETUP

Picture of a Trimble L1/L2 Choke ring antenna:

i. Setup with a spike mount

The picture above shows an assembled spike mount. There is one more leg that should may be attached for better stability, but for alignment purposes, only two legs and the center spike should be touching the ground. The 3rd leg is lowered after the alignment.

At the bottom of the thickest leg there is a plumb bob. The plumb bob is screwed into the leg.

If you are using the Zephyr Geodetic Antenna, you will need to use a leveling plate. The leveling plate has a machined flat side marked 'FLAT'. If you do not see "FLAT" written on the leveling plate, the level side is the one with circular marks in it. Slide the leveling plate so that it is about half way up the center spike mount. Make sure the plate points out to an area where you would be able to place your level (i.e., no legs are blocking the plate).

Two of the smaller legs should be set perpendicular to each other. These two legs are used to adjust the leveling of the antenna (discussed later).

1. Screw the antenna onto the top of the spike mount.
2. Move the assembly so that the tip of the plumb bob is in the hole of the pin in the center of the monument.
3. Adjust the legs so that the assembly may move freely about the pin.
4. Rotate the assembly until the cable port on the antenna is facing true north.
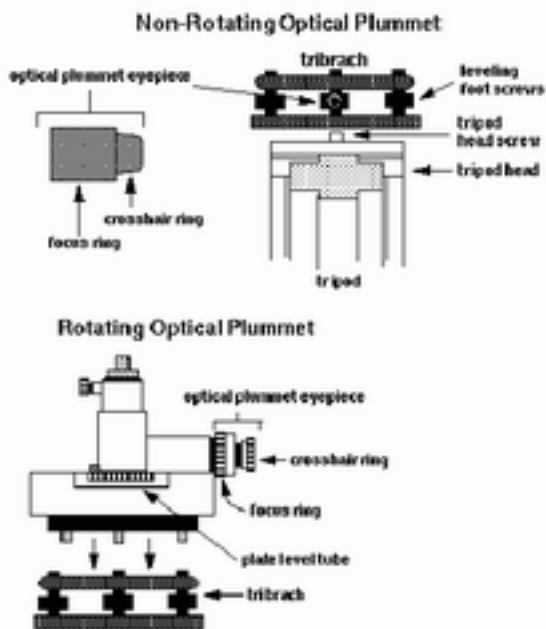
5. Lower the two adjustable legs. Keep the third thin leg (not shown in the picture above) up. Make sure that the base of the legs are secure into the ground so that there will be no possible movement by settling of the soil. Use rocks as your base if you have to.
6. Plug in antenna cable.
7. Place a level perpendicular to one of the adjusting legs and adjust the other leg height until the antenna is level in that direction. (If you are using a Zephyr Geodetic antenna, use the leveling plate and place the level parallel to the direction of a leg, if you are using the choke ring antenna, place the level on the top of the antenna). Turn the level 90 degrees so that it is parallel to the other leg and repeat. Continue to do so until the antenna is perfectly level in both directions. For the choke ring antennas: Try placing the level on top of the antenna but in between the two leveling legs. For the leveling plate: try rotating the level 45 degrees so that the level is parallel to neither of the legs. If the antenna is still level, tighten the adjustable legs and lower and tighten the third. Check again the leveling. Be aware that the leveling is very tricky. I have found that when you tighten the legs you may also throw off the leveling. Observe this phenomenon and try to compensate for it.
8. Double check that the direction of the cable port is still correct
9. Double check that the plumb bob is still in the monument pin.
10. Double check the leveling.
11. Plug the other end of the antenna cable into the receiver.

Continue to Receiver Setup.

ii. Setup with a tripod
The information for the setup with a tripod was obtained through UNAVCO (http://www.unavco.ucar.edu/project_support/campaign/documentation/tripod.pdf).

Tripod and Tribrach Setup Procedure

Non-Rotating Optical Plummet

tribrach

optical plummet eyepiece — leveling foot screws

tripod head screw

tripod head

crosshair ring

focus ring

tripod

Rotating Optical Plummet

optical plummet eyepiece

crosshair ring

focus ring

plate level tube

tribrach

Steps 1-9 are for both rotating and non-rotating tribrachs:

1. Extend tripod legs so the top of the tripod head comes up to your chin. Lock legs at this height with the leg screws. If the ground is not level the legs will have to be extended at different lengths.

2. Attach tribrach to tripod head using the large center screw on the tripod head. Make sure that the leveling foot screws on the tribrach are centered half way between their range of movement.

3. Open tripod legs over the mark and step (set) one leg into the ground at about a 45o slant angle and about 3 feet from the station mark. Look through the optical plummet and position the cross hairs over the point using the remaining two tripod legs. If viewing or crosshairs are out of focus adjust the crosshairs ring first until the crosshairs appear clear and crisp. Adjust the focus ring until the image is in focus. To check for parallax slowly move your head around while looking through the optical plummet. You should see no movement between the crosshairs and the focused background (this is known as being out of parallax), nor should the crosshairs move apart.

4. Once the cross hairs are within 1 cm of the point and the head of the tripod is visually level, step the remaining two legs into the ground. At this point sand bag or tie down the tripod legs.

5. Precisely position the tribrach crosshairs over the point using the leveling foot screws on the tribrach.

6. Level the bull's-eye bubble on the tribrach by using two tripod legs. (Do not level using the tribrach foot screws.) At this point you are leveling the tripod head.

8. Once the bull's-eye bubble is precisely level, look through the optical plummet to ensure that the crosshairs are over the point or at least within a few cms. Center the crosshairs precisely over the point by loosening the tripod head screw and gently slide the tribrach and adapter over the point. When centered, tighten the tripod head screw. If tribrach overhangs tripod head, return to step 2.

9. Check the level bubble. If the level is out:
      just a little - return to step 7.

by a lot - (more than a couple of mms) - return to step 5.

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For Tribrachs with Non-Rotating Optical Plummets:

10.Check the set up and calibration of the tribrach by attaching the plumb bob to the tripod head screw so it hangs over the point. It should hang precisely over the point +/- the plumb bob string width.

> NOTE: This will not necessarily be true in windy conditions. In windy conditions the plumb bob will be blown away from the mark. If the site is located in an area with high winds the calibration of the tribrach can be checked indoors by performing the set up procedure.

For Tribrach with Rotating Optical Plummet:

10. Follow steps 1-9 above.

11. Turn the optical plummet so that the plate bubble tube is parallel to two footscrews of the tribrach. Center the bubble by adjusting these two footscrews in equal and opposite directions.

12. Turn the optical plummet through $90_\circ$. Center the bubble with the third footscrew.

13. Turn the optical plummet through $90_\circ$ so that the bubble is parallel to the first 2 footscrews. Note position of bubble. If the bubble is centered between the middle divisions, then the tribrach is level in this plane. If the bubble sits more than one division off center, then note how many divisions off center it lies and by adjusting the two footscrews in equal and opposite directions bring the bubble toward the center by half the amount it was off center before. Turn the optical plummet through $180_\circ$ again and check where the bubble rests. Repeat the process until the bubble is within one division of the central division.

14. Now turn the optical plummet through $90_\circ$ and check the level in this plane. Note the position of the bubble. If the bubble is off center by more than one division, turn the third footscrew to bring the bubble to a point halfway between the position noted and the centered position. Rotate through $180_\circ$ and check again using the third footscrew for any fine adjustment.

15. Now rotate the optical plummet through $360_\circ$ and check if the bubble remains within 1 division of the center for any position.

16. Center the adapter precisely over the point by loosening the tripod head screw and gently sliding the tribrach and adapter over the point. When centered tighten the tripod head screw.

17.Check the set up and calibration of the tribrach by rotating the adapter $180_\circ$ and check the plummet. If the tribrach is off center by more then 1mm then loosen the tripod head screw and gently slide the tribrach and adapter half the distance it was off. Rotate the adapter $180_\circ$ and recheck the plumb. The offset should be the same. If not repeat this step again.

2. ATTACHING THE GPS ANTENNA

When attaching the antenna to the tribrach first screw the brass adapter plug into the antenna then gently slide the plug into the tribrach adapter or rotating optical plummet.

18. Continue with receiver setup.

3A. 4000ssi RECEIVER SETUP (UNAVCO DIRECTIONS)

The UM-RSMAS Geodesy lab likes to hook the receiver up to two batteries in parallel for redundancy. Notice there are two ports for power. If you really wanted to you can hook up an secondary power supply. In this procedure we only use one.

Hook up two batteries in parallel and connect them to the alligator clips inside the battery cable sack (usually carried in the receiver case).

Connect the other end of the wire to the receiver. Be extremely careful not to cross the leads in this process. It is very dangerous to both you and the equipment!

The information for this section was taken from the UNAVCO website (http://www.unavco.ucar.edu/project_support/campaign/documentation/4000sessions.pdf).

ALPHANUMERIC KEY PAD   PROGRAM KEYS   SOFT KEYS

EXTERNAL REFERENCE TIMER (NOT USED)

POWER & INPUT/OUTPUT (5 PIN)

ANTENNA

POWER 2 & 3 (5 PIN)

AUXILIARY (7 PIN) (NOT USED)

INPUT/OUTPUT (7 PIN) (NOT USED)

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Programming Sessions in the Trimble 4000 Receiver

(The documentation conventions are: **BOLD CAPITALS** indicate a button, **bold** indicates a screen, *ITALICS* indicate a softkey (the keys to the right of the display), and "UPPERCASE QUOTATIONS" indicate a screen quote).

1. Program the receiver at least 20 minutes before the project scheduled start time, if there is one. Turn the receiver on by pressing the **POWER** button. The receiver will boot and self test. Watch for any errors during the self test.

2. Press the **STATUS** button to display the **status** screen. To verify proper operation, check the power strength bars, that the "lollipop" icon is present (indicating the antenna is attached), that the receiver is tracking satellites on the third line, and UTC time.

3. Delete all uneccessary files. Caution: Make sure the files have been downloaded or are not wanted before removing them.

a. Press **CONTROL**, *LOGGED DATA FILES*, *DELETE* and then *DELETE IT* until the screen shows "FILE DIRECTORY IS EMPTY".

b. Press **SESSIONS** then *DELETE IT* until you see "NEW STATION: 0000". Input the four character station identification and push **ENTER.** Then enter the station name up to 48 characters and push **ENTER.**

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4. Choose *AUTOMATIC* reference position determination.

5. Enter the new session: day#. "day" is the three character julian day of the year, and "#" is the session number. The first session of the day is number 0. Ex: "3650" for a new session beginning on December 31.Push **ENTER**.

6. Choose *USE RECEIVER DEFAULTS*.

7. Choose *ANY DAY AT SPECIFIED TIME* to schedule the survey.

a. Input the UTC start time, hours:minutes.

b. Input survey length, hours:minutes.

c. Press *ACCEPT*.

8. Set the elevation mask to 10 degrees.

9. Set minimum number of satellites (SV's) = 1.

10. Set measurement sync time. This varies depending on the type of survey. It is usually 30 seconds for surveys longer than 4 hours and can be as high as 1 second for kinematic surveys.

11. Press *ACCEPT*.

12. Choose *NO* to "ADD ANOTHER SESSION FOR STATION xxxx?"

13. Choose *NO* to "ADD ANOTHER STATION?"

14. Press *MORE*.

15. Select *ENABLE AUTO-SURVEY TIMER*. The screen should now display "SCHEDULED SESSIONS: 1 EVERDAY SESSION, NO ONCE ONLY SESSIONS.

16. Select *ENABLE*.

17. Select *ENABLE AND STAY AWAKE BETWEEN SURVEYS.*

18. Input the antenna height and press **ENTER**.

19. Input the antenna serial number.

20. Press *ACCEPT*.

The survey will automatically start. The screen will read:

"STARTING SESSION: XXXX-###-0"

"IN 30 SECONDS."

Once the survey has started check the control parameters by pressing the *MORE* softkey option. If any of the parameters are incorrect you will

have to stop the current survey and reprogram the receiver from the beginning.

21. Complete the Monument Visit Logsheet.

22. End the survey. A programmed survey will end automatically. When the survey has ended the receiver will automatically start a new survey session. To stop the current survey press the **LOG DATA** key. Then select *END SURVEY*. The receiver will prompt "STOP CURRENT SURVEY?". Select *YES*.

Now you are ready to go! Depending on the station you have just installed you may have to baby-sit it, or you may just be able to leave it. Try to check up on it at least once a day for the next few days.

3B. 4000ssi RECEIVER SETUP (PETE'S DIRECTIONS)
NOTICE: DO NOT POWER THE RECEIVER UNTIL THE ANTENNA IS CONNECTED

1.) Set-up antenna on spike mount on top of mark and level the antenna. Make sure there are no obstructions (e.g. tree limbs, concrete posts, etc.) blocking the antenna.
2.) Press the **POWER** button
3.) Press the **SESSIONS** button – Delete any sessions stored in memory
    a. NEW STATION – input 4 character name for station – ***accept***
    b. NEW STATION – input site name (usually the nearest town or landmark) - ***enter***
    c. Reference Position – automatic
    d. Input session # = UTC day (Day of year; e.g. January 1 = 001) - ***enter***
    e. Special Controls: Choose *Use Receiver Defaults*
    f. Select schedule: Choose *Any day at specified time*
        i. Start time: 00:00:00
        ii.   Observation time:23:59 – ***accept***
4.) Receiver Defaults
    a. Elevation mask = 07° - 15°
    b. Minimum SV's = 4
    c. Measure Sync. Time = 15.00 – 30.00 seconds
5.) Add Another session – NO
6.) Add Another station – NO
7.) List – Choose ***More***
    a. Choose *Enable auto survey timer*
    b. Enable
    c. Choose *Enable stay awake*
8.) Input antenna <u>height</u> (0.5 meters) and <u>serial number</u> (last 6 digits found on the preamplifier of the antenna (i.e., where the antenna cable is attached to the antenna). *Accept*

9.) The session will now start in 30 seconds
10.)   On the log sheet make note of :
       a.   Starting time
       b.   Date
       c.   Position. The position may be found by pressing the **STATUS** button.
           Then choose **Position** from the menu.

4. TROUBLESHOOTING PROBLEMS WITH THE FEILD EQUIPMENT

<u>TRIMBLE 4000SSI RECEIVERS</u>

The Trimble 4000ssi receivers are older and no longer offered through the Trimble
website. Problems we have encountered with the aging systems and our solutions to the
problems are listed here.

<u>Initializing Problems</u>

The receiver cannot stop initializing. It will not bring you into the main menu and
none of the command buttons seem to work. It cannot find any satellites. Why does the
receiver hate me?!?!?!

Well, it sounds like some of the Firmware files may be corrupted. Or perhaps the system
just got confused. The current (as of 1-20-04) Firmware version we use is 7.19b. So
what do you do?

THESE DIRECTIONS ARE ONLY MEANT AS A LAST RESORT. IF YOU
CANNOT GET THE SYSTEM WORKING ANY OTHER WAY THEN YOU CAN
ATTEMPT THESE DIRECTIONS. GOOD LUCK.

First, you want to try to take as much of your data off the receiver as possible. Use
GPload to download your data on your machine.

Then you want to do a hard reset by pressing the LOG DATA and CLEAR buttons
while turning on the machine. THIS WILL DELETE ALL THE DATA ON YOUR
MACHINE.

Wait about ten minutes to see if the machine will start seeing satellites and acquire its
position. If this happens, everything is dandy and you can get on with the rest of the day.

What's that? It didn't work? It sounds like you may have some greater problems on
your plate. It sounds like your system is beyond being confused—it is corrupted! You
may not be able to get your data back if this happens. At this point you will have to
download Firmware files on your machine that will replace the corrupted ones. This can
be a bit tricky.

Download Firmware v.7.19b to your machine by going to the Trimble website at:

http://www.trimble.com/support_trl.asp?Nav=Collection-3849

The upload is the first one listed. Connect the power to the receiver (power 2) and the download cable to IO/Power 1. Double click the update_s.bat and let it run the update. If you are using DOS, go to the directory with the updates and run "UPDATE 1".   You may have to type a different number ie, UPDATE 2 or 3 or 4, in order to run in DOS due to your DOS configuration.

YOU MAY LOOSE ALL OF YOUR DATA FILES ON THE RECEIVER.

CHAPTER 2: USING GIPSY/OASIS CAN BE FUN!
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GIPSY/OASIS (**GPS I**nferred **P**ositioning **SY**stem Software) is the software used in the RSMAS Geodesy Lab for processing rinex files produced by GPS (**G**lobal **P**ositioning **S**ystems). Rinex is defined as **R**eceiver **IN**dependent **EX**change format. It consists of a set of standard definitions and formats that permits interchangeable use of GPS data from dissimilar GPS receiver models or post-processing software. The format includes definitions of time, phase and range. If you are planning on doing any sort of GPS work in this lab, it is absolutely imperative that you know how to process and interpret the data. Try to learn how to use GIPSY as soon as you feel comfortable enough with UNIX.

PROCESSING YOUR DATA

1. LOCATION OF THE PROCESSING SCRIPTS

GPS prcessing scripts are found in/raphael/daily/bin or /giotto/local/bin. GIPSY/ OASIS processes ONLY rinex files.

2. STATION NAMES

Station names are four characters long. The name has the flexibility to be lowercase or uppercase, and can also contain numbers. From now on, the sample four character station name used in this manual will be referred to as **SITE**. Other labels used in this manual are:

JJJ = number of the day of the year, starting from January 1 (001)
YY, YYYY = year
MM, MMM = month
DD = day
# = numerical label indicating file number for that day (0, 1, 2...)

3. DESCRIPTION OF TRIMBLE DATA FILES

Trimble data files come in several types. Among those are:

- R-files (of the form *.r00, where the size of the file is approximately 0.5 Mbyte/day)

- Data file, downloaded with GPLoad (of the form *.dat, where the approximate size is 1-3Mbytes/day). The Geodesy Lab uses GPLoad to download data from the 4000ssi receivers. GPLoad also provides *.mes, *.ion and *.eph. These files are generally not used/needed during processing unless if you have problems with the XYZ position and/ or satellite orbits are off. The *.dat files must be run through TEQC (Translate/Edit/Quality Check, see section **5. TEQC**). TEQC converts *.dat files to rinex2 files (rinex2 is the latest version, as of May 7, 2003). For more information on the RINEX v.2 file format, please visit http:// www.ngs.noaa.gov/CORS/Rinex2.html.

4. DESCRIPTION OF RINEX FILES

Rinex files are in the form of SITEJJJ#.YYo. Be sure that the o at the end of the name is lowercase.

The first few lines of a rinex files look similar to this:

```
2        OBSERVATION DATA    G (GPS)              RINEX VERSION / TYPE
TRRINEXO V2.5.3 LH  IFAG, FFM       14-OCT-96 12:12    PGM / RUN BY / DATE
Rinex conversion                                        COMMENT
BIT 2 OF LLI (+4) FLAGS DATA COLLECTED UNDER "AS" CONDITION COMMENT
KOSENJAK                                               MARKER NAME
0091                                                  MARKER NUMBER
MEDVED          GURS                          OBSERVER / AGENCY
2322            TRIMBLE 4000SSE     5.68 / 1.26    REC # / TYPE / VERS
67153           4000ST L1/L2 GEOD               ANT # / TYPE
4237539.4409  1137813.0515  4616000.4325       APPROX POSITION XYZ
0.6055      0.0000      0.0000                 ANTENNA: DELTA H/E/N
1    1                                        WAVELENGTH FACT L1/2
5   C1   L1   L2   P2   P1                     # / TYPES OF OBSERV
15                                            INTERVAL
1995    9   29   9   1   0.000000            TIME OF FIRST OBS
                                              END OF HEADER
 95  9 29  9  1  0.0000000  0  5 01 15 21 28 31
21933437.742   -12129273.292 6 -9235809.40146  21933438.4344
21643688.844   -14115592.591 7 -10752804.35947 21643689.6764
21647761.906   -3430766.119 6 -2596626.27447  21647763.2774
-1305495.601 5 -1017270.439 6  21993701.625    21993700.359
20320366.828   -7365142.305 7 -5612569.05947  20320366.4304
 95  9 29  9  1 15.0000000  0  5 01 15 21 28 31
21922261.305   -12188003.146 6 -9281572.92146  21922263.1094
21629040.945   -14192570.871 7 -10812787.43147 21629041.0984
21646125.023   -3439367.402 6 -2603328.57047  21646126.5594
-1300910.244 5 -1013697.451 6  21994574.051    21994573.328
20314893.188   -7393905.788 7 -5634982.16447  20314892.7194
```

The header labels are on the right and the header information is on the left. The actual data begins under the header in columnar form.

The data starts the first epoch with the line:
95 9 29 9 1 0.0000000 0 5 01 15 21 28 31
The second epoch starts with the line:
95 9 29 9 1 15.0000000 0 5 01 15 21 28 31

What to look for in a rinex file:

1. Be sure that all the files for one site have the same four letter site name. Sometimes multiple names exist for the same site.

Example
Suppose you have 10 rinex files from 1994 for the same site, but the files there are 5 files named ALAM and 5 files named LAMO. In this case, I choose to make all sites named LAMO. To do this, you can type:

mvwilds ALAM LAMO ALAM*.94o

In other words, change the name from ALAM to LAMO for all files that fit the criteria alam*.94o.

2. Do your files end in .YYo? If not, go immediately to **A. When do I need to TRANSLATE?** in section **5. TEQC**

3. Make sure the file can be read by TEQC (section **5. TEQC**, but for example, type: teqc +meta SITEJJJ#.YYo). If TEQC can read the file, then it will read the start and end time of the file, as well as a bunch of other useful information. If not, read the prompt line to check for problems. Some typical problems are that TEQC cannot understand the values of certain parameters listed in the rinex file. For instance, TEQC does not like it if the INTERVAL line reads 0. Noting the time difference between the data epochs, you can change the interval in the header either manually or using TEQC (see below)

4. Make sure that the file contains more than just a few hours of data. The processing routine will crash if there are only a few hours of data.

5. Does the date in the file correspond to the gps day of year in the rinex file name? If it does not, you will need to change the name of the rinex file to fit the day the data was collected.

6. Does the data leak over into the next day? If it does, then you will have to split the file using TEQC (see section **5. TEQC**).

7. Check the file. Is there a space between the header and the data? If so, remove it.

8. Is the last epoch at the end of the file complete? If not, make sure that you have copied the entire file correctly. If you did, remove the last epoch (~9 lines).

Gather your log sheets for your sites. The following questions may involve a bit of detective work:

9. Does your antenna height in the rinex header match the log sheets?

10. Does your antenna type in the header match the log sheets?

<u>**5. TEQC**</u>

Check your files with the points listed above under **To Start--What to look for in a rinex file**. If the antenna height, station name or any other label is incorrect, if the date given in the name does not match the date inside the file, or the file contains more than one day of data, then you need to TEQC, or if the file does not match this description at all, you need to TEQC.

What is TEQC?

TEQC stands for Translate/Edit/Quality Check, and has been presented to us by the good people of UNAVCO. This program deals with reformatting, splicing, changing, and checking all your needs as far as GPS rinex files are concerned. Sometimes you will not have to use TEQC for your data set, and other times you may have to use several functions. If you need additional information, refer to the online manual found at: http://www.unavco.org/software/teqc/tutorial.html.

Helpful TEQC hints:

1. Typing "teqc +help" will display all the possible commands you ever wanted to know.

2. Typing "teqc +meta SITEJJJ#.YYo" will display important header information of the file to the screen.

A. When do I need to TRANSLATE?

Look at your data files. Are they in the format *.YYo or *.YYo.Z (YY—last two digits of the year the data were taken)? If so, you do not need to translate. If you have *.r00 (binary file) or *.dat (non-binary file) you will need to translate.

How do I translate?

The geodesy lab has concocted some useful routines for 'translating' the files into a rinex format. These routines execute TEQC commands that will change the format.
If your files are *.dat, then you must copy into your working directory the dat2rnx file (found in /raphael/daily/bin). Edit the file by changing the incoming directory, year and station name.

Type:
dat2rnx *.dat

If your files are *.r00, then type:
r002rnx *.rnx

B. When do I need to EDIT my rinex files?

You need to edit when:

1. You have files whose dates given in the name are not the same as the dates given in the file.
2. A file has part of another day's data in it.
3. You want to change any information in the rinex header, e.g. - antenna heights, station names, etc.
4. The XYZ position stated in your rinex file is not well constrained.
5. For any reason given under **To Start--What to look for in a rinex file**.

For this version of this text, I am going to go through two examples: **I.** how to split and append files; **II.** how to change the XYZ position stated in the rinex file. Future versions will include other example situations.

**Remember, you can always type: teqc +help for information on all the commands available for teqc.

I. How to split and append files:

Example Situation: You would like to process rinex files for station SITE. The file containing data for January 31st of year YY is named SITE0310.YYo. Your rinex file is perfect, only, the data for the day marked is there, but so is part of the data for the next day (February 1st)! You have the remainder of the data for February 1st in a second file named SITE0320.YYo. How do I make a file that contains only data for January 31st? How do I take only data for February 1st in file SITE0310.YYo and append it to SITE0320.YYo?

It is important to keep the data for each day separated because GIPSY uses satellite orbit data that are specific to each day. If other days' data are input into the file which you are processing, the satellite orbits will be wrong.
In this example you have a file that contains data from both January 31 and February 1st named SITE0310.YYo. You have a second file named SITE0320.YYo which contains data only for February 1st.

To put *only* data from January 31st into a file (truncating the data collected on February 1st) type:

teqc –st 01:31:00:00:00 +dh 23.99 SITE0310.YYo >SITE0311.YYo

This command string will put all the information for only January 31ˢᵗ into a file labeled SITE0311.YYo.

To place all the data from February 1ˢᵗ in file SITE0310.YYo to a separate file, type:

teqc –st 02:01:00:00:00 +dh 23.99 SITE0310.YYo >SITE0321.YYo

This command string will put all the information only for February 1ˢᵗ into a file named SITE0321.YYo.

Now you are left with the second problem – you now have two files for the same day (SITE0321.YYo and SITE0320.YYo)! As long as the antenna type and heights are the same, you may merge the two files by typing:

teqc SITE0321.YYo SITE0320.YYo >SITE0322.YYo

Merging has to be done in chronological order.

To test your new files, type:

teqc +meta SITE032#.YYo

Make sure that the file is okay by checking the start and end times of the files.

If you are a computer guru, you can write a program that will take care of your needs and all your sites in one swoop. Good luck with that.

II. How to attain more accurate XYZ values in your rinex header

Sometimes the receiver will give you incorrect XYZ positions in the rinex file header. This problem can occur if the receiver is operated in one location, shut down, and operated in another location that is very far from the first. Poorly constrained XYZ positions recorded in the sta_info files may cause problems and much heartache in the processing.

NEED TO TEST!!!

In order to remedy this situation, you will need your original *.eph or *.YYn files. If you do not have these files, and had taken the data from an archive, you may be able to retrieve them from the archive. You may be able to

III. How to change Rinex Header Information

Unfortunately, some rinex file headers may not have complete or correct information. If, for instance, the antenna height in the header is 1.0000m and you know from log sheets that it is really 0.5000m, you can change using TEQC.

If you type: *teqc +help*, it will list for you the commands for changing the header. the command is –O.{opt}.   In the example given above, you can change the antenna height by typing:

teqc –O.pe 0.5000 0.0000 0.0000 SITEJJJ0.YYo > SITEJJJ1.YYo

In the same file, you may also have noticed that the sampling interval (marked INTERVAL in the rinex header) is 0, but you see in the file that the time between epochs is 30 seconds. If this is the case, you can type:

teqc –O.int 30.0 SITEJJJ1.YYo > SITEJJJ2.YYYo.

C. When do I use the Quality Check?

Typing *teqc +qc SITEJJJ#.YYo* will perform a quality check on the rinex file. Usually this is used after processing when something is suspicious in the results. This command will tell you important details, such as:
    a. The *specific satellites* used at which time,
    b. *How many* are seen at one time.
    c. The start and end times of the file
    d. The duration and observation intervals.
    e. The total Rx clock drift, rate of clock drift and the time between resets. The slower the clock drift, the more accurate the timing in the rinex file.

If, after finishing the processing routine, there are specific days for a certain site that are acting strangely, it may be helpful to take a look at the quality of the data. Here you can see if the clock of the receiver is having difficulties, or if the receiver was not seeing enough satellites. Are there any breaks in the data throughout the file? This may also attribute to strange results.

For more information, read the TEQC Manual located at:
http://www.unavco.ucar.edu/software/teqc/tutorial.html.

6. GENERATING THE STA_INFO FILES

Download your rinex files to your work directory, but check disk space before downloading. Keep in mind that /giotto does not have enough space to download the files, let alone to process them.

REMINDER: Your rinex files must have the station names in capital letters and the first character must be a letter.

In order to run GIPSY/OASIS, there are 3 files needed in addition to the rinex files. These files are:

    i   sta_id
    ii   sta_pos
    iii sta_svec

You can find the most recent examples of the sta_info files in Pete or Gina's home directories. You may copy one of ours into your own home directory. gps day of year. Your file MUST be in your home directory. This may be the easiest way to set up these files. When revising these files, be sure that the spacing is identical to the copy.

The files must be kept in your home directory during the processing.

i sta_id
The sta_id file is in the format of: (space) SITE (5 spaces) 0 (space) SITE. An example of a sta_id file looks like this:

```
A504      0 A504
A505      0 A505
A613      0 A613
A616      0 A616
ALVA      0 ALVA
C616      0 C616
CAUV      0 CAUV
FIBR      0 FIBR
GOUD      0 GOUD
GRSY      0 GRSY
LAMO      0 LAMO
LASY      0 LASY
LNDA      0 LNDA
LOSP      0 LOSP
MADC      0 MADC
NAPO      0 NAPO
P807      0 P807
POSO      0 POSO
POZO      0 POZO
RUS1      0 RUS1
SAL2      0 SAL2
SALT      0 SALT
SIMM      0 SIMM
SHIM      0 SHIM
TWR2      0 TWR2
```

Be sure that your spacing is correct. Any missed or added spaces will not be processed later on.

DO NOT USE TABS to fill in the spaces. GIPSY does not like tabs.

Make sure that there are no extra lines at the end of the file.

ii sta_pos

The sta_pos file comes in the form of:

(space) SITE (space)YYYY (space) MM (space) DD (space) HH (space) mm (space) SS.SS (space) (the amount of time (in days) the position is valid for) (15 spaces until the end of the next column) (earth center position x (m)) (14 spaces until the end of the next column) (earth center position y (m)) (14 spaces until the end of the next column) (earth center position z (m)) (15 spaces until the end of the next column) (earth velocity in x-direction in meters/yr; if not known then = 0.0000000E+00) (14 spaces until the end of the next column) (earth velocity in y-direction in meters/yr; if not known then = 0.00000000E+00) (14 spaces until the end of the next column) (earth velocity in x-direction in meters/yr; if not known then = 0.00000000E+00) (Comment:YYYY MM DD INT)

YYYY = year
MM = month
DD = day
HH = hour
mm = minute
SS.SS = second
INT = initials of processor

An example of a sta_pos file looks like this:

```
A504 1994 03 15 18 58 30.00 1000001.00   -2602485.0000  -4537278.0000   3638445.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
A505 1994 03 17 18 47 30.00 1000001.00   -2658546.0000  -4498184.0000   3645536.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
A613 1994 03 08 19 22 30.00 1000001.00   -2530704.0000  -4517228.0000   3711964.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
A616 1994 03 10 19 16 30.00 1000001.00   -2545588.0000  -4549722.0000   3662107.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
ALVA 1994 03 01 22 54 30.00 1000001.00   -2677094.0000  -4523659.0000   3600928.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
C616 1994 11 07 18 09 30.00 1000001.00   -2596978.0000  -4497992.0000   3690078.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
CAUV 1994 11 07 16 33 30.00 1000001.00   -2592500.0000  -4517446.0000   3671009.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
FIBR 1994 03 07 15 42 00.00 1000001.00   -2554674.0000  -4534924.0000   3674026.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
GOUD 1994 11 02 17 35 00.00 1000001.00   -2583737.0000  -4517626.0000   3675590.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
GRSY 1994 03 04 17 20 00.00 1000001.00   -2656668.0000  -4525635.0000   3613531.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
LAMO 1994 03 06 17 46 30.00 1000001.00   -2642123.0000  -4529287.0000   3619794.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
LASY 1994 11 04 19 50 00.00 1000001.00   -2598106.0000  -4507898.0000   3678414.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
LNDA 1994 03 09 18 54 00.00 1000001.00   -2640232.0000  -4518274.0000   3634325.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
LOSP 1994 03 02 19 45 30.00 1000001.00   -2666622.0000  -4507899.0000   3628469.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
MADC 1994 03 08 19 27 30.00 1000001.00   -2618499.0000  -4523125.0000   3645287.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
NAPO 1994 11 04 18 32 00.00 1000001.00   -2596247.0000  -4504210.0000   3683975.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
P807 1994 11 02 16 29 00.00 1000001.00   -2584426.0000  -4502907.0000   3692603.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
POSO 1994 11 05 16 49 30.00 1000001.00   -2607680.0000  -4496184.0000   3685407.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
POZO 1994 11 02 01 15 30.00 1000001.00   -2627936.0000  -4497409.0000   3669666.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
RUS1 1994 03 01 23 31 00.00 1000001.00   -2678535.0000  -4524296.0000   3598860.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
SAL2 1994 11 07 17 33 00.00 1000001.00   -2603657.0000  -4527542.0000   3650592.0000  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
SALT 2003 10 30 01 04 45.00 1000001.00   -2603655.5653  -4527535.1218   3650597.8651  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
SIMM 2003 10 21 23 19 45.00 1000001.00   -2604498.4671  -4510491.4418   3670051.4678  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
SHIM 2005 05 20 17 21 15.00 1000001.00    939511.8554  -5688797.1663   2717613.1918  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
TWR2 1993 05 09 04 35 00.00 1000001.00   -2601384.6240  -4502436.8153   3682565.9854  0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS
```

I purposely decreased the font size so that you can see how the columns line up. Be sure that the columns line up exactly in this format or GIPSY will not like you. Here is a normal sized line so you can better see the information it contains:

A504 1994 03 15 18 58 30.00 1000001.00 -2602485.0000 -4537278.0000 3638445.0000 0.00000000E-01 0.00000000E-01 0.00000000E-01 2005 07 26 GMS

The start date and time, as well as the position from the center of the earth in x, y and z is given in the rinex header. We use 1000001.00 as the default value for how long the position is good for.

The sta_pos file only needs one line of information per station. Be sure, however, that the line contains the dates and times and positions from the earliest occupation's start time.

iii sta_svec

And last, but certainly not least, the sta_svec file. Among its qualities is the following format:

(space) SITE (space) SITE (space) YYYY (space) MM (space) DD (space) HH:mm:SS.SS (space) (number of seconds in the total observations*) (space) (code name for the antenna used, as of 08/03/05, only use labeling beginning with R. If you use one of the other notations, be consistent, and use names with the same first letter) (11 spaces until the end of the next column) (velocity component x) (10 spaces until the end of the next column) (velocity component y) (10 spaces until the end of the next column) (velocity component z) (5 spaces) (vertical antenna height) c (comments)

Here is an example of a sta_svec file:

```
A504 A504 1994 03 15 18:58:30.00 00864000.000 RT1453200       .0000      .0000      .0000     2.2200 c 2005 07 26 GMS
A504 A504 1998 07 01 18:28:15.00 00864000.000 RT2202000       .0000      .0000      .0000     2.0000 c 2005 07 26 GMS
A504 A504 2001 01 31 16:51:15.00 00014400.000 RT4800          .0000      .0000      .0000     1.6587 c 2005 07 26 GMS
A504 A504 2001 02 01 16:41:15.00 00007500.000 RT4800          .0000      .0000      .0000     1.8009 c 2005 07 26 GMS
A504 A504 2001 02 01 20:13:00.00 00086400.000 RT4800          .0000      .0000      .0000     1.5124 c 2005 07 26 GMS
A504 A504 2001 10 17 15:07:10.00 00086400.000 RT4800          .0000      .0000      .0000     1.6076 c 2005 07 26 GMS
A504 A504 2001 10 31 15:59:00.00 00086400.000 RT4800          .0000      .0000      .0000     1.5976 c 2005 07 26 GMS
A504 A504 2003 10 31 21:16:15.00 00864000.000 RT2965900       .0000      .0000      .0000     0.5000 c 2005 07 26 GMS
A505 A505 1994 03 17 18:47:30.00 00864000.000 RT1453200       .0000      .0000      .0000     2.2200 c 2005 07 26 GMS
A505 A505 2001 01 31 17:04:45.00 00007800.000 RT4800          .0000      .0000      .0000     1.7378 c 2005 07 26 GMS
A505 A505 2001 01 31 20:45:45.00 00009000.000 RT4800          .0000      .0000      .0000     1.5354 c 2005 07 26 GMS
A505 A505 2001 02 01 16:15:15.00 00009000.000 RT4800          .0000      .0000      .0000     1.4653 c 2005 07 26 GMS
A505 A505 2001 02 01 20:15:45.00 00009000.000 RT4800          .0000      .0000      .0000     1.5996 c 2005 07 26 GMS
A505 A505 2001 11 06 16:25:45.00 00025200.000 RT4800          .0000      .0000      .0000     1.4893 c 2005 07 26 GMS
A505 A505 2001 11 07 15:23:50.00 00864000.000 RT4800          .0000      .0000      .0000     1.5474 c 2005 07 26 GMS
A613 A613 1994 03 08 19:22:30.00 00864000.000 RT1453200       .0000      .0000      .0000     2.2200 c 2005 07 26 GMS
A613 A613 2003 10 18 02:18:45.00 00864000.000 RT2965900       .0000      .0000      .0000     0.5000 c 2005 07 26 GMS
A616 A616 1994 03 10 19:16:30.00 00259300.000 RT1453200       .0000      .0000      .0000     2.2200 c 2005 07 26 GMS
A616 A616 1998 06 26 19:05:30.00 00864000.000 RT2202000       .0000      .0000      .0000     2.0000 c 2005 07 27 GMS
ALVA ALVA 1994 03 02 02:10:30.00 00864000.000 RT1453200       .0000      .0000      .0000     1.1276 c 2005 07 27 GMS
C616 C616 1994 11 07 18:09:30.00 00001140.000 RT1453200       .0000      .0000      .0000     0.8252 c 2005 07 27 GMS
C616 C616 1994 11 07 18:34:00.00 00086400.000 RT1453200       .0000      .0000      .0000     0.8293 c 2005 07 27 GMS
C616 C616 2000 08 29 00:00:30.00 00864000.000 RAOAD/M_T       .0000      .0000      .0000     1.1248 c 2005 07 27 GMS
CAUV CAUV 1994 11 07 16:33:30.00 00432000.000 RT1453200       .0000      .0000      .0000     1.5463 c 2005 07 27 GMS
CAUV CAUV 2003 10 19 22:03:15.00 00864000.000 RT2965900       .0000      .0000      .0000     0.5000 c 2005 07 27 GMS
FIBR FIBR 1994 03 07 15:42:00.00 00086400.000 RT1453200       .0000      .0000      .0000     1.1418 c 2005 07 27 GMS
FIBR FIBR 1994 03 09 19:17:00.00 00086400.000 RT1453200       .0000      .0000      .0000     2.2200 c 2005 07 27 GMS
FIBR FIBR 1994 11 11 16:26:00.00 00432000.000 RT1453200       .0000      .0000      .0000     0.9857 c 2005 07 27 GMS
FIBR FIBR 1999 08 25 23:49:00.00 00864000.000 RAOAD/M_T       .0000      .0000      .0000     0.9827 c 2005 07 27 GMS
FIBR FIBR 2003 10 18 00:00:15.00 00864000.000 RT2965900       .0000      .0000      .0000     0.5000 c 2005 07 27 GMS
GOUD GOUD 1994 11 02 17:35:00.00 00864000.000 RT1453200       .0000      .0000      .0000     1.0034 c 2005 07 27 GMS
GOUD GOUD 2003 10 18 21:38:45.00 00864000.000 RT2965900       .0000      .0000      .0000     0.5000 c 2005 07 27 GMS
GRSY GRSY 1994 03 04 17:20:00.00 00432000.000 RT1453200       .0000      .0000      .0000     1.1510 c 2005 07 28 GMS
GRSY GRSY 1994 03 17 18:52:00.00 00864000.000 RT1453200       .0000      .0000      .0000     2.2200 c 2005 07 28 GMS
LAMO LAMO 1994 03 06 17:46:30.00 00864000.000 RT1453200       .0000      .0000      .0000     0.9230 c 2005 07 28 GMS
LASY LASY 1994 11 04 19:50:00.00 00864000.000 RAOAD/M_T       .0000      .0000      .0000     0.8325 c 2005 07 28 GMS
LASY LASY 2003 10 21 21:58:15.00 00864000.000 RT2965900       .0000      .0000      .0000     0.5000 c 2005 07 28 GMS
LNDA LNDA 1994 03 09 18:54:00.00 00864000.000 RT1453200       .0000      .0000      .0000     0.9825 c 2005 07 28 GMS
LNDA LNDA 2003 10 27 23:36:00.00 00950400.000 RT2965900       .0000      .0000      .0000     0.5000 c 2005 07 28 GMS
LOSP LOSP 1994 03 03 00:01:30.00 00864000.000 RT1453200       .0000      .0000      .0000     1.0265 c 2005 07 28 GMS
MADC MADC 1994 03 08 19:27:30.00 00864000.000 RT1453200       .0000      .0000      .0000     1.0602 c 2005 07 28 GMS
NAPO NAPO 1994 11 04 18:32:00.00 00864000.000 RT1453200       .0000      .0000      .0000     0.7441 c 2005 07 28 GMS
NAPO NAPO 2003 10 23 17:57:15.00 00950400.000 RT2965900       .0000      .0000      .0000     0.5000 c 2005 07 28 GMS
P807 P807 1994 11 02 16:29:00.00 00864000.000 RT1453200       .0000      .0000      .0000     0.8676 c 2005 07 28 GMS
P807 P807 2000 08 29 03:56:00.00 00864000.000 RAOAD/M_T       .0000      .0000      .0000     0.3522 c 2005 07 28 GMS
P807 P807 2003 10 18 18:08:45.00 00864000.000 RT2965900       .0000      .0000      .0000     1.2440 c 2005 07 28 GMS
POSO POSO 1994 11 05 16:49:30.00 00003600.000 RT1453200       .0000      .0000      .0000     0.7524 c 2005 07 28 GMS
POSO POSO 1994 11 07 17:55:30.00 00453600.000 RAOAD/M_T       .0000      .0000      .0000     0.8233 c 2005 07 28 GMS
POSO POSO 1994 11 12 00:00:00.00 00864000.000 RAOAD/M_T       .0000      .0000      .0000     0.8243 c 2005 07 28 GMS
POSO POSO 2000 08 29 17:02:30.00 00864000.000 RAOAD/M_T       .0000      .0000      .0000     0.9287 c 2005 07 28 GMS
POZO POZO 1994 11 02 01:15:30.00 00864000.000 RT1453200       .0000      .0000      .0000     0.9839 c 2005 07 28 GMS
RUS1 RUS1 1994 03 02 01:59:30.00 00864000.000 RT1453200       .0000      .0000      .0000     1.0725 c 2005 07 28 GMS
SAL2 SAL2 1994 11 07 17:33:00.00 00023220.000 RT1453200       .0000      .0000      .0000     1.0136 c 2005 07 28 GMS
SAL2 SAL2 1994 11 08 00:01:30.00 00864000.000 RT1453200       .0000      .0000      .0000     1.0131 c 2005 07 28 GMS
SAL2 SAL2 2003 10 30 00:06:30.00 00864000.000 RT2965900       .0000      .0000      .0000     0.5000 c 2005 07 28 GMS
SALT SALT 2003 10 30 01:04:45.00 00864000.000 RT2965900       .0000      .0000      .0000     0.9100 c 2005 07 28 GMS
SIMM SIMM 2003 10 21 23:19:45.00 02160000.000 RT2965900       .0000      .0000      .0000     0.5000 c 2005 07 28 GMS
SHIM SHIM 2005 05 20 17:21:15.00 00864000.000 RT2965900       .0000      .0000      .0000     0.5000 c 2005 07 28 GMS
TWR2 TWR2 1993 05 09 04:35:00.00 00033900.000 RA700228A       .0000      .0000      .0000     1.2614 c 2005 07 28 GMS
TWR2 TWR2 1993 11 17 16:09:00.00 00864000.000 RA700228D       .0000      .0000      .0000     1.1705 c 2005 07 28 GMS
TWR2 TWR2 1996 05 09 15:54:00.00 00864000.000 RA700718A       .0000      .0000      .0000     1.2579 c 2005 07 28 GMS
TWR2 TWR2 2001 05 17 19:35:30.00 00864000.000 RAOAD/M_T       .0000      .0000      .0000     1.3725 c 2005 07 28 GMS
TWR2 TWR2 2003 03 26 18:43:30.00 00864000.000 RAOAD/M_T       .0000      .0000      .0000     1.2614 c 2005 07 28 GMS
```

Once again, I shrank the font so that you can see how the columns align. This is how one row of data looks in a normal font size:

```
 A504 A504 1994 03 15 18:58:30.00 00864000.000 RT1453200      .0000     .0000
 .0000    2.2200 c 2005 07 26 GMS
```

Helpful sta_svec hints:

* The number of seconds in the total observation can always be more, but never less than the total amount of time the data was recorded for that site in that sitting. Therefore, since there are 86,400 seconds in one day, if the GPS were running without interruption for four days, then the number you will put is (86,400 x 4) = 345600.

If the antenna *height* changes, or the *type* of antenna changes, a new line must be added to the sta_svec file. For example, look at station A504 in the example listed above. Notice the station was repeated because the antenna height and type changed. If these parameters did not change for a given campaign, the station would not have to be repeated.

If the antenna type or height for any given site has changed, you must add another line with the new information. **Be sure that the time in seconds from the previous occupation does not overlap into the next occupation time.**

Be sure each line is in reverse chronological order ie, the most recent date is above the other dates.

The code names of the antennas used are found in **/goa/sta_info/pcenter** (Modified Mar 11, 2002 by Giovanni Sella). If your data was obtained using a tripod, then you may be given a slant height instead of the antenna height. In order to get the antenna height, you must have the radius of the antenna used. These antenna radii are located at http://www.ngs.noaa.gov/ANTCAL/Models/TRM_choice.html. And don't forget $a^2+b^2=c^2$!!!

The velocity components are .0000.

Anything put after the c is a comment. You can put whatever you want after the c, but you may want to try something useful, like the date the file is being processed and your initials, so that way if you mess up people know who to make fun of.

REMINDERS:

Be sure that the formatting is EXACTLY how you see it in the examples or you will be sorry. Don't worry, it usually takes several attempts to get these files right.

Make sure your antenna heights and types are correct. You will need to have the site log sheets to verify the correct height. These log sheets may also be useful in interpreting other questions you may have.

The rinex files should be in your working directory, and the sta_info files should be in your home directory.

7. MAKING YOUR *.stacov AND *.gd FILES
Now comes the fun part:
(Updated August 3, 2005 by Pete and Gina)

Once in your working directory:

1. Type:

*compress *.YYo*

to compress the data. The file name should have a .Z at the end. The number of days for one process cannot exceed 100.

2. Type:

addst local >&log&

This command creates a directory for each day of rinex data. Within each daily dir/ a local station covariance (*.stacov) file is created, among other things. For example, if you collected data on May 19, 2005 at site SITE you will have a directory 05may19/ that contains your rinex file (now in long format), a qmfile (decimated binary version of your rinex) and hopefully a stacov file 05may19.stacov. For more information regarding *.stacov files or other files that will mysteriously appear in your daily directory, read the GIPSY-OASIS 2 manual (good luck with that) or ask Tim, Gina or Pete.

The log file you have created is important in troubleshooting. Here is what to look for:

Enter the file 'log' using your favorite text editor.

Search for the phrase 'STA info'.

If, in these sections, a core is dumped, you had problems with your processing. This may be due to how many hours of data exist in the file. If the file contains less then an hour of data, then GIPSY will core dump. Pete and Gina try to use only rinex files with 6 or more hours of data. If there is a sufficient amount of data, then it could be a formatting error. Return to section **3. Description of Rinex files** for more information.

If, it says, No sta_id, and/or, No sta_pos and/or No sta_svec, GIPSY had trouble reading your sta_info files. Return to the sta_info section for hints on fixing this problem.

If none of these dumps or warnings appears, then GIPSY successfully processed your data.

Once all of your stacov files are created:

Make a directory named stacov
mkdir stacov

In your working directory, copy your stacov files into your new directory stacov by typing:

foreach d (YY*)
cp $d/*.stacov stacov/
end

Do this for each year being processed. This will copy all the stacov files into your new directory named stacov.

Change to your stacov directory

cd stacov/

List all of the stacov's into a file called list:

ls *.stacov >list

Copy the command carriage from Pete's directory. Also copy the program apply_igsb00_any into the directory for future use:

cp giotto/home/pete/bin/carriage .

cp giotto/home/pete/bin/apply_igsb00_any .

Use the carriage command to take the column list of stacovs and truncate the .stacov part. It will also put all the names in one line:

carriage < list > list2

In your favorite text editor, open list2 and create the following foreach loop:

#!/bin/csh
foreach d (list of stacov dates)

splitcov $d.stacov
end

Make sure you can execute list2:
chmod u+x list2

Execute:
list2

This splits your daily splitcov files into daily site specific stacov files (e.g., 05MAY19SITE.stacov).

bzip2 the *.stacov files:

*bzip2 *.stacov*

Make another file named "apply".

Open apply and type:

#!/bin/csh
foreach d (SITE1, SITE2…)
apply_igsb00_any $d
end

Make the file executable:

chmod u+x apply

Execute:
apply

This applies the reference frame transformation parameters to your stacov file and outputs a transformed stacov (e.g., 05MAY19SITE.igsb00.stacov) and your *.gd files.

Create a new file and name it stats.
Type:

#!/bin/csh
foreach d (SITE1 SITE2 ….)
stat $d.GD .
end

Save and close the texteditor.

 Type:

chmod u+x stats

Type:
stats

This step creates your *.GD and *.GD.ps files. The positions are calculated for each day of data per site.

8. MERGING DIFFERENT YEARS IN YOUR *.GD FILES

Since, in this manual, we did not process different years separately, we do not have to worry about merging the data. If this is your case, then proceed to section 9.

Let's say, however, that we have other years of pre-processed data that we would like to merge with our set of processed data for the same sites.   In a new directory used specifically for placing the new merged files type:

cat /(directory your first yr's data is in)/SITE.GD /(directory your second yr's data is in)/ SITE.GD > /(directory your merge will be in)/SITE.GD

9. CALCULATING ERROR

There are several different programs used to calculate error and show the individual site's results: doerror and gmtplot. doerror may ONLY be done on Corsica. gmtplot may be used on any machine. The preferred is doerror because it also includes white and flicker noise. If you want to use doerror type:

doerror SITE.GD win3.0

If you want to use gmtplot type:

gmtplot SITE.GD win3.0

Enter the file you just made and remove the second header that separated the data for the two years (keep the first header). When the middle headers are removed, type:

gs SITE.GD.ps

to view your plot.

CREATING A VELOCITY PROFILE FROM PROCESSED DATA

In order to plot this data in a way that makes sense, it is useful to plot the data with respect to a stable reference frame. Usually, we will claim a plate to be stable, in other words, the plate is fixed, and we solve for the velocities of each site. In the example

given below, we try to rotate the data so that the velocities are with respect to the stable North American plate.

10. CREATING A sites.gd FILE
First you have to create a sites.gd file. Examples of this file is located in /raphael/daily/ plate. The information needed for the sites.gd file is found in the *.itrf.gd files.
Tips for creating a sites.gd file:

1. Use the EXACT format found in the *.itrf.gd files, spaces and everything!
2. Copy the information for your stations found in the *.itrf.gd files. The purpose of this file is to plot your stations on a map, therefore one entry per station is sufficient.

11. CREATING A noam.st FILE
In this particular example, noam stands for North American. You can name this file whatever you like. Examples of this file are found in /raphael/daily/plate. Use these examples as guides, and follow them EXACTLY—spaces and all!!! The first three lines in the file describe to Euler pole you wish to use in matrix form. You need to pick an Euler pole that is most appropriate for your set of sites. Use table 3 in

Sella, G.F., et al., REVEL: A model for recent plate velocities from space geodesy, *Jour. of Geophys. Research*, 107, 2002, 11-1 – 11-32.

As previously mentions, the first three lines of the file are set up in matrix form. The format is:

Omiga X	ωXb	xxc	Xyc	xzc
Omiga Y	ωYb	xyc	Yyc	yzc
Omiga Z	ωZb	xzc	Yzc	zzc

These euler pole matrices are in /diker/sella/plates/euln.

Below the matrix, you will need to input the velocity components. Your velocity components are found on your SITE.GD.ps plots. (Tip: print out you plots for a quick and easy reference). The format is

SITE.GD   Velocity N   Velocity E   Error N   Error E   Variance

Remember that the north velocity component is the Latitude slope on your graph, and the east velocity component is the Longitude slope on your graph. Follow the exact formatting as in the example.

If you do not have the variances, just input 0.00000.

11.2 WHAT, YOU WANT TO MAKE YOUR OWN POLE??? (update by GS 2/6/ 12)

The following commands will allow you to create a pole using *vplate*.

Let list.dat = the file that contains all the site names you wish to use for the pole.
Let alldata.dat = your ITRF velocity field in the format:

Lon Lat Vn Ve Sn Se Corr Site

cat alldata.dat | egrep -f list.dat > subset.dat
vplate < subset.dat > mypole.st
cat mypole.st alldata.dat > noam.st
cp alldata.dat noam.dat
touch noam.res

12. CREATING A noam.dat FILE
Make a noam.dat file which is the same as the noam.st file but the Euler pole positions are not included.

13. CREATING A noam.res FILE
Make a blank file and name it noam.res. This will be an input file.

14. CREATING YOUR VELOCITY MAP
Type:
pvel < *.st > *.res

Then type:
vmap *.res –diff

A file by the name of map.ps will be created.
Type:
gs map.ps

to view your results.