

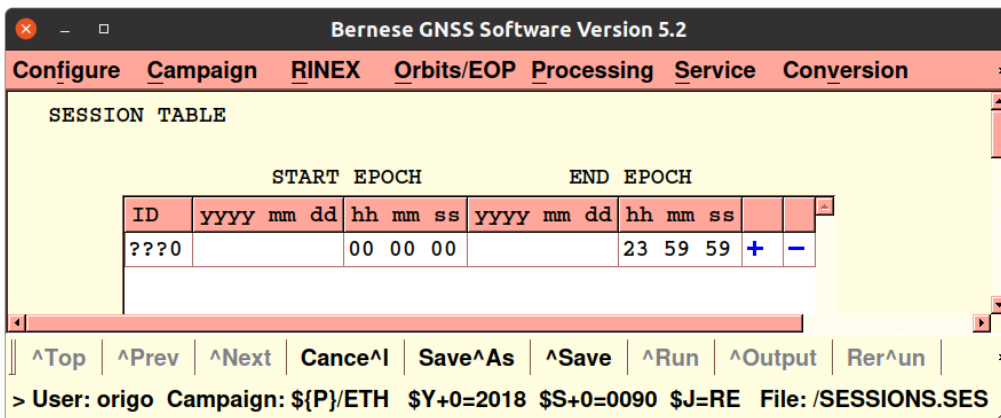
Bernese 5.2 introductory course, notes and screen shots

February 22, 2022

1 Setting up sessions, choosing active session

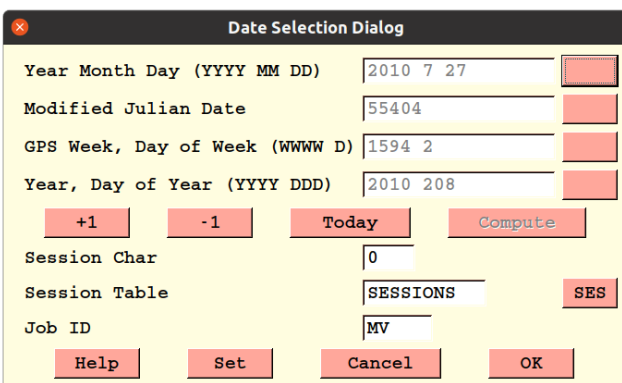
Here, *only* enter ???0 for the session ID. This matches any session day, like 2010 session 207 or 208 or 2011 session 205 or 206. The final “0” means the first and only session for that day.

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, Modified 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

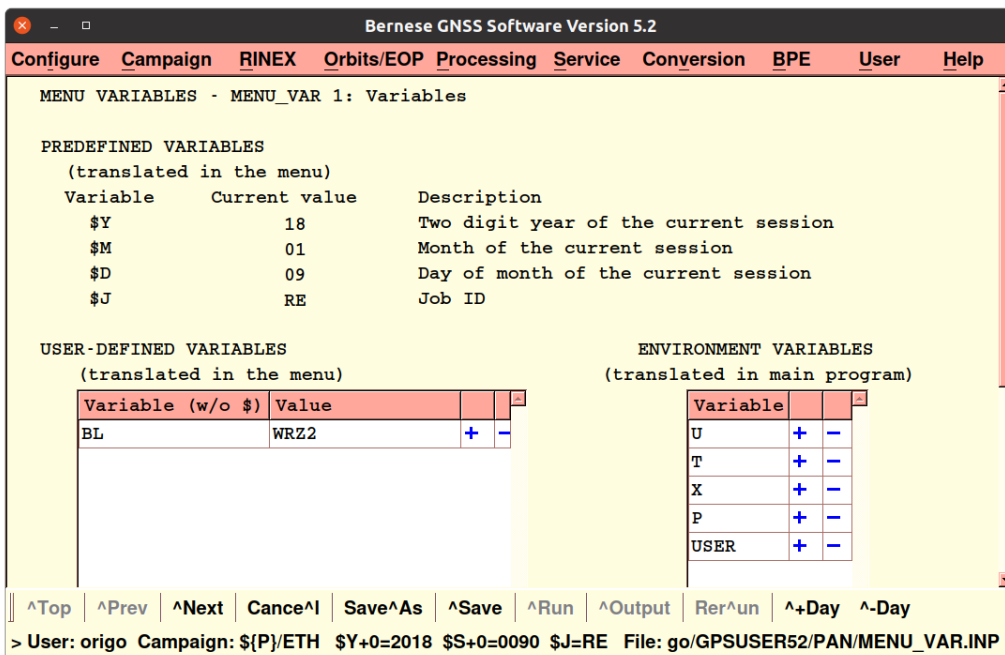
\$T Temporary GPSTEMP

\$X Executables BERN52/GPS

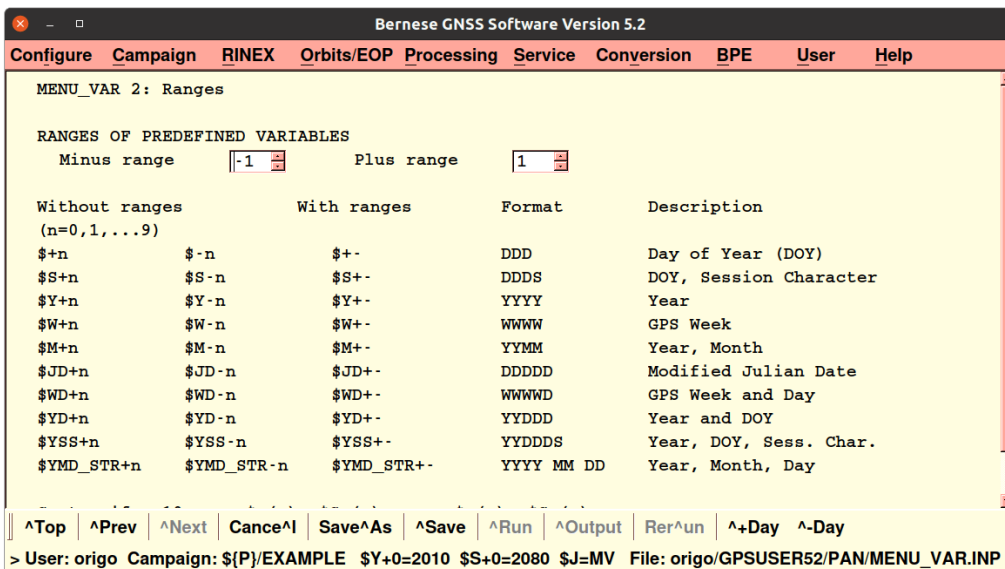
\$P Campaign directory GPSDATA/CAMPAIGN52

\$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)

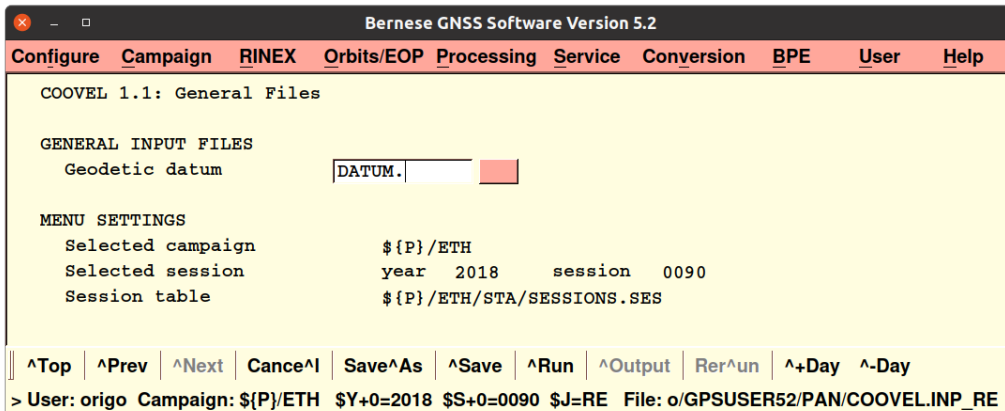
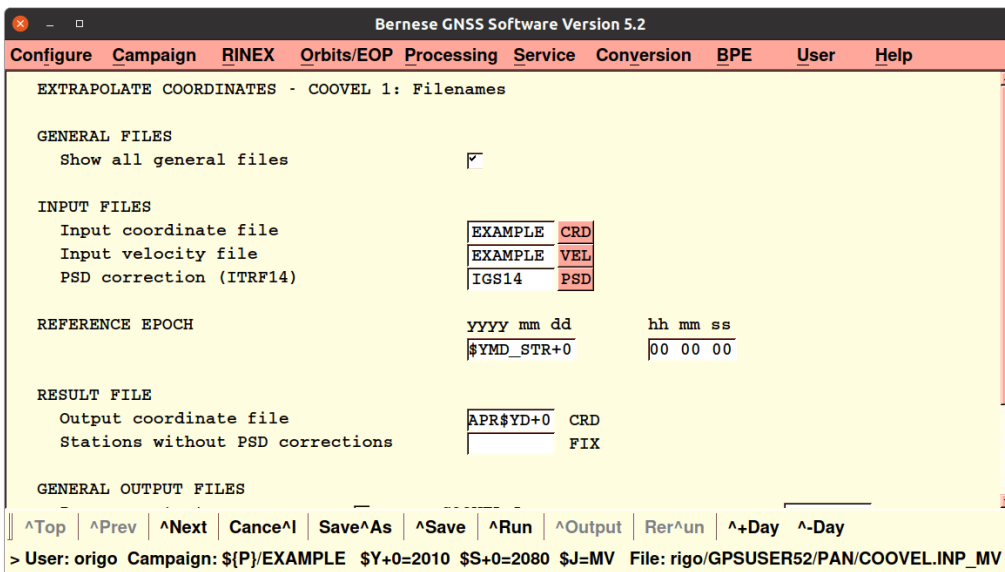
`MM` month (07)

`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

```
origo@origo-NJ50GU: ~/BERN52/GPS/EXE
origo@origo-NJ50GU:~/BERN52/GPS/EXE$ CRX2RNX -h
Usage: CRX2RNX [file] [-] [-f] [-s] [-d] [-h]
  stdin and stdout are used if input file name is not given.
  - : output to stdout
  -f : force overwrite of output file
  -s : skip strange epochs (default:stop with error)
      This option may be used for salvaging usable data when middle of
      the Compact RINEX file is missing. The data after the missing part,
      are, however, useless until the compression operation of all data
      are initialized at some epoch. Combination with use of -e option
      of RNX2CRX may be effective.
      Caution : It is assumed that no change in the list of data types
      happens in the lost part of the data.
  -d : delete the input file if conversion finishes without errors
      (i.e. exit code = 0 or 2).
      This option does nothing if stdin is used for the input.
  -h : display help message

exit code = 0 (success)
           = 1 (error)
           = 2 (warning)
[version : ver.4.1.0]
origo@origo-NJ50GU:~/BERN52/GPS/EXE$
```

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

```
origo@origo-NJ50GU: ~/BERN52/GPS/EXE
CRZ2RNX : C-shell script to decompress multiple RINEX files.

Usage : CRZ2RNX [-c] [-d] [-f] [-q] [-v] file ...

  -c : output to the current directory
  -d : delete input files if decompressed successfully
  -f : force overwriting output files without inquiring
  -q : quiet mode (suppress display of files in progress)
  -v : verbose mode
  -h : show this message and stop
  file ... : input compressed RINEX (or CRINEX) files.
            Wildcards can be used.

compressed RINEX/CRINEX -->   CRINEX      -->   RINEX
?????????.??d      -->   ??????????.??o
?????????.??d.gz(Z) -->   (?????????.??d) -->   ??????????.??o
?????????.??o.gz(Z) -->   ??????????.??o
?????????.??n.gz(Z) -->   ??????????.??n
?????????.??g.gz(Z) -->   ??????????.??g
?????????.??l.gz(Z) -->   ??????????.??l
?????????.??p.gz(Z) -->   ??????????.??p
?????????.??h.gz(Z) -->   ??????????.??h
?????????.??b.gz(Z) -->   ??????????.??b
?????????.??m.gz(Z) -->   ??????????.??m
?????????.??c.gz(Z) -->   ??????????.??c
*.?O.crx.gz(Z)      -->   *.?O.rnx
*.rnx.gz(Z)         -->   *.rnx

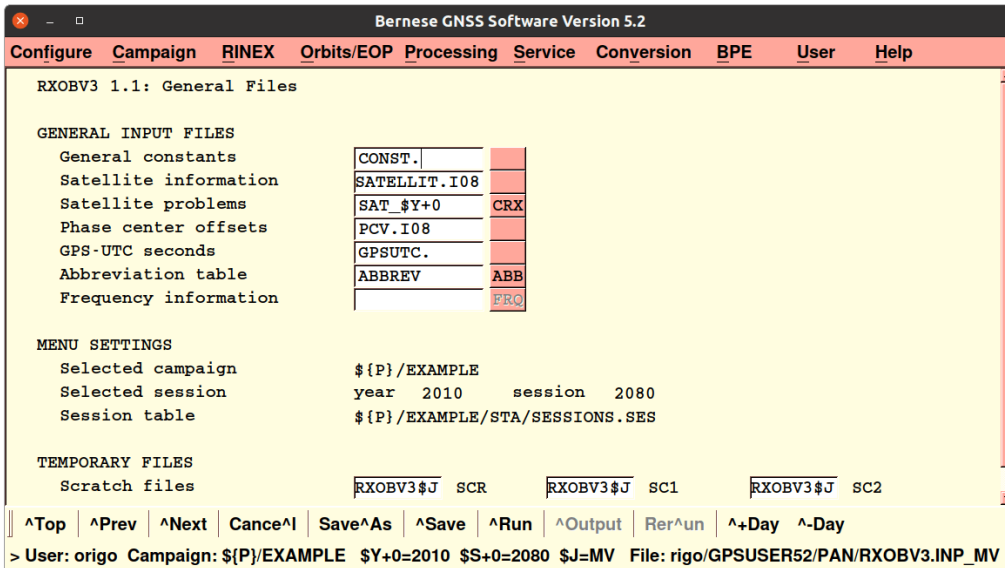
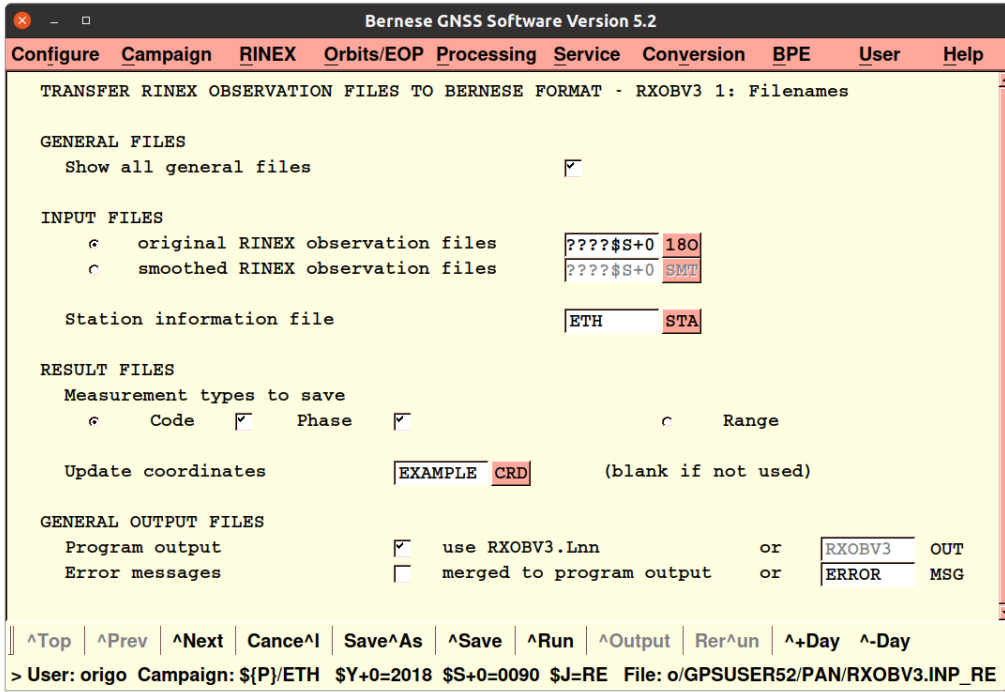
Remarks:
- Installation of CRX2RNX is necessary to use this tool.
- The extensions of the input files must conform to the RINEX convention.
origo@origo-NJ50GU:~/BERN52/GPS/EXE$
```

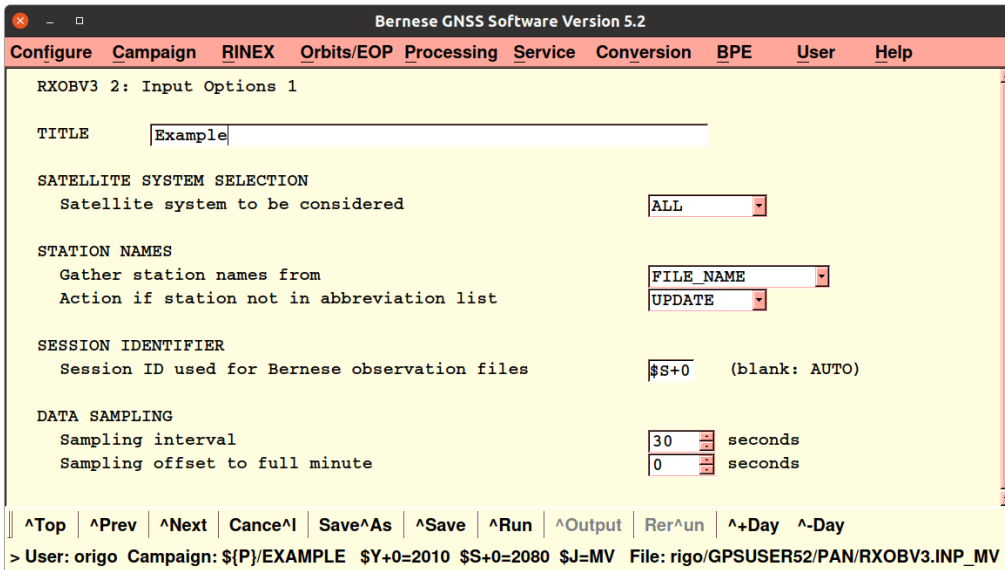
????\$S+0 STATDDDS → STAT2080

???? station

DDD day of year (208)

S session character (0)





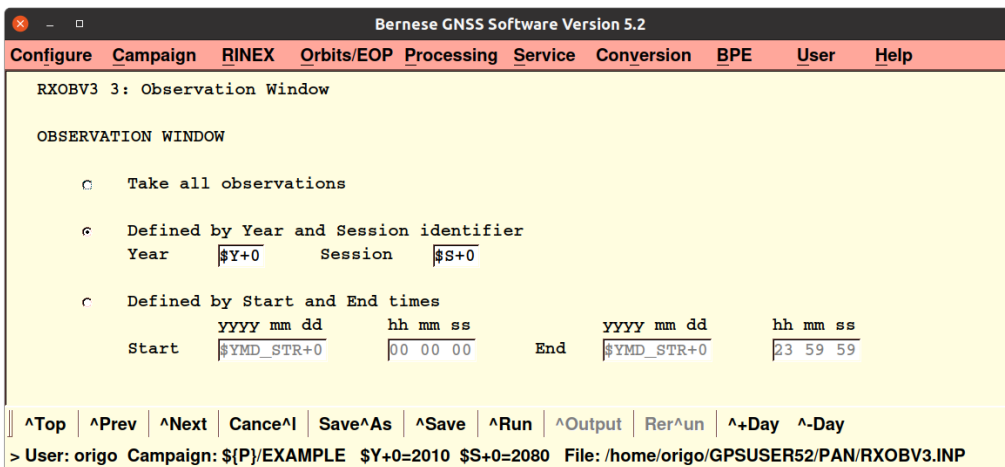
\$Y+0 YYYY → 2010

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
 Accept signal strength = 0
 Accept cycle slip flags from RINEX

MINIMUM OBSERVATION NUMBER

Minimum number of epochs requested per file epochs

OPTIONS CONCERNING ANTENNAS

Consider radome code of the antennas
 Correct position of radome code
 Check phase center file for antenna type else

EVENT FLAG HANDLING

What to do in case of event flags

FREQUENCY CHECK FOR SLR

Check frequency information file for frequency

|| ^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 Try also filename
 Receiver/antenna type
 Receiver/antenna number
 Antenna position
 Marker type

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

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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
 Verify station name using RINEX filename

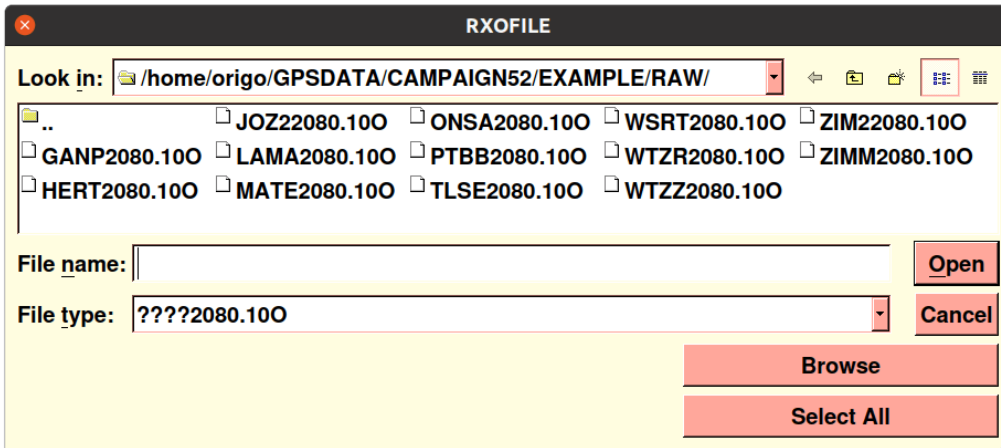
HANDLING OF KNOWN INCONSISTENCIES

Accepted station information

|| ^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 CODWWWD COD15942

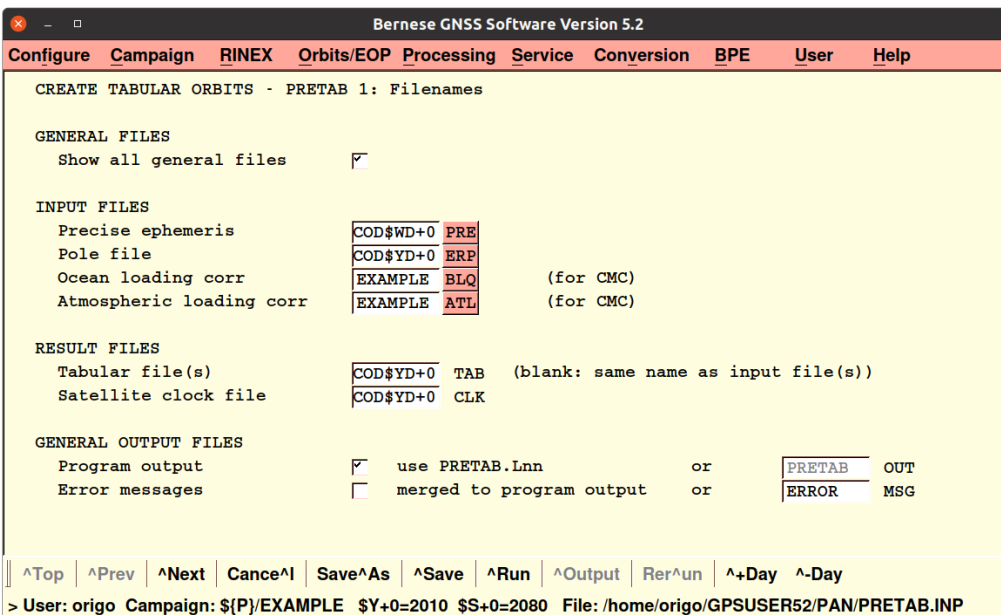
WWW GPS week (1594)

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/GPSUSERS52/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:	<input checked="" type="checkbox"/>
	ATL:	<input checked="" type="checkbox"/>

SATELLITE OPTIONS

Remove bad satellites	<input checked="" type="checkbox"/>
Use accuracy codes from SP3-file	<input checked="" type="checkbox"/>
Exclude sat. with accuracy code 0	<input checked="" type="checkbox"/>
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/GPSUSERS52/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

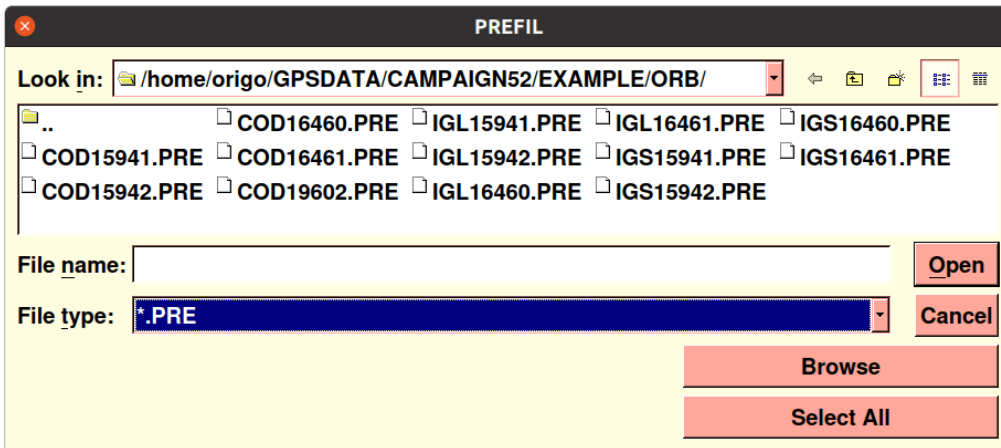
OPTIONS FOR CLOCKS

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/GPSUSERS52/PAN/PRETAB.INP

5.1 Precise ephemeris files

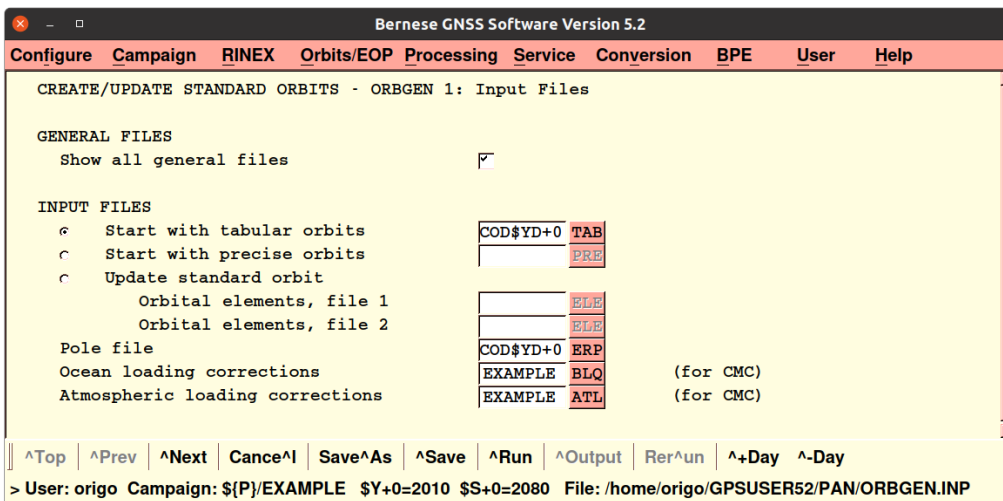


6 Generate standard orbits (ORBGEN)

COD\$YD+0 CODYYDDD COD10208

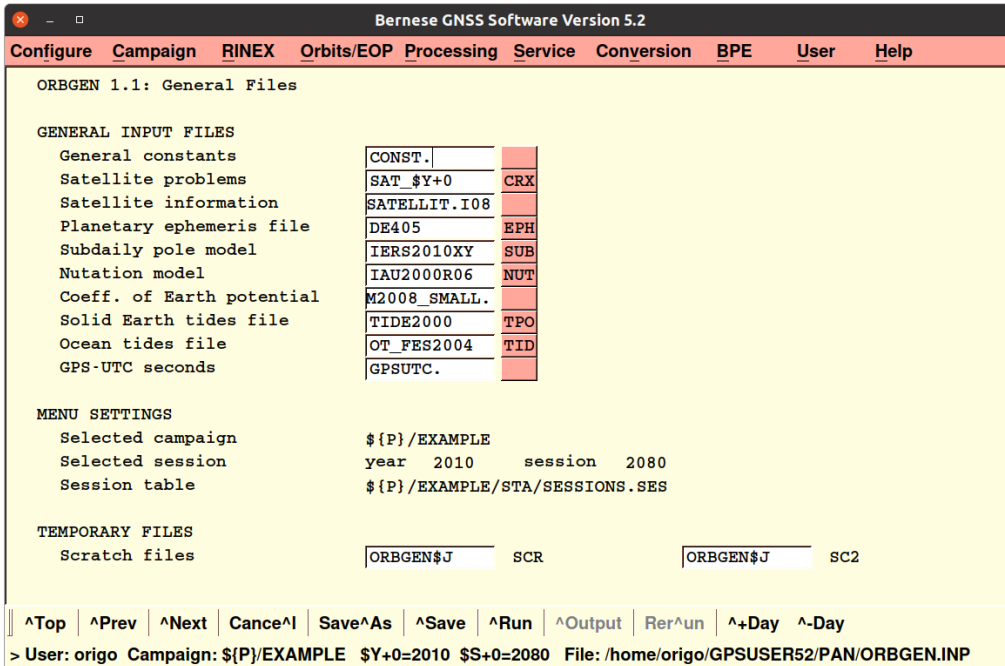
YY year (10)

DDD day of year (208)

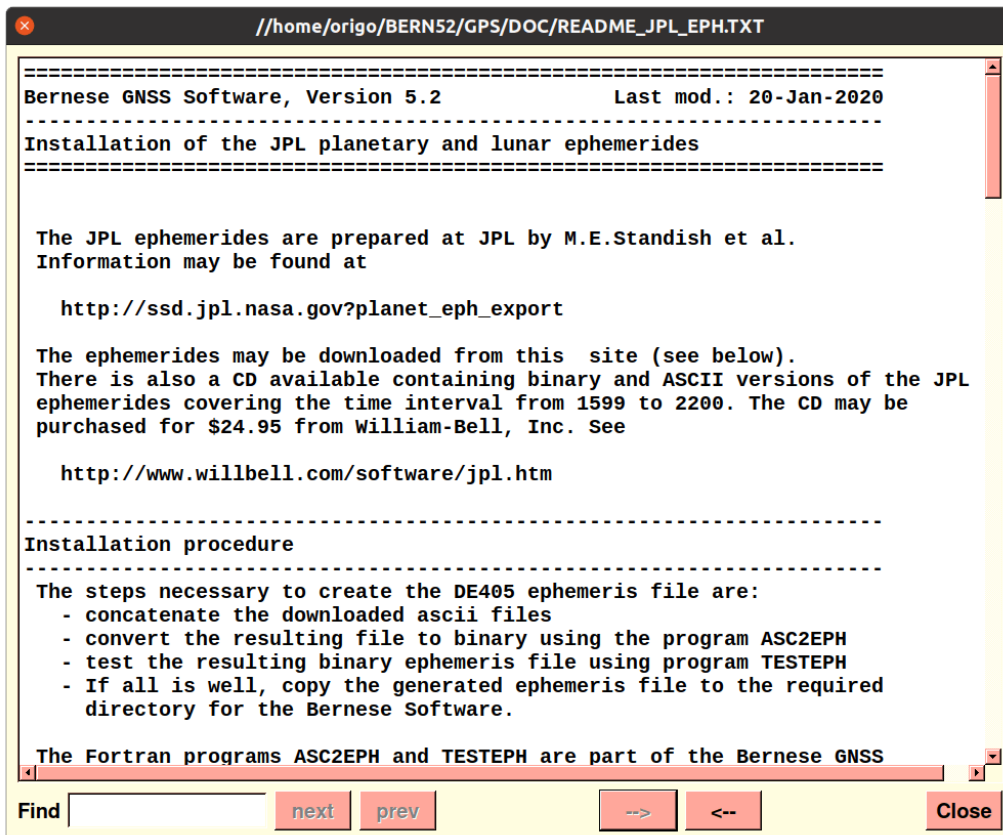


DE405.EPH

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 2: Result and Output Files

RESULT FILES

Standard orbits	COD\$YD+0	STD
Radiation pressure coeff.		RPR
Residual file		RES

OUTPUT FILES

Summary file		LST
Summary file for IGS-ACC	ORB\$YD+0	LST
Plot file of residuals		PLT

GENERAL OUTPUT FILES

Program output	<input checked="" type="checkbox"/>	use ORBGEN.Lnn	or	ORBGEN	OUT
Error messages	<input type="checkbox"/>	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 \$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 3.1: Options

TITLE ORBGEN title

TIME FRAME, POTENTIAL AND TIDAL CORRECTIONS

Time frame	GPS
Earth potential degree	12
Ocean tides max degree	8

Apply CMC correction OTL: ATL:

Apply antenna offset

SYSTEM FOR DYNAMICAL ORBIT PARAMETERS

DYX Sun-oriented (constant + D1, Y1, X1) - old CODE model	e
D2X Sun-oriented (constant + D2, D4, X1) - new CODE model	c
RSW (radial, along-track, cross-track) - LEO + SLR	c
DRSW (Direct, radial, along-track, cross-track) - LEO + SLR	c

^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 3.2: Options

PRINT RESIDUALS

NUMERICAL INTEGRATION
Number of iterations

EQUATION OF MOTION
Polynomial degree
Length of interval (hh mm ss)

VARIATIONAL EQUATIONS
Polynomial degree
Length of interval (hh mm ss)
Additional sets
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)	<input type="checkbox"/>	Periodic D1 terms (cos, sin)	<input checked="" type="checkbox"/>
		Periodic D2 terms (cos, sin)	<input checked="" type="checkbox"/>
		Periodic D4 terms (cos, sin)	<input checked="" type="checkbox"/>
Y0 (y-bias)	<input checked="" type="checkbox"/>	Periodic Y1 terms (cos, sin)	<input checked="" type="checkbox"/>
X0	<input checked="" type="checkbox"/>	Periodic X1 terms (cos, sin)	<input checked="" type="checkbox"/>
R (radial)	<input type="checkbox"/>	Periodic R1 terms (cos, sin)	<input type="checkbox"/>
S (along-track)	<input type="checkbox"/>	Periodic S1 terms (cos, sin)	<input type="checkbox"/>
W (out-of-plane)	<input type="checkbox"/>	Periodic W1 terms (cos, sin)	<input type="checkbox"/>

STOCHASTIC PULSES IN (R, S, W)-DIRECTIONS
Satellite selection
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

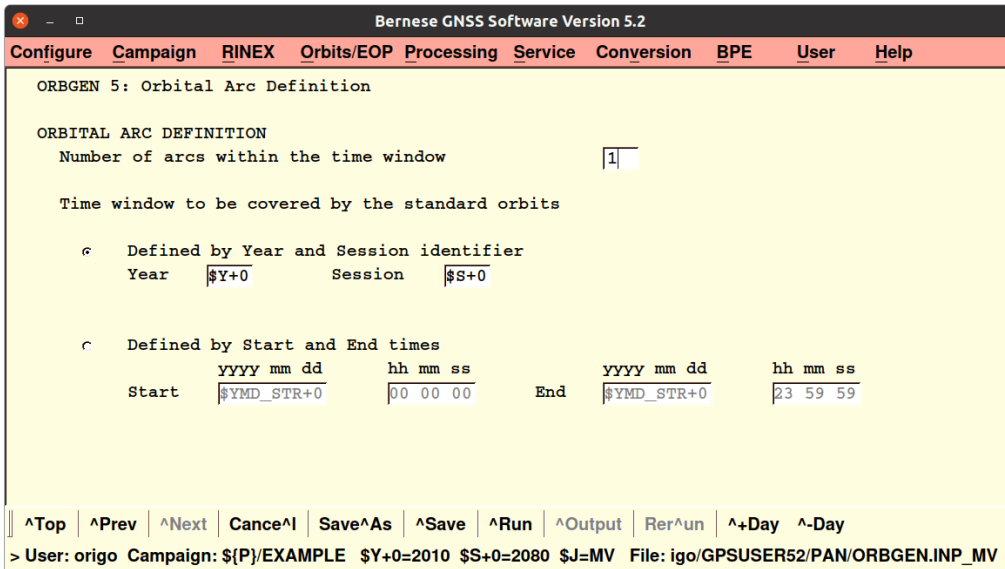
$\$Y+0$ YYYY → 2010

YYYY year (2010)

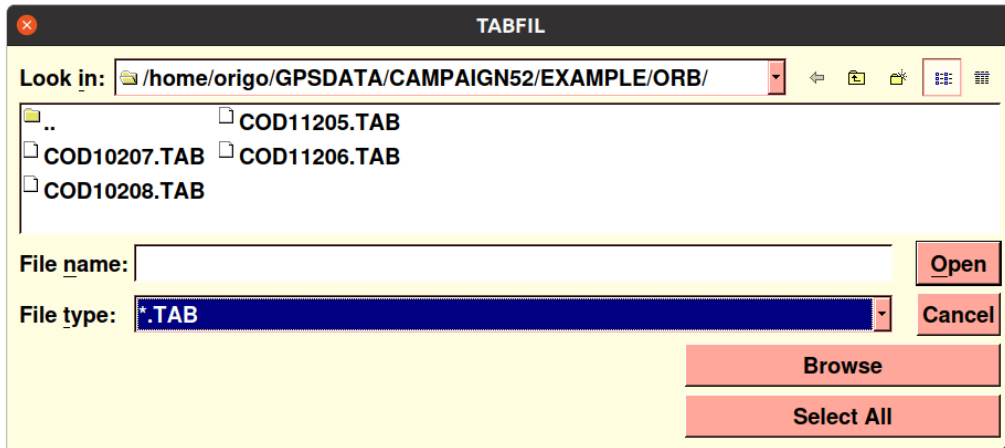
$\$S+0$ DDDS → 2080

DDD day of year (208)

S session character (0)



6.1 Tabular orbit files



7 Import Earth orientation parameters (POLUPD)

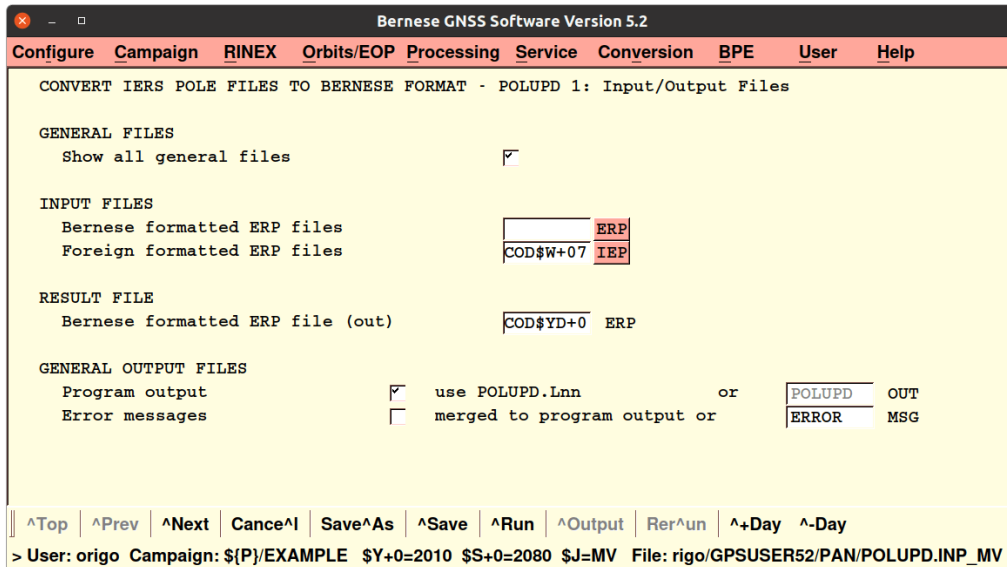
COD\$W+07 CODWWWW7 COD15947^a

WWWW GPS week (1594)

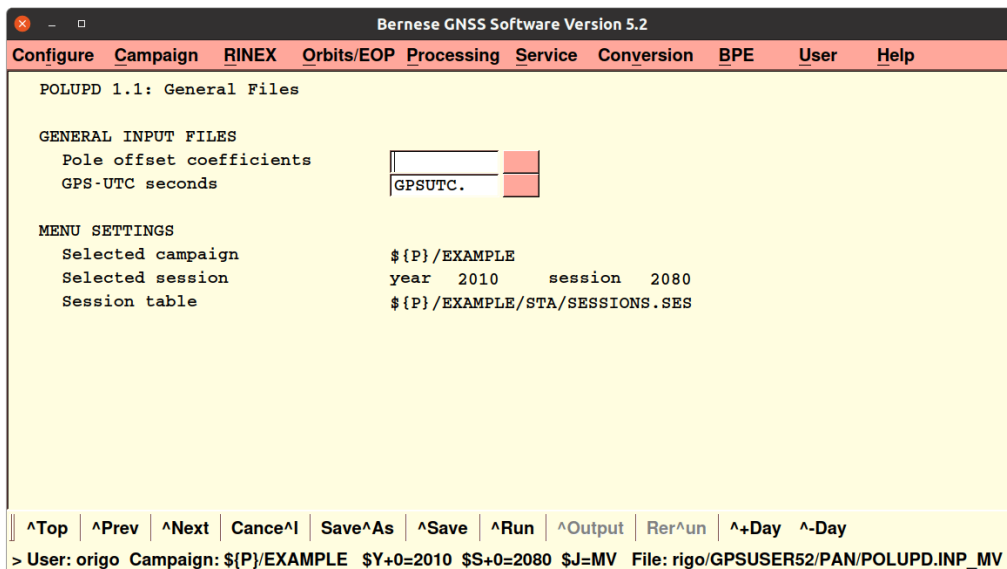
COD\$YD+0 CODYYDDD COD10208

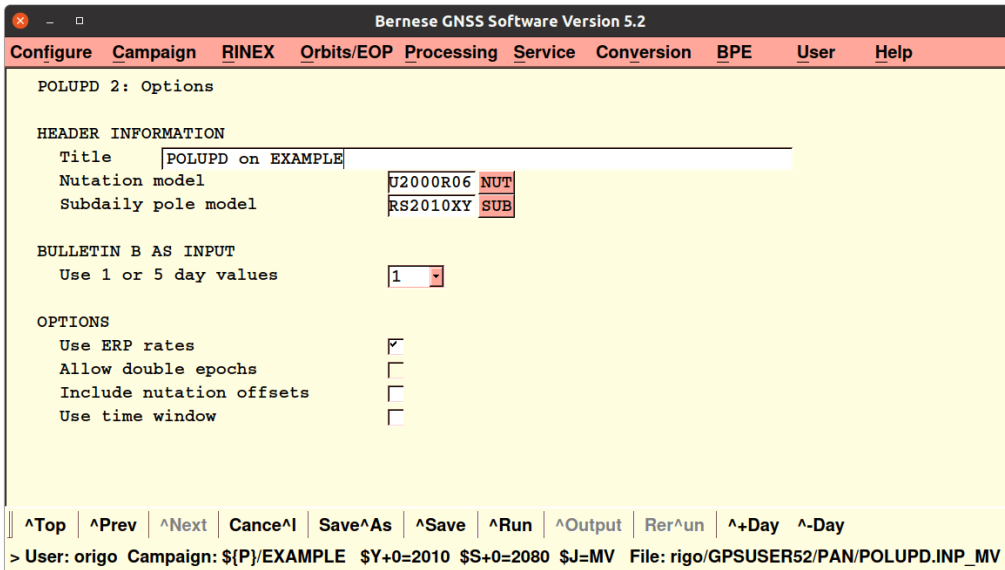
YY year (10)

DDD day of year (208)

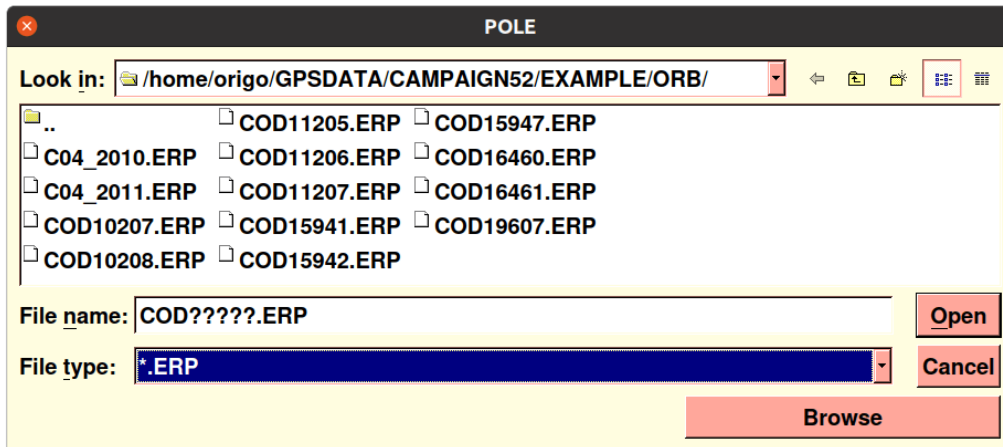


^aWhy the digit 7? Probably because these are *weekly* files giving values for 7+2 epochs, the target GPS week plus one day before and one day after. Data are given for noon each day.





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



8 Code based clock-synchronization (CODSPP)

[http://www.bernese.unibe.ch/faq/#mess101:](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

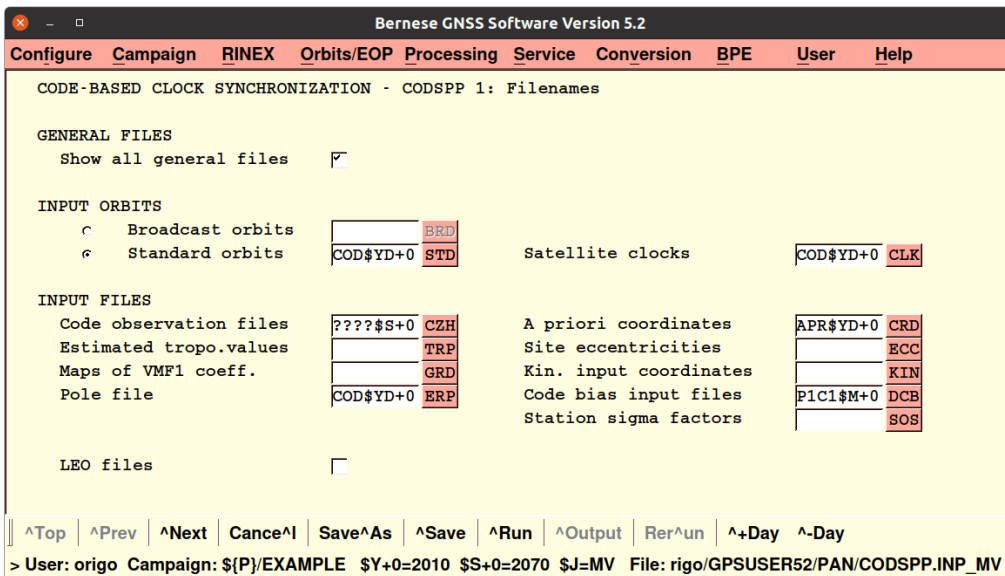
????\$S+0 STATDDDS → STAT2080

???? station name (STAT)

S session character (0)

P1C1\$M+0 P1C1YYMM → P1C11007

MM month (07)



¹The 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 SCR SC1 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	<input type="text"/>	CRD
Kinematic coordinates	<input type="text"/>	KIN
Residual file	<input type="text"/>	RES
Satellite clock results	<input type="text"/>	CLK
Clock RINEX results	<input type="text"/>	CLK
GNSS receiver LC DCB values	<input type="text"/>	DCB

OUTPUT FILES

Output summary (XYZ coord.) SMC
Output summary (Ell.coord.) SME

GENERAL OUTPUT FILES

Program output use CODSPP.Lnn or OUT
Error messages merged to program output or 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

PARAMETERS

Frequency
Clock polynomial degree E: one offset per epoch
Save clock estimates
Estimate coordinates

ATMOSPHERE MODELS

Troposphere
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 degrees

Sampling rate

Interpolation of clocks allowed over 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

OUTLIER DETECTION

Outlier detection

Max. residual allowed meters

Confidence interval (in units of one sigma)

Min. degree of freedom

Max. RMS of kin. solution meters

Mark outliers in obs. files

|| ^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)

Bernese GNSS Software Version 5.2

Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help

CREATE SINGLE-DIFFERENCE/BASELINE FILES - SNGDIF 1: Input File Selection

GENERAL FILES

Show all general files

GENERAL OPTIONS

Measurement type PHASE

Processing strategy OBS-MAX

Stations must contain observ. from GPS

AUTOMATED BASELINE CREATION

Zero-difference observation files ????\$S+0 PZH ????\$S+0 CZH

Reference station for STAR strategy PZH CZH

MANUAL BASELINE CREATION

First zero-difference input file PZH CZH

Second zero-difference input file PZH CZH

Single-difference output file PSH CSH

^Top ^Prev ^Next Cancel 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/SNGDIF.INP_MV

Bernese GNSS Software Version 5.2

Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help

SNGDIF 1.1: General Files

GENERAL INPUT FILES

General constants CONST.

Satellite information SATELLIT.I08

Geodetic datum DATUM.

Abbreviation table ABBREV ABB

MENU SETTINGS

Selected campaign \${P}/EXAMPLE

Selected session year 2010 session 2080

Session table \${P}/EXAMPLE/STA/SESSIONS.SES

^Top ^Prev ^Next Cancel 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/SNGDIF.INP

APR\$YD+0 APRYYDDD APR11206

YY year (11)

DDD day of year (206)

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Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help

SNGDIF 2: Filenames

INPUT FILES

Station coordinates	APR\$YD+0	CRD
Site eccentricities		ECC
Predefined baselines		BSL
Cluster definition		CLU

RESULT FILES

Listing of formed baselines		BSL
Cluster/baseline assignment		CLB (2 digits will be appended)

GENERAL OUTPUT FILES

Program output	<input checked="" type="checkbox"/>	use SNGDIF.Lnn	or	SNGDIF	OUT
Error messages	<input type="checkbox"/>	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/SNGDIF.INP

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Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help

SNGDIF 3: Options

TITLE |title|

SIMULTANEOUS OBSERVATIONS

Tolerance to identify observations of one epoch	1.0	seconds
---	-----	---------

SETTING OF NEW AMBIGUITIES

Merge ambiguities from input files	<input type="checkbox"/>	
After a gap in the observations larger than	20	minutes
If a cycle slip flag in one of the input files	<input type="checkbox"/>	

^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/SNGDIF.INP

Bernese GNSS Software Version 5.2

Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help

SNGDIF 3.1: Options for Strategy OBS-MAX

SPEED UP BASELINE SELECTION ALGORITHM

Minimum number of observations requested	600	(scaled, see help)
Maximum distance for fast observation count	0	kilometers
Maximum baseline length considered	9000	kilometers

ALLOW REDUNDANT BASELINES

Add redundant baselines	<input type="checkbox"/>
-------------------------	--------------------------

ADD BONUS DEPENDING ON BASELINE LENGTH

Maximum bonus for number of observations	10	percent
Direct L1/L2: Baseline length from 0 to	20	kilometers
Wide-/Narrowlane: Baseline length from 0 to	200	kilometers
Other: Baseline length from 0 to	0	kilometers

^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/SNGDIF.INP

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)

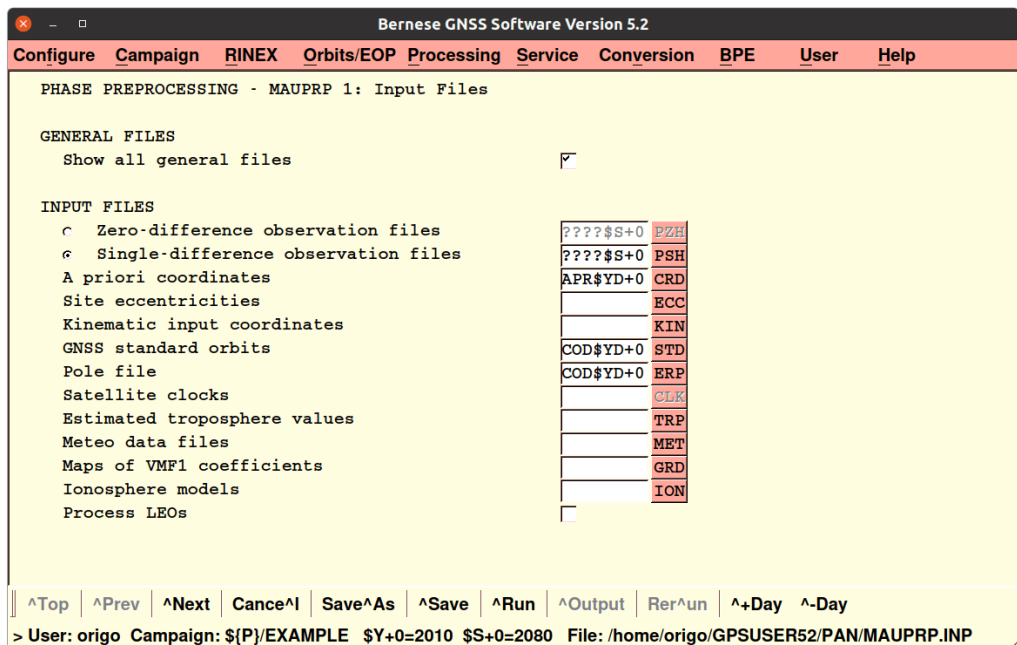
DDD day of year (208)

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 \$\$+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	<input checked="" type="checkbox"/>	use MAUPRP.Lnn	or	MAUPRP	OUT
Error messages	<input type="checkbox"/>	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 \$\$+0=2080 File: /home/origo/GPSUSER52/PAN/MAUPRP.INP

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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

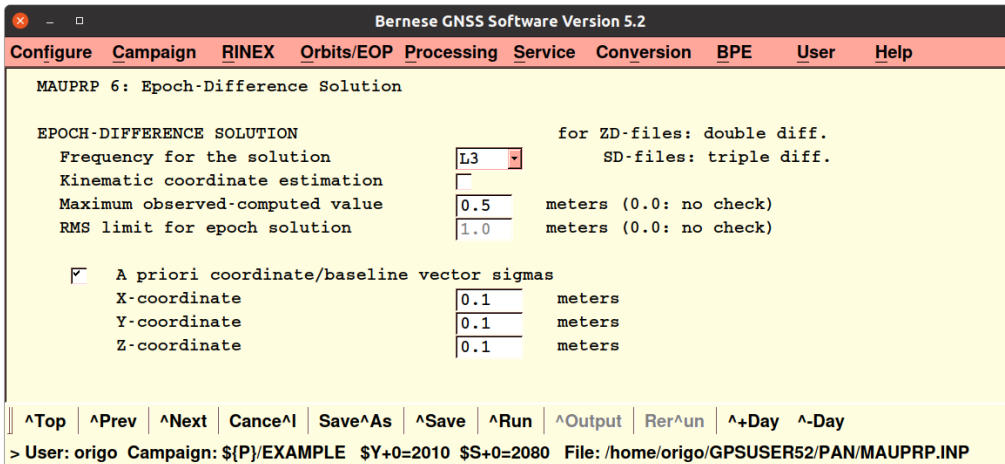
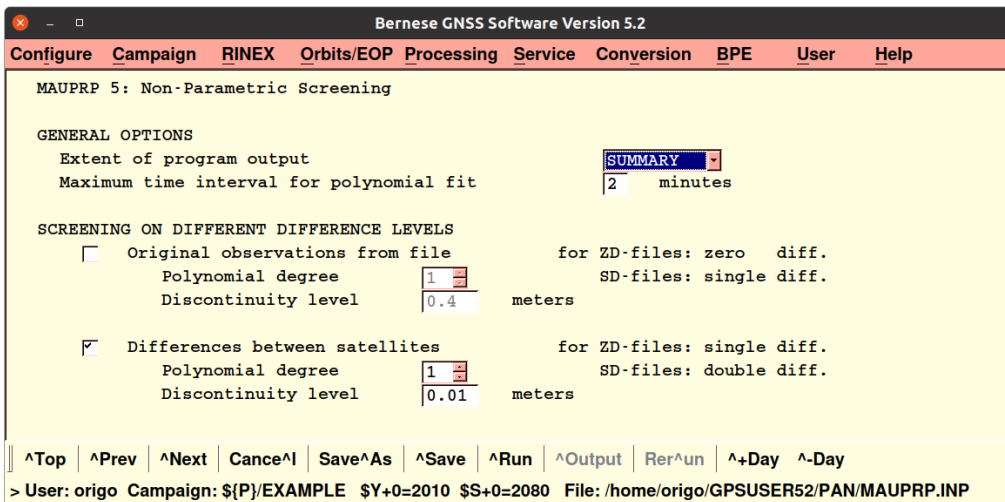
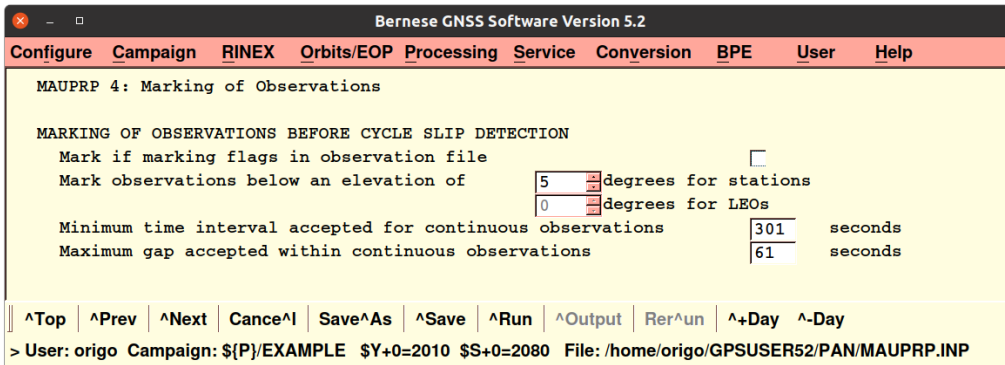
SAVING COORDINATES

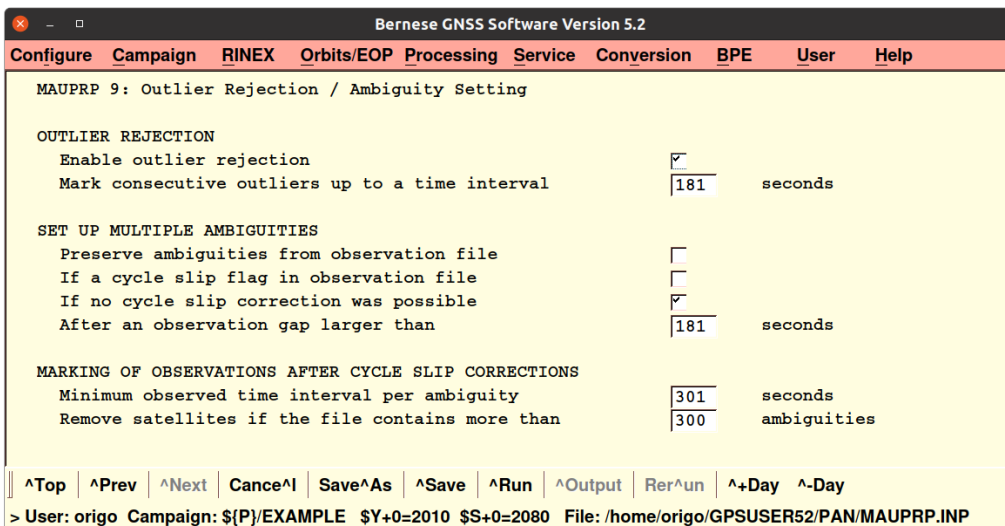
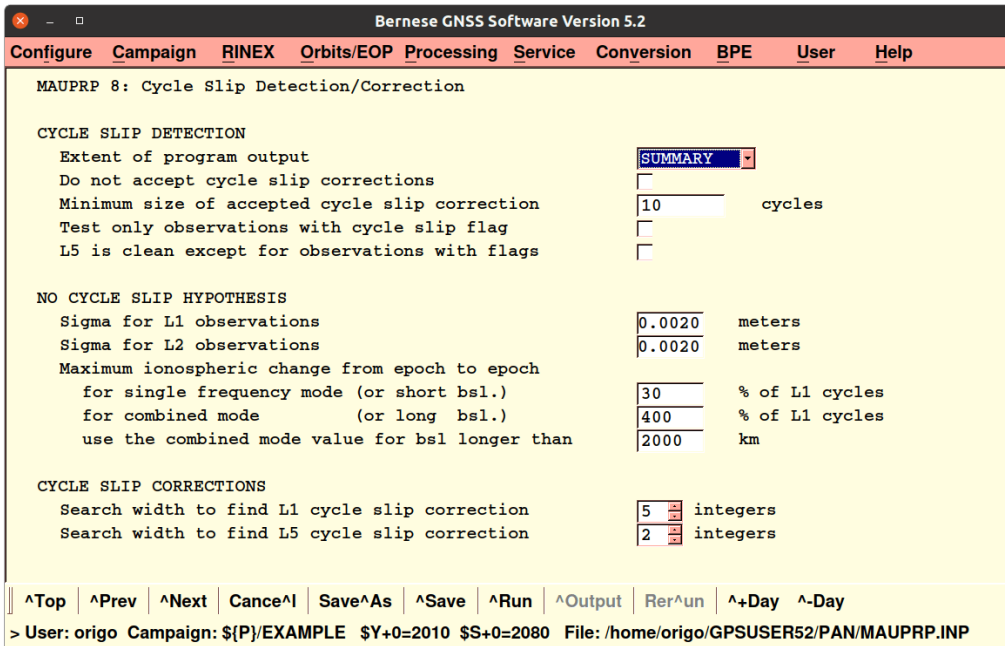
Define the fixed station

(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 \$\$+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)

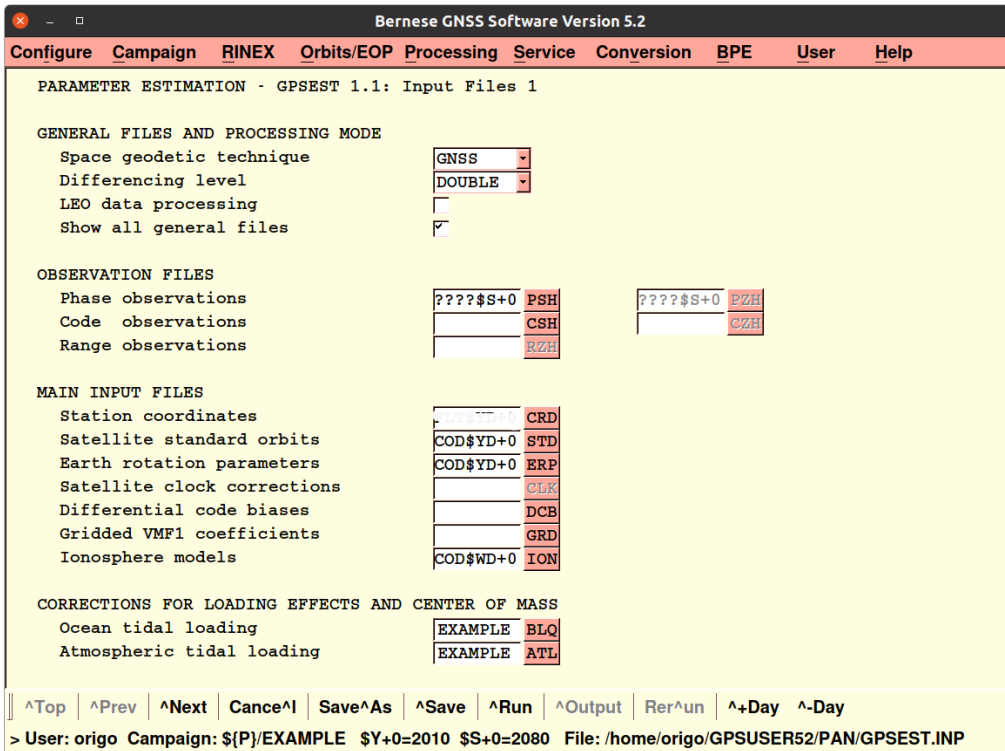
DDD day of year (208)

S session character (0)

FLT\$YD+0 FLTYYDDD FLT10208

YY year (10)

COD\$YD+0 CODYYDDD COD10208



Bernese GNSS Software Version 5.2

Configure Campaign RINEX Orbits/EOP Processing Service Conversion BPE User Help

GPSEST 1.4: General Files

GENERAL INPUT FILES

General constants	CONST.	
Geodetic datum	DATUM.	
Phase center variations	PCV.I08	
Receiver information	RECEIVER.	
Satellite information	SATELLIT.I08	
Satellite problems	SAT_\$Y+0	CRX
Earth potential coefficients	M2008_SMALL.	
Subdaily pole model	IERS2010XY	SUB
Nutation model	IAU2000R06	NUT
SINEX header file	SINEX.	
IONEX control file	IONEX.	
GPS-UTC file	GPSUTC.	
Frequency information		FRO

MENU SETTINGS

Selected campaign \${P}/EXAMPLE
Selected session Year 2010 Session 2080
Session table \${P}/EXAMPLE/STA/SESSIONS.SES

TEMPORARY FILES

Scratch files GPSEST\$J SCR GPSEST\$J SC1 GPSEST\$J SC2

^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day

> User: origo Campaign: \${P}/EXAMPLE \$Y+0=2010 \$\$+0=2080 File: /home/origo/GPSUSERS52/PAN/GPSEST.INP

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 3.1: General Options 1

TITLE title

OBSERVATION SELECTION

Satellite system	GPS/GLO	
Frequency/linear combination	L3	
Elevation cutoff angle	3	degrees
Sampling interval		seconds
Tolerance for simultaneity	100	milliseconds
Special data selection	NO	
Observation window		

OBSERVATION MODELING AND PARAMETER ESTIMATION

A priori sigma of unit weight	0.001	meters
Elevation-dependent weighting	COSZ	
Type of computed residuals	NORMALIZED	
Correlation strategy	BASELINE	

LEO-SPECIFIC SELECTION AND MODELING OPTIONS

Elevation cutoff angle	0	degrees
Elevation-dependent weighting	NONE	

^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day

> User: origo Campaign: \${P}/EXAMPLE \$Y+0=2010 \$\$+0=2080 File: /home/origo/GPSUSERS52/PAN/GPSEST.INP

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
MEENDES-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

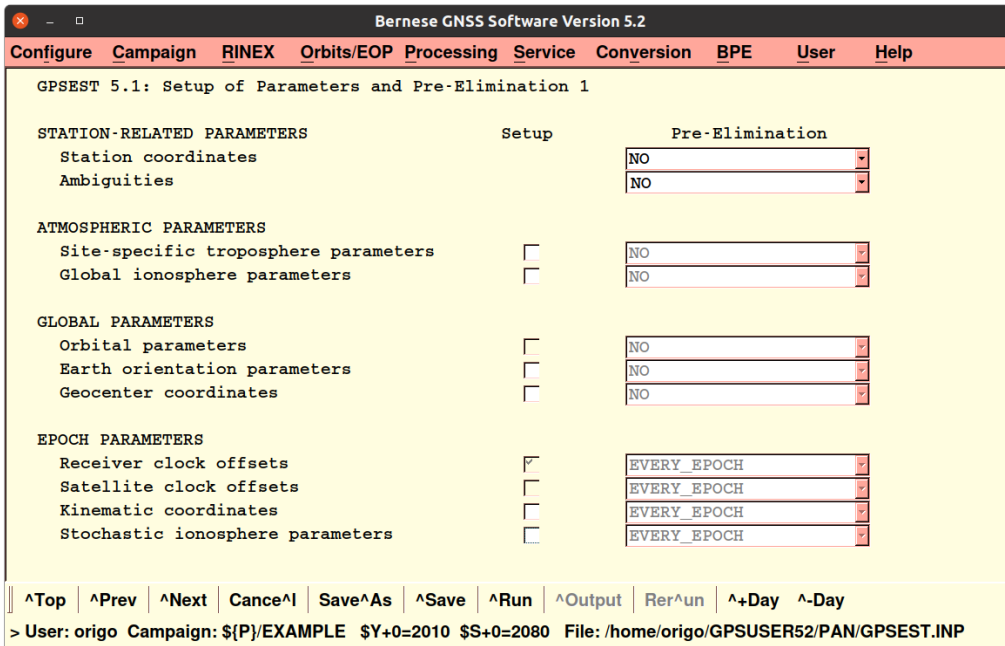
Free network solution
 Coordinates constrained MANUAL
 Coordinates fixed MANUAL

A PRIORI SIGMAS

North 0.0001 meters
East 0.0001 meters
Up 0.001 meters

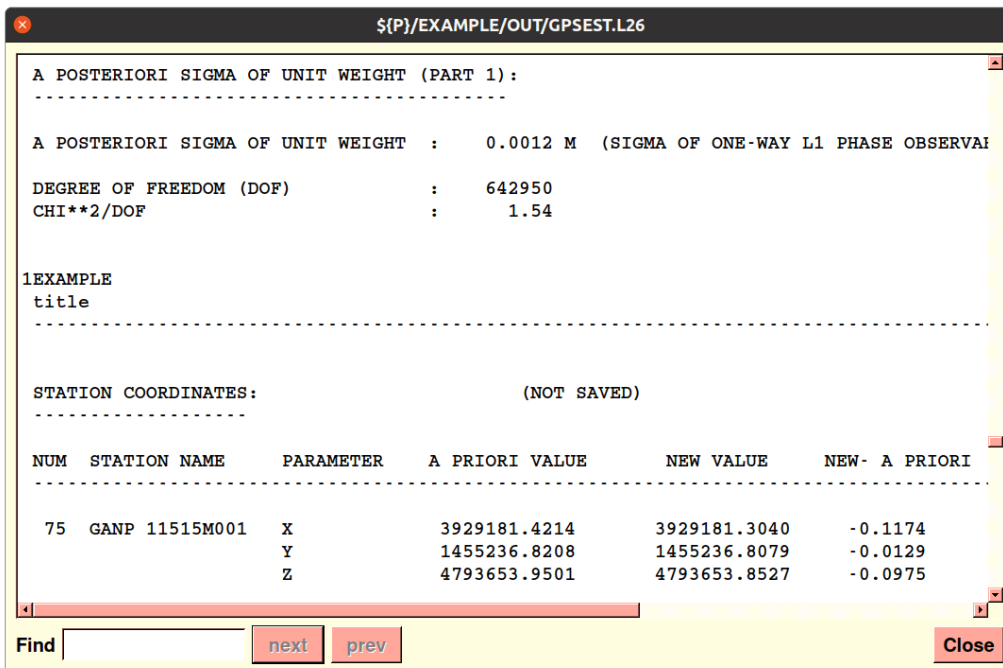
^Top ^Prev ^Next Cance^l Save^As ^Save ^Run ^Output Rer^un ^+Day ^-Day

> 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 $\frac{\chi^2}{\text{DOF}}$ 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.

SITE-SPECIFIC TROPOSPHERE PARAMETERS: (NOT SAVED)

REFERENCE ELEVATION ANGLE OF GRADIENT TERMS : 45.0 DEGREES
 MINIMUM ELEVATION ANGLE : 3.0 DEGREES
 MAPPING FACTOR AT MINIMUM ELEVATION ANGLE : 19.1

REQU.	STATION NAME	CORRECTIONS (M)			RMS ERRORS (M)			ANG
		NORTH	EAST	ZENITH	NORTH	EAST	ZENITH	
1	GANP 11515M001	0.00061	0.00187	0.13441	0.00003	0.00004	0.00057	
2	GANP 11515M001	0.00053	0.00171	0.13302	0.00002	0.00003	0.00039	
3	GANP 11515M001	0.00045	0.00155	0.13854	0.00002	0.00003	0.00034	
4	GANP 11515M001	0.00037	0.00139	0.15232	0.00002	0.00003	0.00035	
5	GANP 11515M001	0.00029	0.00123	0.16631	0.00002	0.00002	0.00034	
6	GANP 11515M001	0.00021	0.00107	0.16658	0.00002	0.00002	0.00031	
7	GANP 11515M001	0.00013	0.00091	0.16863	0.00002	0.00002	0.00030	
8	GANP 11515M001	0.00005	0.00075	0.16816	0.00002	0.00002	0.00036	
9	GANP 11515M001	-0.00003	0.00059	0.16226	0.00002	0.00002	0.00034	
10	GANP 11515M001	-0.00011	0.00043	0.15624	0.00002	0.00003	0.00032	
11	GANP 11515M001	-0.00019	0.00027	0.17003	0.00002	0.00003	0.00038	
12	GANP 11515M001	-0.00027	0.00011	0.16475	0.00003	0.00003	0.00036	
13	GANP 11515M001	-0.00035	-0.00005	0.15662	0.00003	0.00004	0.00053	
14	HERT 13212M010	-0.00053	-0.00194	0.21237	0.00004	0.00005	0.00084	
15	HERT 13212M010	-0.00057	-0.00168	0.20591	0.00004	0.00005	0.00055	
16	HERT 13212M010	-0.00060	-0.00142	0.19330	0.00003	0.00004	0.00046	
17	HERT 13212M010	-0.00064	-0.00116	0.19483	0.00003	0.00004	0.00048	
18	HERT 13212M010	-0.00068	-0.00090	0.22340	0.00003	0.00003	0.00047	

Find next prev Close

12 Parameter estimation (2)

We add a ionosphere model, and produce co-ordinate 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)

PARAMETER ESTIMATION - GPSEST 1.1: Input Files 1

GENERAL FILES AND PROCESSING MODE

Space geodetic technique GNSS

Differencing level DOUBLE

LEO data processing

Show all general files

OBSERVATION FILES

Phase observations ????\$S+0 PSH ????\$S+0 PZH

Code observations CSH CZH

Range observations RZH

MAIN INPUT FILES

Station coordinates APR\$YD+0 CRD

Satellite standard orbits COD\$YD+0 STD

Earth rotation parameters COD\$YD+0 ERP

Satellite clock corrections CLK

Differential code biases P1C1\$M+0 DCB

Gridded VMF1 coefficients GRD

Ionosphere models COD\$WD+0 ION

CORRECTIONS FOR LOADING EFFECTS AND CENTER OF MASS

Ocean tidal loading EXAMPLE BLQ

Atmospheric tidal loading EXAMPLE ATL

^Top | ^Prev | ^Next | Cance^I | Save^As | ^Save | ^Run | ^Output | Rer^un | ^+Day ^-Day

> User: origo Campaign: \${P}/EXAMPLE \$Y+0=2010 \$S+0=2080 File: /home/origo/GPSUSERS52/PAN/GPSEST.INP

Output iono- and troposphere estimates to file.

FLT\$YD+0 FLTYYDDD FLT10208

YY year (10)

DDD day of year (208)

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GPSEST 2.1: Output Files 1

GENERAL OUTPUT FILES

Program output	<input checked="" type="checkbox"/>	use GPSEST.Lnn	or	<input type="text" value="GPSEST"/>	OUT
Error message	<input type="checkbox"/>	merged to program output	or	<input type="text" value="ERROR"/>	MSG

NORMAL EQUATION SYSTEM NQ0

STATION- AND SATELLITE-RELATED RESULTS

Station coordinates	<input type="text" value="FLT\$YD+0"/>	CRD
Satellite orbital elements	<input type="text" value=""/>	ELE
Earth rotation parameters	<input type="text" value=""/>	ERP
Earth rotation parameters (IERS)	<input type="text" value=""/>	IEP

ATMOSPHERE-SPECIFIC RESULTS

Troposphere estimates	<input type="text" value="FLT\$YD+0"/>	TRP
Troposphere estimates (SINEX)	<input type="text" value=""/>	TRO
Ionosphere models	<input type="text" value=""/>	ION
Ionosphere models (IONEX)	<input type="text" value=""/>	INX

^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

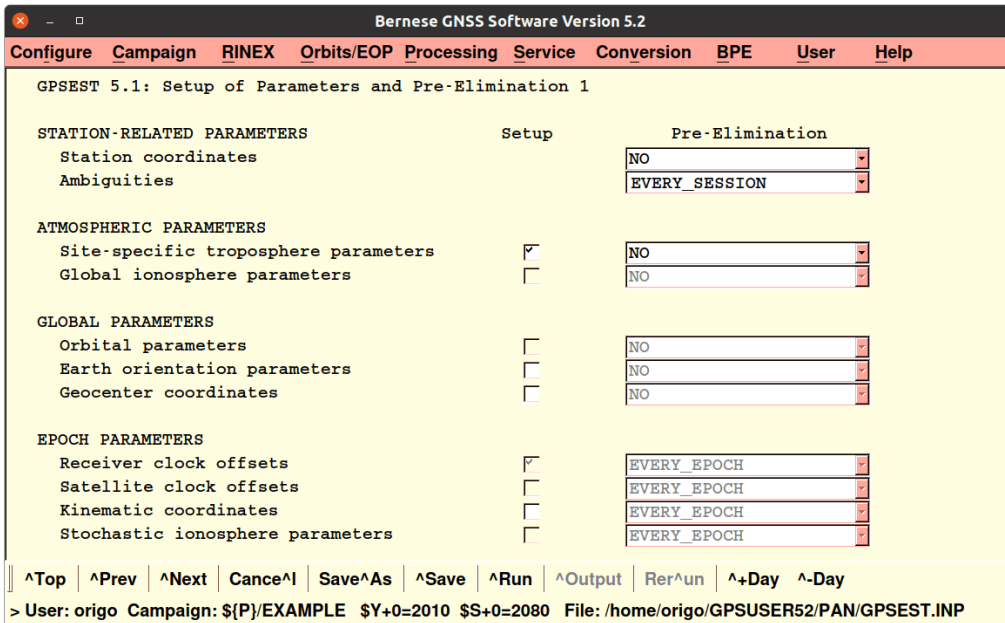
<input type="radio"/> Free network solution	
<input checked="" type="radio"/> Coordinates constrained	<input type="text" value="WITH_FLAG"/>
<input type="radio"/> Coordinates fixed	<input type="text" value="MANUAL"/>

A PRIORI SIGMAS

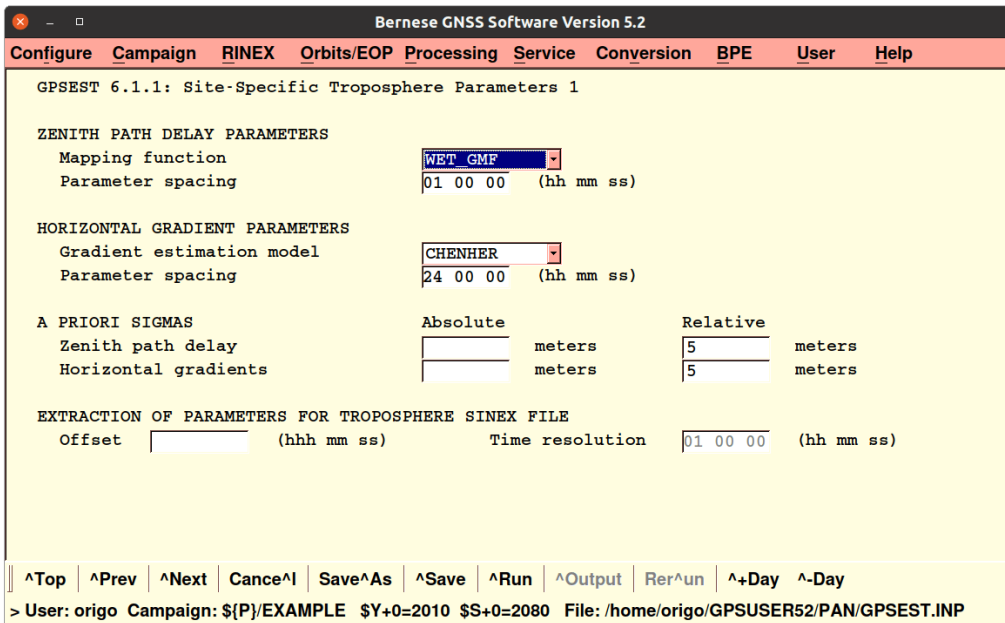
North	<input type="text" value="0.001"/>	meters
East	<input type="text" value="0.001"/>	meters
Up	<input type="text" value="0.001"/>	meters

^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



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 tropospheric parameter files determined earlier: FLT\$YD+0.CRD and FLT\$YD+0.TRP.

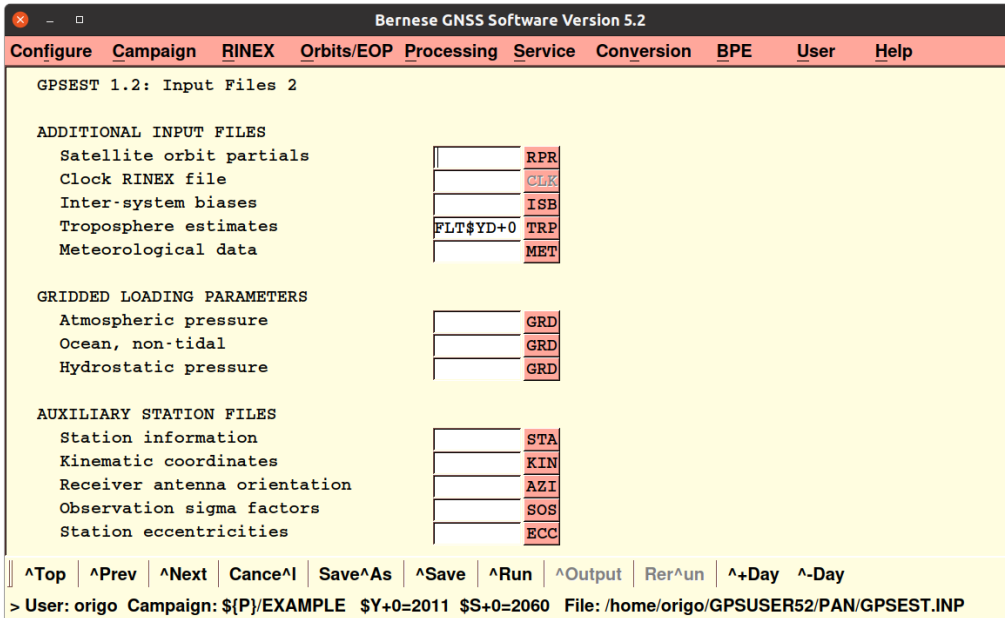
Baselines and network:

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

FLT\$YD+0 FLTYYDDD FLT10208

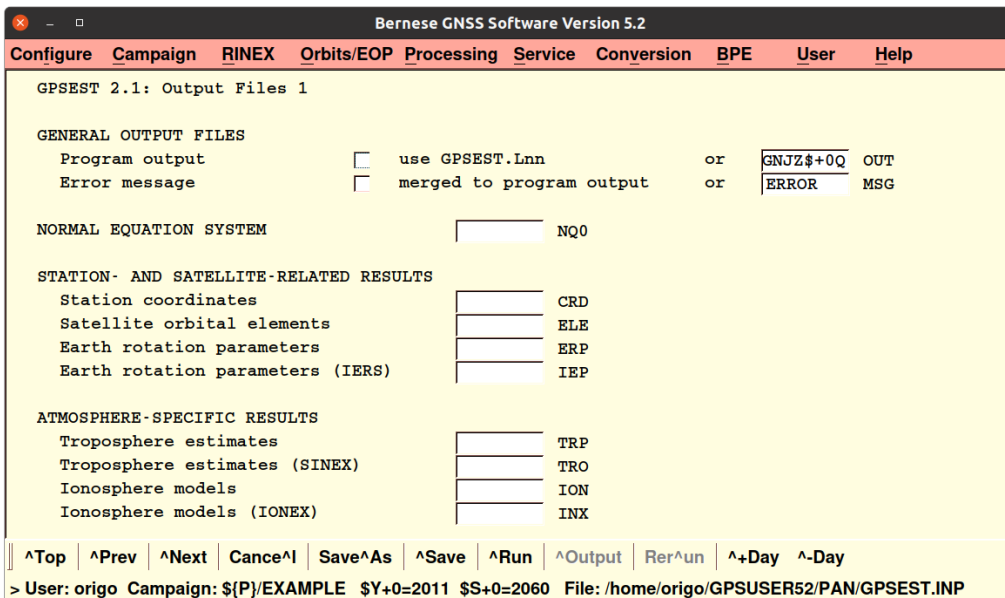
YY year (10)

DDD day of year (208)

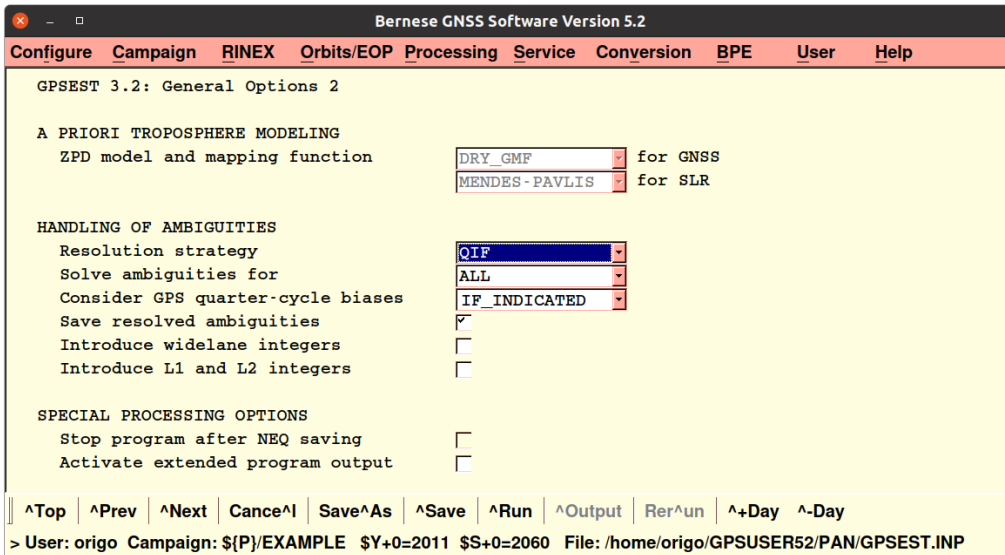
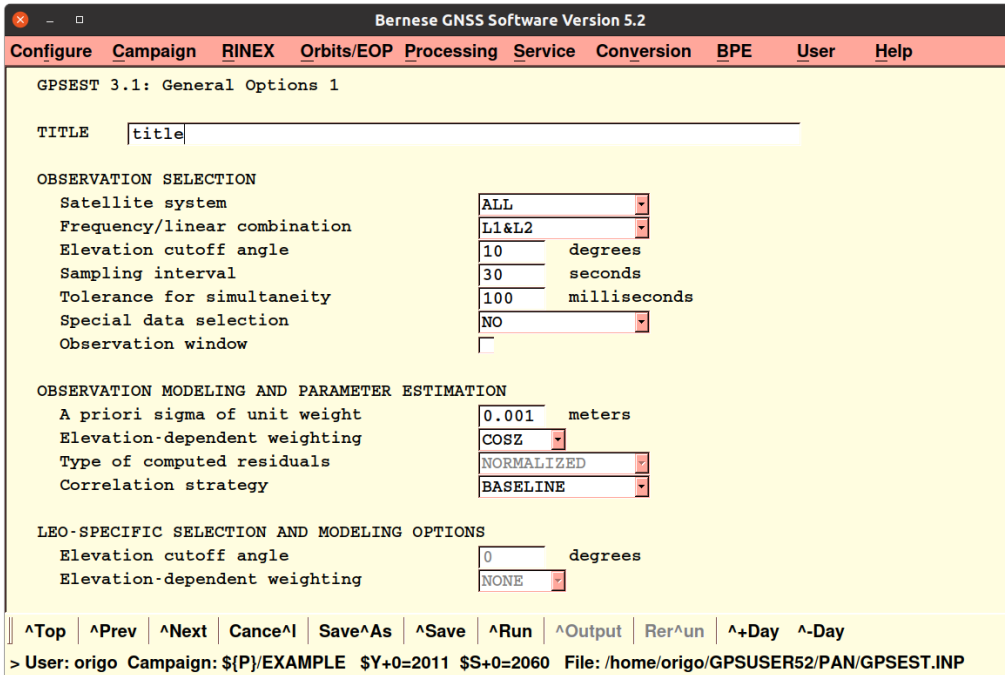


GNJZ\$+0Q GNJZDDDQ → GNJZ206Q

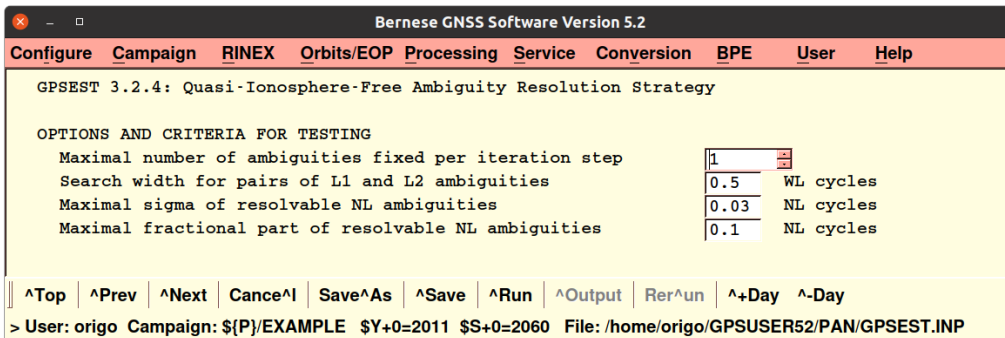
DDD day of year (208)

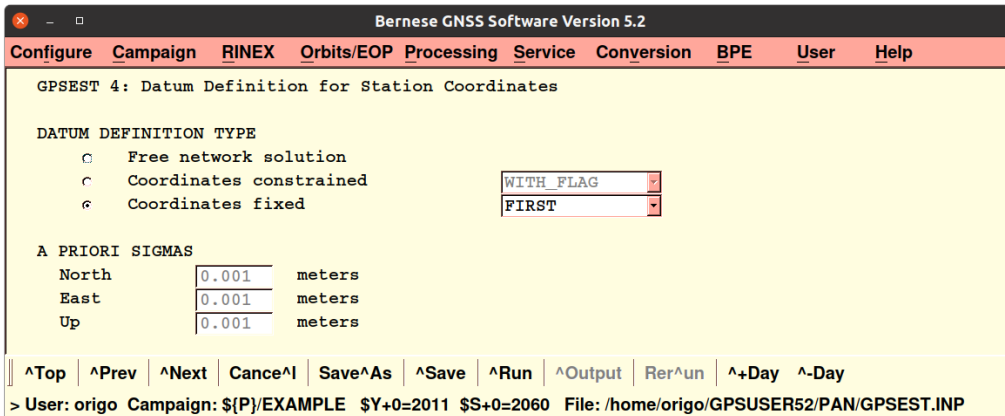


L1&L2 concurrent processing is mandatory for quasi-ionosphere-free ambiguity resolution.

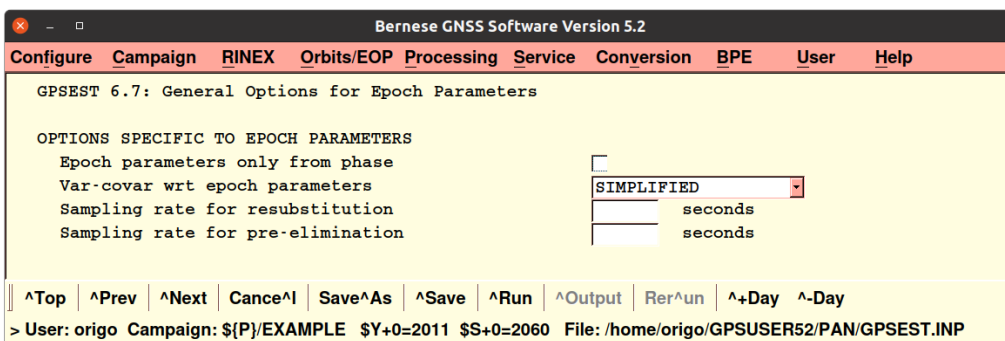
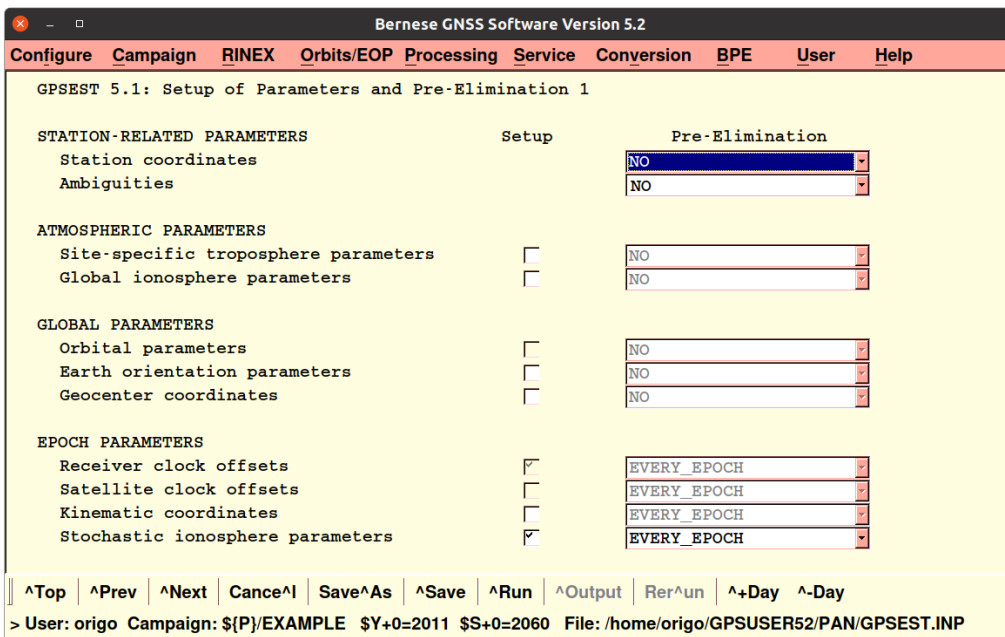


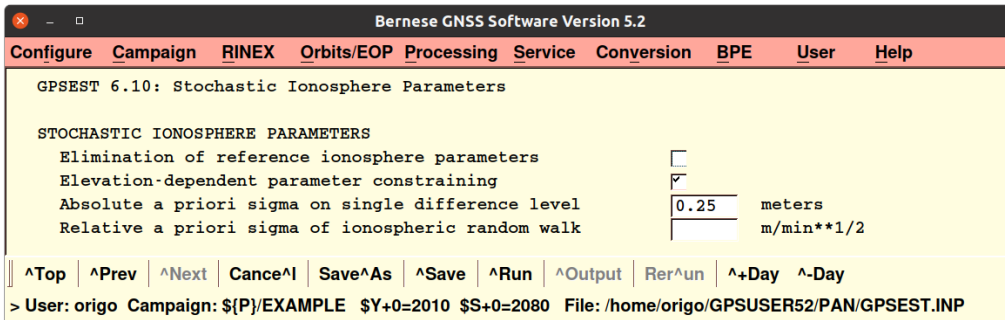
One ambiguity fix per iteration step is necessary when processing GLONASS.





Stochastic ionosphere parameters are mandatory with QIF.

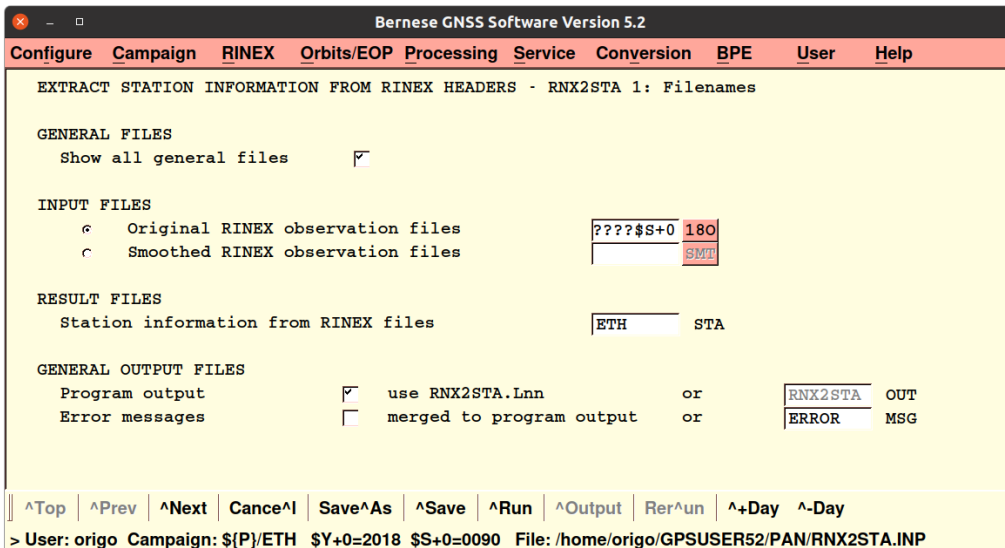


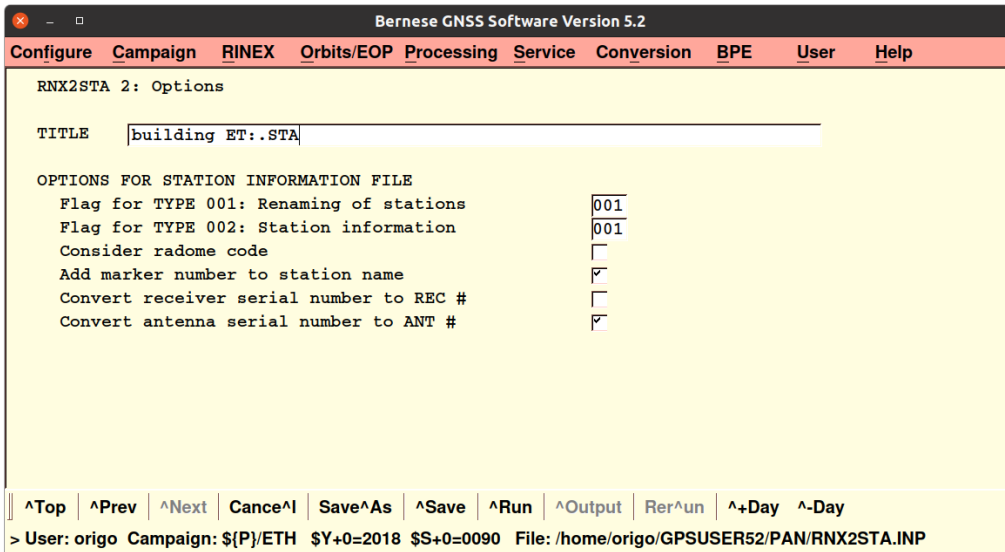


14 The Station Information File etc.

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`.



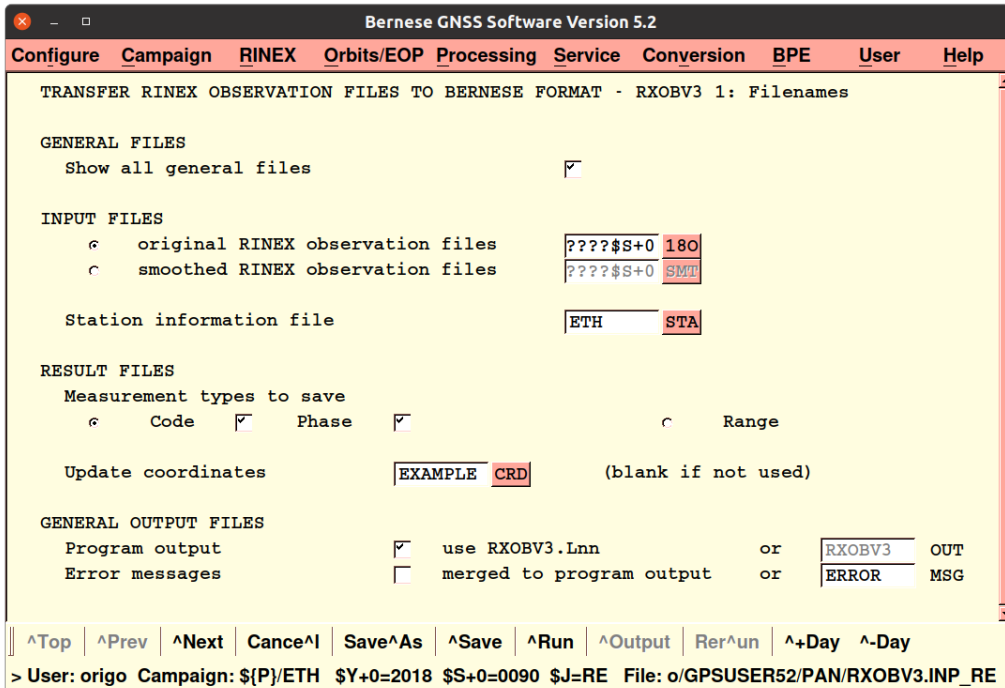


Noteworthy is that in Panel 2, there is the option “Convert antenna serial number to ANT #”. This option should be chosen if the software fails to find the antenna calibration information from the general file PCV.* used, though the information is there.

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.



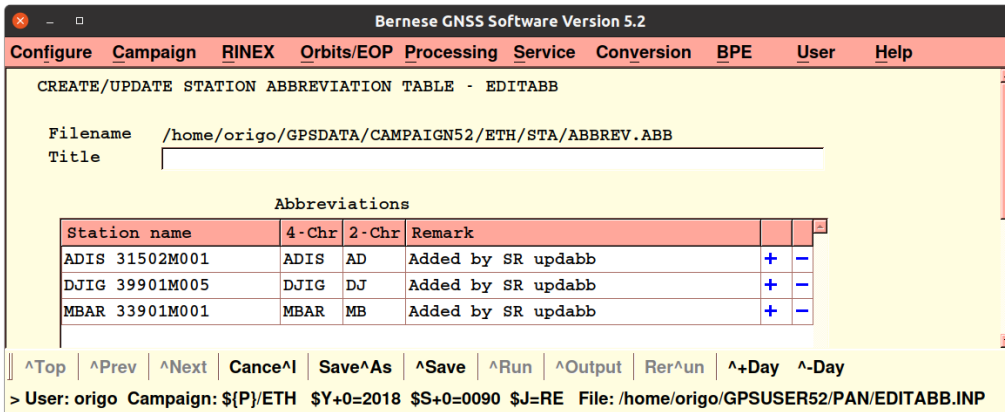


Figure 1: A well-formed station-name abbreviation file.

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

