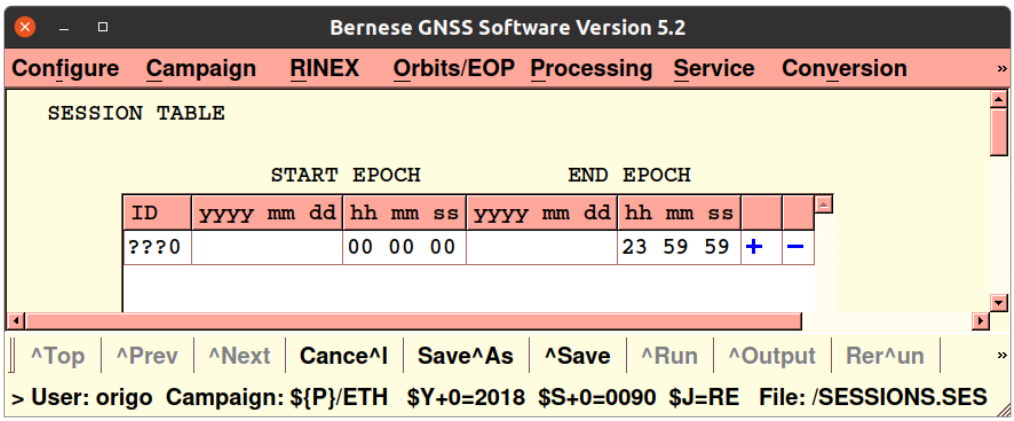
Bernese 5.2 introductury course, notes and screen shots

February 22, 2022

1 Setting up sessions, choosing active session

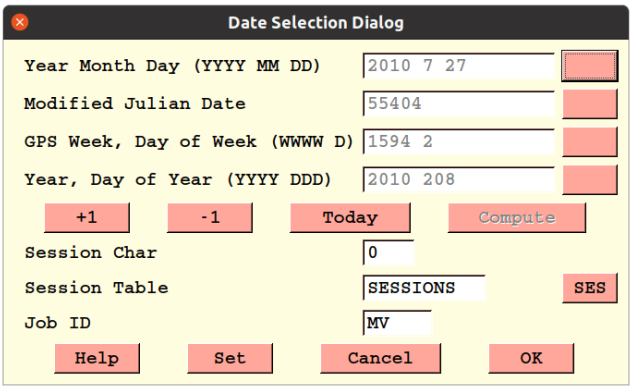
Here, *only* enter ???0 for the session ID. This matches any session day, like 2010 session 207 or 208 or 2011 session 205 or 206. The final "0" means the first and only session for that day.

The currently active session is listed on the bottom line: **$Y+0 = 2010** = year 2010, **$S+0 = 2080** = DOY 208 session char 0.



Choose the currently active session. Click on one of the four buttons to the right and enter the value. Like the first: change 2010 7 27 to 2011 7 24, and click on "Compute". The other three, Modifed Julian Date, GPS Week & Day of Week, and Year, Day of Year (DOY) will be filled in.

Then, click on "Set" and exit by clicking OK.



2 Variable names

The environment variables (bottom right) also work on the command line:

$U User space GPSUSER52

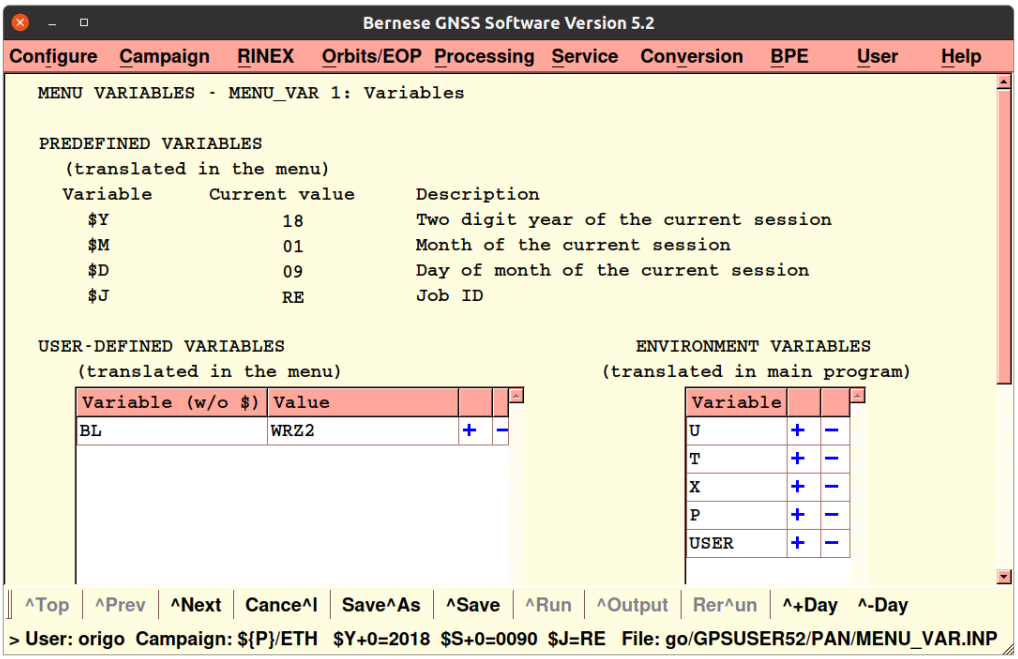
$T Temporary GPSTEMP

$X Executables BERN52/GPS

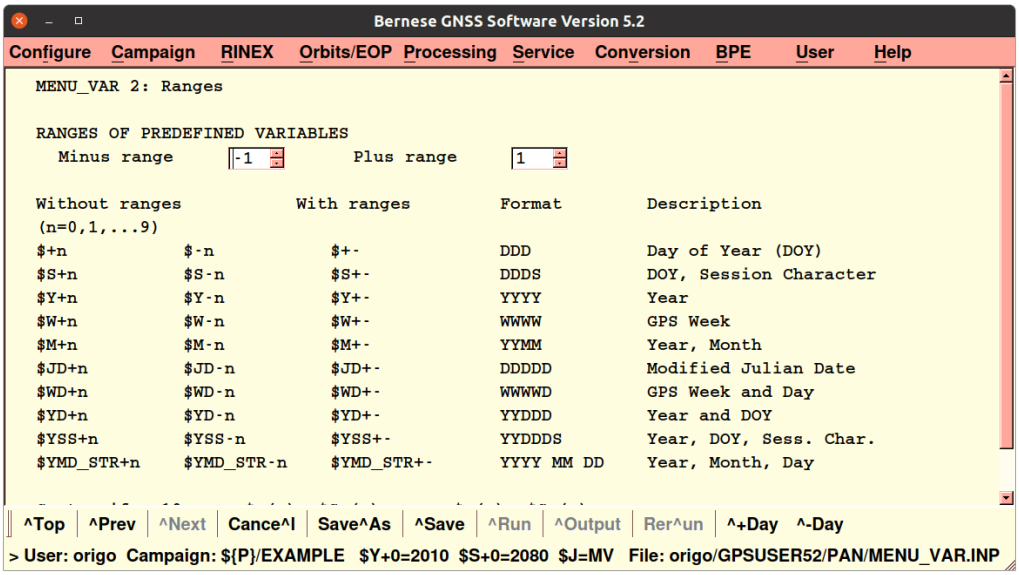
$P Campaign directory GPSDATA/CAMPAIGN52

$D Datapool GPSDATA/DATAPOOL

$S Savedisk GPSDATA/SAVEDISK



The menu variables are mainly about defining dates and sessions.



3 Extrapolation of co-ordinates

$YMD_STR+0 YYYY MM DD → 2010 07 27

YYYY year (2010)

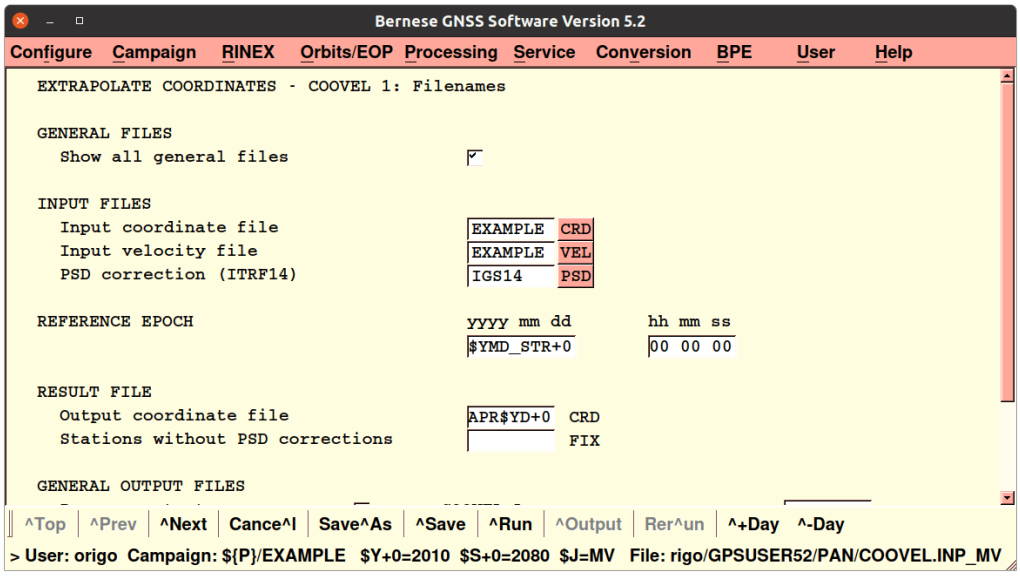
MM month (07)

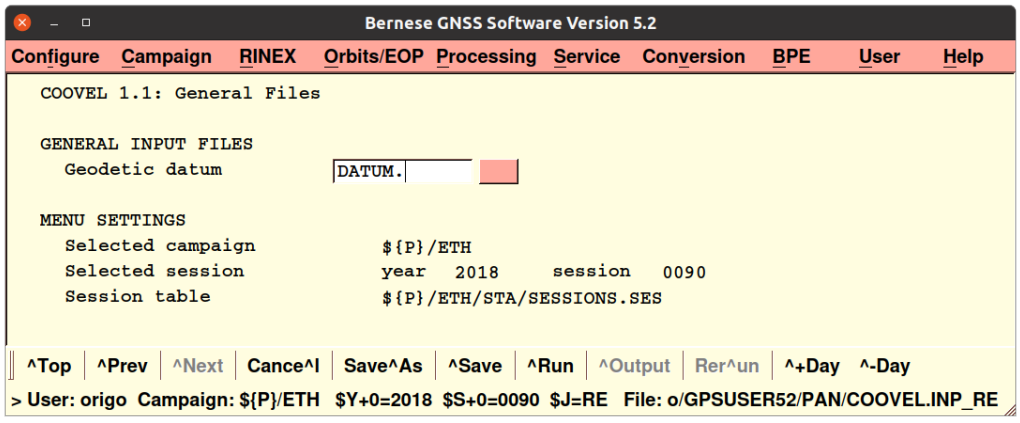
DD day of month (27)

APR$YD+0 APRYYDDD → APR10208

YY year (10)

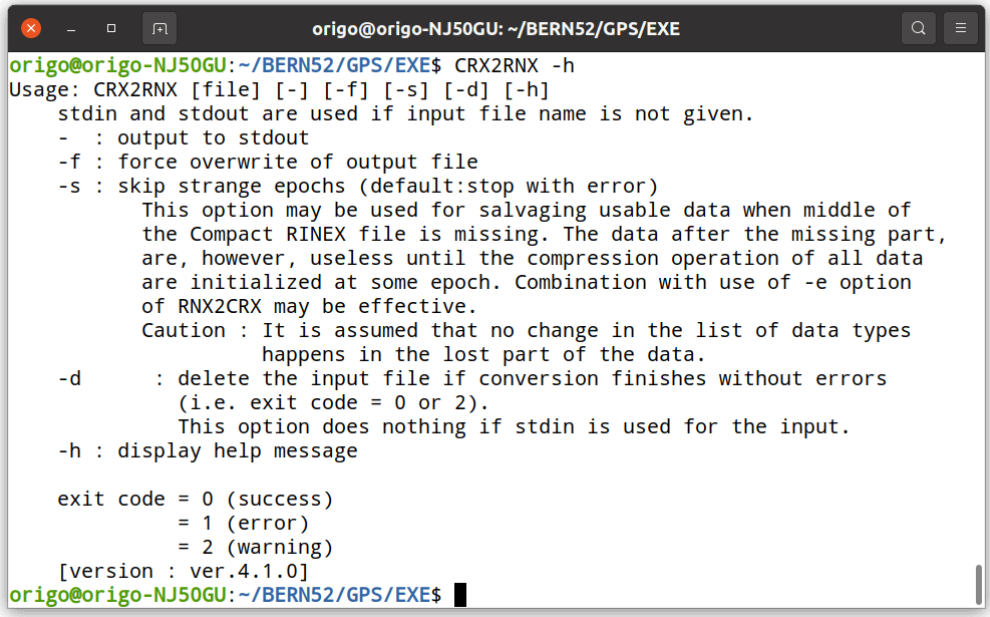
DDD day of year (208)



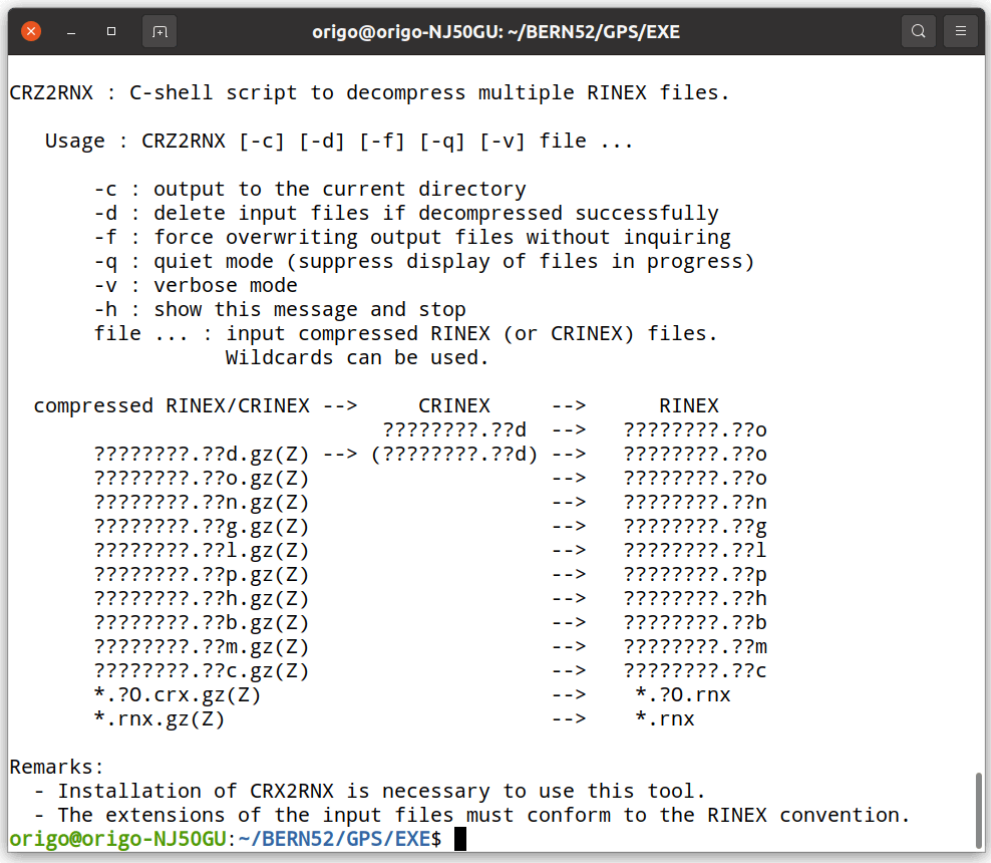


4 Importing RINEX (RXOBV3)

Note that the RINEX files that were downloaded into the DATAPOOL are likely both .Z and Hatanaka compressed. You need to install CRZ2RNX and CRX2RNX to do the decompression. Place the binaries in $X/EXE. For example



Note how .??D.Z is converted to .??O. Works for Unix compress (.Z) as well as for Gnu Zip (.gz):

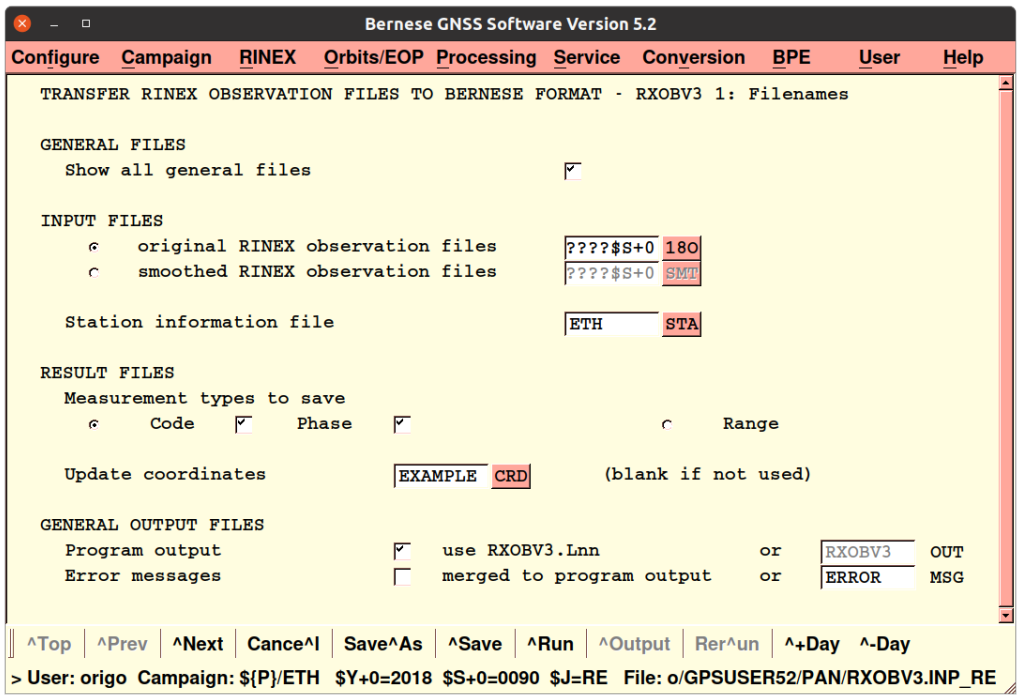


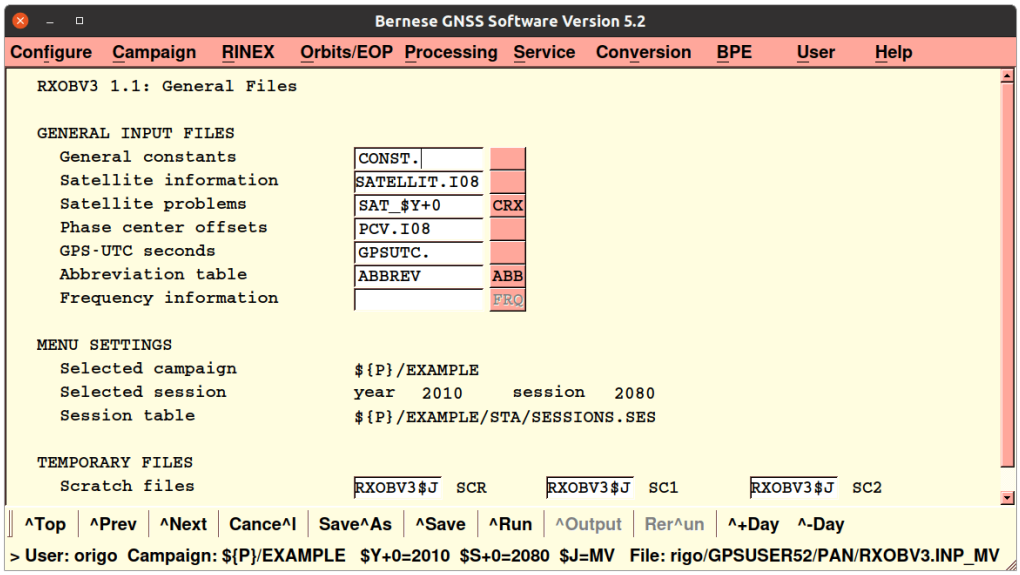
????**$S+0** STATDDDS → STAT2080

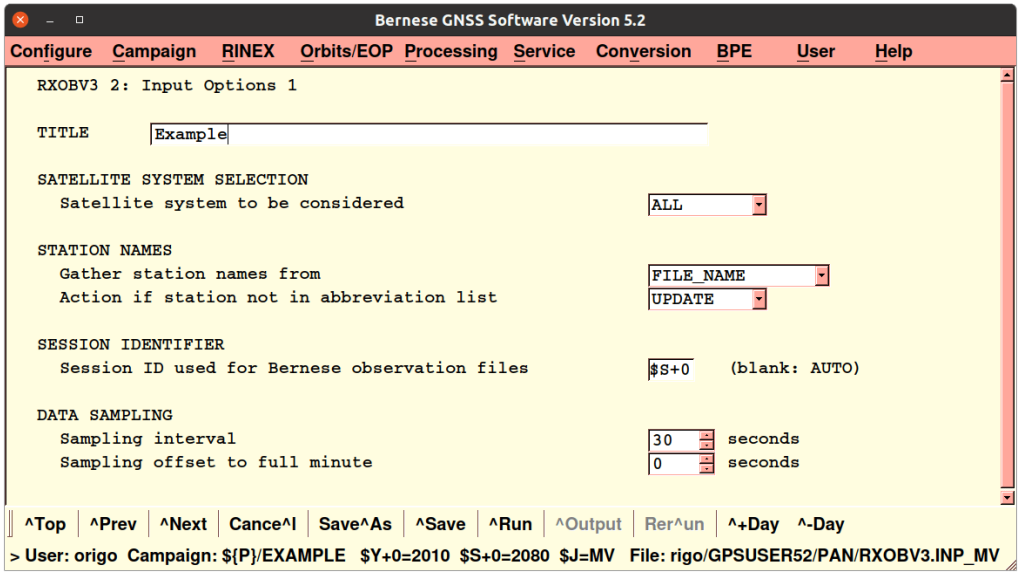
???? station

DDD day of year (208)

S session character (0)







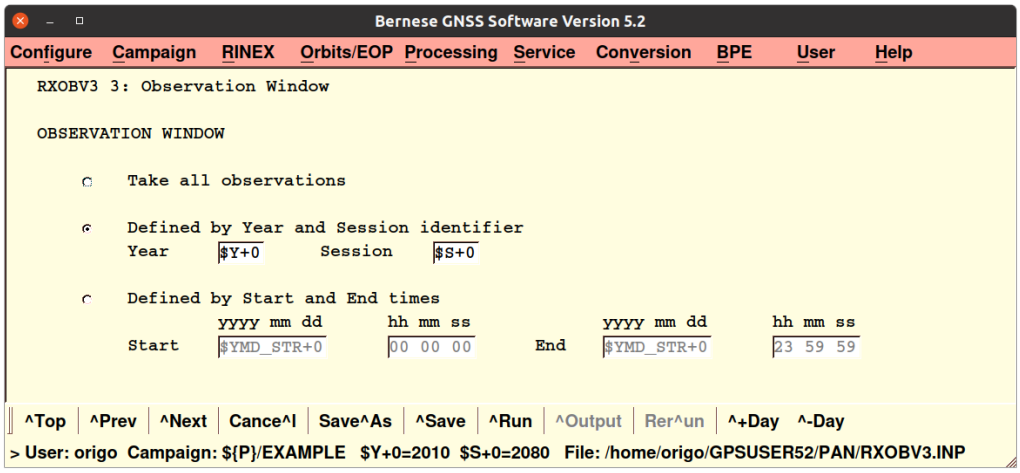
$Y+0 YYYY → 2010

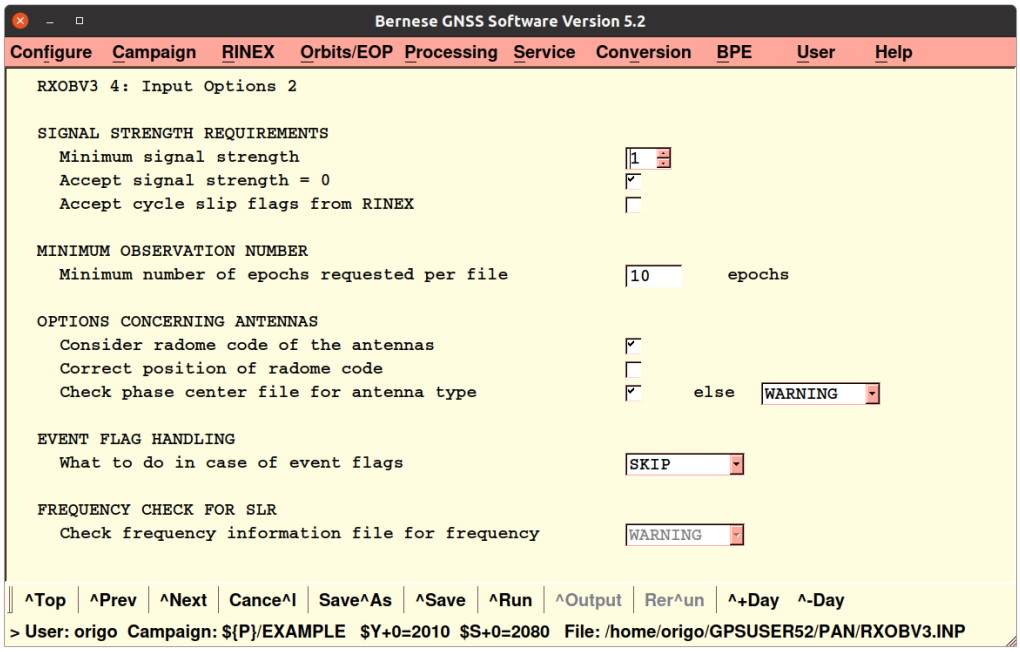
YYYY year (2010)

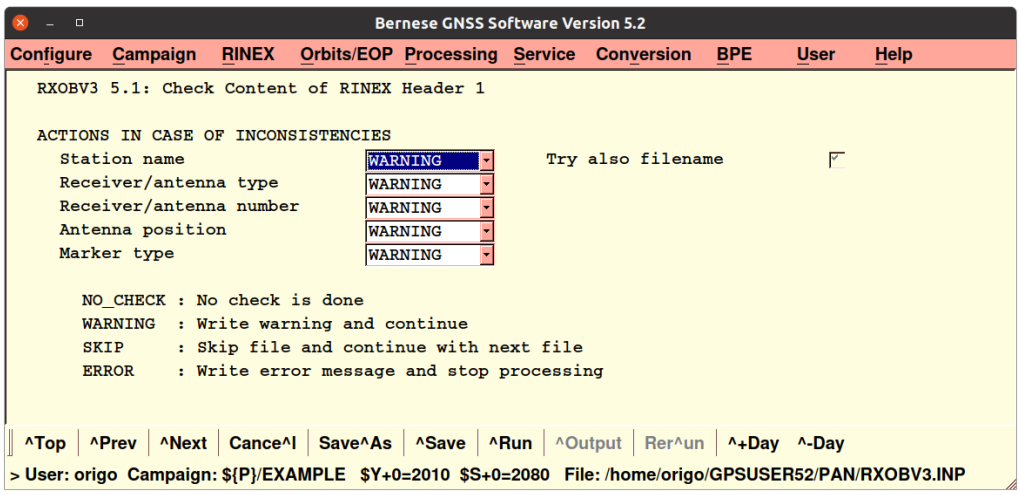
$S+0 DDDS → 2080

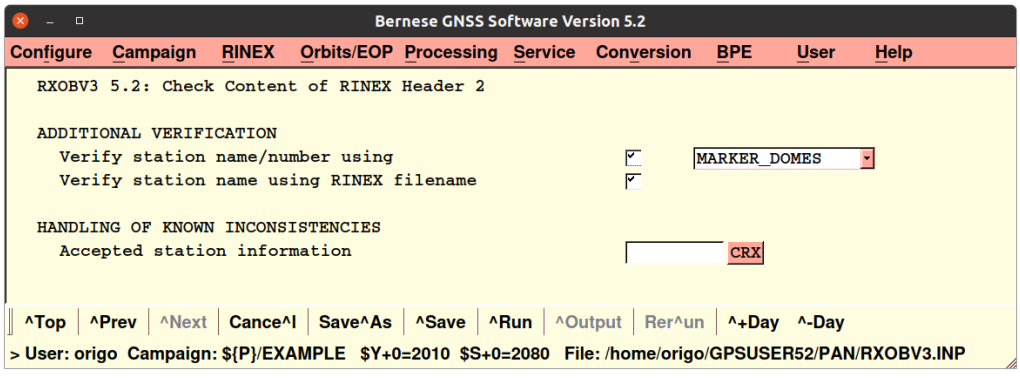
DDD day of year (208)

S session character (0)

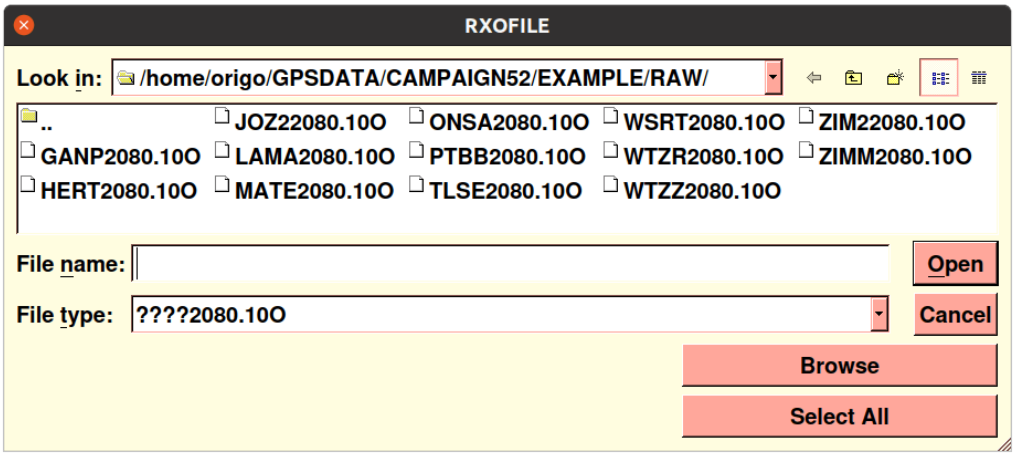



Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
RXOBV3 4: Input Options 2
SIGNAL STRENGTH REQUIREMENTS
Minimum signal strength
1
Accept signal strength = 0
Accept cycle slip flags from RINEX
MINIMUM OBSERVATION NUMBER
Minimum number of epochs requested per file
10
epochs
OPTIONS CONCERNING ANTENNAS
Consider radome code of the antennas
Correct position of radome code
Check phase center file for antenna type
else
WARNING
EVENT FLAG HANDLING
What to do in case of event flags
SKIP
FREQUENCY CHECK FOR SLR
Check frequency information file for frequency
WARNING
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/RXOBV3.INP


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
RXOBV3 5.1: Check Content of RINEX Header 1
ACTIONS IN CASE OF INCONSISTENCIES
Station name
WARNING
Try also filename
Receiver/antenna type
WARNING
Receiver/antenna number
WARNING
Antenna position
WARNING
Marker type
WARNING
NO_CHECK : No check is done
WARNING : Write warning and continue
SKIP : Skip file and continue with next file
ERROR : Write error message and stop processing
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/RXOBV3.INP


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
RXOBV3 5.2: Check Content of RINEX Header 2
ADDITIONAL VERIFICATION
Verify station name/number using
MARKER_DOMES
Verify station name using RINEX filename
HANDLING OF KNOWN INCONSISTENCIES
Accepted station information
CRX
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/RXOBV3.INP

4.1 RINEX files



5 Create tabular orbits (PRETAB)

COD$WD+0 CODWWWWD COD15942

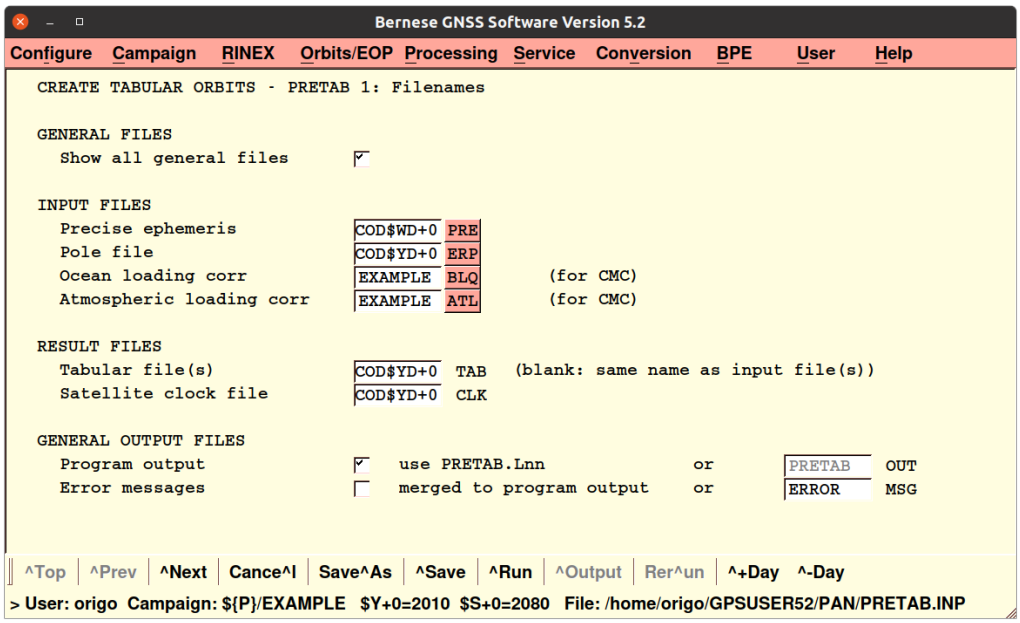
WWWW GPS week (1594)

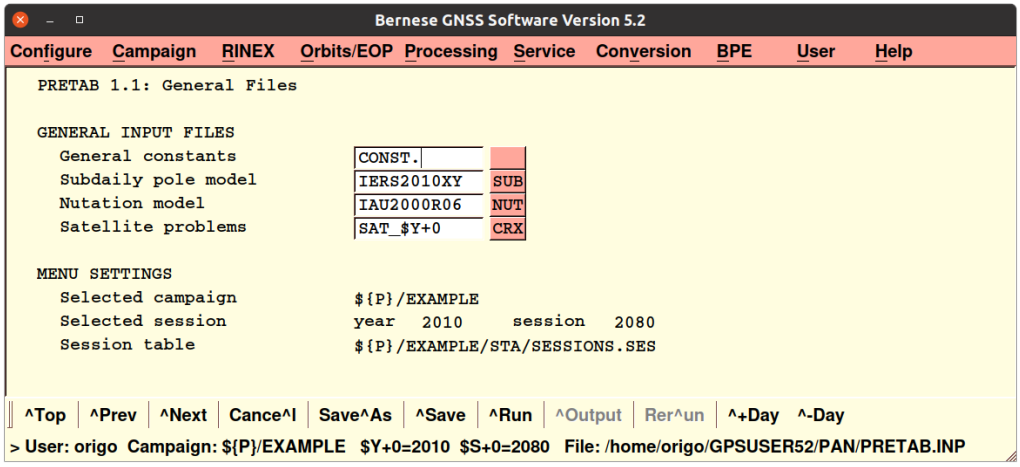
D GPS day (2)

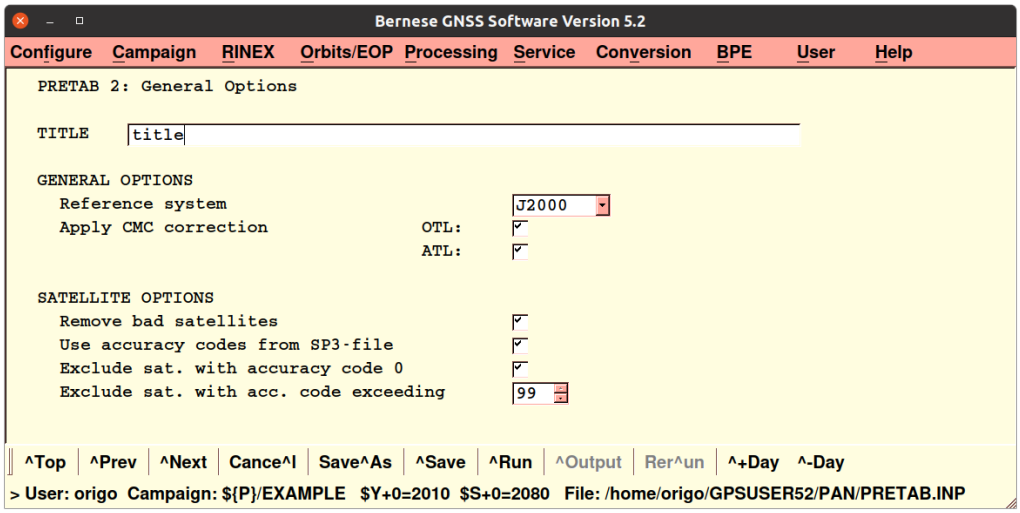
COD$YD+0 CODYYDDD COD10208

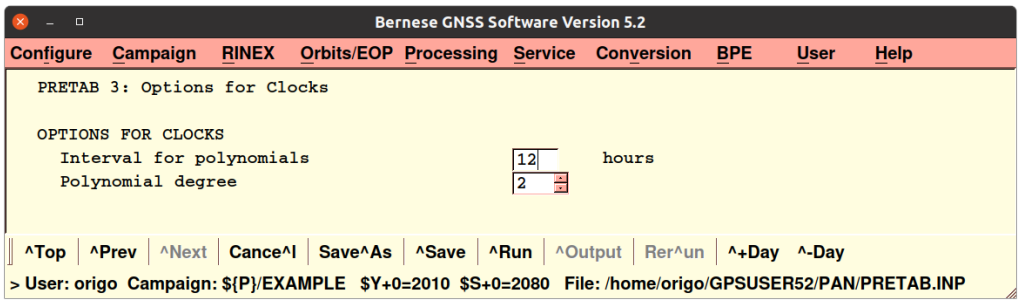
YY year (10)

DDD day of year (208)

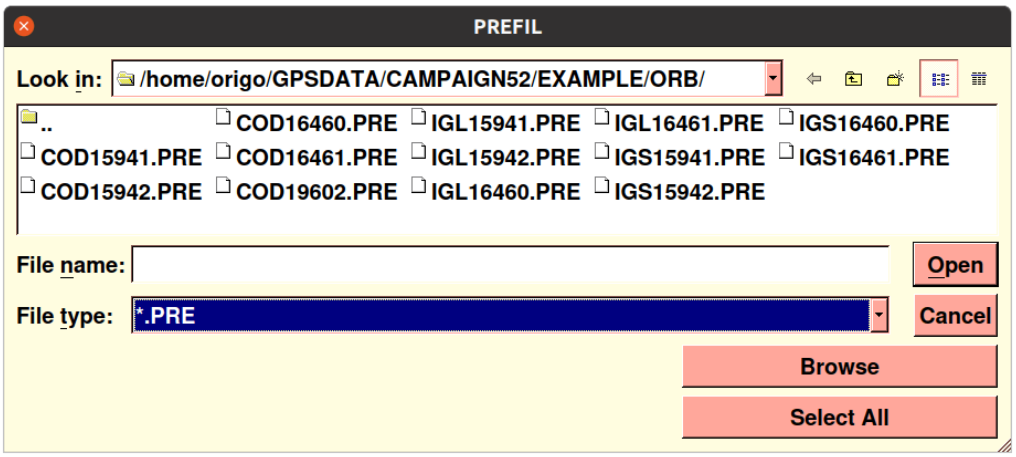



Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
PRETAB 1.1: General Files
GENERAL INPUT FILES
General constants CONST.
Subdaily pole model IERS2010XY SUB
Nutation model IAU2000R06 NUT
Satellite problems SAT_$Y+0 CRX
MENU SETTINGS
Selected campaign ${P}/EXAMPLE
Selected session year 2010 session 2080
Session table ${P}/EXAMPLE/STA/SESSIONS.SES
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/PRETAB.INP


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
PRETAB 2: General Options
TITLE title
GENERAL OPTIONS
Reference system J2000
Apply CMC correction OTL:
ATL:
SATELLITE OPTIONS
Remove bad satellites
Use accuracy codes from SP3-file
Exclude sat. with accuracy code 0
Exclude sat. with acc. code exceeding 99
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/PRETAB.INP


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
PRETAB 3: Options for Clocks
OPTIONS FOR CLOCKS
Interval for polynomials 12 hours
Polynomial degree 2
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/PRETAB.INP

5.1 Precise ephemeris files

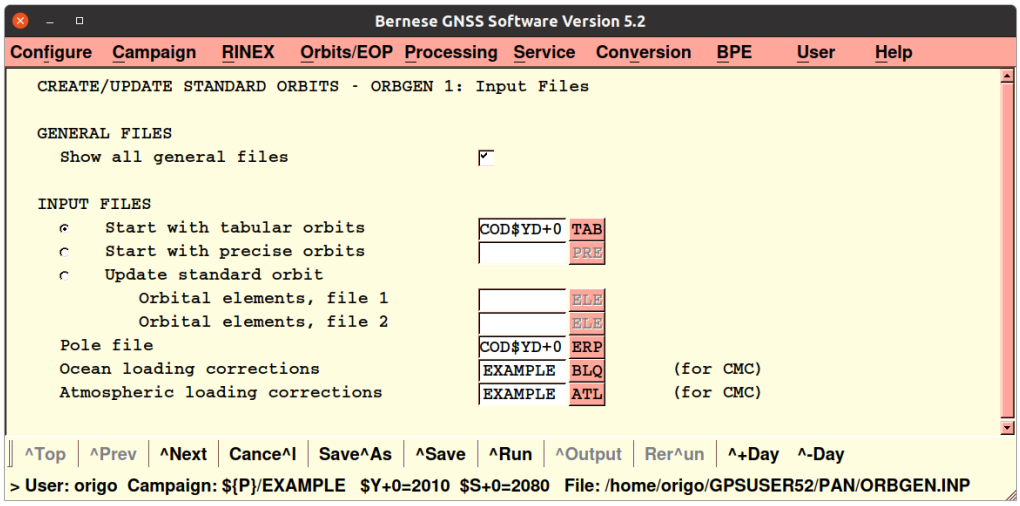


6 Generate standard orbits (ORBGEN)

COD$YD+0 CODYYDDD COD10208

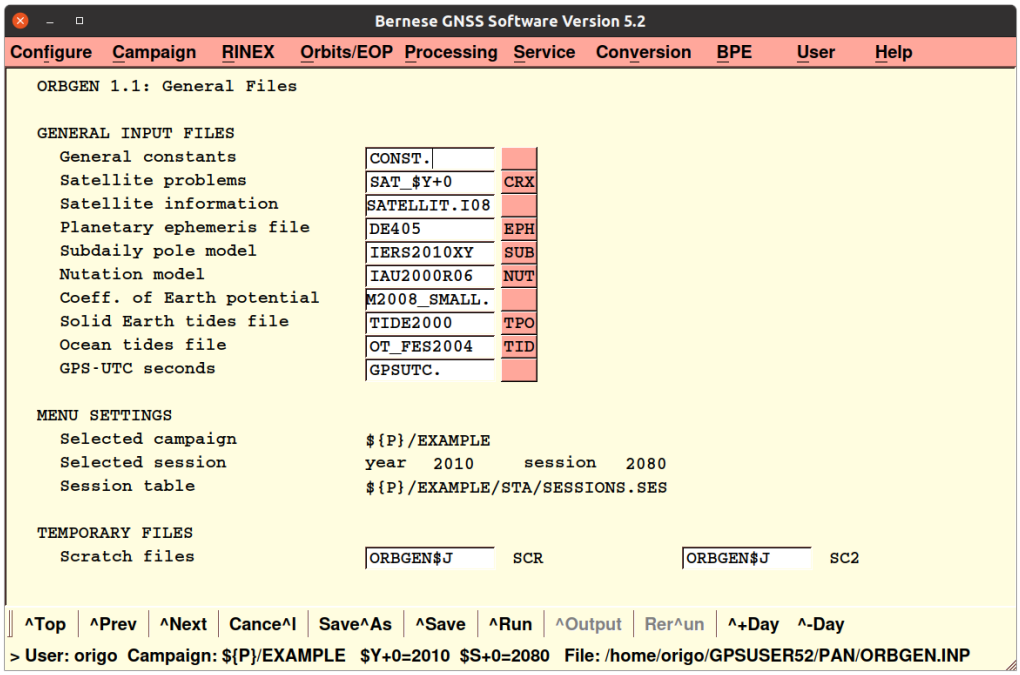
YY year (10)

DDD day of year (208)

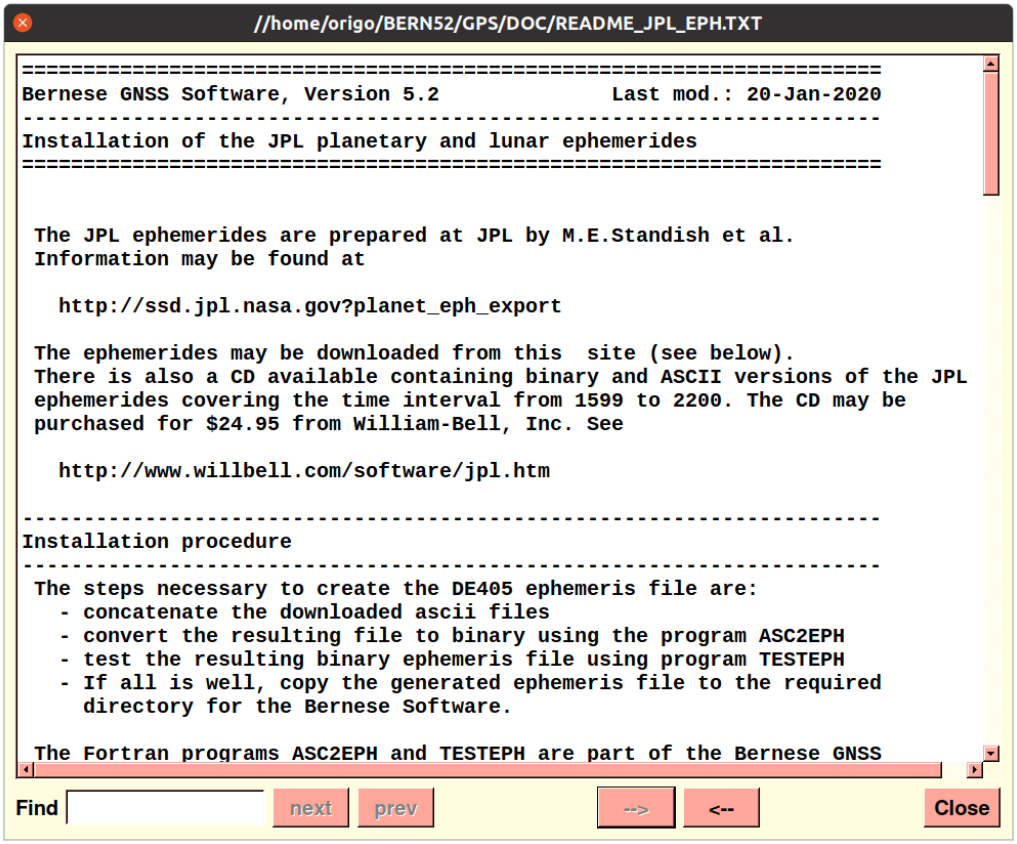


DE405.EPH

Planetary ephemeris file. You may need to generate this yourself from files found on JPL web site.



Generating DE405.EPH

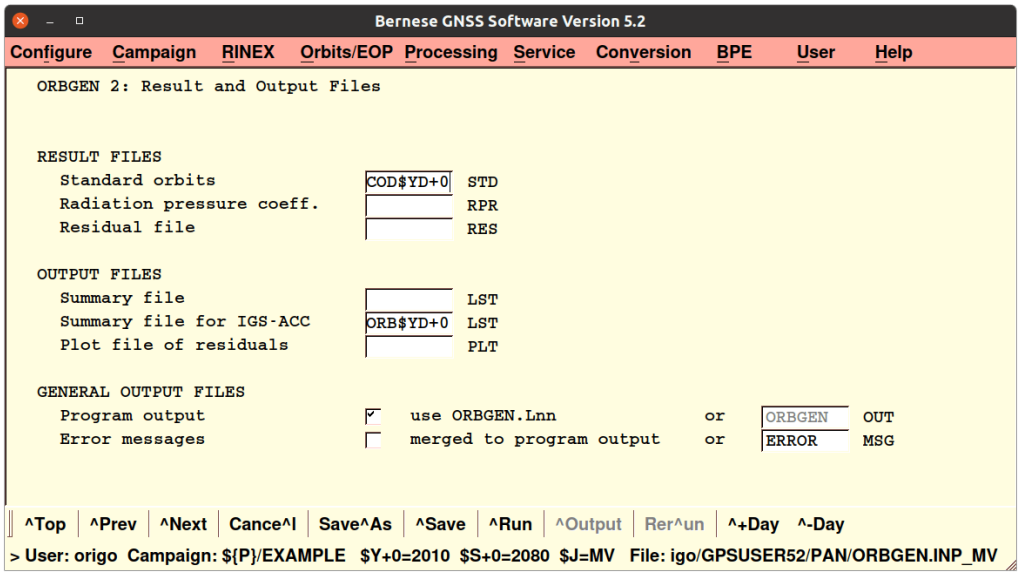


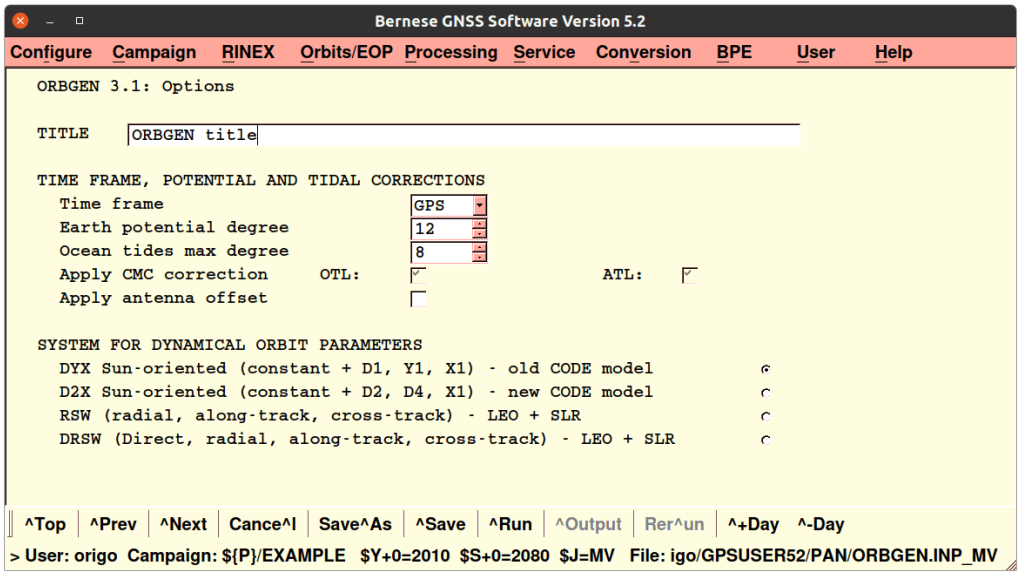
COD$YD+0 CODYYDDD COD10208

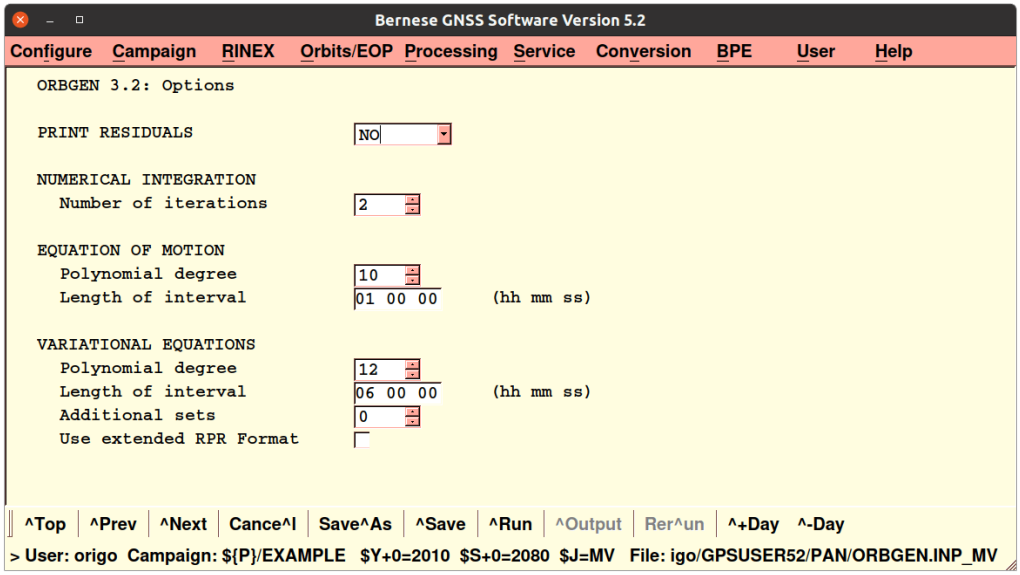
YY year (10)

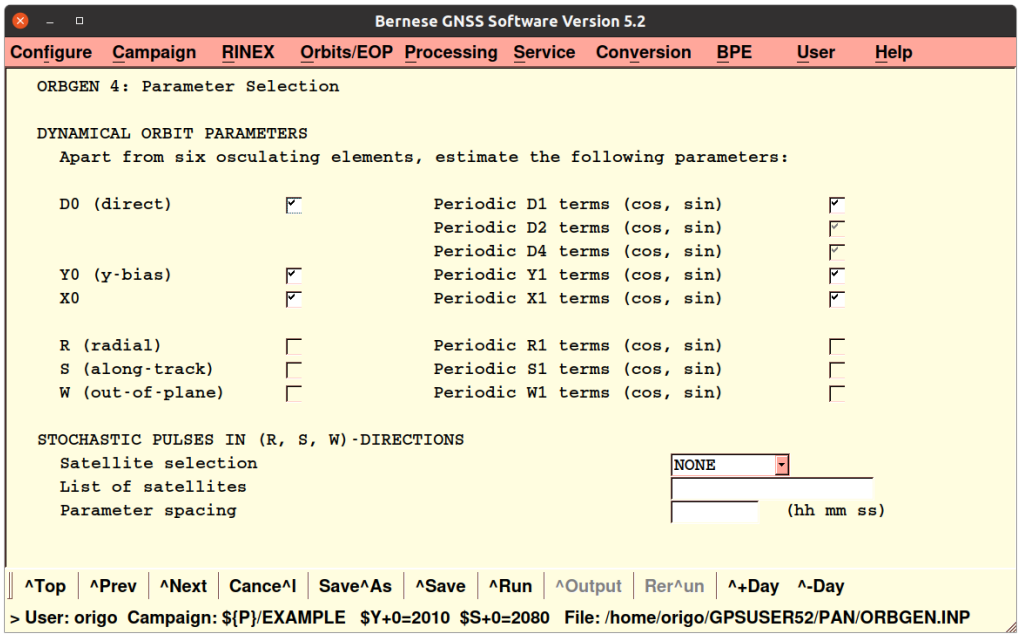
DDD day of year (208)

ORB$YD+0 ORBYYDDD ORB10208






Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
ORBGEN 3.2: Options
PRINT RESIDUALS NO
NUMERICAL INTEGRATION
Number of iterations 2
EQUATION OF MOTION
Polynomial degree 10
Length of interval 01 00 00 (hh mm ss)
VARIATIONAL EQUATIONS
Polynomial degree 12
Length of interval 06 00 00 (hh mm ss)
Additional sets 0
Use extended RPR Format
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 $J=MV File: igo/GPSUSER52/PAN/ORBGEN.INP_MV


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
ORBGEN 4: Parameter Selection
DYNAMICAL ORBIT PARAMETERS
Apart from six osculating elements, estimate the following parameters:
D0 (direct)
Periodic D1 terms (cos, sin)
Periodic D2 terms (cos, sin)
Periodic D4 terms (cos, sin)
Y0 (y-bias)
Periodic Y1 terms (cos, sin)
X0
Periodic X1 terms (cos, sin)
R (radial)
Periodic R1 terms (cos, sin)
S (along-track)
Periodic S1 terms (cos, sin)
W (out-of-plane)
Periodic W1 terms (cos, sin)
STOCHASTIC PULSES IN (R, S, W)-DIRECTIONS
Satellite selection NONE
List of satellites
Parameter spacing (hh mm ss)
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/ORBGEN.INP

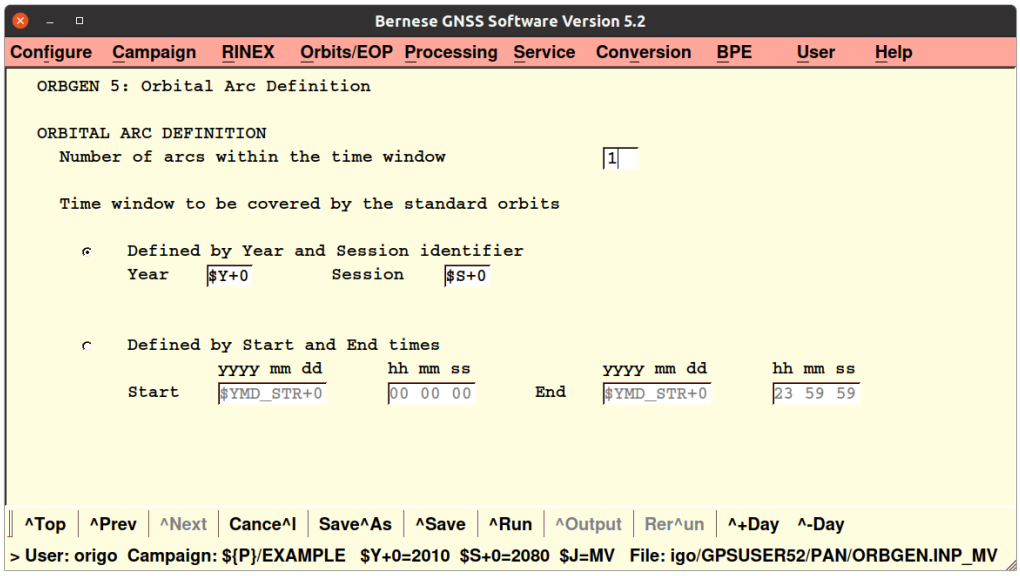
$Y+0 YYYY → 2010

YYYY year (2010)

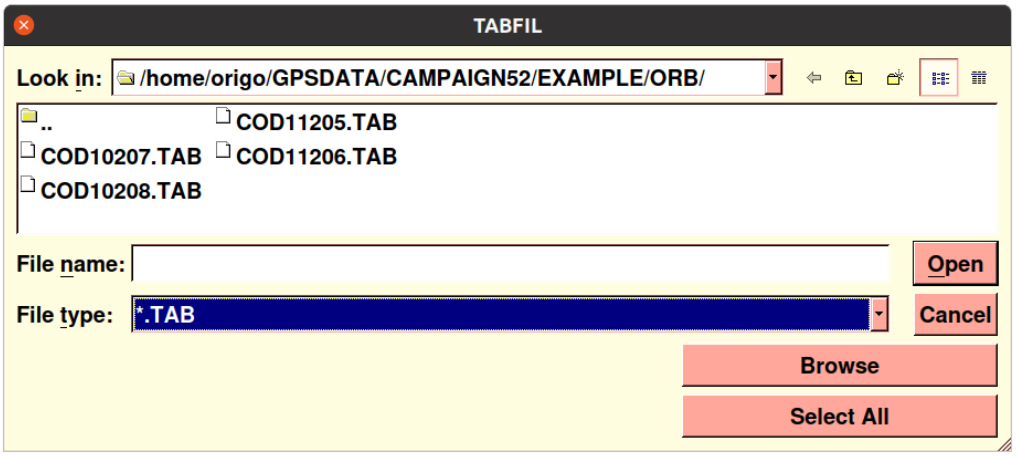
$S+0 DDDS → 2080

DDD day of year (208)

S session character (0)



6.1 Tabular orbit files



7 Import Earth orientation parameters (POLUPD)

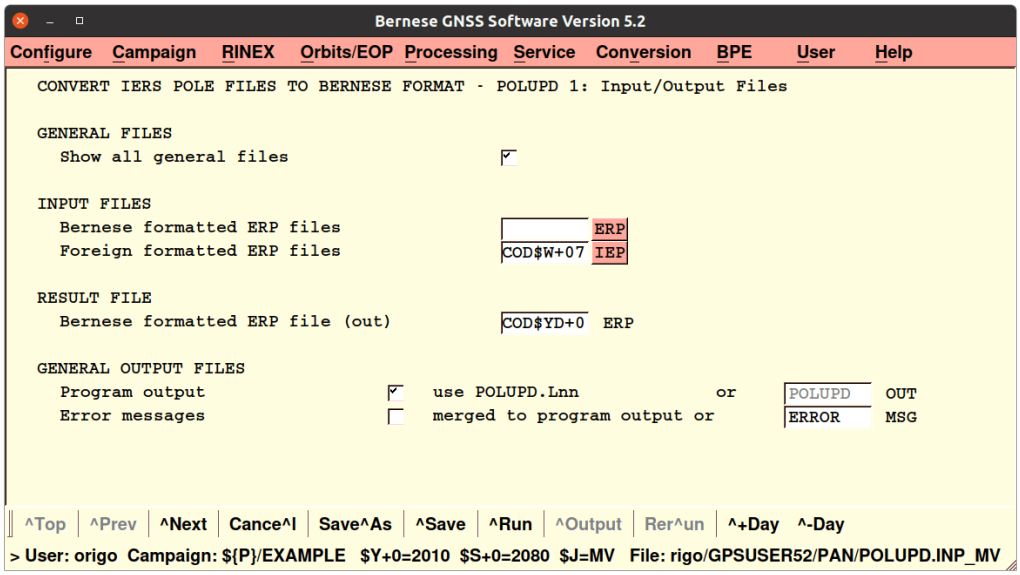
COD$W+07 CODWWWW7 COD15947[a]

WWWW GPS week (1594)

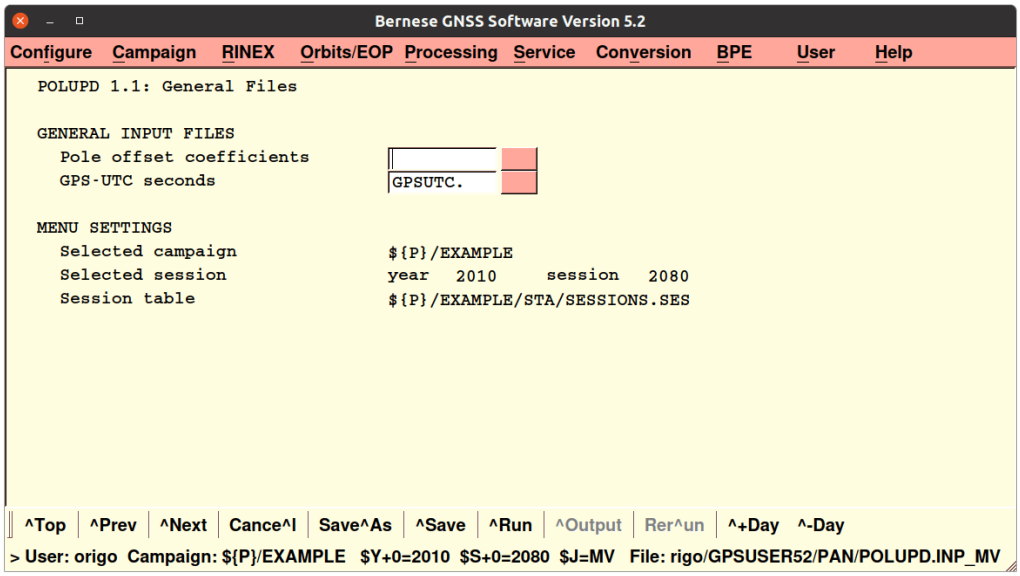
COD$YD+0 CODYYDDD COD10208

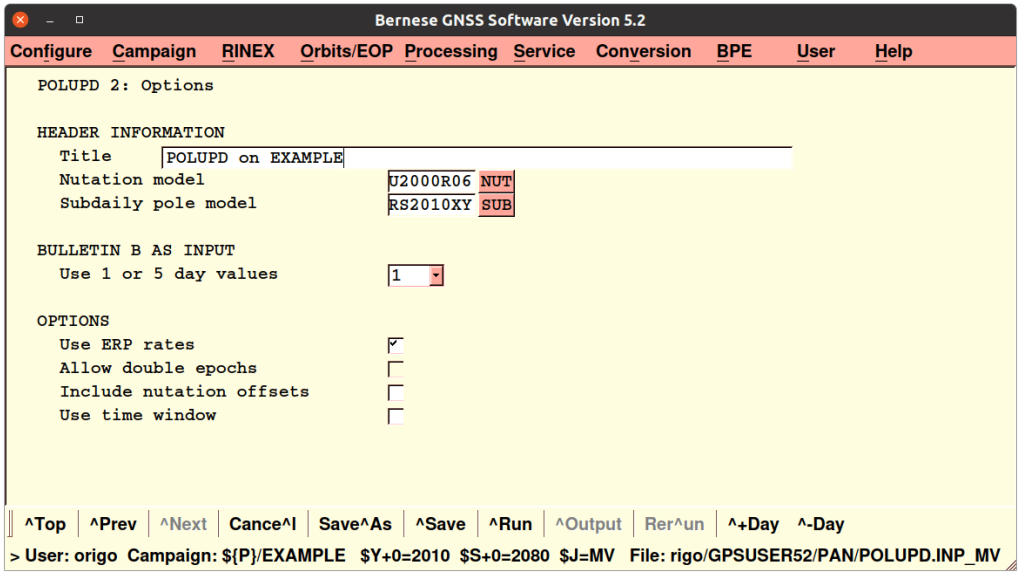
YY year (10)

DDD day of year (208)

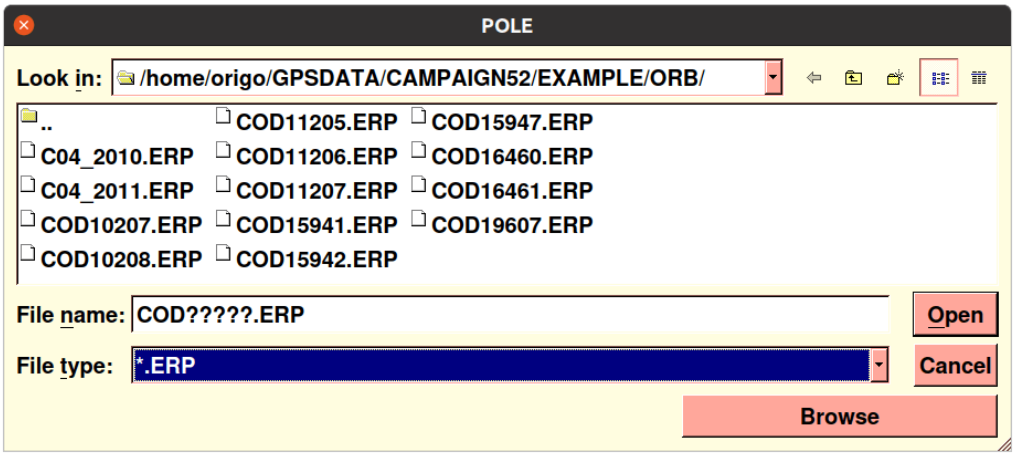


[a]Why the digit 7? Probably because these are *weekly* files giving values for 7+2 epochs, the target GPS week plus one day before and one day after. Data are given for noon each day.





7.1 Bernese native Earth Orientation Parameter files (”pole files”)



8 Code based clock-synchronization (CODSPP)

`http://www.bernese.unibe.ch/faq/#mess101`:

GETSTAF: COORDINATES NOT FOUND

> The reason for this message is very likely that the renaming of the stations in the station information file (.STA) was missed by RXOBV3 or the RINEX header does not fit in the search pattern of the STA file. Because as the corresponding station is used in your observation file, it needs also be added to the .CRD, .KIN and .STA files.

In my case, a remedy was looking in the subdirectory $P/EXAMPLE/OBS: there are files there having the general form

????$S+0.PZO for phase observations, like GANP2070.PZO

????$S+0.PZH header file GANP2070.PZH

????$S+0.CZO for code observations, like GANP2070.CZO

????$S+0.CZH header file GANP2070.CZH.

The station name here is GANP. This is the original four-character station name, when the "remapped",[1] unique four-character station name according to $P/EXAMPLE/STA/ABBREV.ABB should be GAN1. Similarly HERT, which is remapped to HER1, etcetera.

> ***This is wrong.***

The names of Bernese native observation files should use re-mapped four-character names, not the original ones.

These non-remapped four-character station-name observation files should all be deleted. They are probably leftovers from a flawed, earlier run. Sadly, Bernese isn't very robust against being misled by its own file names in this way...

Also ABBREV.ABB should be cleaned up to only offer the original four-character station names with DOMES marker names. See figure 1 for a well-formed file.

COD$YD+0 CODYYDDD COD10208

YY year (10)

DDD day of year (208)

APR$YD+0 APRYYDDD APR10208

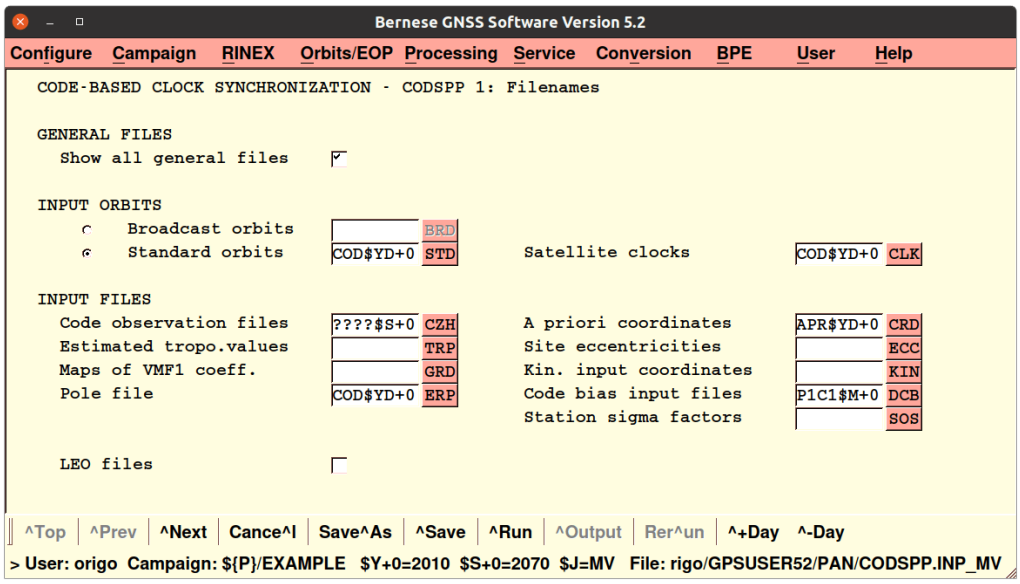
????$S+0 STATDDDS → STAT2080

???? station name (STAT)

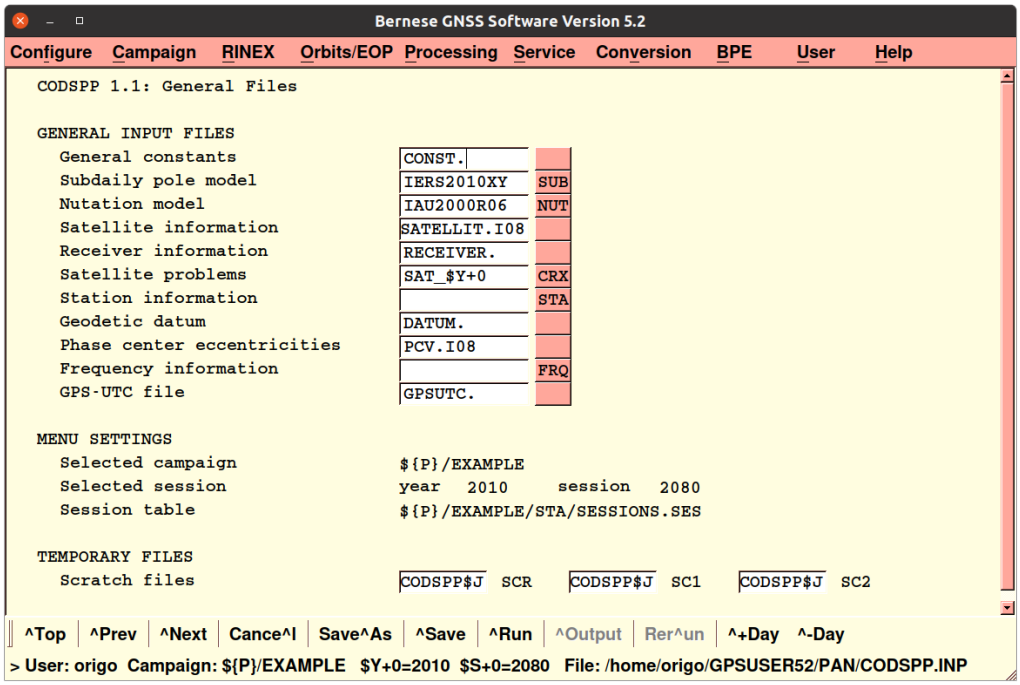
S session character (0)

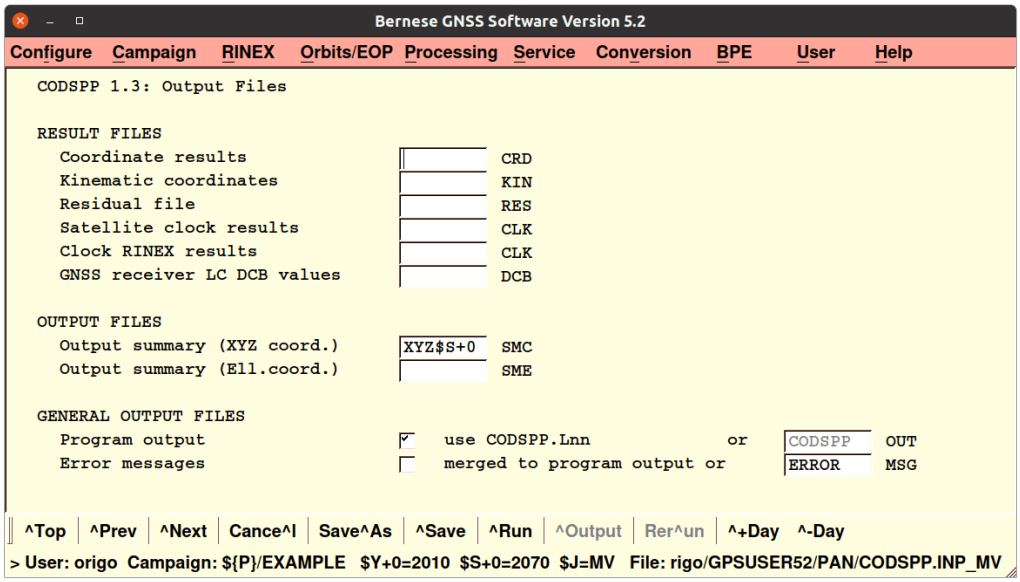
P1C1$M+0 P1C1YYMM → P1C11007

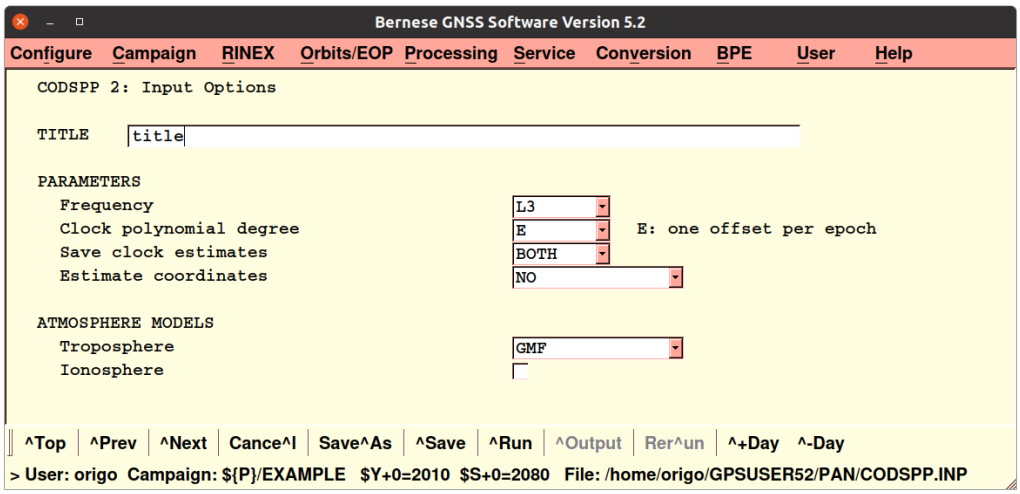
MM month (07)

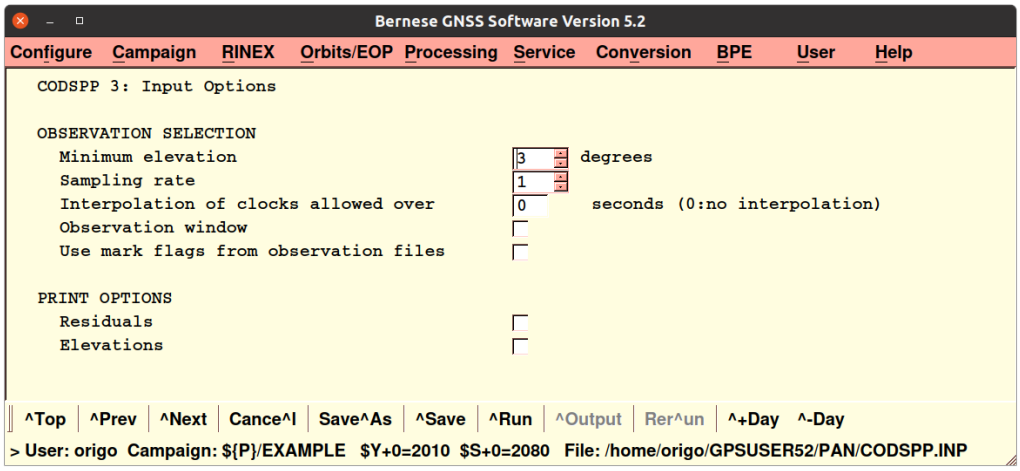


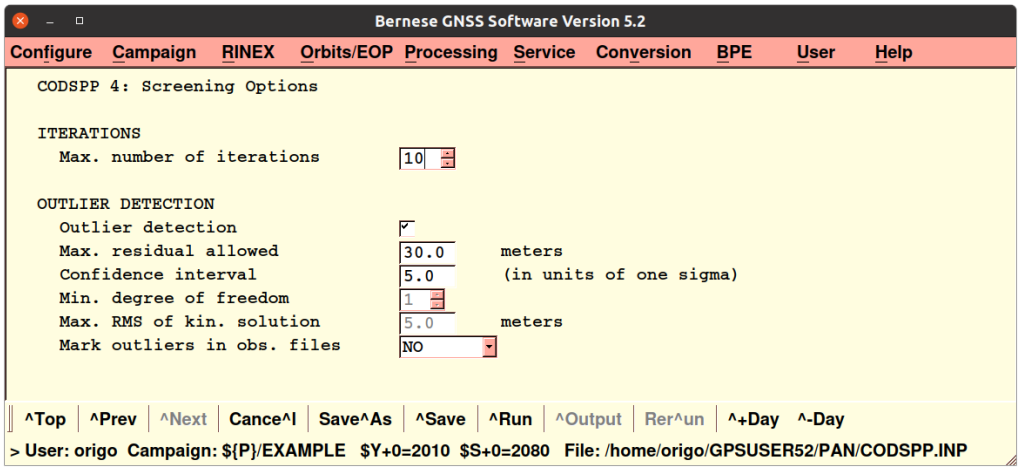
[1] The remapping apparently consists of taking the station name including the DOMES marker name and finding, from left to right, the first unique character to include in the remapped name. So, if both GANP and GANP 11515M001 are on the list, the latter is mapped to GAN1.


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
CODSPP 1.1: General Files
GENERAL INPUT FILES
General constants CONST.
Subdaily pole model IERS2010XY SUB
Nutation model IAU2000R06 NUT
Satellite information SATELLIT.I08
Receiver information RECEIVER.
Satellite problems SAT_$Y+0 CRX
Station information STA
Geodetic datum DATUM.
Phase center eccentricities PCV.I08
Frequency information FRQ
GPS-UTC file GPSUTC.
MENU SETTINGS
Selected campaign ${P}/EXAMPLE
Selected session year 2010 session 2080
Session table ${P}/EXAMPLE/STA/SESSIONS.SES
TEMPORARY FILES
Scratch files CODSPP$J SCR CODSPP$J SC1 CODSPP$J SC2
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/CODSPP.INP


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
CODSPP 1.3: Output Files
RESULT FILES
Coordinate results CRD
Kinematic coordinates KIN
Residual file RES
Satellite clock results CLK
Clock RINEX results CLK
GNSS receiver LC DCB values DCB
OUTPUT FILES
Output summary (XYZ coord.) XYZ$S+0 SMC
Output summary (Ell.coord.) SME
GENERAL OUTPUT FILES
Program output use CODSPP.Lnn or CODSPP OUT
Error messages merged to program output or ERROR MSG
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2070 $J=MV File: rigo/GPSUSER52/PAN/CODSPP.INP_MV


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
CODSPP 2: Input Options
TITLE title
PARAMETERS
Frequency L3
Clock polynomial degree E E: one offset per epoch
Save clock estimates BOTH
Estimate coordinates NO
ATMOSPHERE MODELS
Troposphere GMF
Ionosphere
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/CODSPP.INP


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
CODSPP 3: Input Options
OBSERVATION SELECTION
Minimum elevation 3 degrees
Sampling rate 1
Interpolation of clocks allowed over 0 seconds (0:no interpolation)
Observation window
Use mark flags from observation files
PRINT OPTIONS
Residuals
Elevations
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/CODSPP.INP


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
CODSPP 4: Screening Options
ITERATIONS
Max. number of iterations 10
OUTLIER DETECTION
Outlier detection
Max. residual allowed 30.0 meters
Confidence interval 5.0 (in units of one sigma)
Min. degree of freedom 1
Max. RMS of kin. solution 5.0 meters
Mark outliers in obs. files NO
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/CODSPP.INP

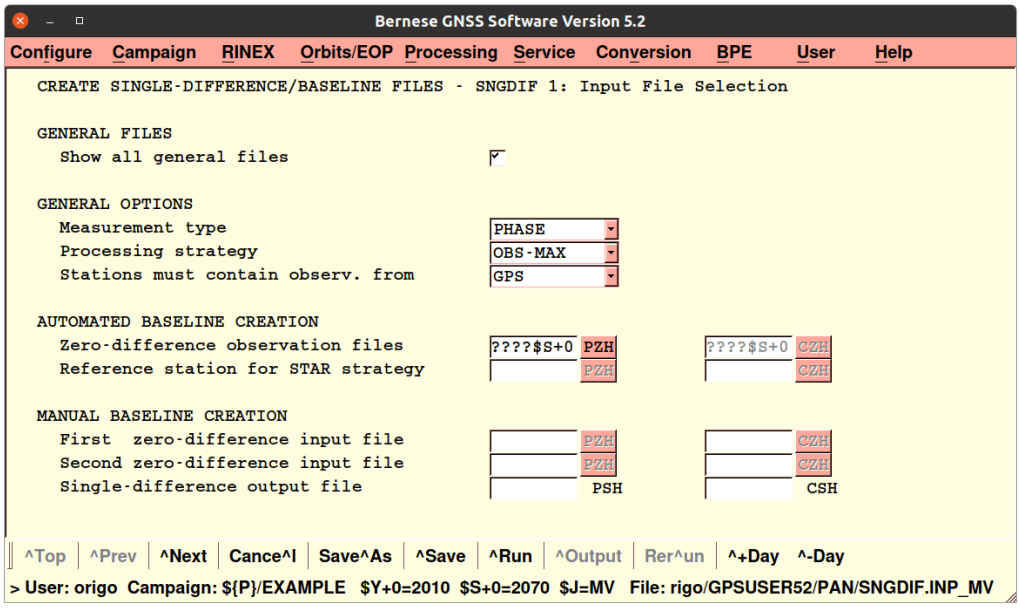
9 Form baselines (SNGDIF)

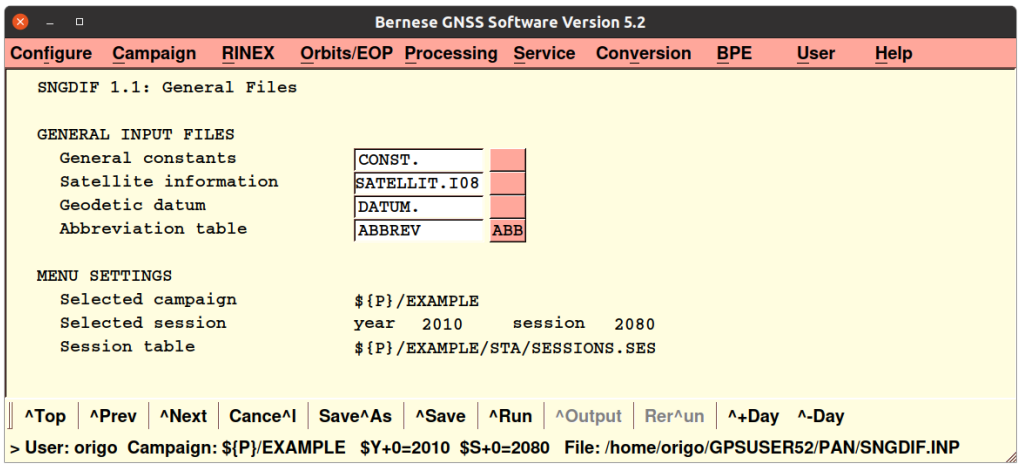
????$S+0 STATDDDS STAT2070

STAT station name (STAT)

DDD day of year (207)

S session character (0)

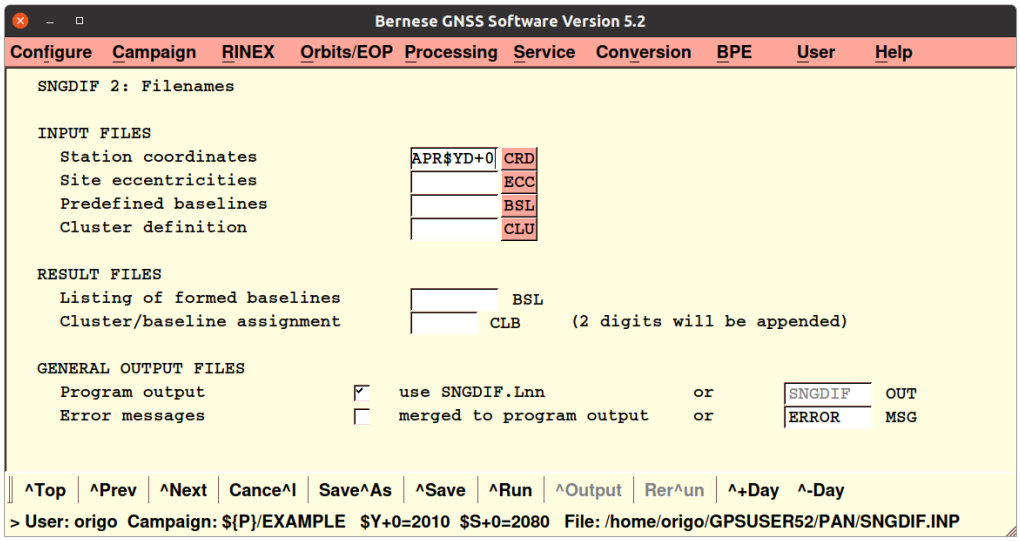


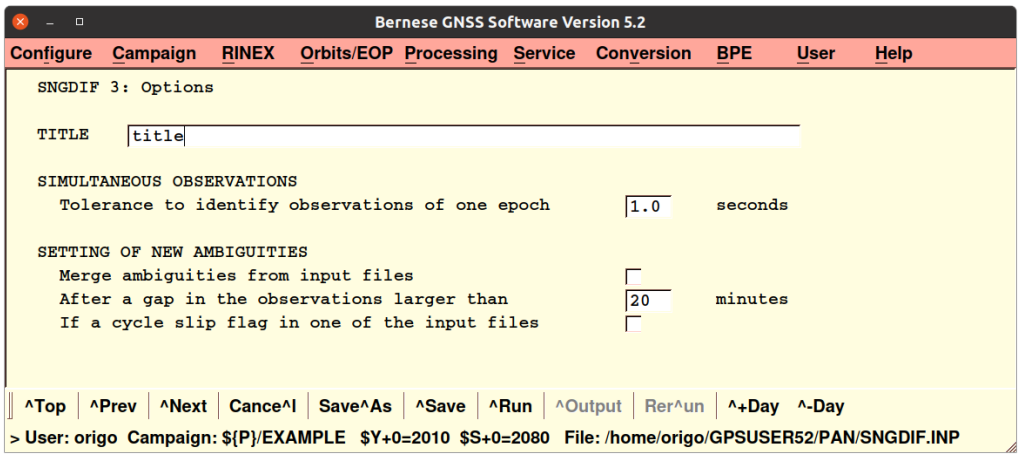


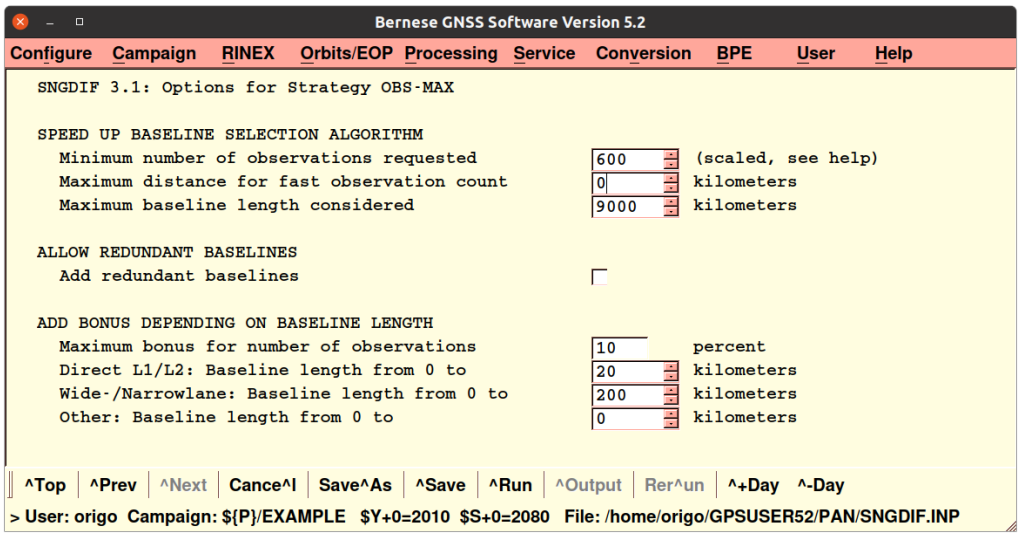
APR$YD+0 APRYYDDD APR11206

YY year (11)

DDD day of year (206)







10 Phase preprocessing (MAUPRP)

The main purpose of this processing phase is to clean the single-difference carrier-phase observation files from "outliers" (individual erroneous observations) and to fix "cycle slips" — sudden changes in the integer ambiguity of a single-difference observation arc of a satellite due to loss of lock by the receiver on the radio signal of the satellite. Normally, after acquisition by the receiver of a satellite's radio signal, it tracks the cycling of the phase of the carrier wave, counting the whole cycles. The fractional cycle (the part between 0 and 2π radians, or 0 and 1 cycles), is measured at acquisition.

????$S+0 STSTDDDS STST2080

ST station names (two characters)

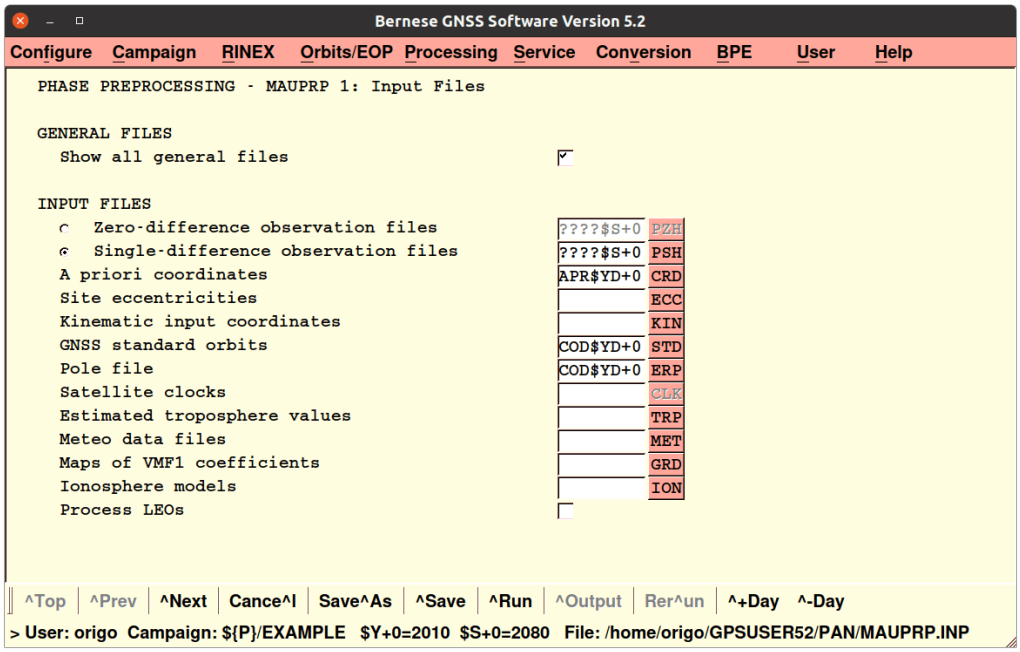
DDD day of year (208)

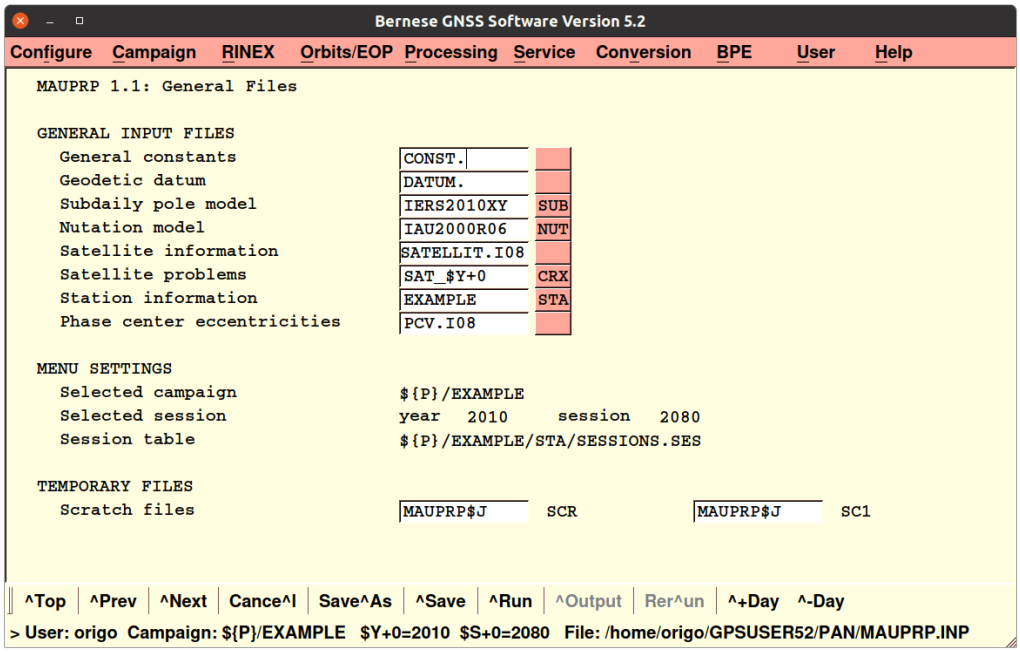
S session character (0)

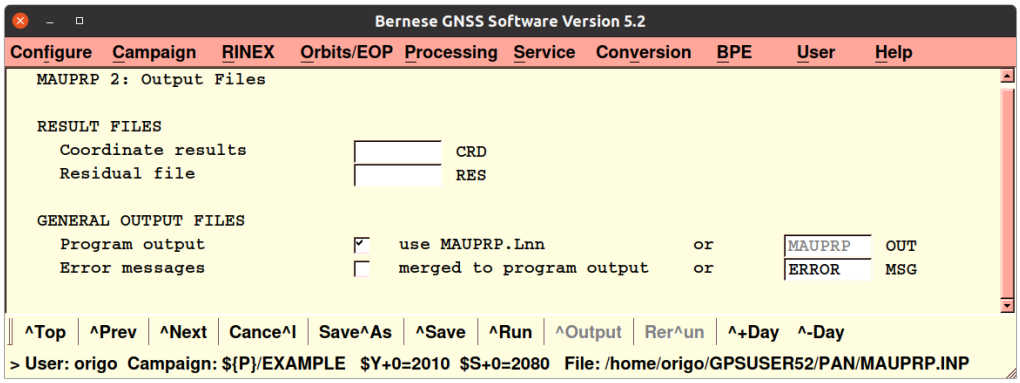
APR$YD+0 APRYYDDD APR10208

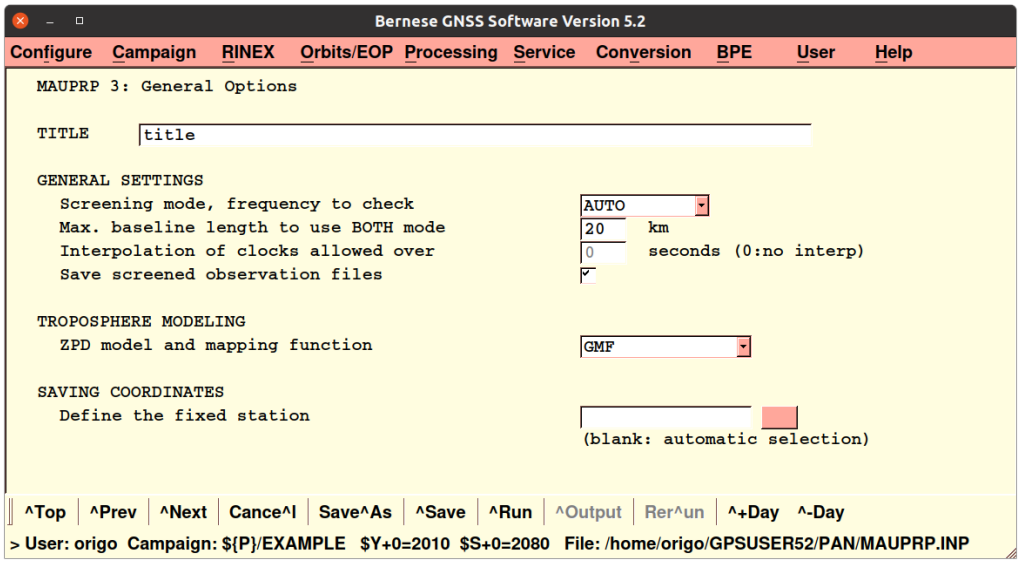
YY year (10)

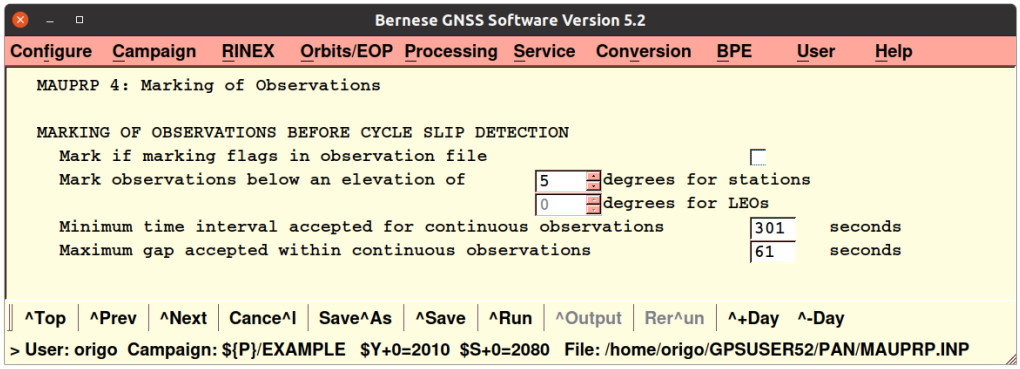
COD$YD+0 CODYYDDD COD10208

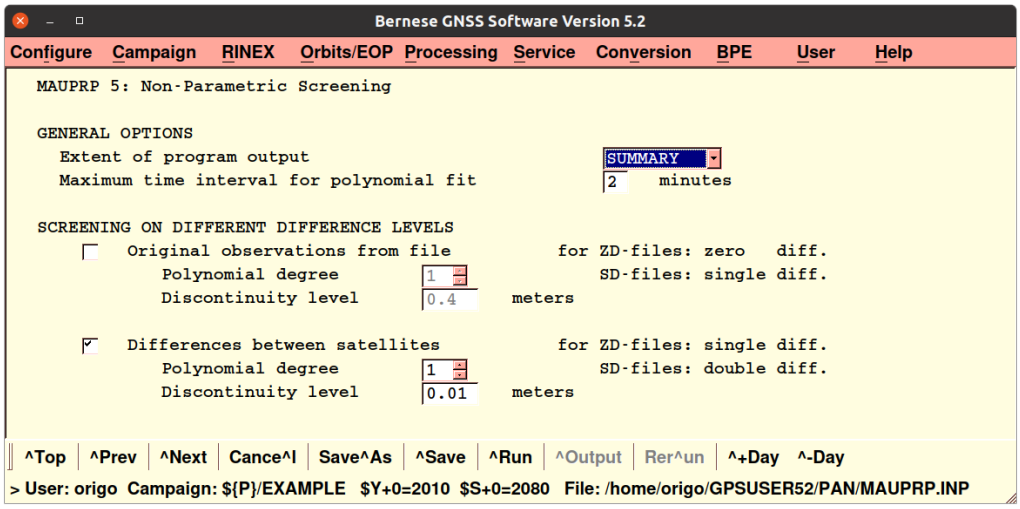


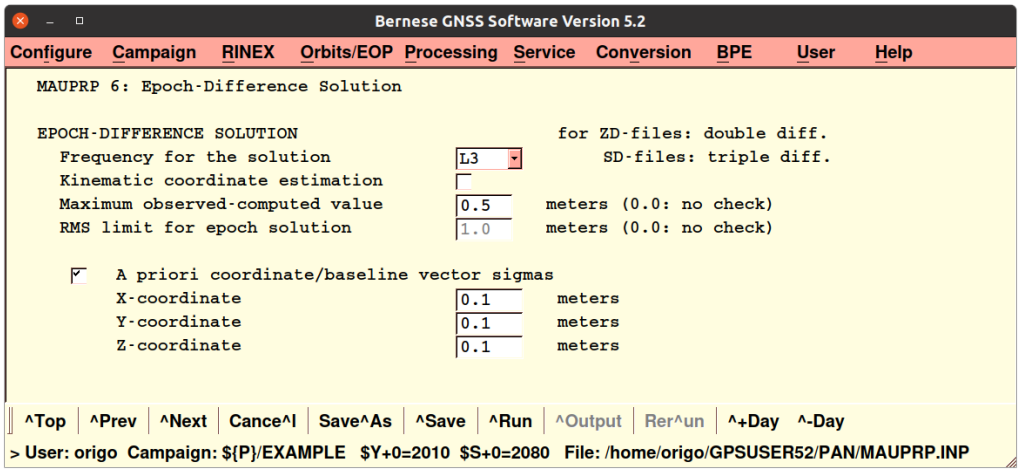

Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
MAUPRP 1.1: General Files
GENERAL INPUT FILES
General constants CONST.
Geodetic datum DATUM.
Subdaily pole model IERS2010XY SUB
Nutation model IAU2000R06 NUT
Satellite information SATELLIT.I08
Satellite problems SAT_$Y+0 CRX
Station information EXAMPLE STA
Phase center eccentricities PCV.I08
MENU SETTINGS
Selected campaign ${P}/EXAMPLE
Selected session year 2010 session 2080
Session table ${P}/EXAMPLE/STA/SESSIONS.SES
TEMPORARY FILES
Scratch files MAUPRP$J SCR MAUPRP$J SC1
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/MAUPRP.INP

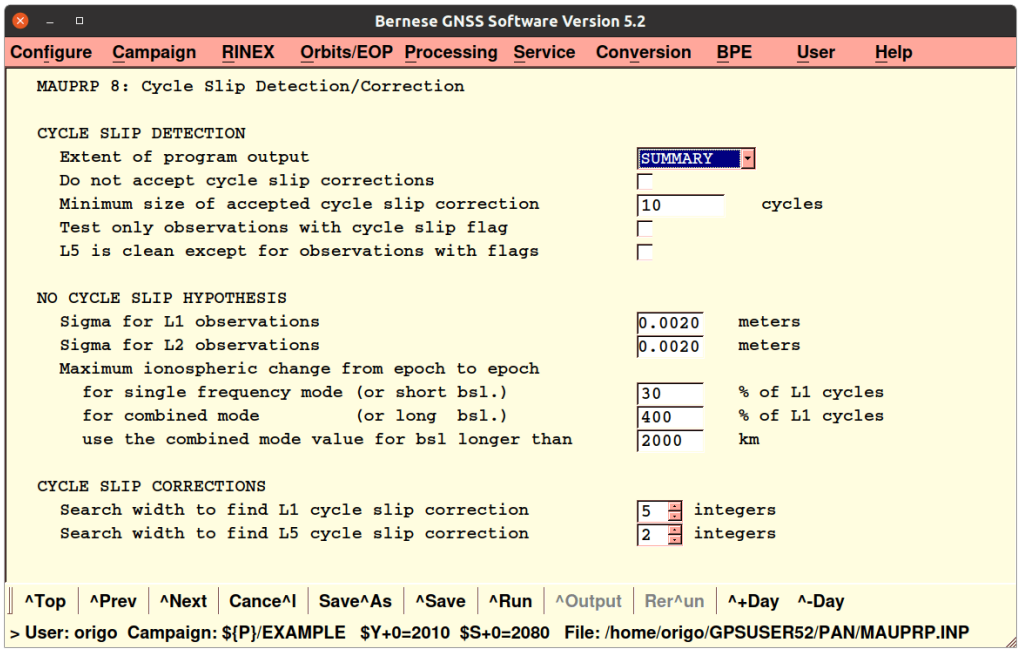

Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
MAUPRP 2: Output Files
RESULT FILES
Coordinate results CRD
Residual file RES
GENERAL OUTPUT FILES
Program output use MAUPRP.Lnn or MAUPRP OUT
Error messages merged to program output or ERROR MSG
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/MAUPRP.INP

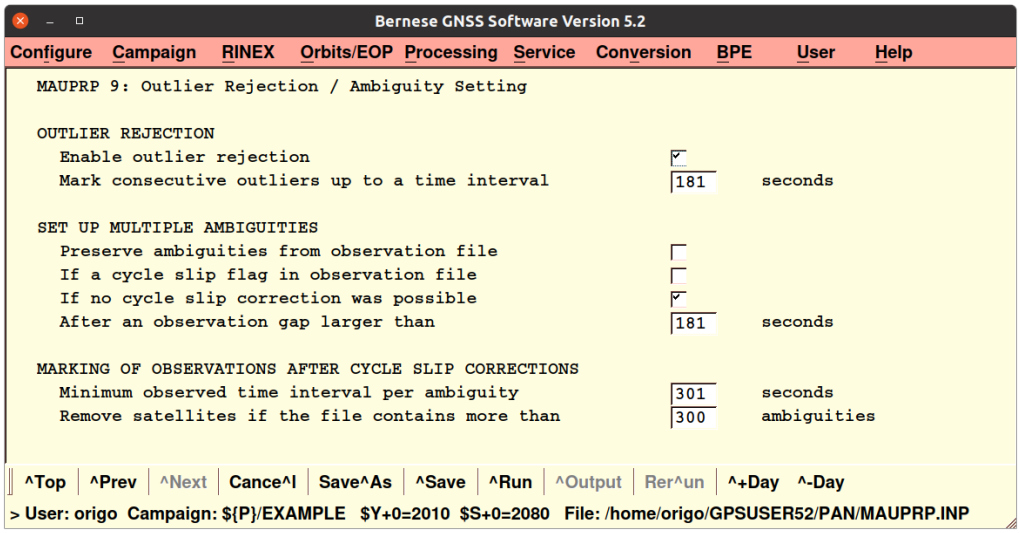

Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
MAUPRP 3: General Options
TITLE title
GENERAL SETTINGS
Screening mode, frequency to check AUTO
Max. baseline length to use BOTH mode 20 km
Interpolation of clocks allowed over 0 seconds (0:no interp)
Save screened observation files
TROPOSPHERE MODELING
ZPD model and mapping function GMF
SAVING COORDINATES
Define the fixed station
(blank: automatic selection)
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/MAUPRP.INP


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
MAUPRP 4: Marking of Observations
MARKING OF OBSERVATIONS BEFORE CYCLE SLIP DETECTION
Mark if marking flags in observation file
Mark observations below an elevation of 5 degrees for stations
0 degrees for LEOs
Minimum time interval accepted for continuous observations 301 seconds
Maximum gap accepted within continuous observations 61 seconds
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/MAUPRP.INP


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
MAUPRP 5: Non-Parametric Screening
GENERAL OPTIONS
Extent of program output SUMMARY
Maximum time interval for polynomial fit 2 minutes
SCREENING ON DIFFERENT DIFFERENCE LEVELS
Original observations from file for ZD-files: zero diff.
Polynomial degree 1 SD-files: single diff.
Discontinuity level 0.4 meters
Differences between satellites for ZD-files: single diff.
Polynomial degree 1 SD-files: double diff.
Discontinuity level 0.01 meters
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/MAUPRP.INP


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
MAUPRP 6: Epoch-Difference Solution
EPOCH-DIFFERENCE SOLUTION for ZD-files: double diff.
Frequency for the solution L3 SD-files: triple diff.
Kinematic coordinate estimation
Maximum observed-computed value 0.5 meters (0.0: no check)
RMS limit for epoch solution 1.0 meters (0.0: no check)
A priori coordinate/baseline vector sigmas
X-coordinate 0.1 meters
Y-coordinate 0.1 meters
Z-coordinate 0.1 meters
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/MAUPRP.INP





11 Parameter estimation (GPSEST): initial run

Here, we first determine initial co-ordinates and an initial tropospheric delay solution to be used in further runs. The solution uses the L3 or *ionosphere-free* linear combination of the observables L1 and L2, and no ambiguity resolution is attempted: the ambiguities are treated as real-valued unknowns.

The output files produced are called FLT$YD+0.CRD (co-ordinates) and FLT$YD+0.TRP (tropospheric parameters), and re-loaded in later runs.

????$S+0 STSTDDDS STST2080

STAT station names (two characters)

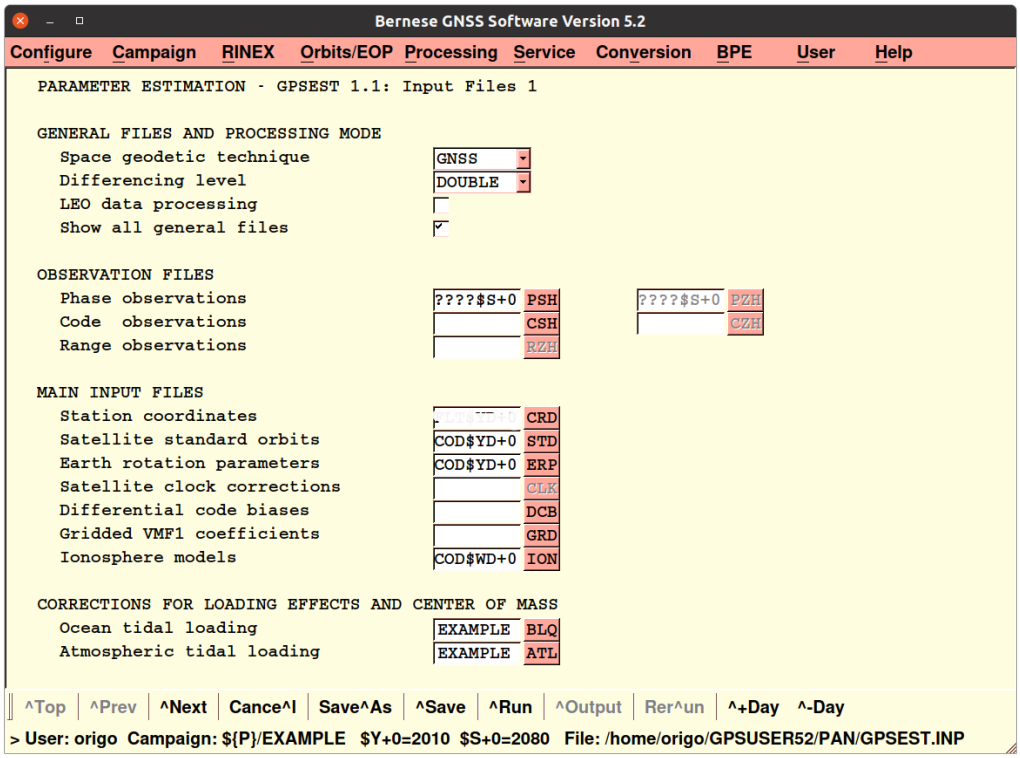
DDD day of year (208)

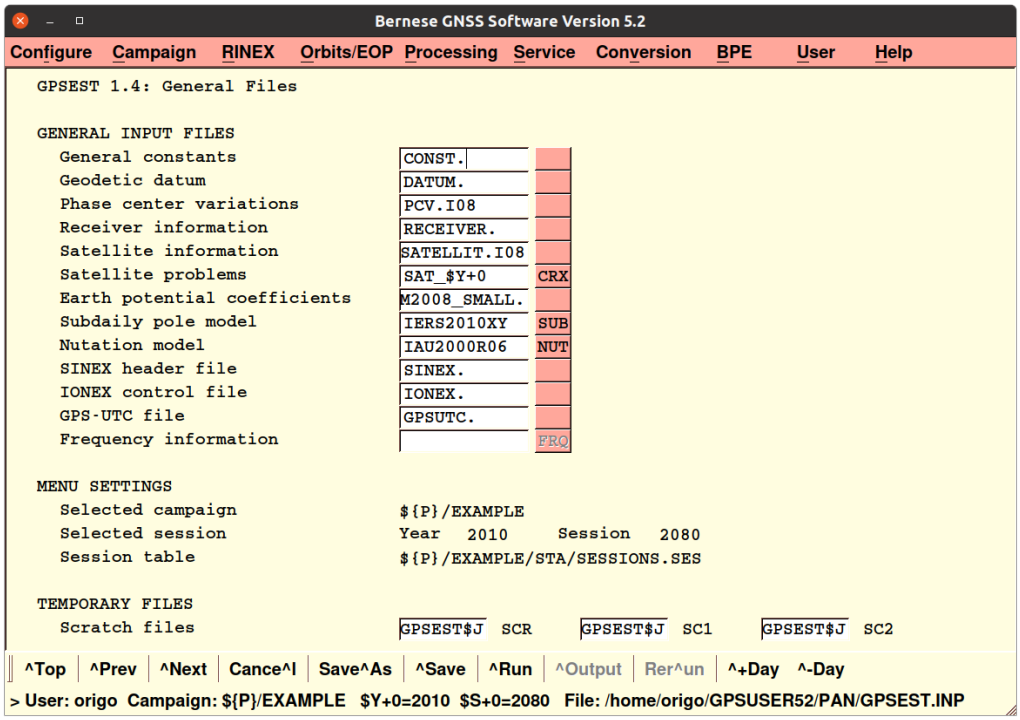
S session character (0)

FLT$YD+0 FLTYYDDD FLT10208

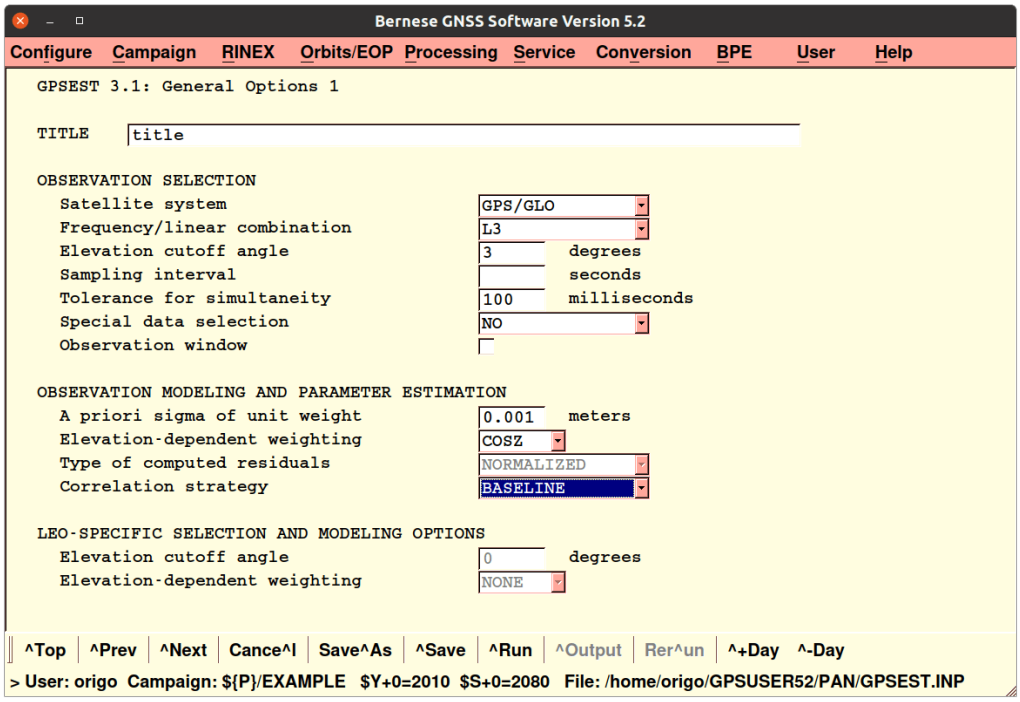
YY year (10)

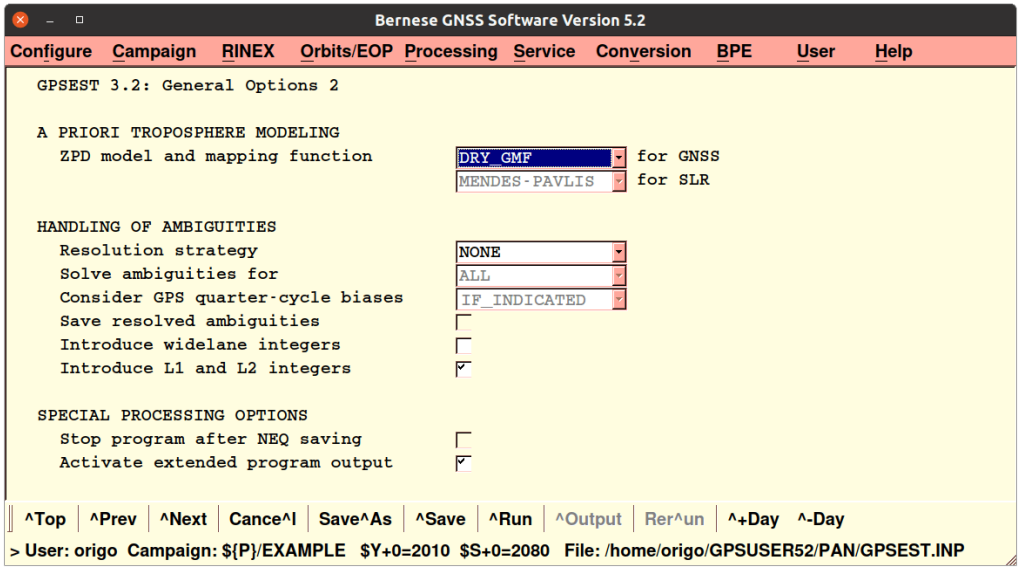
COD$YD+0 CODYYDDD COD10208

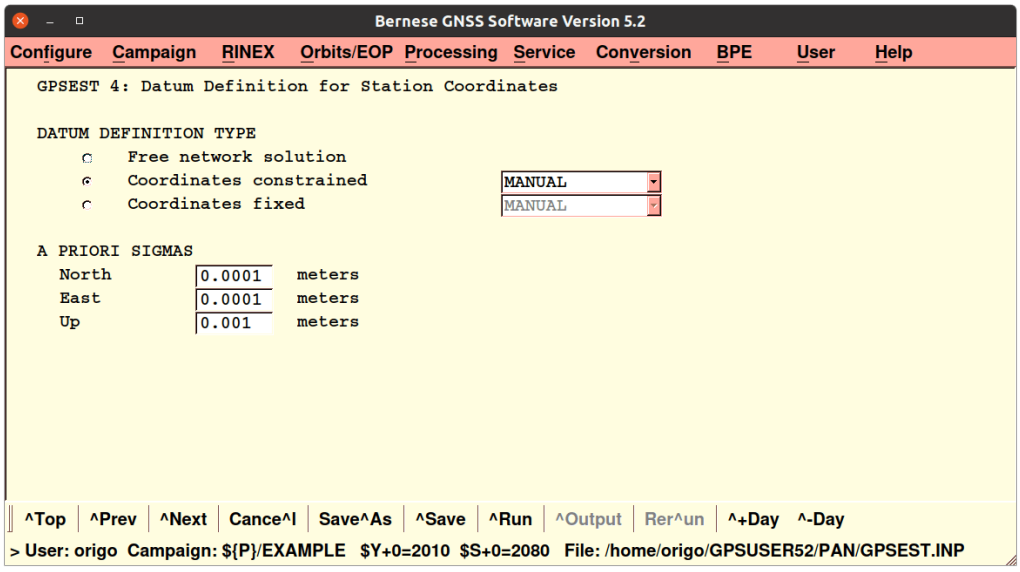


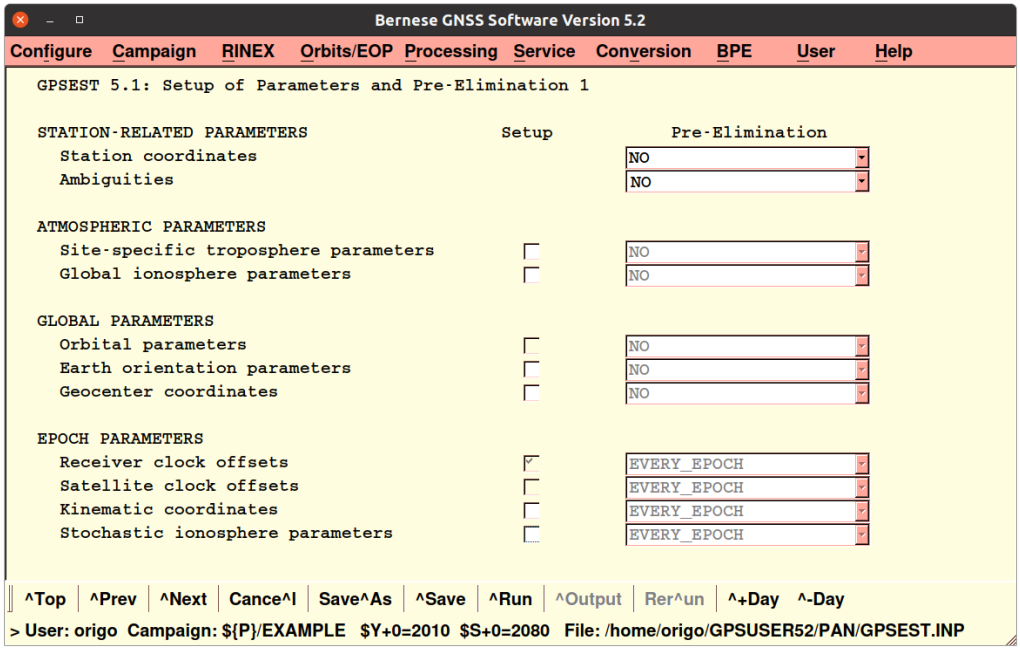


For session 2010 / 208, the normal equation was singular. For this reason, the CORRECT correlation strategy was replaced by the BASELINE one, which led to a successful run for this session.
Also, choose as satellite system GPS/GLO, as that is all we have.



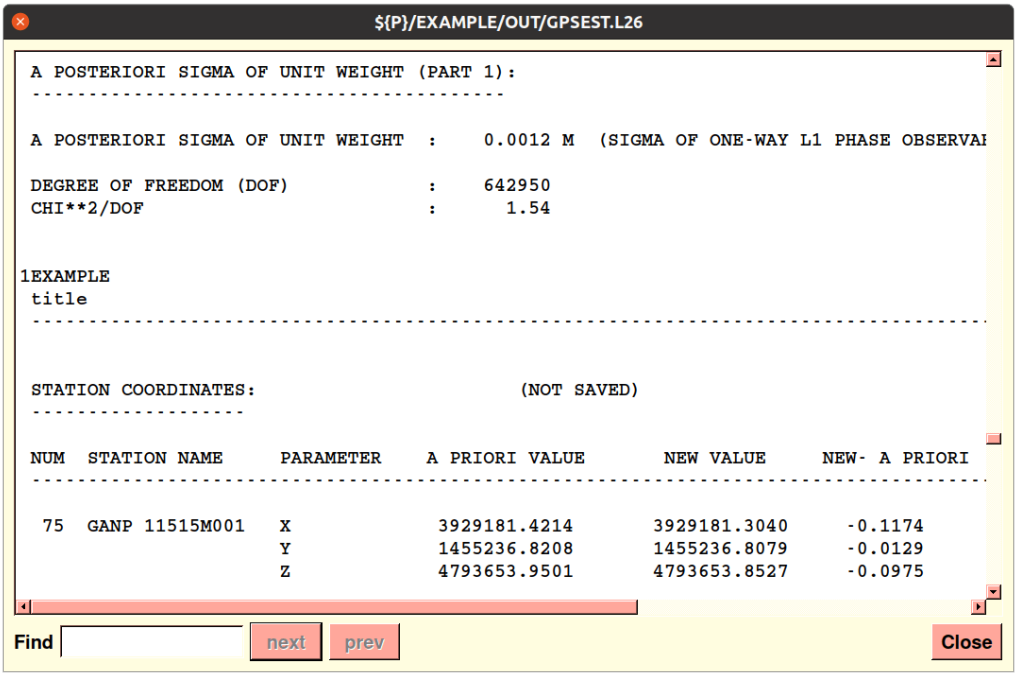

Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
GPSEST 3.2: General Options 2
A PRIORI TROPOSPHERE MODELING
ZPD model and mapping function
DRY_GMF
for GNSS
MENDES-PAVLIS
for SLR
HANDLING OF AMBIGUITIES
Resolution strategy
NONE
Solve ambiguities for
ALL
Consider GPS quarter-cycle biases
IF_INDICATED
Save resolved ambiguities
Introduce widelane integers
Introduce L1 and L2 integers
SPECIAL PROCESSING OPTIONS
Stop program after NEQ saving
Activate extended program output
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/GPSEST.INP


Bernese GNSS Software Version 5.2
Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help
GPSEST 4: Datum Definition for Station Coordinates
DATUM DEFINITION TYPE
Free network solution
Coordinates constrained
MANUAL
Coordinates fixed
MANUAL
A PRIORI SIGMAS
North 0.0001 meters
East 0.0001 meters
Up 0.001 meters
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day
> User: origo Campaign: ${P}/EXAMPLE $Y+0=2010 $S+0=2080 File: /home/origo/GPSUSER52/PAN/GPSEST.INP



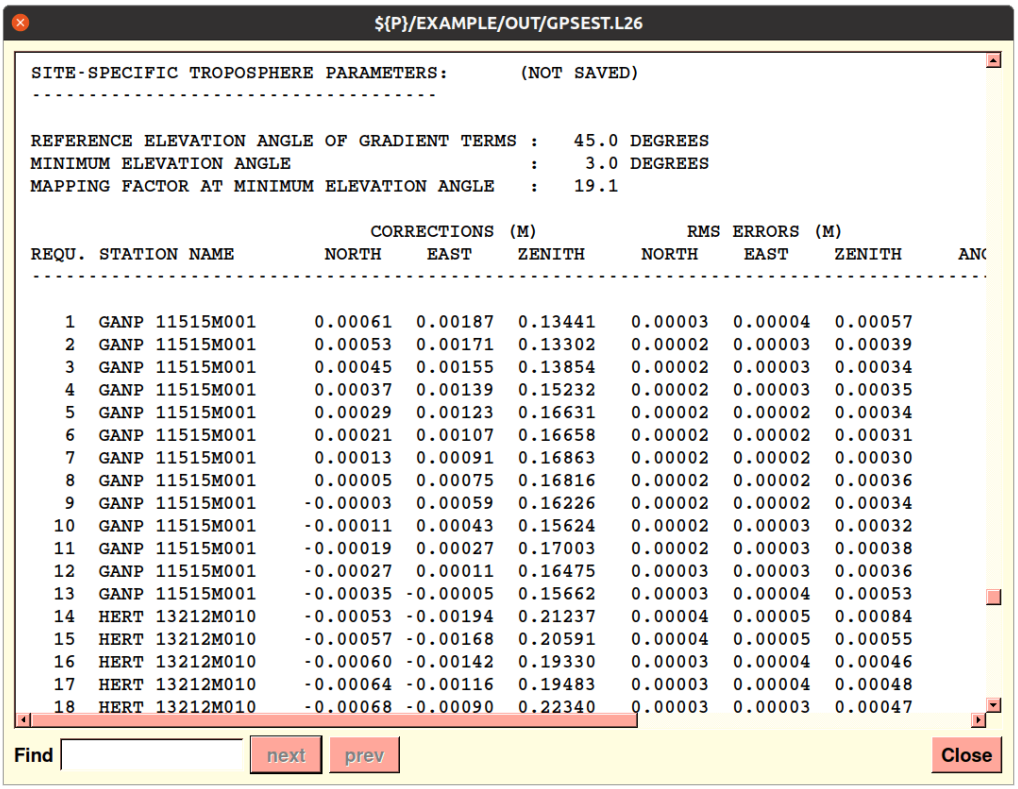
11.1 Results: station coordinates

A posteriori sigma of 1.2 mm is quite good. The *a priori* sigma was 1 mm. The $\frac{\chi^2}{\mathrm{DOF}}$ is 1.54, a bit high. Perhaps because of the per-baseline correlation model. This value is the square of (*a posteriori* / *a priori*).



11.2 Results: tropospheric parameters

Tropospheric parameters were estimated for all stations at 2 hour intervals. Not just total zenith delays, but also north and east direction gradients. These values are offsets from a reference model.



12 Parameter estimation (2)

We add a ionosphere model, and produce co-oordinate output and tropospheric parameter output.

The output files produced are called FLT$YD+0.CRD (co-ordinates)and FLT$YD+0.TRP (tropospheric parameters), and re-loaded in later runs.

Ionosphere model added.

????$S+0 STSTDDDS STST2080

STAT station names (two characters)

DDD day of year (208)

S session character (0)

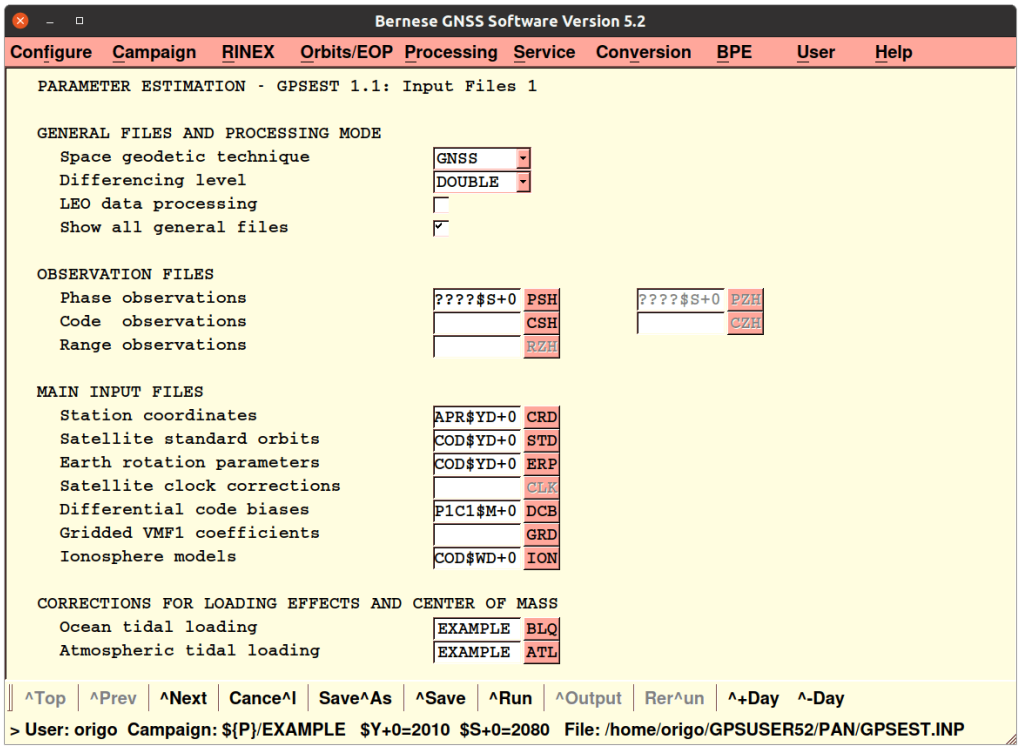
APR$YD+0 APRYYDDD APR10208

YY year (10)

COD$YD+0 CODYYDDD COD10208

P1C1$M+0 P1C1YYMM P1C11007

MM month (07)

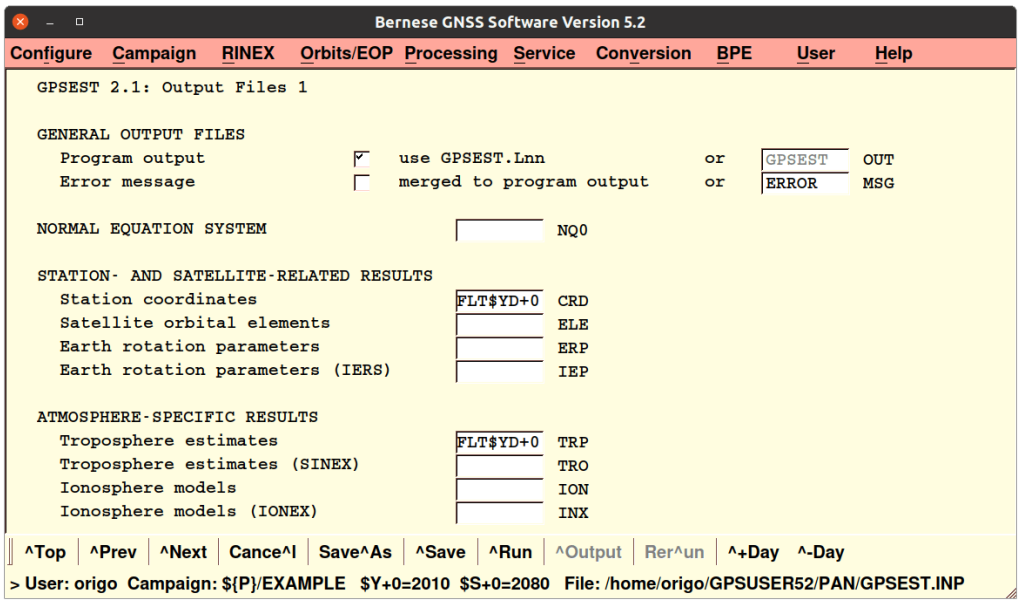


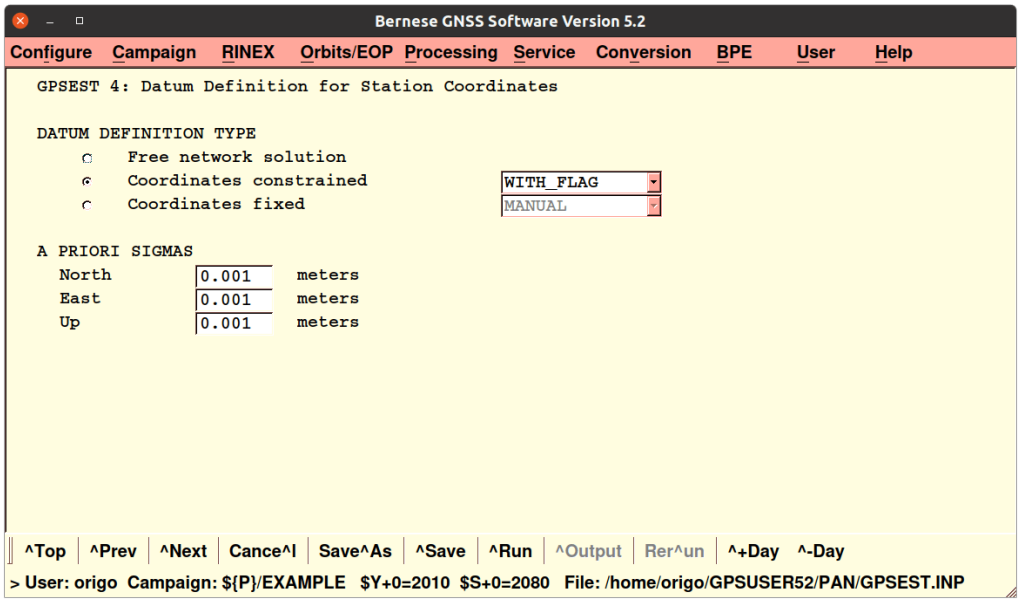
Output iono- and troposphere estimates to file.

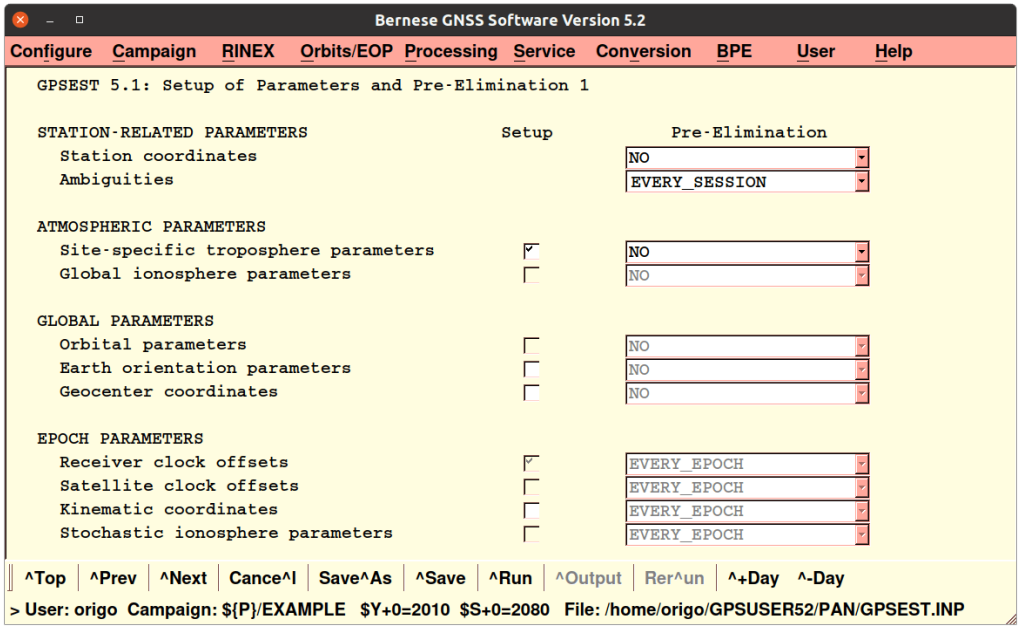
FLT$YD+0 FLTYYDDD FLT10208

YY year (10)

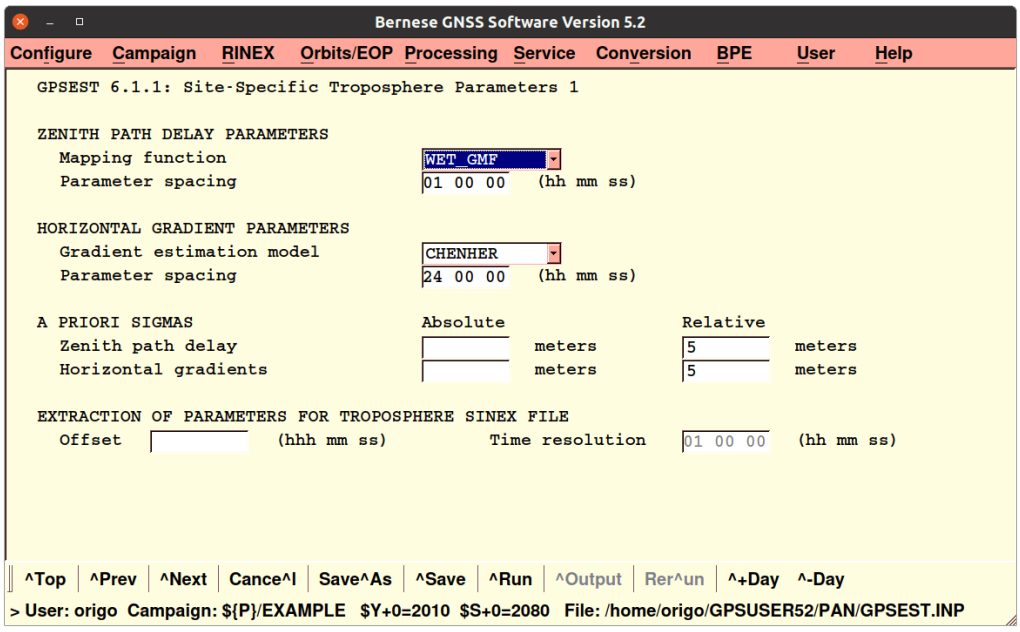
DDD day of year (208)







Add soft regularization constraint on troposphere parameters



13 Ambiguity resolution

Here we resolve the ambiguities *on a baseline-by-baseline basis*. Doing this for all baselines together, even on a session-by-session basis, would be too heavy on the computer. The baseline station names, two two-character names from ABBREV.ABB, are input manually.

For ambiguity resolution, we use the QIF (Quasi Ionosphere Free) technique. This requires use of the original L1&L2 observables together, and stochastic ionosphere parameters. In this stage we *input* the co-ordinate and troposheric parameter files determined earlier: FLT$YD+0.CRD and FLT$YD+0.TRP.

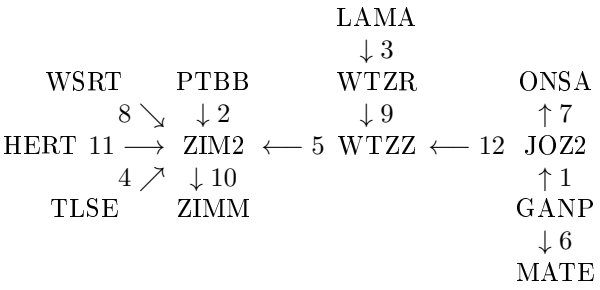
Baselines and network:

Note that this is just one example of a set of baselines generated by SNGDIF. Running the program with different options, or on data with a different processing history, will produce different sets of baselines. So don't

be surprised if you are getting a different set.

The automated strategies, like the OBS-MAX and STAR stategies, will always produce an independent set of baselines. So, with 13 stations, one gets 12 baselines.

1	GNJZ	GANP	JOZ2
2	PBZ2	PTBB	ZIM2
3	LMW1	LAMA	WTZR
4	TSZ2	TLSE	ZIM2
5	W4Z2	WTZZ	ZIM2
6	GNMT	GANP	MATE
7	JZOS	JOZ2	ONSA
8	WRZ2	WSRT	ZIM2
9	W1W4	WTZR	WTZZ
10	Z2Z1	ZIM2	ZIMM
11	HRZ2	HERT	ZIM2
12	JZW4	JOZ2	WTZZ



GNJZ$S+0 STSTDDDS GNJZ2080

GNJZ station names (two characters, here GN and JZ)

DDD day of year (208)

S session character (0)

FLT$YD+0 FLTYYDDD FLT10208

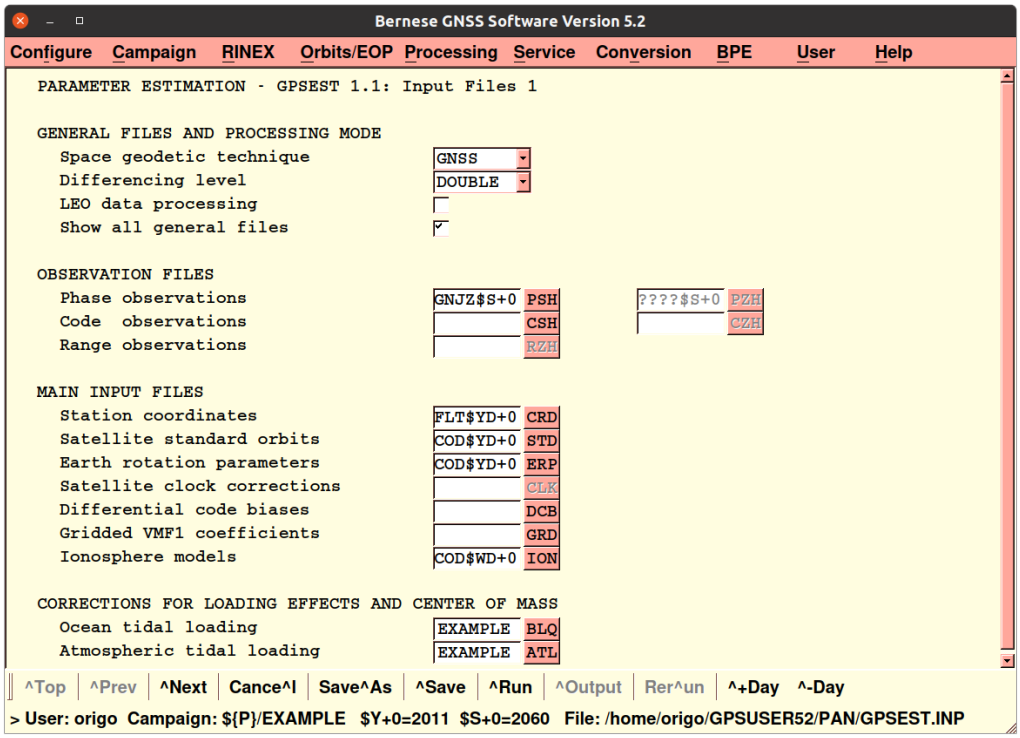
YY year (10)

COD$YD+0 CODYYDDD COD10208

COD$WD+0 CODWWWWD COD15942

WWWW GPS week (1594)

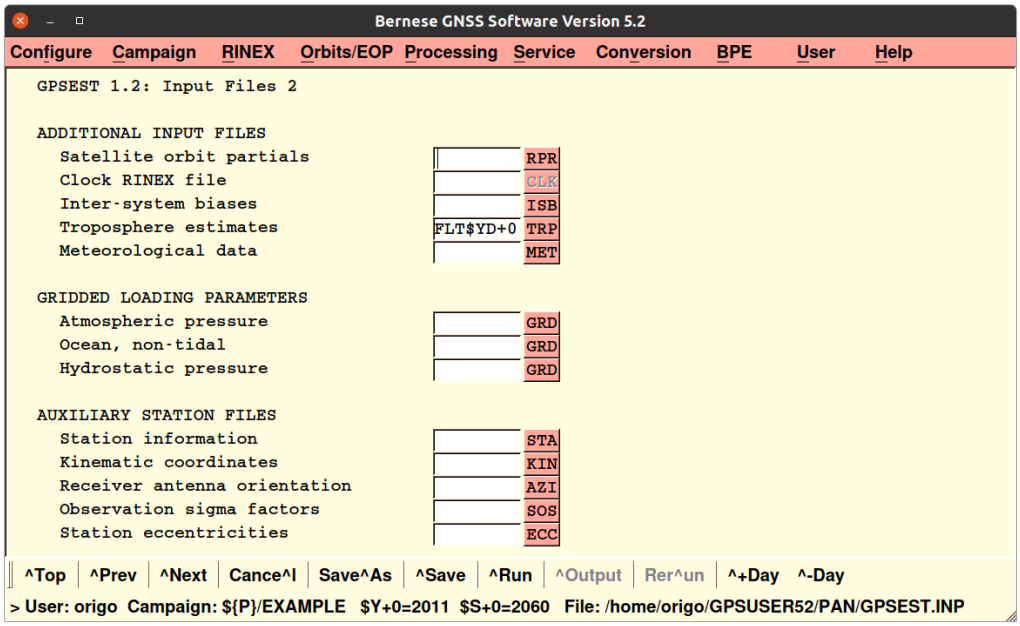
D GPS day (2)



FLT$YD+0 FLTYYDDD FLT10208

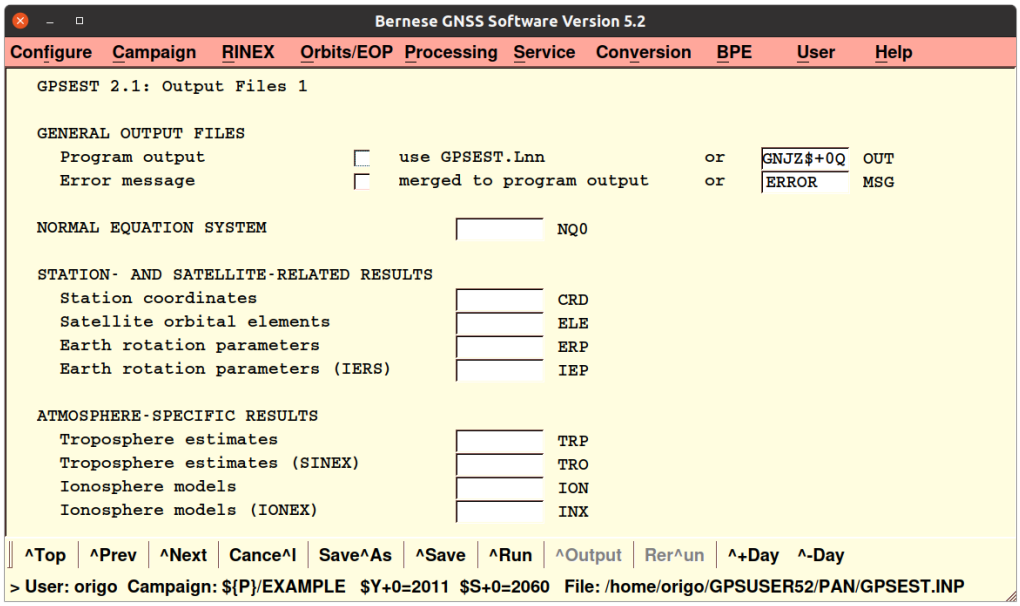
YY year (10)

DDD day of year (208)

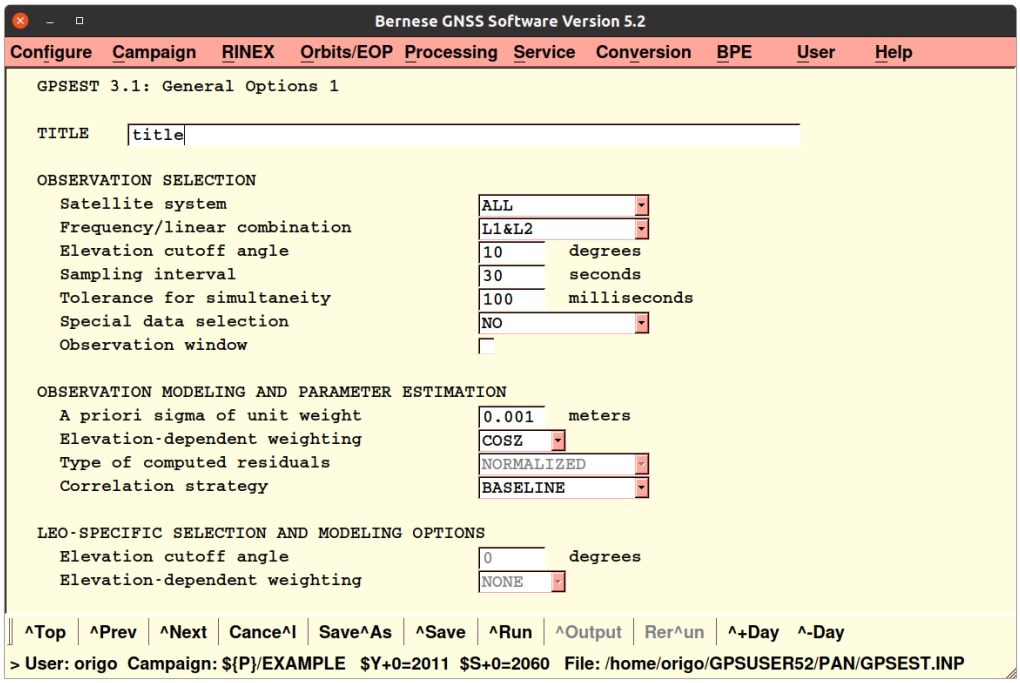


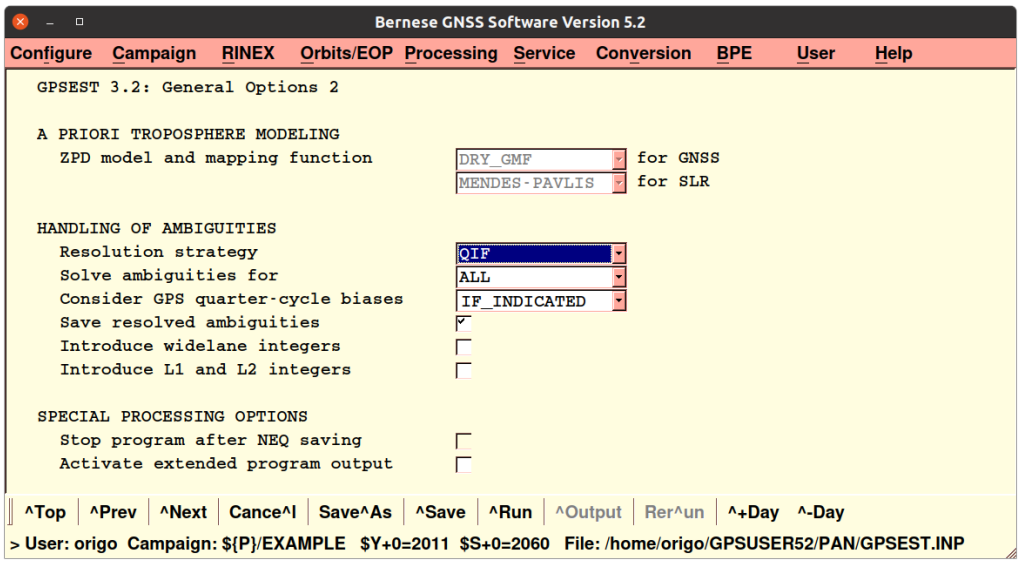
GNJZ$+0Q GNJZDDDQ → GNJZ206Q

DDD day of year (208)

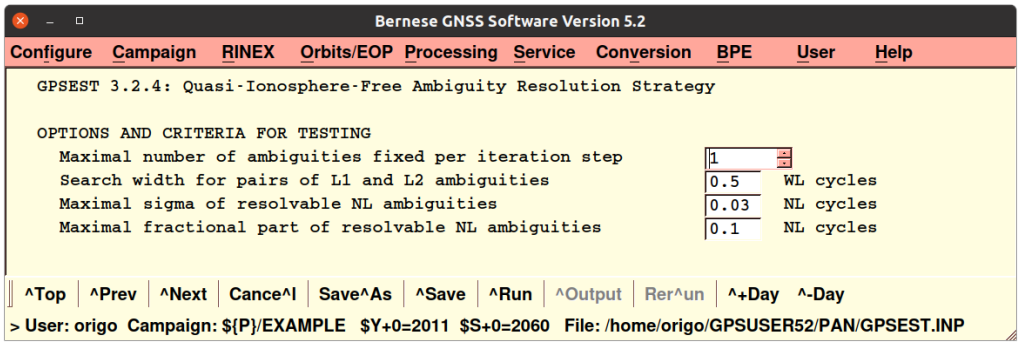


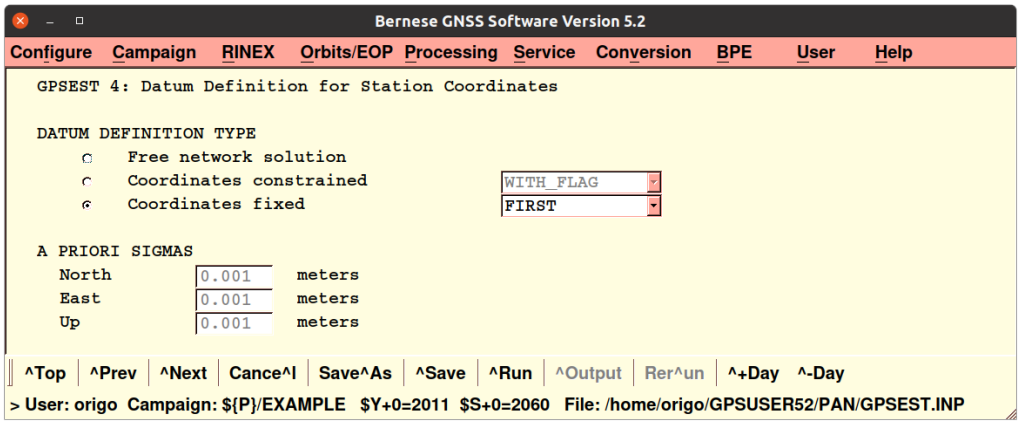
L1&L2 concurrent processing is mandatory for quasi-ionosphere-free ambiguity resolution.



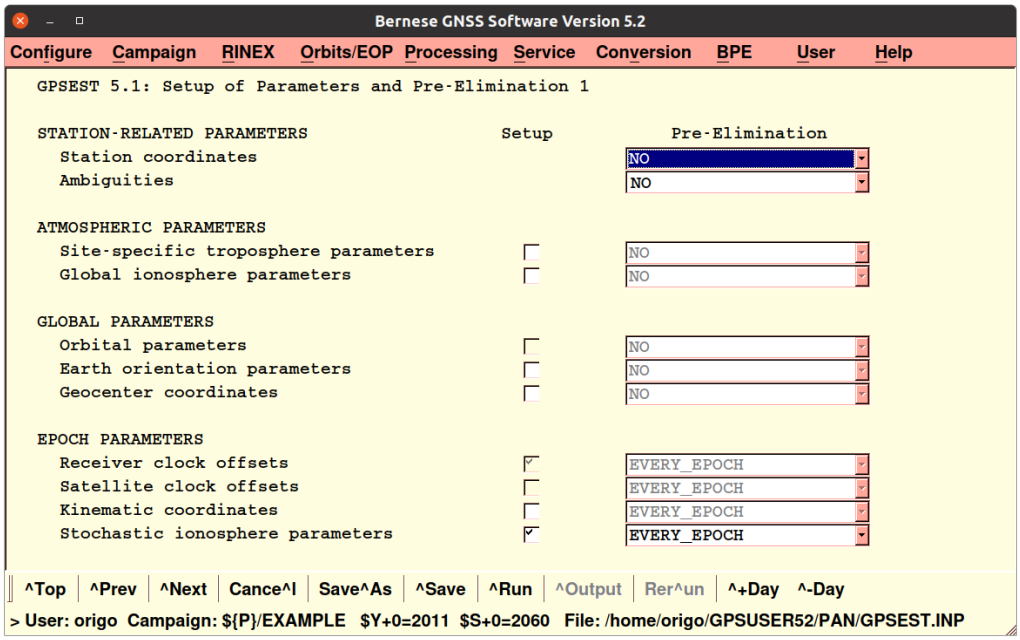


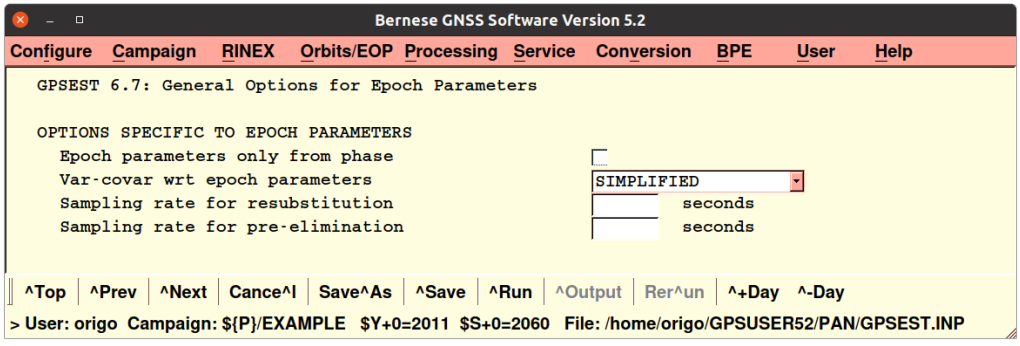
One ambiguity fix per iteration step is necessary when processing GLONASS.

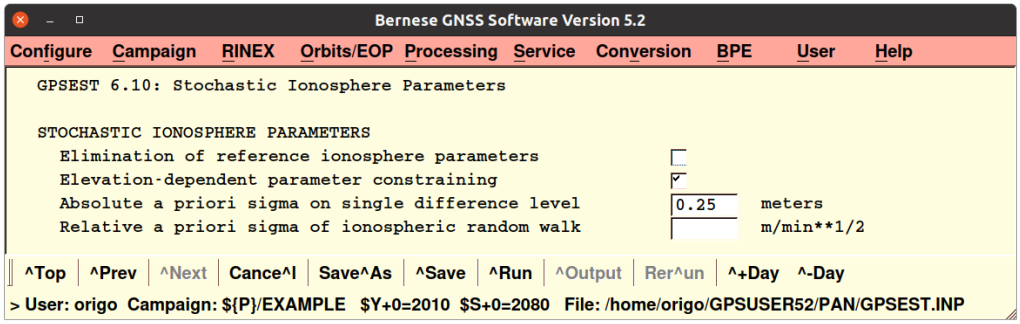




Stochastic ionosphere parameters are mandatory with QIF.



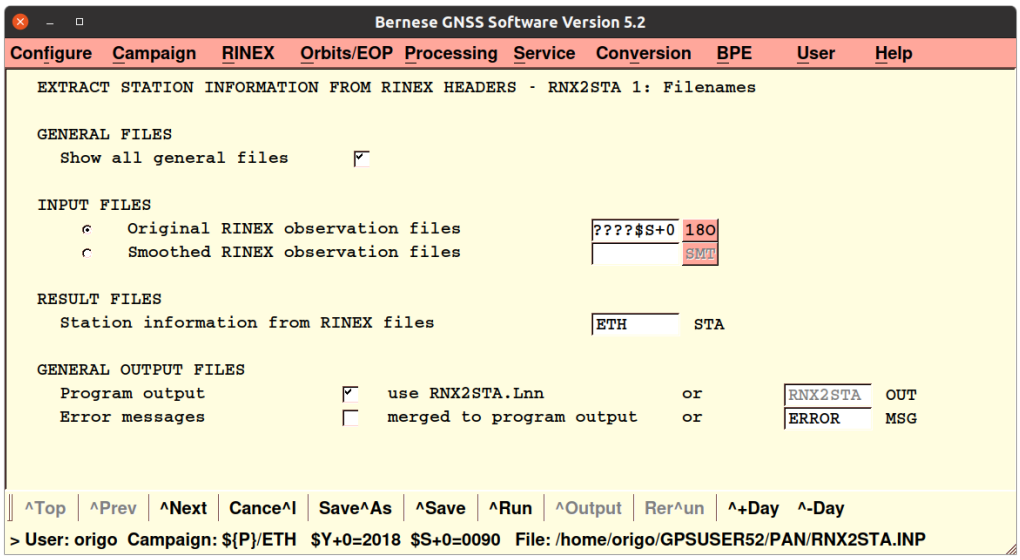


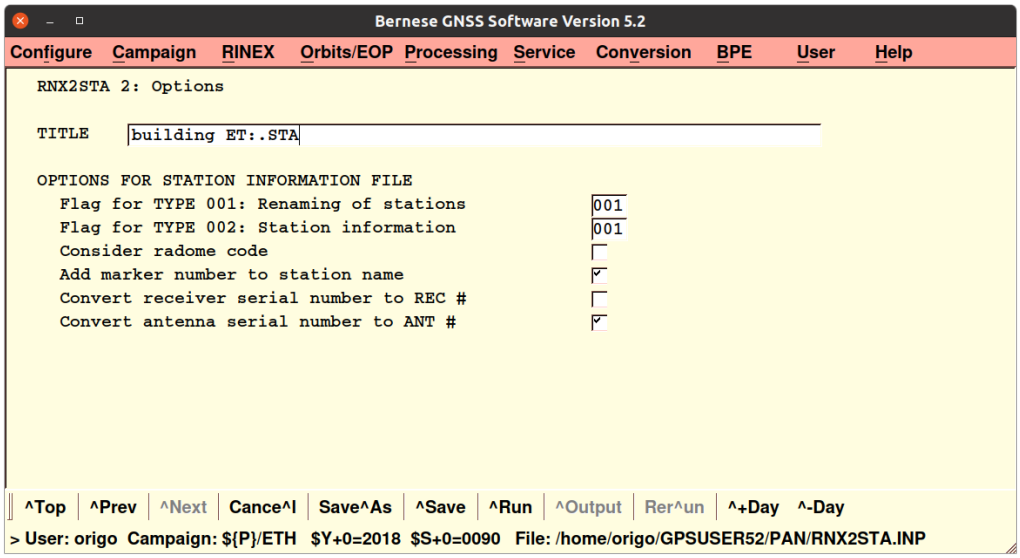


14 The Station Information File etc.

This is a central file used by most of the Bernese software modules, so its content — like that of the session file SESSION.SES and the station name abbreviations file ABBREV.ABB — needs to be correct for everything to function correctly.

The example campaign EXAMPLE or INTRO provided by the Bernese people as part of their training material is ready set up: it is called EXAMPLE.STA. If you want to process your own material, you need to set it up yourself from your RINEX files. Fortunately there is a program called RNX2STA that automates the job: it is found under the menu Service▷Station Information Files▷Extract information from RINEX.



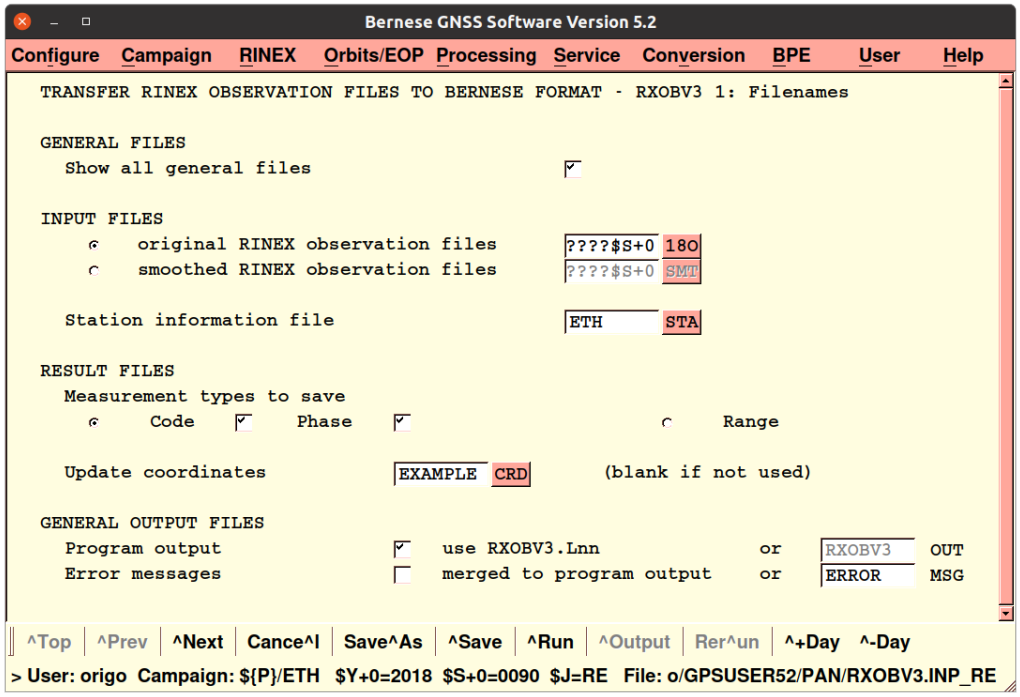


Noteworthy is that in Panel 2, there is the option "Convert antenna serial number to ANT #". This option should be chosen if the software fails to find the antenna calibration information from the general file PCV.* used, though the information is there.

14.1 A priori coordinates

With a new campaign, also a file containing a priori coordinates for the stations must be provided. It ends in *.CRD. Files containing all the IGS stations globally are provided with the Bernese distribution. If your station(s) are not on that list, you must add them manually. The approximate XYZ co-ordinates of a station are found in its RINEX file headers.

The adding of the station co-ordinates is done automatically by RXOBV3 if you give it the name of the pre-existing *.CRD file: "Update coordinates" in the below panel.



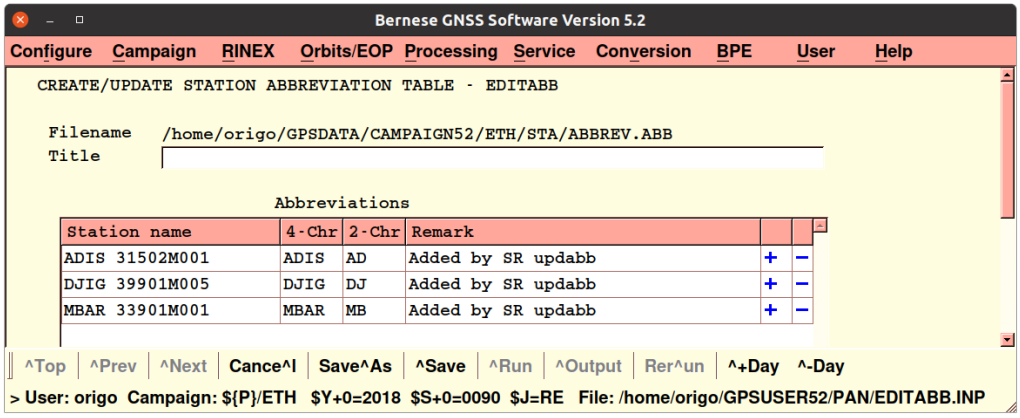
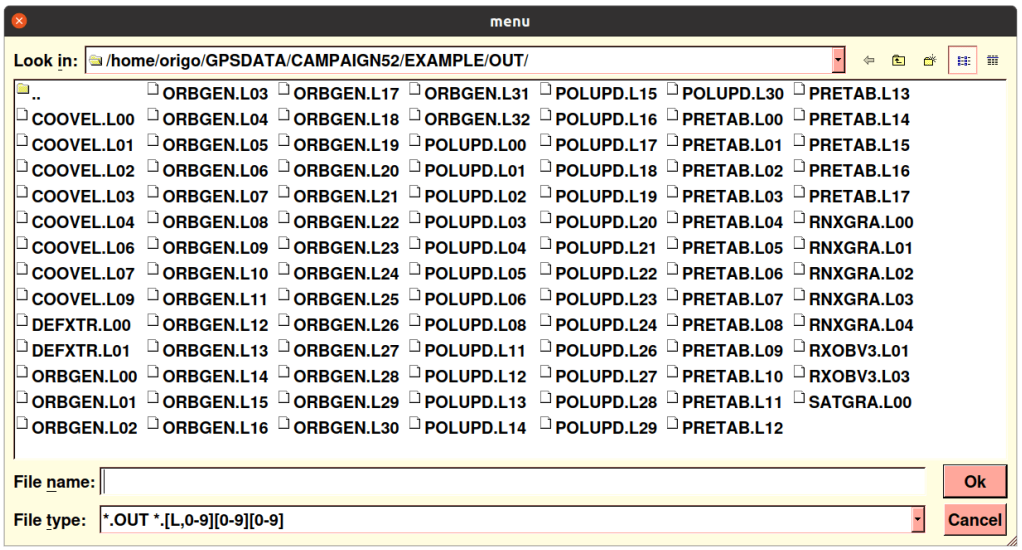


Figure 1: A well-formed station-name abbreviation file.

14.2 The station-name abbreviation file

A well formed station-name abbreviation file looks like figure 1:

Any double or multiple occurrences of names for the same station, or multiple variations of the four- or two-character abbreviations, means that the file is corrupted, which unfortunately can easily happen due to the guesswork Bernese has to do. Delete the superfluous lines and edit to make sure that only reasonable abbreviations remain.

Also, check the directory $P/<CAMPAIGN>/OBS for Bernese observation files having these superfluous names, and delete them.´

15 The output files of the program runs