22. Program Structure

22.1 Introduction

In this chapter we give an overview of the programs of the Bernese GPS Software Version 4.0 . This includes the program structure and a complete list of all GPS programs. We also include the programs which are NOT supported by the menu system.

Furthermore we add remarks concerning programming standards and programming conventions for those users, who for whatever reason would like to (or have to) change the source code.

In Chapter 3 we saw that the *menu system* makes the interaction between the user and the programs much easier. Here we only consider the *GPS main programs*. If there is a menu program available for a specific GPS main program, the name of the menu program may be derived from the (usually 6-character) name of the main program by adding a "`_P`".

22.2 Overview of the Program Structure

The directory structure is given in Figure 22.1.

The root directory `$C` (UNIX) or `C:` (VMS or DOS) of the Bernese GPS Software Version 4.0 may be defined by the user (e.g. `BERN40`). Below we give a short description of the contents of its subdirectories.

`PGM` In the `PGM` directory and its subdirectories all `FORTRAN` sources files of the main programs are stored.

- `MAIN40` contains all important programs dealing with the processing of the GPS observations,
- `MENU40` contains the programs of the menu system, and
- `BPE40` contains all programs necessary for the automated processing.

`LIB` The Library directory contains five subdirectories. The

- `ASTLIB40` directories contain general routines (e.g. inversion routines, transformation routines, astronomical routines), the
- `GPSLIB40` directories contain most of the subroutines called by the `MAIN40` programs, the

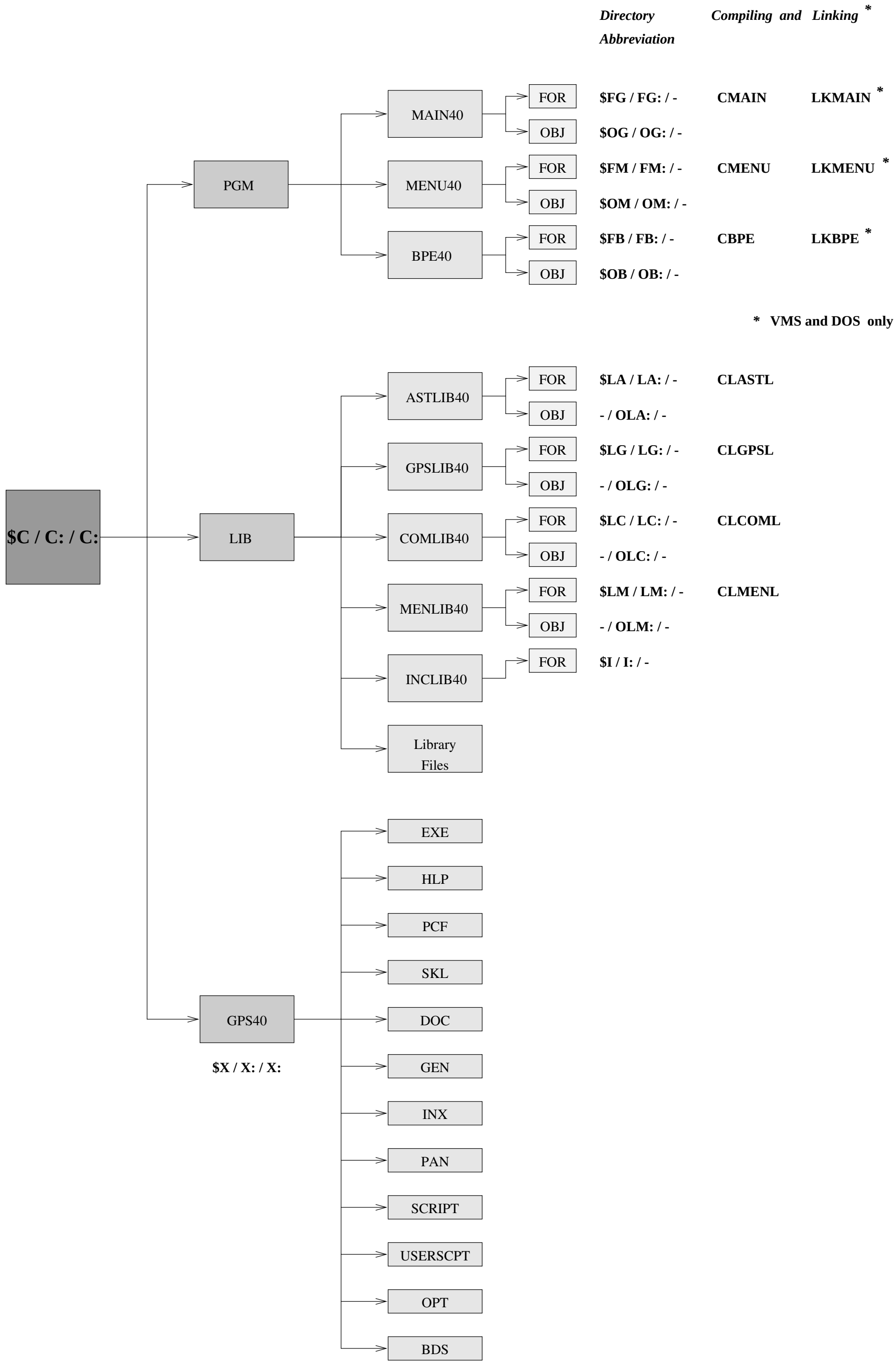

Figure 22.1: Program Structure of the Bernese GPS Software Version 4.0 . The Directory Abbreviations are given for the UNIX System (first entry), the VMS System (second entry), and the DOS System (third entry).

`COMLIB40`	directories contain most of the subroutines which are platform-dependent (DOS: L_*.FOR, UNIX: U_*.f, VMS: VMS_*.FOR). For the UNIX version you also find some `C` routines here. The linking process on some platforms makes it necessary to store some platform-dependent routines also in the `ASTLIB40` and the `MENLIB40` directories. The
`MENLIB40`	directories contain most of the subroutines called by the `MENU40` programs, and the
`INCLIB40`	directories contain the `FORTRAN`include files.

`GPS40` is a directory where different important information is stored. Many of the files in this directory are described in Chapter 23.

`EXE`	contains command files (scripts) to compile and link single routines or to recompile all modules of the software.
`HLP`	contains the HELP panels. HELP panels may be displayed on request as online HELP for each input panel of the menu system.
`PCF`	contains an example of a process control file for the BPE (see Chapter 21).
`SKL`	contains skeleton files needed by the menu system to prepare the input files for the Bernese main programs.
`DOC`	contains the documentation files (in ASCII and in postscript format), such as the installation guide and the entire documentation.
`GEN`	contains important general files (e.g. satellite information files, geodetic datum definition files, the definition of the constants to be used by the Bernese programs, etc).
`INX`	contains the necessary input file examples for the programs of the `MAIN40` directory which are **not** supported by the menu system.
`PAN`	contains the original panels (master copies). On a multi-user system these panels are copied automatically to the corresponding user directories (`$U/PAN / U:[PAN]`) during installation.
`SCRIPT`	contains basic command files which are necessary for the automated processing using the BPE.
`OPT`	contains the panels for the example PCF files in the directory `PCF`. These panels are copied automatically to the corresponding user directories (`$U/OPT / U:[OPT]`).
`USERSCPT`	contains the scripts of the example PCF files in the directory `PCF`. These scripts are copied automatically to the corresponding user directories (`$U/SCRIPT / U:[SCRIPT]`).
`BDS`	contains the original BDS files (*platform-independent* script language, see Chapter 21). The corresponding *platform-dependent* files are given in the directory `SCRIPT`.

Predefined *campaign specific* directories `$P, $Q` (UNIX) or freely definable campaign directories (UNIX, VMS, DOS) are not included in Figure 22.1. The data disk(s) may therefore completely be separated from the disk containing the Bernese programs.

22.3 Summary of the Main GPS Programs

The programs of the Bernese GPS Software Version 4.0 (directory `MAIN40`) may be arranged according to Figure 1.1. This subdivision of the programs may also be found in the structure of the menu system (Menu 0.2).

(1) Transformation part (Menu 2, see Chapter 7)
(2) Orbit part (Menu 3, see Chapter 8)
(3) Processing part (Menu 4, see Chapter 10 - 17)
(4) Simulation part (not supported by the menu system, see Chapter 19)
(5) Service part (Menu 5, see Chapter 20)

The following Table gives an overview and a short description of the individual program units of the five parts of the software.

Name	Menu	Purpose
Transformation part		
TRRINEXO	2.5.1.1	Transform Trimble code/phase data into RINEX data
TRRINEXN	2.5.1.2	Transform Trimble broadcast data into RINEX data
ASRINEXO	2.5.4.1	Transform Ashtech code/phase data into RINEX data
ASRINEXN	2.5.4.2	Transform Ashtech broadcast data into RINEX data
RGRINEXO	2.5.5.1	Transform Rogue code/phase data into RINEX data
RGRINEXN	2.5.5.2	Transform Rogue broadcast data into RINEX data
CCRINEXO	2.5.6.1	Concatenate RINEX observation files
CCRINEXN	2.5.6.2	Concatenate RINEX navigation file
CCPREORB	2.5.6.3	Concatenate precise orbit files
RNXSPLIT	2.5.7	Split multiple-station RINEX observation files
RXMETEO	2.5.9	RINEX meteo file creation
BV3RXO	2.6.1	Transform Bernese code/phase data into RINEX files
BV3RXN	2.6.2	Transform Bernese broadcast data into RINEX files
RXOBV3	2.7.1	Transform RINEX code/phase data into Bernese files
RXNBV3	2.7.2	Transform RINEX broadcast data into Bernese files
RXMBV3	2.7.3	Transform RINEX meteo data into Bernese files
RNXGRA	2.7.4	Pseudo-graphics of RINEX observation files
RNXCYC	2.7.5	Preprocessing on the RINEX level
NGSRXO	-	Transform NGS code/phase data into RINEX files
NGSRXN	-	Transform NGS broadcast data into RINEX files
RXSTATUS	-	Produce a 2-lines summary for RINEX files

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Name	Menu	Purpose
Orbit part		
BRDCHK	3.1.1	Check broadcast files (interactive version)
BRDTST	3.1.2	Check broadcast files (automatic version)
PRETAB	3.2	Transform broadcast or precise orb. into tabular orbits
ORBGEN	3.3	Generate / update standard orbits
STDDIF	3.6	Display differences between two standard orbits
STDPRE	3.7	Produce precise eph. format from standard orbit
SATCLK	3.8	Extract satellite clock information from broadcast messages
DEFO93	3.9.1	Extended orbit model: generate standard orbit
UPDO93	3.9.2	Extended orbit model: update standard orbit
ORBIMP	3.9.3	Extended orbit model: fit orbit using precise orbit information as observations
STDELE	3.9.4	Comparison of osculating elements
ORBCMP	-	Helmert transformation between different precise orbits
STDHLM	-	Helmert transformation between two standard orbits
STDPLT	-	Compute differences between 2 standard orbits and create plot file
Processing part		
CODCHK	4.1	Check code (or code single difference files)
CODSPP	4.2	Single point positioning using code
SNGDIF	4.3	Form single difference obs- and header-files
OBSTST	4.4.1	Check phase single diff. files for cycle slips (old version)
MAUPRP	4.4.2	Manual/automatic phase preprocessing (cycle slips, outliers)
GPSEST	4.5	Parameter estimating program
IONEST	4.7	Estimation of ionosphere models
ADDNEQ	4.8.1	Combination of solution based on normal equations
Simulation part		
GPSSIM	-	Simulation of GPS code/phase observations
Service part		
SATGRA	5.1	Graphical display of observation files
SATMRK	5.1	Mark/reset observation flags
OBSSPL	5.1	Split observation files
CHGHED	5.2	Change header information of observation files
REDISP	5.3.1	Display residual files
RESRMS	5.3.2	Check residuals for outliers
COMPAR	5.4.1	Comparison of several coordinate sets, repeatabilities
HELMER	5.4.2	Helmert transformation between two coordinate files
CRDMRG	5.4.3	Merge coordinate files
POLUPD	5.5.1	Reformat and update pole format

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Name	Menu	Purpose
POLXTR	5.5.2	Compose continuous pole file from a series of pole files
CODXTR	5.6.1	Extraction summary of COMPAR output
DEFXTR	5.6.2	Extraction summary of ORBGEN output
MPRXTR	5.6.3	Extraction summary of MAUPRP output
GPSXTR	5.6.5	Extraction of coordinates, baselines, ambiguities from GPSEST / ADDNEQ output
PREWEI	5.6.7	Change accuracy code of precise orbit files
OBSFMT	5.7.1	Transform binary header- and obs-files into ASCII
FMTOBS	5.7.2	Transform ASCII into binary header- and obs-files
STDFMT	5.7.3	Transform std. orbit and radiation pressure coeff. files into ASCII
FMTSTD	5.7.4	Transform ASCII into std. orbit and radiation pressure coeff. files
NEQFMT	-	Transform binary NEQs into ASCII NEQs and vice versa
SNXNEQ	-	Transform SINEX file (V0.05, V1.00) into Bernese NEQ files
SP3SP1	-	Transform precise SP3 orbit format into SP1 format
SP3SP2	-	Transform precise SP3 orbit format into SP2 format
PHCCNV	-	Transform Antenna phase center corrections into the Bernese format
PRPMET	-	Transform estimated TRP files into meteo input files (MET)
BLHXYZ	-	Transform geographic coordinates into geocentric x-y-z coordinates
COOVEL	-	Propagate coordinates with a given velocity field
AMBCHK	-	Check the solved ambiguities from different resolution strategies
COOSYS	-	Apply Helmert parameters to a coordinate set
NUVELO	-	Compute NUVEL1 or NUVEL1A velocities
WD2PWV	-	Extract PWV values from zenith wet delay values from TRP files

Table 22.1: List of the Bernese GPS Software Version 4.0 Main Programs.

To run programs which are not included in the menu system (symbol - in Table 22.1) you may use the `RUNGPS` command (see Section 3.8). In that case you have to “manually” prepare the input files (so-called N-files, F-files, and I-files).

22.4 Flow Diagrams and Decompositions

In the documentation of the former Versions of the Bernese GPS Software flow diagrams and decompositions were included for each program. This information is of interest for those users wishing to understand the programs in more detail. This information is still available on request. Please contact the Bernese team in order to obtain the decomposition files for a special program (or for all programs).

22.5 Programming Standards and Conventions

All Bernese GPS programs Version 4.0 (in the `MAIN40` directory as well as the menu system programs of the `MENU40` directory) are written in `FORTRAN77`. Those users who would like to make changes in the programs have to look to the following aspects:

(1) maximum dimensions

(2) COMMON declarations

(3) Recompilation of single programs

22.5.1 Maximum Dimensions and Commons

Most of the main programs contain in the declaration part maximum dimensions. Figure 22.2 shows the maximum dimensions for the program COMPAR as an example.

```
C
C MAXIMAL DIMENSIONS
C ------------------
C_BEG_LAHEY
C     PARAMETER (MAXFIL= 50,MAXSTA=200,MAXFLG= 10,MAXLIN= 40,MAXFLD=  1,MAXBSL=2000)
C_END_LAHEY
C_BEG_LINUX
C     PARAMETER (MAXFIL= 50,MAXSTA=200,MAXFLG= 10,MAXLIN= 40,MAXFLD=  1,MAXBSL=2000)
C_END_LINUX
C_BEG_HP_835 + HP_750 + IBM_AIX + SUN_OS
C     PARAMETER (MAXFIL=740,MAXSTA=200,MAXFLG= 10,MAXLIN= 40,MAXFLD=  1,MAXBSL=2000)
C_END_HP_835 + HP_750 + IBM_AIX + SUN_OS
C_BEG_SOLARIS + ULTRIX + SILICON + DEC_OSF1
C     PARAMETER (MAXFIL=740,MAXSTA=200,MAXFLG= 10,MAXLIN= 40,MAXFLD=  1,MAXBSL=2000)
C_END_SOLARIS + ULTRIX + SILICON + DEC_OSF1
C_BEG_VMS
      PARAMETER (MAXFIL=740,MAXSTA=200,MAXFLG= 10,MAXLIN= 40,MAXFLD=  1,MAXBSL=2000)
C_END_VMS
```

Figure 22.2: Maximum Dimension Declaration of the Main Program COMPAR.

Maximum dimensions are defined in a different way for different computer platforms. To increase a specific parameter (e.g. MAXSTA) you may change the corresponding entry (e.g. change MAXSTA=200 to MAXSTA=300). The necessary *recompilation* has to be done according to Section 22.6.

Usually it is enough to change the parameters in the main programs. The values of the maximum dimensions are passed to the subroutines using the FORTRAN COMMON blocks (see Figure 22.3).

```
C
C COMMON BLOCKS
C -------------
      COMMON/MCMFIL/MXCFIL,MXNFIL
      COMMON/MCMSTA/MXCSTA,MXNSTA
C
C INITIALIZE COMMON BLOCKS FOR MAXIMAL DIMENSIONS
C -----------------------------------------------
      MXCFIL=MAXFIL
      MXNFIL='MAXFIL'
      MXCSTA=MAXSTA
      MXNSTA='MAXSTA'
```

Figure 22.3: Common Blocks defined in the Main Program COMPAR.

In some cases the subroutines use *local* variables for *local* maximum dimensions. Therefore it may happen that some subroutines give an error message, if you increased a dimension parameter in a main program. To successfully run the changed program you may then have to correct local dimensions in some subroutines, too. In the next section we explain how to recompile a subroutine.

For a maximum dimension statement occurring in many programs (such as `MAXSTA` or `MAXSAT`) it makes sense to search (using the VMS command `SEARCH` or the UNIX command `grep`) for the corresponding string. That may help to reduce the iterations considerably.

Problems related to the change of a maximum dimension parameter may arise if the computer memory is not sufficient to allow for the increased program size. That may happen, if "memory-critical" parameters are changed such as the parameters `MAXPAR, MAXSAS, MAXFLS, MAXSNG` in program GPSEST, or parameters `MAXPAR, MAXNEQ` in program ADDNEQ. The increased program size may also reduce the program run-time considerably, if the computer system starts swapping in and out parts of the memory.

22.6 Recompilation of Single Programs

Scripts to recompile program units are given in Figure 22.1. To recompile e.g. the subroutine GETSTA in the directory `GPSLIB40` we have to use the command `CLGPSL GETSTA`. To recompile and link e.g. the main program COMPAR in the directory `MAIN40` we enter the command `CMAIN COMPAR`. On the VMS and DOS platforms the link command `LKMAIN COMPAR` has to be used to activate the changes.

Please note, that many routines are called from different places. An inexperienced (with the Bernese programs) user, who wants to change a routine, should therefore use the mentioned `SEARCH` or `grep` commands to find out which programs are affected.
Scripts for a recompilation of all modules software are given in the installation guide (see Chapter 24).

23. Data Structure

23.1 Introduction

This chapter gives an introduction into the data structure of the Bernese GPS Software Version 4.0 . This includes a detailed description of the data files and formats used in the software. We start with general input files used by most of the programs and conclude with a variety of output files.

23.2 Overview of the Data Structure

There are four major categories of files:

(1) *general files*
(2) *campaign-specific files*
(3) *user-specific files*
(4) *temporary files*

These four categories are illustrated in Figure 23.1.

General files and skeleton files (master copies) are stored in the *program-specific directories*. We have a closer look at these general files in Section 23.4. An overview of the other directories of this category (USERSCPT, etc.) was given in the previous Chapter (see Section 22.2).
There is a close connection between the files in some of the program-specific directories, in the user-specific directories and the temporary directories: The SKL files are the skeleton files used by the menu programs for the generation of the INP files (program input files) in both, the user-specific (manual processing) and the temporary area (automated processing using the BPE). The directories OPT, PAN, PCF, and USERSCPT contain master copies of panel options and script files. The content of these directories is copied to the user-specific directories OPT, PAN, PCF and SCRIPT when creating the user area. With the exception of the directory GEN most of the data files belonging to the program area are of technical nature (e.g. the I-, N-, F-, and T- files, see Section 23.9 or Chapter 3). We therefore do not put much emphasis on these files, here.

All *campaign-specific files* are stored in the campaign directories ATM, DATPAN, OBS, ORB, ORX, OUT, RAW, and STA. A detailed overview of the content of important files in these subdirectories is given in the next sections of this chapter. The names of the subdirectories are not fixed. They might be changed using the menu system (Menu 0). This is not recommended, however. More information may be found in the Chapters 3 and 5.

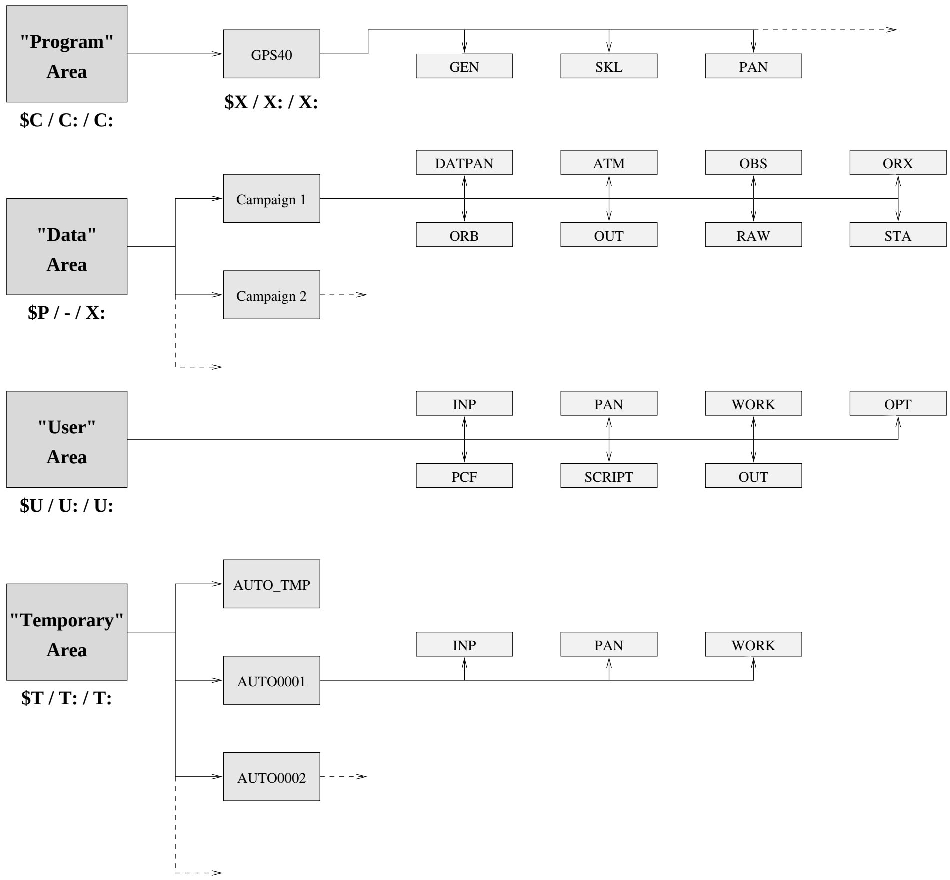

Figure 23.1: Data Structure of the Bernese GPS Software Version 4.0 . The Directory Abbreviations are given for the UNIX System (first entry), the VMS System (second entry), and the DOS System (third entry). The Data Area Abbreviations have to be defined on all Systems (e.g. in the `LOADGPS` Script) and are in principle arbitrary. All "Program Area" Subdirectories are shown in Figure 22.1.

User-specific data directories are used for the manual processing mode. Most of the directories contain, as mentioned, copies from the master files of the program directories: `INP` (from INX or SKL) or the directories `OPT, PAN, PCF, SCRIPT` stemming from the directories with the same names in the "program area" (Exception: Files in the user directory `SCRIPT` stem from the master directory `USERSCPT` and not `SCRIPT`; see also Chapter 22). The directory `WORK` is used in the manual processing mode for temporary copies of files or for scratch files. The directories `SCRIPT` and `PCF` are used for the BPE, only.

Temporary files are important when processing with the BPE (see Chapter 21). The files of this group are, in principle, nothing else than local copies for the automated processing with the BPE.

23.3 Overview of the Data Files

The file types involved in the Bernese GPS Software Version 4.0 are summarized in this first section. In the following sections we will explain the content of the files in more detail. We concentrate on some specific directories: The *General files* of the program-specific area and all important files of the *campaign-specific* area.

We may also divide the file types according to Menu 0.3 into the following groups (see Chapter 5).

`GENERAL`	General files: Menu 0.3.1 (*general data* files stored in the *program-specific* directory `GEN`).
`OBSERVATIONS`	Observation files: Menu 0.3.2 (raw data, RINEX data, Bernese observation files). Stored in the campaign-specific directory `OBS`.
`ORBIT`	Orbit files: Menu 0.3.3 Stored in the campaign-specific directory `ORB`.
`MISCELLANEOUS`	Miscellaneous files: Menu 0.3.4 Stored in the campaign-specific directories `STA, ATM, ORB`, and `OUT`.
`BPE`	BPE files: Menu 0.3.5 (usually stored in the user area, master files also available in the program-specific directories).

Table 23.1 summarizes the data files, ordered according to the directory structure (and not according to the menu items), and gives a short description for each file type.

Menu	Example file	Ext.	Refer.	Purpose
`GENERAL` **files:** directory `$X/GEN`				
0.3.1	`CONST.`	-	23.4.1	All physical constants used in the program system
0.3.1	`DATUM.`	-	23.4.2	Geodetic datum information
0.3.1	`RECEIVER.`	-	23.4.3	Receiver characterization file
0.3.1	`...`	`TRN`	23.4.4	Receiver/antenna name translation table
0.3.1	`PHAS_IGS.01`	-	23.4.5	Antenna phase center eccentricities
0.3.1	`GEMT3.`	-	23.4.6	Earth potential coefficients
0.3.1	`C04_1996.ERP`	-	23.4.7	Pole coordinates, UT1-UTC, UTC-GPS
0.3.1	`POLOFF.`	-	23.4.8	Pole offsets of the combined C04 pole series
0.3.1	`SINEX.`	-	23.4.9	General information file to be included in SINEX output files
0.3.1	`SATELLIT.TTT`	-	23.4.10	Satellite information file
0.3.1	`SAT_1996.CRX`	-	23.4.11	Satellite problem file

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Menu	Example file	Ext.	Refer.	Purpose
0.3.1	STACRUX.	-	23.4.12	Station problem file
RINEX files: directory RAW				
RINEX file names and extension in transfer programs selectable				
should follow the RINEX convention (see Section 23.5)				
-	...	...	23.5	NGS code/phase observation files
-	...	...	23.5	NGS broadcast messages
-	...	...	23.5	RINEX observations
-	...	...	23.5	RINEX broadcast messages
-	...	...	23.5	RINEX meteo data
OBSERVATIONS: directory OBS				
0.3.2	...	CZH	23.6	Header file for code observations
0.3.2	...	CZO	23.6	Code observations
0.3.2	...	PZH	23.6	Header file for phase observations
0.3.2	...	PZO	23.6	Phase observations
0.3.2	...	CSH	23.6	Header file for code single difference observations
0.3.2	...	CSO	23.6	Code single difference observations
0.3.2	...	PSH	23.6	Header file for phase single difference observations
0.3.2	...	PSO	23.6	Phase single difference observations
0.3.2	...	FCH	23.6	ASCII image of a header and observation file (code, zero- or single differences)
0.3.2	...	FPO	23.6	ASCII image of a header and observation file (phase, zero- or single differences)
ORBIT **files**: directory ORB				
0.3.3	...	BRD	23.7.1	Satellite broadcast messages
0.3.3	...	PRE	23.7.2	Precise ephemeris in SP1, SP2, or SP3 format
0.3.3	...	TAB	23.7.3	Tabular orbits
0.3.3	...	STD	23.7.4	Standard orbits (Bernese orbit representation)
0.3.3	...	RPR	23.7.5	Radiation pressure coefficient file
0.3.3	...	ELE	23.7.6	Improved orbit parameters (result of an orbit determination)
0.3.3	...	FSO	23.7.4	ASCII image of a standard orbit file
0.3.3	...	FRP	23.7.5	ASCII image of a radiation pressure coefficient file
MISCELLANEOUS **files:**				
a) station related files: directory STA				
0.3.4	...	CRD	23.8.1	Station coordinates (geocentric)

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Menu	Example file	Ext.	Refer.	Purpose
0.3.4	...	ECC	23.8.2	Station eccentricity elements
0.3.4	...	VEL	23.8.3	Station velocities
0.3.4	...	STN	23.8.4	Station name translation table
0.3.4	...	HTR	23.8.24	Antenna height translation table
0.3.4	...	BSL	23.8.25	Baseline definitions
0.3.4	...	CLU	23.8.26	Cluster definitions input
0.3.4	...	CLB	23.8.27	Cluster definitions output
0.3.4	...	FIX	23.8.28	Special fixed station file
0.3.4	...	FTP	23.8.29	Special station ftp file
0.3.4	...	SIG	23.8.30	Special troposphere file
b) Atmosphere related files: directory ATM				
0.3.4	...	MET	23.8.18	Meteo or water vapor radiometer data
0.3.4	...	TRP	23.8.19	Troposphere parameter estimates
0.3.4	...	ION	23.8.20	Ionosphere models
0.3.4	...	INX	23.8.21	Ionosphere maps
c) Orbit related files: directory ORB				
0.3.4	...	CLK	23.8.22	Satellite clocks
0.3.4	...	CLK	23.8.23	Receiver clocks
d) Output files: directory OUT				
0.3.4	...	COV	23.8.5	Covariances (of coordinates or of all parameters)
0.3.4	...	RES	23.8.6	Residuals
0.3.4	...	OUT	23.8.7	Program output
0.3.4	...	NEQ	23.8.8	Normal equations
0.3.4	...	LST	23.8.9	Output listing files
0.3.4	...	PLT	23.8.10	Plot files
0.3.4	...	ERP	23.4.7	Earth rotation parameters (Bernese)
0.3.4	...	IEP	23.8.11	IERS format of Earth rotation parameters
0.3.4	...	SNX	23.8.12	SINEX format (coordinates and velocities)
0.3.4	...	WGT	23.8.13	Covariance components, NEQ-scaling file
0.3.4	...	EDT	23.8.14	Observation editing file
0.3.4	...	DEL	23.8.15	List of files to be deleted
0.3.4	...	SUM	23.8.16	Summary output file
0.3.4	...	SMC	23.8.17	CODSPP output summary
0.3.4	...	SME	23.8.17	CODSPP output summary

Program related files: directory INP or/and SKL				
0.3.1	......N.	INP*	23.9	Table to access general file names
0.3.1	......F.	INP*	23.9	File containing list of input file names
				continued on next page

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Menu	Example file	Ext.	Refer.	Purpose
0.3.1	......M.	INP*	23.9	File containing list of meteo file names (GPSEST only)
0.3.1	......I.	INP*	23.9	Program options
0.3.1	......T.	SKL	23.9	Text file

* Master copies (skeletons) in directory `$X/SKL` with extension `SKL`

Table 23.1: List of the Bernese GPS Software Version 4.0 Data Files. The Directory Names are those of the UNIX Version. "..." stands for File Names or File Extensions chosen by the User.

Examples for all file types presented in the next sections are available on-line in the directory `$X/INX` (UNIX) / `X:[INX]` (VMS) / `X:\INX` (DOS) usually with the name `EXAMPLE.ext` (ext is the default extension).

23.4 General Files

The *general files* are important files for the processing part. They are independent from the user and also independent from the campaign processed. The files belonging to this group are stored in the directory `GEN` of the Bernese GPS Software Version 4.0 .

23.4.1 Constant File

Type : ASCII

Directory : `$X/GEN` (UNIX) / `X:[GEN]` (VMS) / `X:\GEN` (DOS)

Content : All physical constants used in the program system.

Created by : User-defined.

Used by : Most of the programs.

Example : Figure 23.2. Also available in the distribution.

Further Information :

- The constants refer to the WGS-84 system of constants. Exception is GM, where the value from Laser ranging is used.
- The constant file is read at the beginning of a program and the values are put into the `FORTRAN COMMON/CONST/` (Include file).
- The values for `WGTPHA` and `WGTCOD` are suited to specify the relative weights between phase and pseudo-code observations (if you use both observation types simultaneously in the parameter estimation program GPSEST).
- `HREF, PREF, TREF`, and `HUMREF` are used for the definition of the a priori troposphere models (option `EXTRAPOLATION` in GPSEST).
- The major constants contained in this file should **not** be changed by the user.

```
GENERAL CONSTANTS FOR BERNESE GPS SOFTWARE VERSION 4.0
------------------------------------------------------

C      = 299792458.D0     VELOCITY OF LIGHT                M/SEC
FREQ1  = 1575420000.D0    L1-CARRIER FREQUENCY             1/SEC
FREQ2  = 1227600000.D0    L2-CARRIER FREQUENCY             1/SEC
FREQP  =   10230000.D0    P-CODE     FREQUENCY             1/SEC
GM     = 398.6004415D12   GRAVITY CONSTANT*EARTH MASS      M**3/SEC**2
GMS    = 1.3271250D20     GRAVITY CONSTANT*SOLAR MASS      M**3/SEC**2
GMM    = 4.9027890D12     GRAVITY CONSTANT*LUNAR MASS      M**3/SEC**2
AE     = 6378137.D0       EQUATORIAL RADIUS OF EARTH       M
CONRE  = 6371.D3          MEAN RADIUS OF THE EARTH         M
P0     = -.94D-7          NOMINAL RAD.PR. ACCELERAT.       M/SEC**2
OMEGA  = 7292115.1467D-11 ANGULAR VELOCITY OF EARTH        RAD/SEC
ET -UTC= 55.              EPH. TIME (ET) MINUS UTC         SEC
WGTPHA = 1.D0             WEIGHT FOR PHASE OBSERVATIONS    1
WGTCOD = 1.D-4            WEIGHT FOR CODE OBSERVATIONS     1
HREF   =    0.            REFERENCE HEIGHT FOR METEO MODEL M
PREF   = 1013.25          PRESSURE AT HREF                 MBAR
TREF   =   18.            TEMPERATURE AT HREF              DEG. CELSIUS
HUMREF =   50.            HUMIDITY AT HREF                 %
```

Figure 23.2: File of all Physical Constants `CONST.`

23.4.2 Geodetic Datum Information

Type	:	ASCII
Directory	:	`$X/GEN` (UNIX) / `X:[GEN]` (VMS) / `X:\GEN` (DOS)
Content	:	Information concerning different geodetic datum definitions.
Created by	:	User-defined.
Used by	:	All routines accessing coordinate files.
Example	:	Figure 23.3. Also available in the distribution.
Further Information	:	Users may add more geodetic datums. Each coordinate file refers to one of the datums specified in this list. The datum information is only used to compute ellipsoidal coordinates of the sites.

23.4.3 Receiver Characterization File

Type	:	ASCII
Directory	:	`$X/GEN` (UNIX) / `X:[GEN]` (VMS) / `X:\GEN` (DOS)
Content	:	Characteristics of different receiver types.
Created by	:	User-defined.
Used by	:	Programs GPSSIM (no menu support) and BV3RXO (Menu 2.6.1).
Example	:	Figure 23.4. Also available in the distribution.
Further Information	:	The antenna phase center offsets in this file are no longer used because these values are taken from the antenna phase center eccentricity file (see Section 23.4.5). Only the programs GPSSIM (simulation of GPS observations) and BV3RXO (Conversion of Bernese observation files to RINEX) use the file to obtain information concerning the observation types and frequencies collected by a specific receiver.

```
LOCAL GEODETIC DATA FOR BERNESE GPS SOFTWARE VERSION 4.0
--------------------------------------------------------
DATUM                ELLIPSOID           SHIFTS (M)          ROTATIONS (")

WGS - 84             AE = 6378137.000    DX =      0.0000    RX =    0.0000
                     1/F= 298.2572236    DY =      0.0000    RY =    0.0000
                     SC = 0.00000D+00    DZ =      0.0000    RZ =    0.0000

WGS - 72             AE = 6378135.000    DX =      0.0000    RX =    0.0000
                     1/F= 298.2600000    DY =      0.0000    RY =    0.0000
                     SC = 0.00000D+00    DZ =     -4.5000    RZ =    0.0000

GRS - 80             AE = 6378137.000    DX =      0.0000    RX =    0.0000
                     1/F= 298.2572221    DY =      0.0000    RY =    0.0000
                     SC = 0.00000D+00    DZ =      0.0000    RZ =    0.0000

CH - 1903            AE = 6377397.200    DX =    679.0000    RX =    0.0000
                     1/F= 299.1528000    DY =     -2.0000    RY =    0.0000
                     SC = 0.00000D+00    DZ =    404.0000    RZ =    0.0000
```

Figure 23.3: File of the Geodetic Datum Definitions `DATUM`.

```
GPS RECEIVER INFORMATION BERNESE GPS SOFTWARE VERSION 4.0
---------------------------------------------------------

RECEIVER TYPE    #FREQ  CODE  FREQ  WAVE.F.  ANT.ECCENTRIC.(N,E,U)(M)
****************   *     **    L*:     *      **.**** **.**** **.****

TI-4100            2     P     L1:     1       0.0000  0.0000  0.2270
                         P     L2:     1       0.0000  0.0000  0.2020

ROGUE              2     P     L1:     1       0.0000  0.0000  0.0000
                         P     L2:     1       0.0000  0.0000  0.0000

ASHTEC             1     CA    L1:     1       0.0000  0.0000  0.0000

WM102              2     CA    L1:     1       0.0000  0.0000  0.0000
                         P     L2:     1       0.0000  0.0000  0.0000

TRIMBLE 4000SSE    2     CA    L1:     1       0.0000  0.0000  0.0692
                         P     L2:     2       0.0000  0.0000  0.0677

MINIMAC            2     CA    L1:     1       0.0000  0.0000  0.0000
                               L2:     2       0.0000  0.0000  0.0000

SIMULA             2     P     L1:     1       0.0000  0.0000  0.0000
                         P     L2:     1       0.0000  0.0000  0.0000

SR299              2     CA    L1:     1       0.0000  0.0000  0.0000
                         P     L2:     1       0.0000  0.0000  0.0000


*) ANTENNA ECCENTRICITIES MEASURED FROM BOTTOM OF GROUND PLATE TO
   L1/L2 PHASE CENTER
```

Figure 23.4: Receiver Characterization File `RECEIVER`.

23.4.4 Receiver/Antenna Name Translation File

Type : ASCII
Directory : `$X/GEN` (UNIX) / `X:[GEN]` (VMS) / `X:\GEN` (DOS)
Content : Receiver/antenna name translation file.
Created by : User-defined, assistance using Menu 1.4.5.

Used by : Program RXOBV3 (Menu 2.7.1).

Example : Figure 23.5. Also available in the distribution. Updated files for IGS sites are available in the anonymous CODE ftp area (see Section 7.4).

Further Information : This translation table may be used in the transformation program RXOBV3 to make sure that a unique and well-defined set of receiver and antenna names is used in the Bernese GPS Software. This is important because of the "antenna phase center offset" file (see Section 23.4.5), where antenna phase center values have to be defined for each receiver/antenna pair. If the file name of such a translation file is specified in Menu 2.7.1 (option `RCVR / ANTENNA`) all receiver/antenna names found in the RINEX observation files will be translated according to the translation table.
Please note, that in our example (Figures 23.6 and 23.7) the translation is station-dependent (warning, if the specified translation does not match with the given station name) and therefore fully dependent on the sites of a campaign. If you specify no special station names (the original intention of this file) the translations will be performed independently of the station names.
Note: Wildcards (*,?) are also allowed in the fields `OLD RECEIV. TYPE` and `OLD ANTENNA TYPE`.

```
RECEIVER AND ANTENNA TYPE TRANS. TABLE FOR JAN93 CAMPAIGN        1-JUL-93 15:40
--------------------------------------------------------------------------------

OLD RECEIV. TYPE  OLD ANTENNA TYPE  NEW RECEIV. TYPE  NEW ANTENNA TYPE  STATION NAME

ROGUE SNR-8       DORNE MARGOLIN B  ROGUE SNR-8       DORNE MARGOLIN B  MATE 12734M008
ROGUE SNR-8       DORNE MARGOLIN B  ROGUE SNR-8       DORNE MARGOLIN B  TROM 10302M003
ROGUE SNR-800     DORNE MARGOLIN B  ROGUE SNR-800     DORNE MARGOLIN B  WETT 14201M009
ROGUE SNR-800     DORNE MARGOLIN B  ROGUE SNR-800     DORNE MARGOLIN B  TAIW 23601M001
ROGUE SNR-8C      DORNE MARGOLIN B  ROGUE SNR-8C      DORNE MARGOLIN B  GRAZ 11001M002
ROGUE SNR-8000    DORNE MARGOLIN T  ROGUE SNR-8000    DORNE MARGOLIN T  GRAZ 11001M002B
ROGUE SNR-8C      DORNE MARGOLIN B  ROGUE SNR-8C      DORNE MARGOLIN B  HERS 13212M007
ROGUE SNR-8000    DORNE MARGOLIN R  ROGUE SNR-8000    DORNE MARGOLIN R  MCMU 66001S006
ROGUE SNR-8100    DORNE MARGOLIN T  ROGUE SNR-8100    DORNE MARGOLIN T  NOTO 12717M003
ROGUE SNR-8100    DORNE MARGOLIN T  ROGUE SNR-8100    DORNE MARGOLIN T  MATE 12734M008B
ROGUE SNR-12 RM   DORNE MARGOLIN B  ROGUE SNR-12 RM   DORNE MARGOLIN B  KOSG 13504M003
ROGUE SNR-12 RM   DORNE MARGOLIN T  ROGUE SNR-12 RM   DORNE MARGOLIN T  THU1 43001M001
ROGUE SNR-12 RM   DORNE MARGOLIN T  ROGUE SNR-12 RM   DORNE MARGOLIN T  MASP 31303M002C
TRIMBLE 4000SSE   4000ST L1/L2 GEO  TRIMBLE 4000SSE   4000ST L1/L2 GEO  ZIMM 14001M004
ASHTECH Z-XII3    DORNE MARGOLIN T  ASHTECH Z-XII3    DORNE MARGOLIN T  LAMA 12209M001
ASHTECH L-XII     ASHTECH L-XII     ASHTECH L-XII     MARINE/RANGE
ASHTECH Z-XII3    GEODETIC L1/L2 P  ASHTECH Z-XII3    GEODETIC L1/L2 P
ASHTECH Z-XII3    GEODETIC L1/L2 L  ASHTECH Z-XII3    GEODETIC L1/L2 L
*4000*SSE         *4000*SSE         TRIMBLE 4000SSE   4000ST L1/L2 GEO
*4000*SSE         *GEODETIC*        TRIMBLE 4000SSE   4000ST L1/L2 GEO
```

Figure 23.5: Receiver/Antenna Name Translation (`.TRN`) File.

23.4.5 Antenna Phase Center Eccentricities

Type : ASCII

Directory : `$X/GEN` (UNIX) / `X:[GEN]` (VMS) / `X:\GEN` (DOS)

Content	:	Antenna phase center offsets and variations.
Created by	:	User-defined.
Used by	:	All programs dealing with GPS observation files.
Example	:	Figures 23.6 and 23.7 show an example using format 2 (formats are explained at the bottom of Figure 23.6). The file `PHASITRF.` in the distribution shows an example of values measured by [*Schupler et al.*, 1994] given in format 1 (readable also with Version 3.5). Updated files are available in the anonymous CODE ftp area (see Section 7.4).
Further Information	:	• Because the antenna phase center eccentricities are no longer stored in the observation file headers it is very easy to change the eccentricities if new information is available concerning the phase centers of different receiver types. • It is even possible to define a different phase center location for each individual receiver/antenna. • Elevation-dependent antenna phase center corrections are of importance for the combination of different antenna pairs in the network. Between TRIMBLE and ROGUE antennas the effect of non-modeled elevation-dependent variations may reach more than 10 cm in station height [*Rothacher et al.*, 1996*b*]. At present (July 1996) the recommended values to be used in the processing is the model `IGS_01` [*Rothacher*, 1996]. These values were obtained from a combination of the results of several antenna test campaigns (estimated from the GPS data with given ground truth) [*Rothacher et al.*, 1995*b*], [*Rothacher*, 1996]. For more details concerning the estimation of elevation- (and azimuth) dependent antenna phase center variations see Chapter 17. Please note the different formats. 0 means no elevation dependent corrections, 1 means elevation dependent values given to the right of the offset values, and 2 means *phase center maps* or *spherical harmonics* available (see Figure 23.7).

```
MODEL NAME: IGS_01    , PHASE CENTER VARIATIONS                       30-JUN_96
-----------------------------------------------------------------------------------------------------------------------------

RECEIVER TYPE          ANTENNA S/N  FREQ  PHASE CENTER OFFSETS (M)           ELEVATION DEPENDENCE OF PHASE CENTER (MM)
ANTENNA  TYPE          FROM    TO    L*    NORTH    EAST     UP    FMT   90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 05 00
********************  ****** ******   *    **.**** **.**** **.****   *    ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **

ROGUE SNR-8000              0 999999   1    0.0     0.0     0.0780   0
DORNE MARGOLIN B                       2    0.0     0.0     0.0960

ROGUE SNR-8                 0 999999   1    0.0     0.0     0.110    0
DORNE MARGOLIN T                       2    0.0     0.0     0.128

TRIMBLE 4000SSI             0 999999   1    0.0015 -0.0012  0.0751   2
TR GEOD L1/L2 GP                       2   -0.0011  0.0017  0.0692

TRIMBLE 4000SSE             0 999999   1    0.0000  0.0000  0.0796   2
M-PULSE L1/L2 SURVEY                   2    0.0000  0.0000  0.0932

ASHTECH Z-XII3              0 999999   1    0.0005  0.0003  0.0799   2
GEODETIC L1/L2 L                       2   -0.0012  0.0008  0.0792

SR299                       0 999999   1    0.0031 -0.0002  0.1131   2
INTERNAL                               2    0.0013 -0.0035  0.1172

SR399E                      0 999999   1    0.0048  0.0019  0.0492   2
EXTERNAL WITH GP                       2    0.0034 -0.0052  0.0418

MACROMETER                  0 999999   1    0.0022 -0.0082  0.1631   2
MACROMETER X-DIPOLE                    2    0.0043  0.0020  0.0913

TOPCON                      0 999999   1   -0.0039  0.0073  0.1471   2
72110                                  2   -0.0044  0.0065  0.1278

GEOTRACER                   0 999999   1    0.0008 -0.0017  0.0954   2
2200                                   2    0.0004  0.0001  0.0739

FORMAT INDICATOR:
  FMT=0 :  ONLY PHASE CENTER OFFSETS ARE USED
  FMT=1 :  ZENITH DEPENDENT CORRECTIONS GIVEN TO THE RIGHT OF THE OFFSET
           VALUES ARE USED
  FMT=2 :  PHASE CENTER MAPS OR SPHERICAL HARMONICS ARE USED (ZENITH/AZIMUTH
           DEPENDENT)
ANTENNA PHASE CENTER OFFSETS MEASURED FROM ANTENNA REFERENCE POINT (ARP)
TO THE MEAN L1/L2 PHASE CENTER.
```

Figure 23.6: Antenna phase center offsets model IGS_01 (file PHAS_IGS.01).

```
PHASE CENTER MAPS AND/OR COEFFICIENTS OF SPHERICAL HARMONICS IN MILLIMETERS:
---------------------------------------------------------------------------

TYPE 1 :  ELEVATION/AZIMUTH GRID
TYPE 2 :  SPHERICAL HARMONICS COEFFICIENTS (UNNORMALIZED)
TYPE 3 :  SPHERICAL HARMONICS COEFFICIENTS (NORMALIZED)

D(Z)   :  ZENITH  TABULAR INTERVAL (DEGREES)
D(A)   :  AZIMUTH TABULAR INTERVAL (DEGREES)
N(Z)   :  DEGREE OF SPHERICAL HARMONICS DEVELOPMENT
N(A)   :  ORDER  OF SPHERICAL HARMONICS DEVELOPMENT

RECEIVER TYPE        ANTENNA TYPE         FROM   TO      TYP   D(Z) D(A)
******************** ******************** ****** ******  ***    ***  ***
TRIMBLE 4000SSE      4000ST L1/L2 GEOD         0 999999    1      5  360

    A\Z     0      5     10     15     20     25     30     35     40     45     50     55     60     65     70     75     80     85     90
L1   0   0.00   1.10   3.10   6.30  10.20  13.70  15.70  16.40  16.30  15.80  14.60  13.00  11.40  10.20   8.50   7.30   7.00   0.00   0.00
L2   0   0.00   0.10   0.50   0.70   1.20   2.20   3.40   4.20   4.20   3.90   3.60   3.30   2.70   2.00   1.50   1.00   0.20   0.00   0.00

RECEIVER TYPE        ANTENNA TYPE         FROM   TO      TYP   D(Z) D(A)
******************** ******************** ****** ******  ***    ***  ***
TRIMBLE 4000SSI      TR GEOD L1/L2 GP          0 999999    1      5  360

    A\Z     0      5     10     15     20     25     30     35     40     45     50     55     60     65     70     75     80     85     90
L1   0   0.00   1.80   4.60   8.10  11.70  14.50  16.10  16.90  16.90  16.20  14.90  13.40  11.90  10.40   9.00   7.90   8.20   0.00   0.00
L2   0   0.00   0.30   0.90   1.80   3.00   4.10   4.90   5.40   5.60   5.60   5.30   4.50   3.60   2.80   2.10   1.20   0.10   0.00   0.00


.................................


RECEIVER TYPE        ANTENNA TYPE         FROM   TO      TYP   D(Z) D(A)
******************** ******************** ****** ******  ***    ***  ***
TOPCON               72110                     0 999999    1      5  360

    A\Z     0      5     10     15     20     25     30     35     40     45     50     55     60     65     70     75     80     85     90
L1   0   0.00  -1.10  -1.10  -0.30   0.90   2.30   3.70   4.80   5.30   5.30   4.50   2.90   0.30  -3.20  -7.60 -12.90 -19.00   0.00   0.00
L2   0   0.00  -0.50  -0.70  -0.80  -0.70  -0.60  -0.50  -0.50  -0.60  -1.00  -1.60  -2.50  -3.70  -5.30  -7.30  -9.70 -12.50   0.00   0.00

RECEIVER TYPE        ANTENNA TYPE         FROM   TO      TYP   D(Z) D(A)
******************** ******************** ****** ******  ***    ***  ***
GEOTRACER            2200                      0 999999    1      5  360

    A\Z     0      5     10     15     20     25     30     35     40     45     50     55     60     65     70     75     80     85     90
L1   0   0.00   1.30   2.70   4.40   6.00   7.20   8.00   9.10  10.20  10.40   9.40   8.30   7.80   7.40   6.30   4.60   3.70   0.00   0.00
L2   0   0.00  -0.30  -1.70  -3.90  -5.80  -6.30  -6.10  -6.40  -7.30  -7.80  -7.50  -6.90  -6.00  -4.10  -1.70  -1.70  -6.40   0.00   0.00
```

Figure 23.7: Elevation dependence of the antenna phase centers according to model `IGS_01` (file `PHAS_IGS.01`, part 2).

23.4.6 Geopotential Coefficients

Type	:	ASCII
Directory	:	`$X/GEN` (UNIX) / `X:[GEN]` (VMS) / `X:\GEN` (DOS)
Content	:	Earth Potential Coefficients.
Created by	:	User-defined.
Used by	:	Program ORBGEN.
Example	:	Figure 23.8. Also available in the distribution.
Further Information	:	The GEMT3 coefficients are included in the distribution. The files `GEM10N` and the `JGM3` are available on request (and are supported in version 4.1). The user of version 4.0 should use the GEMT3 model. As an example we included here a part of the GEMT3 model. The file is read by the subroutine `GETPOT` in the form `READ(LFN...,...) SCRATCH,N,M,C,S` where N is the zonal, M is the tesseral index, C is the C(N,M), S is the S(N,M) coefficient.

```
  GEM-T3N
CONSTANTS USED: GM=000000.00, A=0000.000, F=1/298.257, C=299792.458
RECOEF 2 0-0.48416510D-03 0.0
RECOEF 3 0 0.95720109D-06 0.0
RECOEF 4 0 0.53952118D-06 0.0
RECOEF 5 0 0.68343345D-07 0.0
......
RECOEF 2 1-0.17000000D-09 0.11900000D-08
RECOEF 3 1 0.20277142D-05 0.24921712D-06
RECOEF 4 1-0.53615108D-06-0.47343598D-06
RECOEF 5 1-0.58280231D-07-0.96083937D-07
......
```

Figure 23.8: The Geopotential File `GEMT3`.

23.4.7 Pole Coordinates

Type	:	ASCII
Directory	:	`$X/GEN` (UNIX) / `X:[GEN]` (VMS) / `X:\GEN` (DOS) as input files or in the campaign-specific directory `OUT` as output files
Content	:	Pole coordinates, UT1 - UTC, UTC - GPS.
Created by	:	Download from Berne anonymous account (`C04_yyyy.ERP`) in Bernese ERP format (see Section 7.4) or download from different places (C04 pole, rapid pole, IGS pole) and use Menu 5.5.1 to transform to Bernese ERP format (currently 13 different pole formats are supported). The pole file may also be created as a result of a parameter estimation using programs GPSEST or ADDNEQ.
Used by	:	All orbit programs and all processing programs.
Example	:	Figure 23.9.

Further Information :

- ERP files are input files for most of the programs (Menu 0.3.1, directory GEN) but they may also be created as output files using GPSEST or ADDNEQ (Menu 0.3.4 extension selection).
- The subdaily Earth rotation model RAY will be a feature of version 4.1 . Available nutation models are NO (default) and for special test also OBSERVED and HERRING
- The pole file is accessed by the subroutine GETPOL. It is not important that the pole positions are given at equidistant time intervals. GETPOL checks, however, for each request that the spacing between the two data points used for interpolation is smaller than 10 days. The table values are linearly interpolated and a warning is given if a leap second occurred in the interpolation interval.

```
DAILY C04 POLE COORDINATES OF THE YEAR 1996                      21-JUL-96 02:16
-----------------------------------------------------------------------------------------------
CELESTIAL POLE OFFSET: NO                              SUBDAILY POLE MODEL: RAY
    DATE    TIME    X-POLE    Y-POLE   UT1-UTC GPS-UTC    RMS XP  RMS YP   RMS DT   DE-CPO   DP-CPO
YYYY MM DD HH MM     (")       (")       (S)      (S) REM     (")     (")      (S)      (")      (")

1996  1  1  0  0 -0.17662  0.19103  0.555279  11. C04  0.00000 0.00000 0.000000 -0.00455 -0.02931
1996  1  2  0  0 -0.17805  0.19404  0.553452  11. C04  0.00000 0.00000 0.000000 -0.00459 -0.02928
....
1996  7 12  0  0  0.21830  0.51749  0.173434  11. C04  0.00000 0.00000 0.000000 -0.00859 -0.03605
1996  7 13  0  0  0.22134  0.51461  0.172470  11. C04  0.00000 0.00000 0.000000 -0.00848 -0.03606
```

Figure 23.9: Pole File (.ERP) in Bernese Format.

23.4.8 Pole Offsets for the C04 and Rapid Pole Series

Type : ASCII

Directory : $X/GEN (UNIX) / X:[GEN] (VMS) / X:\GEN (DOS)

Content : Pole Offsets for the C04 combined pole series (the C04 pole series is based on a reference system different from the ITRF realizations).

Created by : User-defined. Transformation parameters obtained from the IERS Annual reports (usually Table II-3).

Used by : POLUPD (Menu 5.5.1).

Example : Figure 23.10.

Further Information : If no file is specified in Menu 0.3.1 no offsets are applied. Updated pole files are available in Berne, so that format conversion and transformation are not necessary (see Section 7.4).

23.4.9 SINEX General Information File

Type : ASCII

```
POLE OFFSET COEFFICIENTS IERS EOP SERIES -- IERS REFERENCE FRAMES
--------------------------------------------------------------------------------
REFERENCE TIME (YYYY MM DD HH.H): 1988 00 00 00.0

      X    RMSX     Y    RMSY    UT1   RMSU  DPSI   RMS   DEPSI  RMS
     MAS   MAS     MAS   MAS   0.1MS  0.1MS  MAS    MAS    MAS   MAS
**  *****  ****  *****  ****  *****  ****  *****  ****  *****  ****
A   -0.10  0.40   0.70  0.40  -0.60  0.20  -0.20  0.01   0.30  0.01
A'   0.08  0.04   0.15  0.04   0.04  0.03   0.00  0.00   0.00  0.00
```

Figure 23.10: Pole Offset File in Bernese Format. The Values are valid for the Transformation of the C04 Pole to the ITRF94 Realization of the Terrestrial Reference Frame.

Directory : `$X/GEN` (UNIX) / `X:[GEN]` (VMS) / `X:\GEN` (DOS)

Content : General Information file to be included in SINEX output files (see Section 7.3 and 18.4).

Created by : User-defined.

Used by : ADDNEQ (Menu 4.8.1) to include general information into the the SINEX files.

Example : Figure 23.11.

Further Information : If no file is specified in Menu 0.3.1 no information concerning your institution is included in the SINEX file (not-given fields (`---`) are used instead). If you want to generate SINEX result files to be exchanged with other institutions, modify this file to contain information concerning your institute.

23.4.10 Satellite Information File

Type : ASCII

Directory : `$X/GEN` (UNIX) / `X:[GEN]` (VMS) / `X:\GEN` (DOS)

Content : Satellite information (block, antenna offsets, masses).

Created by : User-defined.

Used by : Most orbit and processing programs.

Example : Figure 23.12. Also available in the distribution. In addition the file `SATELLIT.OLD` (old version 3.5 file in the new format) is also included in the distribution. Other files (with the extension `.ZZZ`, `.SSS`) are available on request to realize a different a priori radiation model. The difference of these files is of importance only for orbit determination purposes of highest quality. Please use the file `SATELLIT.TTT`.

Further Information : The satellite information file contains the block numbers, the masses, the antenna offsets, and a priori values for the direct radiation pressure coefficients (corrections to ROCK4/42 model) and for the y-biases. The mentioned files contain furthermore information concerning the radiation pressure model to be used. We recommend to use the T model as a priori model, even if the differences to the other models is negligible for the creation of the standard orbits from tabular / precise orbits. If a new satellite is

```
SINEX : OPTION INPUT FILE                                  30-MAY-95 18:02
--------------------------------------------------------------------------
(REMARK: YES=1,NO=0 ; 2 EMPTY LINES AFTER EVERY INPUT GROUP)

AGENCY:
-------

       ***
--> :  COD


DATA :
------

       ***
--> :  COD


HEADER INFORMATION TO BE INCLUDED:
----------------------------------

+FILE/REFERENCE
 DESCRIPTION        CODE COORDINATE AND VELOCITY RESULTS SINEX FORMAT V1.00
 OUTPUT             UNIVERSITY OF BERNE
 CONTACT            BROCKMANN@AIUB.UNIBE.CH
 SOFTWARE           BERNESE V4.0
 HARDWARE           VAX ALPHA
 INPUT              CODE
-FILE/REFERENCE
*-------------------------------------------------------------------------------
+FILE/COMMENT
-FILE/COMMENT
*-------------------------------------------------------------------------------
+INPUT/ACKNOWLEDGMENTS
*AGY DESCRIPTION________________________________________________________________
 COD Center for Orbit Determination in Europe, Astronomical Inst., Univ. Berne
-INPUT/ACKNOWLEDGMENTS
```

Figure 23.11: General SINEX Information File `SINEX`.

launched the information for this new satellite has to be included into the file. It is sufficient in this case to copy a line referring to a satellite of the same block and to modify it for the new satellite (the antenna offsets have to be correct).

23.4.11 Satellite Problem File

Type : ASCII

Directory : `$X/GEN` (UNIX) / `X:[GEN]` (VMS) / `X:\GEN` (DOS)

Content : Problems with satellites (manoeuvres, bad data).

Created by : User-defined.

Used by : Most orbit and processing programs.

Example : Figure 23.13. Also available in the distribution.

Further Information :

- We recommend to use the updated files (file name characterized by the year) from the anonymous CODE ftp area (see Section 7.4). By specifying this file in the Panel 0.3.1 you avoid many troubles related with problem satellites. All programs that allow for

```
SATELLITE SPECIFIC DATA                                                  08-MAR-95
--------------------------------------------------------------------------------
RADIATION PRESSURE MODEL : T950101    (ROCK MODEL T, FLIEGEL ET AL, 1992)

     BLOCK    ANTENNA OFFSETS (M)      MASS      DP0      P2     ROCK MODEL
PRN   NO.     DX       DY       DZ     (KG)    (1.E-8)  (1.E-9)   (T=1,S=2)

  1    3    0.2794  0.0000  1.0259    975.    -0.2132   0.5640      1    ok
  2    2    0.2794  0.0000  1.0259    878.2    0.0169   0.3178      1    ok
  3    3    0.2794  0.0000  1.0259    975.                          1    new
  4    3    0.2794  0.0000  1.0259    975.    -0.1072   0.7666      1    ok
  5    3    0.2794  0.0000  1.0259    975.    -0.1145   0.4401      1    ok
  6    3    0.2794  0.0000  1.0259    975.    -0.1410   0.8875      1    ok
  7    3    0.2794  0.0000  1.0259    975.    -0.0807   0.8180      1    ok
  8    3    0.2794  0.0000  1.0259    975.                          1    new
  9    3    0.2794  0.0000  1.0259    975.    -0.0835   0.6081      1    ok
 10    3    0.2794  0.0000  1.0259    975.                          1    new
 11    1    0.2100  0.0000  0.8540    522.2    0.0385   0.3159      1    off
 12    1    0.2100  0.0000  0.8540    519.8    0.0475   0.1326      1    ok
 ........

BLOCK NUMBER: BLOCK I = 1, BLOCK II = 2, BLOCK IIA = 3, BLOCK IIR = 4
```

Figure 23.12: Satellite Information File SATELLITE.TTT (T means: ROCK Model T to be used as a priori Radiation Pressure Model).

a satellite problem file will automatically use this file if specified in Menu 0.3.1.

- The satellite problem file invokes the handling of the following problems:

  (1) manoeuvre epochs (problem 0)
  (2) satellite modelling (problem 4)
  (3) time intervals with bad data (phase/code) for specific satellites (problems 1, 2, 3)

  A *manoeuvre* is usually detected by BRDTST because of drastic changes in the orbital elements of the broadcast ephemerides. BRDTST (Menu 3.1.2) creates a new satellite number for the manoeuvre satellite after the event. The new number is equal to the old satellite number + 50. All broadcast messages after the event are related to the new satellite number. Programs BRDTAB (Menu 3.2) and ORBGEN (Menu 3.3) treat the "new" satellite as any other satellite. The satellite SVN+50 is only present in the orbit files, but not in the observation files. An approximate time for the manoeuvre may be retrieved from the BRDTST output file. A more precise epoch may be obtained by looking at the residuals of CODSPP (Menu 4.2) for this satellite. Even if the manoeuvre time may be determined quite accurately (the residuals of MAUPRP (Menu 4.4.2) may be used for refinements) it may be necessary to delete observations around the manoeuvre epoch because the satellite may behave in an unpredictable way around this epoch (the first few minutes or even hours). The manoeuvre time has to be introduced into the satellite problem file. The processing programs will read this file and use the orbit of satellite SVN or SVN+50 depending on whether the epoch lies before or past the manoeuvre time. For manoeuvres the action number is always 0.

The problem type *satellite modelling* is used for long-arc computations using program ADDNEQ (Menu 4.8.1). This problem type indicates to set up a new arc (action 0) for the specified satellite at the specified time (only arc boundaries are allowed).

The problem type *bad satellite* is used to exclude data stemming from a particular satellite from the processing. If you specify this file in RXOBV3 (Menu 2.7.1) you have the possibility to transfer them to the Bernese formats as marked observations (action item 1) or to remove them (action item 2; not transferred to the Bernese-specific format). The remove action is supported only in program RXOBV3. For program CODSPP (Menu 4.2) the presence of this file means not to use the pseudorange data (problem 2 or 3, action 1) for the estimation of the receiver clock corrections. To assume that the pseudorange observations of a certain satellite are bad, but that the corresponding phase observations are good may be true in some cases. It may be better to mark both, pseudorange and phase observations, to avoid problems in the next processing steps.

To use this file in the program MAUPRP (Menu 4.4.2) means that the phase data are marked (problem 1 or 3, action 1). Please note: If you use the file in the program GPSEST (Menu 4.5) you exclude the corresponding observations from the parameter estimation without having to mark them with the program SATMRK (Menu 5.1). The observations are not marked in the observation files, however. When marked with SATMRK it is impossible to reset the marked observations without also resetting the marks set by the preprocessing programs or the SATMRK options. *With the satellite problem file on the other hand data can easily be excluded for any satellite and time interval in* GPSEST *without any consequences for future program runs.*

23.4.12 Station Problem File

Type	:	ASCII
Directory	:	`$X/GEN` (UNIX) / `X:[GEN]` (VMS) / `X:\GEN` (DOS)
Content	:	Station problems (station name changes, set up new sites, antenna height problems).
Created by	:	User-defined.
Used by	:	ADDNEQ
Example	:	Figure 23.14. File available in the distribution.
Further Information	:	The station problem file is accessed by program ADDNEQ, only. The following changes may be specified in this file:

```
SATELLITE PROBLEMS: MANOEUVRES OR BAD OBSERVATION INTERVALS          15-JAN-95
--------------------------------------------------------------------------------

SATELLITE  PROBLEM    ACTION           FROM                   TO
   **         *         *       YYYY MM DD HH MM SS  YYYY MM DD HH MM SS

   24         3         1       1996  1  8 00 00 00  1996  1  9 24 00 00
   24         0         0       1996  1  8 12 00 00
   16         3         1       1996  2  6 00 00 00  1996  2  6 24 00 00
   16         0         0       1996  2  6 12 00 00
   12         3         1       1996  2  8 00 00 00  1996  2  8 24 00 00
   16         4         0       1996  2 17 00 00 00
   16         4         0       1996  2 18 00 00 00
   ...
   14         4         0       1996  7 15 00 00 00
   14         3         2       1996  7 16 00 00 00  1996  7 16 24 00 00
   14         0         0       1996  7 16 12 00 00
   16         4         0       1996  7 17 00 00 00
   16         4         0       1996  7 18 00 00 00
   19         4         0       1996  7 20 00 00 00
   19         4         0       1996  7 21 00 00 00
   20         3         2       1996  7  2 00 00 00  1996 12 31 24 00 00

PROBLEM DESCRIPTION    PROBLEM          ACTION DESCRIPTION          ACTION
-------------------    -------          ------------------          ------

SATELLITE MANOEUVRE       0             SET UP SAT. WITH SVN=SVN+50    0
SATELLITE MODELLING       4             SPLIT UP ARCS IN ADDNEQ        0
BAD PHASE DATA            1             MARK PHASE OBSERVATION         1
BAD PHASE DATA            1             REMOVE PHASE OBSERVATION       2
BAD CODE DATA             2             MARK CODE OBSERVATIONS         1
BAD CODE DATA             2             REMOVE CODE OBSERVATIONS       2
BAD PHASE AND CODE DATA   3             MARK BOTH OBSERVATION TYPES    1
BAD PHASE AND CODE DATA   3             REMOVE BOTH OBSERVATION TYPES  2
```

Figure 23.13: Satellite Problem File (Example File `SAT_1996.CRX` available in the Anonymous FTP Area in Berne.

(1) `STATION NAME CHANGES:`
Using a time window you may change to a different station characterization (station number and the station name).

(2) `EXCLUDE STATION AND STORE TO SCRATCH STATION:`
For a given time interval you may exclude a site from a "continuous" observation series (of e.g. daily NEQ files). The site is NOT removed from the normal equations, but the combination of the normal equation parts belonging to the specified time interval will be associated with a new name (e.g. the station name `SCRATCH`). Specifying also a different station number allows you to remove (preeliminate) the site (together with the option `NUMBERS OF STATIONS TO BE PREELIMINATED`).

(3) `SETUP NEW STATION:`
If you have the impression that for a certain time interval a site seems to have significantly different coordinate results than for another time period you may wish to solve for an additional set of site coordinates for this time period.

(4) `REMOVE CENTER STATIONS FROM NEQS:`
If you wish to remove center stations (see Section 23.8.2) from your normal equations (only the eccentric location of the GPS receiver is

of interest) you have to specify "1" here.

(5) `ANTENNA ECCENTRICITIES:`
It is sometimes quite difficult to make sure that from the very beginning of processing correct antenna height information is used in the analysis of GPS data. If it happens, that in the processing (including GPSEST) a wrong antenna height was used, it is not necessary to recreate the normal equations. Antenna heights may be changed in ADDNEQ without having to reprocess of the GPS data using GPSEST. Only the antenna heights but not horizontal eccentricities may be changed.

(6) `NUMBERS OF STATIONS TO BE PREELIMINATED:`
To pre-eliminate a site for a certain time interval is sometimes useful. That means that this site is not included in the combined solution. Please **note** that pre-elimination is not identical to removing the site for that particular interval from the solution. The effect of the site coordinate parameters in a normal equation system on other parameters is still present (cannot be removed as if the site was not used at a particular day), but the influence of outliers on the combined solution can be reduced.

The effect of the first three options is in principle the same: to specify a different station name and station number. The division into these three options is useful, to keep an oversight of the reason to handle a site in this specific way. Please **note** that the renaming is done sequentially. This means, e.g, that *if you change a station name in the first option item, you have to use this new name in all following sections.*

```
STATION PROBLEMS: NAMES, SITE CHANGES, HEIGHTS, ECCENTRICITIES         6-APR-94
--------------------------------------------------------------------------------

STATION NAME CHANGES : (BUT STILL THE SAME SITE)
----------------------

    OLD STATION          NEW STATION
NUM       NAME       NUM       NAME                    FROM                 TO
*** **************** *** **************** YYYY MM DD HH MM SS  YYYY MM DD HH MM SS

117 JOZE             117 JOZE 12204M001   1992 01 01 00 00 00  1993 12 31 23 59 59
188 NOTO             188 NOTO 12717M003   1992 01 01 00 00 00  1999 12 31 23 59 59
  1 NOTO             188 NOTO 12717M003   1992 01 01 00 00 00  1999 12 31 23 59 59
112 MASP 31303M001   122 MASP 31303M002   1994 08 02 00 00 00  1999 12 31 23 59 59
122 MASP 31303M001B  122 MASP 31303M002   1994 08 02 00 00 00  1999 12 31 23 59 59
122 MASP 31303M001C  122 MASP 31303M002   1994 08 02 00 00 00  1999 12 31 23 59 59


EXCLUDE STATION AND STORE TO SCRATCH STATION:
--------------------------------------------

(CHANGED) STATION        SCRATCH STATION
NUM       NAME       NUM       NAME                    FROM                 TO
*** **************** *** **************** YYYY MM DD HH MM SS  YYYY MM DD HH MM SS

152 HERS 13212M007    -1 HERS SCRATCH1    1993 12 17 00 00 00  1994 01 31 23 59 59
152 HERS 13212M007    -1 HERS SCRATCH2    1994 05 25 00 00 00  1994 06 26 23 59 59
152 HERS 13212M007    -1 HERS SCRATCH3    1994 09 14 00 00 00  1994 10 03 23 59 59


SETUP NEW STATION:
------------------

CHANGED  STATION           NEW STATION
NUM       NAME       NUM       NAME                    FROM                 TO
*** **************** *** **************** YYYY MM DD HH MM SS  YYYY MM DD HH MM SS

158 ZIMM 14001M004   158 ZIMM 14001M004A  1992 01 01 00 00 00  1993 07 19 23 59 59


REMOVE CENTER STATIONS FROM NEQ'S:
---------------------------------
                                          *
(0/1 NO/YES)                         --> : 0


ANTENNA ECCENTRICITIES:
----------------------
(CHANGED)            ANTENNA HEIGHT
STATION NAME         OLD        NEW            FROM                 TO
****************  *****.**** *****.**** YYYY MM DD HH MM SS  YYYY MM DD HH MM SS

CAGL 12725M003        0.0000     0.0450 1992 01 01 00 00 00  1999 12 31 23 59 59
SFER 13402M004        1.5536     1.6260 1992 01 01 00 00 00  1999 12 31 23 59 59


NUMBERS OF STATIONS TO BE PREELIMINATED (START A NEW ROW AFTER 15 STATIONS)
------------------------------------------------------  (-99: ALL STATIONS)

   NR  001 002 003 004 005 006 007 008 009 010 011 012 013 014 015

--> :   -1
```

Figure 23.14: Station Problem File.

23.5 Raw Data and RINEX Files

According to Table 23.1 we consider mainly the RINEX files as raw data files. We do not describe the conversion of receiver-specific observation formats to RINEX. Please read the description file of the freely available RINEX converters if you need more information related to this topics. Some information is also given in the help panels referring to the transformation programs Menu 2.5. For the definition of the RINEX format (observation files, navigation files, and meteo files) we refer to [*Gurtner*, 1994].

The RINEX files are usually put into the directory `RAW` of the campaign, initially. We usually expect RINEX data with a well defined session lengths (e.g. 24 hours). The file names and extensions are in principle selectable in the transfer programs. Nevertheless we recommend to use the default extensions (file name: SSSSdddf , file extension: .YYO for observation files, .YYN for navigation files, YYM for meteo files with SSSS as the 4-character station abbreviation, ddd as session identification (e.g. day of the year), f as file characterization (e.g. 1 for the first file of the session), and YY as year). If this is not the case you might prefer to store the *original* RINEX data in the directory `ORI`. The concatenation programs for RINEX observations, RINEX navigation messages, and PRECISE orbits (CCRINEXO (Menu 2.5.6.1), CCRINEXN (Menu 2.5.6.2), and CCPREORB (Menu 2.5.6.3)) may then be used to create RINEX files containing a well-defined time interval of data (e.g. defined by the session table using Menu 1.3) and to store these files in the directory `RAW`.

23.6 Observation Files

23.6.1 General Remarks

For Version 3.0 of the Bernese Software the decision was taken to split the observation information into two parts:

- a header file containing all the relevant information to identify and to process the observations (station, receiver, satellites, ...).
- an observation file with all the code or phase observations.

The same structure is used in Version 4.0 . This decision makes it easier to update resolved ambiguities, since only the header files have to be read and written and not all the observations.

No examples are supplied for the binary observation and header files. The ASCII image of an observation file consisting of header **and** observations contains, however, the full information of the binary version and will be described in detail below.

There are small differences between the formats of the observation files for the different versions of the Bernese Software. *Compatibility* is guaranteed, which means that you may e.g. process version 3.4 observation files with version 4.0 , but not vice versa.

```
                     ----------------------
                     |                    |
                     |    Observation     |
                     |       Files        |
                     |                    |
                     ----------------------
                               |
    ------------------------------------------------------------------
    |       |         |         |         |       |         |         |
-------- -------- --------- --------- -------- -------- --------- ---------
| Code | | Code | | Phase | | Phase | | Code | | Code | | Phase | | Phase |
| Head.| | Obs. | | Head. | | Obs.  | | Sing.| | Sing.| | Sing. | | Sing. |
|      | |      | |       | |       | | Diff.| | Diff.| | Diff. | | Diff. |
|      | |      | |       | |       | | Head.| | Obs. | | Head. | | Obs.  |
-------- -------- --------- --------- -------- -------- --------- ---------
```

Figure 23.15: Observations Files

23.6.2 Code/Phase Zero/Single Difference Header/Observation Files

Because of the identical format of all the header and observation files, these files are described together in one section.

Type	:	binary
Directory	:	Campaign-specific directory `OBS`.
Content	:	Code/phase zero/single difference observation and associated important information in the header files.
Created by	:	Programs RXOBV3 (Menu 2.7.1) and SNGDIF (Menu 4.3).
Used by	:	All programs dealing with observation/header information (all programs in Menu 4) and some other programs (e.g. service programs in Menu 5.1).
Example	:	ASCII image of a header file (first part) and observation file (part 2) in Figure 23.16 for single difference phase observations.
Further Information	:	All observations are stored in a binary format. The program OBSFMT (see Menu 5.7.1) and the edit and browse options of Menu 5.1 create an ASCII image of a binary file. In the binary format the header and the observations are stored in two different files. The program OBSFMT merges these two files into one ASCII image.

Remarks concerning this ASCII file:

Line	:	Comment
1	:	Campaign name (ch∗16); title (ch∗53).
3	:	Measurement type: PHASE or CODE; file creation date and time.

```
 1 IGSA           :  IGS DATA ANALYSIS
 2
 3 MEASUREMENT TYPE:  PHASE                      CREATED :  01-AUG-96 22:43
 4 REFERENCE EPOCH :  1996-07-29  0:00:30 (211)  MODIFIED:  02-AUG-96 03:29
 5
 6 # DIFFERENCES   :      1           FORMAT NUMBER      :      4
 7 # FREQUENCIES   :      2           SESSION IDENTIFIER :   2111
 8 # SATELLITES    :     24           SUBSESSION IDENTIF.:      1
 9 # EPOCHS        :   2878           OBS. INTERVAL (S)  :     30
10 # FLAGGED EPOCHS:      0           REMARK NUMBER      :      0
11
12 STATION NAME    :  KOSG 13504M003             ZIMM 14001M004
13 OPERATOR NAME   :  DANNY VAN LOON             LOGST/COMPAQ
14 RECEIVER TYPE   :  ROGUE SNR-12 RM            TRIMBLE 4000SSE
15 ANTENNA TYPE    :  DORNE MARGOLIN B           4000ST L1/L2 GEO
16 RECEIVER/ANTENNA:     229  /    119              2691  /  67905
17
18 CLOCK CORRECTION:  OFFSET PER EPOCH           OFFSET PER EPOCH
19
20 POS.ECCENTR. (M):   0.0000  0.0000  0.1050      0.0000  0.0000  0.0000
21
22 SAT    #L1-OBS OK  #L1-OBS BAD  #L2-OBS OK  #L2-OBS BAD
23  26         593         122          593          85
24   7         707         322          707         252
25   5         646         174          646         133
26  27         574         174          574         138
27 ....
28
29  AMB SAT EPOCH  WLF    L1-AMBIG.   CLUS    L2-AMBIG.   CLUS    L5-AMBIG.   CLUS
30    1  26     1  1/1      -764604.   47      -595792.   47            0.    1
31    2  26  2312  1/1           0.    2           0.    2            0.    2
32    3  26  2511  1/1     96299170.   47     75031313.   47            0.    3
33    4   7     1  1/1     -1234325.   47      -961808.   47            0.    4
34    5   7  1230  1/1           0.    5           0.    5            0.    5
35    6   7  1652  1/1     57049286.   35     44447173.   35            0.    6
36    7   7  2518  1/1           0.    7           0.    7            0.    7
37    8   7  2802  1/1     93995904.    8     73244004.    8            0.    8
38    9   7  2838  1/1     93995925.   52     73244012.   52            0.    9
39   10   5     1  1/1     -2029030.   47     -1581059.   47            0.   10
40   11   5  2837  1/1           0.   11           0.   11            0.   11
41   12  27     1  1/1           0.   12           0.   12            0.   12
42   13  27  1870  1/1     68211937.   47     52895137.   47            0.   13
43   14  27  2837  1/1           0.   14           0.   14            0.   14
44
45
46 L1,L2 OBSERVATIONS:
47 OBS.N    TIME   F #S   PHASE (M)  FFS SA       ...
48     1   0:00:30    9        -0.016S 8 26      -0.090S 7  7 ... 96-07-29 -0.000000110 -0.000129938
49                              0.060S 6 26      -0.015S 3  7 ...
50     2   0:01:00    9      2394.653  8 26   -2072.678  7  7 ... 96-07-29 -0.000000110 -0.000150902
51                           2394.728  6 26   -2072.604  3  7 ...
52
53     3   0:01:30    9     -1189.807  8  9    4787.722  8 26 ... 96-07-29 -0.000000111 -0.000171865
54                          -1189.790  5  9    4787.795  6 26 ...
55
56     4   0:02:00    7      7182.520  8 26   -6236.349  7  7 ... 96-07-29 -0.000000103 -0.000192823
57                           7182.592  6 26   -6236.273  4  7 ...
```

Figure 23.16: Example for an Observation File (Header in Lines 1-45; Observations in Lines 47-57)

4 : The reference epoch is the full second part of the first observation epoch in the file; File modification date and time (updated by programs changing the file).

6 : # of differences: 0 = zero diff.file, 1 = single diff. file; File format number (at present always set to 4, provided for further updates).

7 : # of frequencies: 1 or 2; session number (used in program IONEST to arrange files in sessions, in program GPSEST to know which files have to be correlated).

8 : Total number of satellites in the file; The session file number is usually 1. It is 2 for the second half of a file which has been split up into two files (only important if more than one file exists for the same station and the same session).

9 : The number of epochs is not equal to the number of observation epochs. It is just the internal number of the last observation in the file. Observation sampling (in former formats the SV-number of the reference satellite was stored for ambiguity resolution).

10 : Number of occurrences of an epoch flag (given in the RINEX format in case of power failure). Remark number: it may be used to mark a file. The remark number is not used in any program so far, but it is printed by GPSEST.

11 : Observation interval in seconds (sampling rates below 1 sec are not supported, at present).

13 : Station name(s) (ch∗16)

14 : Operator name(s) (ch∗16)

15 : Receiver type(s) (ch∗16)

16 : Antenna type(s) (ch∗16)

17 : Receiver and antenna serial number(s) (5 digits).

19 : Type of clock correction computed for the receiver clock(s): POLYNOMIAL DEG n, OFFSET PER EPOCH, or NONE.

21 : Position eccentricities in a local coordinate frame (north,east,up). The transfer programs store the vector from the marker on the ground to the antenna reference point (ARP). See file `ANTENNA.GRA` in the directory `$X/GEN` (UNIX) / `X:[GEN]` (VMS) / `X:\GEN` (DOS) for the definition of the ARP for various antenna types. Usually the eccentricities in north and east direction are zero and the third eccentricity (up) is equal to the antenna height.

23 : List (lines 23-26) of the satellite numbers, and the number of good and marked observations for each satellite (L_1 or L_1&L_2).

30 : List of ambiguities containing the ambiguity number, the satellite number, the start epoch of the ambiguity, the wavelength factor(s) for one or both frequencies, the value of the ambiguities within the corresponding cluster, and the ambiguity cluster number. If two frequencies are available the widelane ambiguity (L_5) is stored (together with its cluster number), too, independently of the L_1 and L_2 ambiguities. If two ambiguities of the same frequency belong to the same ambiguity cluster (i.e. have the same cluster number) they are *resolved* relative to each other (as double difference ambiguity).

48 : List of all the observations, where you find the following values:

- Internal observation number (used as reference)
- Observation time (full seconds only)
- Epoch flag (provided by the RINEX format, e.g. for power failure)
- Number of satellites observed at this epoch
- For each satellite observed (`#S`):

  - observation (in meters)
  - two flags possible (FF):
    S: cycle slip
    M: marked observation
  - signal/noise ratio (S)
  - SV-number (SA)
- Date of observation
- Clock parameter for station 1 (sec):
  - Zero difference files: fractional second of observation epoch
  - Single diff. files: sum of fractional second of observation epoch + clock correction to GPS time for station 1
- Clock parameter for station 2 (sec):
  - Zero difference files: clock correction to GPS time for current epoch
  - Single diff. files: sum of fractional second of observation epoch + clock correction to GPS time for station 2

The L_2-observations follows in the next line (if available).

52 : A blank line is inserted into the formatted file whenever one or more observation epochs are missing or if the satellite scenario changes. Blank lines between the observations will be removed when the file will be transformed back into a binary file.

23.7 Orbit Files

The orbit files types, explained in this section, are shown in Figure 23.17

```
                             -----------------------
                             |                     |
                             |        Orbit        |
                             |        Files        |
                             |                     |
                             -----------------------
                                        |
      ---------------------------------------------------------------------
      |            |            |            |           |                  |
------------- ----------- ----------- ------------ -------------- -------------
| Broadcast | | Precise | | Tabular | | Standard | | Rad. Press.| | Improved  |
| Messages  | | Ephem.  | | Orbits  | | Orbits   | | Coeff.     | | Orb. Par. |
|  .BRD     | |  .PRE   | |   .TAB  | |   .STD   | |     .RPR   | |   .ELE    |
------------- ----------- ----------- ------------ -------------- -------------
```

Figure 23.17: Orbit Files

23.7.1 Satellite Broadcast Messages

Type : ASCII

Directory	:	Campaign-specific directory `ORB`.
Content	:	Satellite broadcast messages.
Created by	:	Transformation programs (e.g. RXNBV3 (Menu 2.7.2)).
Used by	:	BRDCHK, BRDTST, BRDTAB, CODSPP, SATCLK, GPSSIM, and BV3RXN.
Example	:	Figure 23.18.
Further Information	:	The file is truncated in the middle of the first message. The first record is a title line. Each message (containing 2·20 parameters: 20 for ephemerides and 20 for satellite clocks) is preceeded by a record in which the satellite number and a sequence number for the messages of a satellite. This sequence number is never used by the accessing programs, which means that different broadcast files may be merged into one file (by removing the title line of the file to follow). The values in the broadcast messages are explained in the header of the subroutine `GTBRDC`. A description of the message may also be found in [*Dierendonck et al.*, 1978]

```
BROADCAST NAVIGATIONS OF DOY 211 (1996)                          01-AUG-96 22:08
SVN-NUMBER=  2  MESSAGE-NR=  1
    0.864000000000000000D+03
    0.864000000000000000D+05
    0.265604900310201272D+08
    0.158220531884999994D-01
    0.945750839164000046D+00
   -0.369966761091999996D+00
   -0.243774235401000006D+01
   -0.219980265341999992D+01
    0.436696761602000023D-08
    ....
```

Figure 23.18: Broadcast Messages (`.BRD` File). 40 Lines of Information per Message.

23.7.2 Precise Ephemerides in IGS Format

Type	:	ASCII
Directory	:	Campaign-specific directory `ORB`.
Content	:	Precise ephemerides.
Created by	:	STDPRE (Menu 3.7). Official exchange format within IGS.
Used by	:	PRETAB.
Example	:	Figure 23.19 shows a precise orbit file created by CODE for July 26, 1996.
Further Information	:	The example file is truncated. It is given in the SP3 format. Apart from SP3 two older precise orbit file formats (SP1 and SP2) may be read and written by the Bernese GPS Software. All the satellite positions in the precise files are given in an earth- fixed reference frame.

SP1 : positions of the satellites

SP2 : positions and velocities of the satellites

SP3 : positions in km (and optionally velocities) and clock information of the satellites in microsec.

The recommended format is SP3. For detailed informations see [*Remondi*, 1989].
The satellite-specific formal rms values (lines 8-9, specifying the rms in 2^x cm, $x = 5 - 14$) are used in the option Panel 4.5–2.4.5 of the program GPSEST. An automated procedure to include this information into the processing is not yet implemented (but will be implemented in the next Version). For more details on the satellite clock values (last column, 999999.999999 if not available) and their use see Chapter 16.

```
#aP1996  7 26  0  0  0.00000000      96 d+D   ITR94     AIUB
##  863 432000.00000000   900.00000000 50290 0.0000000000000
+   24     1  2  3  4  5  6  7  9 14 15 16 17 18 19 21 22 23
+         24 25 26 27 28 29 31  0  0  0  0  0  0  0  0  0  0
+          0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
+          0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
+          0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
++         5  5  5  5  5  5  6  5 13  5 14  5 10  7  7  5 10
++         5  5  5  5  5  5  5  0  0  0  0  0  0  0  0  0  0
++         0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
++         0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
++         0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
%c cc cc ccc ccc cccc cccc cccc cccc ccccc ccccc ccccc ccccc
%c cc cc ccc ccc cccc cccc cccc cccc ccccc ccccc ccccc ccccc
%f  0.0000000  0.000000000  0.00000000000  0.000000000000000
%f  0.0000000  0.000000000  0.00000000000  0.000000000000000
%i    0    0    0    0      0      0      0      0         0
%i    0    0    0    0      0      0      0      0         0
/*
/* CENTER FOR ORBIT DETERMINATION IN EUROPE (CODE)
/* ORBIT FOR DAY 208, 1996
/* INCLUDING PRECISE CODE CLOCKS
*  1996  7 26  0  0  0.00000000
P  1 -14491.161032 -21128.605174   7084.280168    151.177872
P  2   6536.289780  14333.529397  21736.647326   -276.168883
P  3 -22063.973998 -10882.831340   9736.787369     35.186262
P  4   7644.813614  18503.431109 -17297.334415     36.640813
P  5  23219.281286 -11703.679564  -5382.413597     49.562138
P  6   3915.372266 -16216.668310 -20522.976533      1.941337
P  7  14443.229628  20962.100466   8270.040181    724.363306
P  9  15218.229380 -14514.071947  16079.414784     -4.722523
. ..       ...           ...           ...           ...
```

Figure 23.19: Precise Orbit File in SP3 Format (.PRE File)

23.7.3 Tabular Orbits

Type : ASCII

Directory	:	Campaign-specific directory `ORB`.
Content	:	Tabular satellite positions in the inertial frame B1950.0 or J2000.0.
Created by	:	PRETAB, BRDTAB (Menu 3.2).
Used by	:	ORBGEN (Menu 3.3).
Example	:	Figure 23.20.
Further Information	:	The orbit source is specified in the title line from col. 44 to 53. This information is transferred to the standard orbit file by program ORBGEN. The next two non-blank lines contain start/end time. They are followed by the tabular interval and the (nominal) number of ephemeris points. The next line contains pole information (which is not used by the program system). In the following lines the number of satellites and the satellite numbers (svn-numbers) are defined. Finally the satellite positions (in system 1950.0 or 2000.0 in km) are given. Satellite and epoch belonging to a specific record are reconstructed from the record number which is the first item of each record. Records of satellites for which no positions exist for a certain time interval are missing in the file to save space. The file format is very similar to the "antique" Macrometer so-called "T-Files".

```
TABULAR EPHEMERIS DERIVED FROM BROADCAST:  BR1996.211  SYSTEM J2000.0

   7   29 1996  0.000000000000D+00  0.000000000000D+00  0.000000000000D+00
   7   29 1996  0.220000000000D+02  0.450000000000D+02  0.000000000000D+00
 0.900000000000D+03   92
      0.153823072876D+00       0.257323273765D+00       0.463439049019D+00



   25
SVN       2

...      ..

SVN      28

    1    0.148088880106306D+05    0.526968628751150D+04    0.217210548547628D+05
    2   -0.228073271915016D+05    0.110636130396568D+05    0.758882498409432D+04
    3    0.203270096134166D+05    0.630055979043172D+04   -0.157236271029107D+05
    4    0.497064287709960D+04   -0.259077498072103D+05   -0.306132213646616D+04
```

Figure 23.20: Tabular Orbit Information (`.TAB` File).

23.7.4 Standard Orbits

Type	:	Binary
Directory	:	Campaign-specific directory `ORB`.
Content	:	Standard orbit (Bernese orbit representation using sets of polynomials).
Created by	:	ORBGEN (Menu 3.3).

Used by : Some orbit programs (e.g. STDDIF (Menu 3.6)) and the processing programs (Menu 4).

Example : Figure 23.21.

Further Information : A standard orbit contains all the information to compute position, velocity, and higher time derivatives for each satellite. The orbit is stored in the form of polynomial coefficients (one set of coefficients for typically 1 hour). One standard orbit file may contain several arcs per satellite. For additional information we refer to Chapter 8. The format is binary. To transform it to ASCII and back to binary (e.g. to allow a transfer to a different computer platform) please use the programs STDFMT and FMTSTD (Menu 5.7.3 and Menu 5.7.4) (default extension for the ASCII files: FSO).

```
   1
     24      24      10
  1   2   3   4   5   6   7   9 14 15 16 17 18 19 21 22 23 24 25 26 27 28 29 31
PR1996.211
   50293.00000000000        2.000000000000000
   50293.00000000000
   50293.04166666666
   50293.08333333334
   ...
   50293.95833333334
   50294.00000000000
   26560826.97948544
  3.5948010304332765E-03
  0.9542003285019213
   2.934056532237261
  -1.468848451338153
  0.4411324010901875
  -13048.98532573050
   ...
```

Figure 23.21: Standard Orbits (.STD / .FSO File).

23.7.5 Radiation Pressure Coefficient File

Type : binary

Directory : Campaign-specific directory ORB.

Content : Radiation pressure coefficients and partial derivatives of the satellite positions with respect to the radiation pressure coefficients. Starting with version 4.0 the partial derivatives of the satellite positions with respect to the Keplerian elements at the beginning of the arc are contained in this file, too.

Created by : ORBGEN (Menu 3.3).

Used by : Some orbit programs (e.g. ORBGEN (Menu 3.6) in the UPDATE mode, and the processing program GPSEST (Menu 4.5) for orbit improvements.

Example	:	not given. The structure of this file is similar to the standard orbit file (e.g. more than one arc per satellite possible).
Further Information	:	Only if you want to improve orbits it is necessary to generate an RPR file with the program ORBGEN. In all other cases the STD files are sufficient for the orbit representation. For additional information see Chapter 8. The format is binary. To transform it to ASCII and back to binary (e.g. to allow a transfer to a different computer platform) please use the programs STDFMT and FMTSTD (Menu 5.7.3 and Menu 5.7.4) (default extension for the ASCII files: FRP). **Note:** The new RPR format of version 4.0 is NOT supported by the programs STDFMT and FMTSTD mentioned (only all formats up to version 3.6). This is not essential, because the RPR files may be re-created from precise orbit (PRE) or orbital element (ELE) files.

23.7.6 Improved Orbit Parameters

Type	:	ASCII
Directory	:	Campaign-specific directory ORB.
Content	:	A priori and estimated orbit parameters.
Created by	:	GPSEST (Menu 4.5) and ADDNEQ (Menu 4.8.1)
Used by	:	ORBGEN (Menu 3.3) in the UPDATE mode and in STDPRE (Menu 3.7) to derive approximated rms values of the orbit quality for each satellite.
Example	:	Figure 23.22.
Further Information	:	Information concerning the orbital parameterization is given in Chapter 8. Some additional remarks: The first column contains the a priori orbital parameters, column 2 and 3 the improved values and their rms. The "*" indicates that a parameter was not estimated, ORBSYS 2 in the last column defines the orbital system (ORBSYS 1:B1950.0, ORBSYS 2:J2000.0), and the string T950101A characterizes, if present, the a priori model for radiation pressure and other important details of the orbit model used (e.g. the a priori geopotential model). Pseudo-stochastic orbit parameters are listed at the end of the file.

23.8 Miscellaneous Files

The Bernese GPS Software makes use of a big variety of miscellaneous files. Most of them are pure INPUT files, some are INPUT and/or OUTPUT files. The default path for most of them is the campaign-specific directories OUT or the STA.

```
IGSG: PHASE, DAY 211 2.ITER., UT-DRIFT                               02-AUG-96 01:26
ARC-NUMBER          =  1 SATELLITE          =  1 TOSC=  50293.00000000
-----------------------------------------------------------------------
A                   =  26560826.98946  26560826.91732 +-       0.015    ORBSYS 2
E                   =    0.0035947990    0.0035948031 +- 0.000000001    ORBSYS 2
I                   =    54.671651606    54.671651619 +- 0.000000031    ORBSYS 2
NODE                =   168.109056017   168.109056133 +- 0.000000040    ORBSYS 2
PERIGEE             =   -84.158791831   -84.158795875 +- 0.000005403    ORBSYS 2
ARG. OF LAT (START) =    25.275024577    25.275024809 +- 0.000000071    ORBSYS 2
D0                  = 0.155046176D-08 0.126760141D-08 +- 0.46039D-10    T950101A
Y0                  = 0.471002168D-09 0.257668622D-09 +- 0.40494D-10    T950101A
X0                  = 0.116292411D-13 0.887684490D-14 +- 0.91232D-12    T950101A
DC                  =-0.185798098D-13-0.153224647D-13 +- 0.91232D-12    T950101A
YC                  = 0.244501744D-12 0.253540023D-12 +- 0.91231D-12    T950101A
XC                  =-0.188645824D-13-0.252024003D-13 +- 0.91233D-12    T950101A
DS                  =-0.328753303D-14 0.555007628D-14 +- 0.91231D-12    T950101A
YS                  =-0.302597989D-13-0.359210317D-13 +- 0.91233D-12    T950101A
XS                  = 0.000000000D+00 0.000000000D+00 +- 0.000000+00  * T950101A
ARC-NUMBER          =  1 SATELLITE          =  2 TOSC=  50293.00000000
...
*** STOCHASTIC ORBIT PARAMETERS ***
-------------------------------------------------------------------------------
ARC-NUMBER          =  1 SATELLITE          =  1 TOSC=  50293.00000000
-----------------------------------------------------------------------
 1 3  13 50293.50000  0.000000000D+00 0.631696580D-07    0.90311D-06
 2 3  13 50293.50000  0.000000000D+00-0.568229193D-05    0.10383D-05
 3 3  13 50293.50000  0.000000000D+00-0.558700349D-14    0.91233D-09
...
```

Figure 23.22: File of a priori and estimated Orbit Parameters (.ELE File). The Example File shows that in this Case each Arc is Characterized by 18 Orbital Elements (6 Keplerian Elements, 9 Radiation Pressure Coefficient Parameters, and 3 Pseudo-stochastic Parameters (for the Middle of the Arc).

23.8.1 Station Coordinates

Type : ASCII

Directory : Campaign-specific directory STA.

Content : Geocentric station coordinates.

Created by : User-defined (Menu 1.4.1) or as output result of the processing programs RXOBV3, CODSPP, MAUPRP, GPSEST, or ADDNEQ (Menu 4), or of the service programs HELMR1 and COMPAR.

Used by : Processing programs (with the exception of ADDNEQ) as a priori coordinates.

Example : Figure 23.23. The file is also available in the distribution. ITRF coordinate files (ITRF93, ITRF94, etc.) for most of the permanent global IGS sites are available for each month in the anonymous CODE ftp area (see Section 7.4).

Further Information :

- Each coordinate file has to contain in line 3 the name of a geodetic datum specified in the datum file (see Section 23.4.2). Geocentric datum does **not** mean that the coordinates below are referring to this datum (unless the coordinates are given as latitude, longitude, and height, see remark below). The geodetic datum is only used to compute ellipsoidal coordinates in the processing programs if necessary. Whenever possible the geocentric coordinates should refer to the ITRF (i.e. to the same reference frame as the precise orbits used). You have the following possibilities:

  - Give rectangular coordinates in the geocentric system WGS - 84. (Rectangular coordinates are always taken to be in WGS - 84 even if another geodetic datum is specified in the file !). Format: (I3,2X,A16,3F15.4,4X,A1)
  - Give latitude, longitude, and height in the geodetic system specified in line three. Format: (I3,2X,A16,2X,A1,I2,I3,F9.5,2X,A1,2I3,F9.5,F11.4, 3X,A1)

- The coordinate epoch is written by the program ADDNEQ only. It is used in the programs HELMR1 (see Chapter 11) and the non-menu-program COOVEL (propagation of coordinates to a different epoch with help of a velocity file).
- Two title lines are followed by the line where the geodetic datum is specified. The end of the input file is indicated by a blank line. Lines below the blank line are ignored. The station number is read and used in the program system (mainly for selecting stations in the F-files). There are two ways to specify input coordinates:
- different programs mark the estimated coordinates with different flags.

R	:	coordinates extracted from RXOBV3
C	:	coordinates estimated by CODSPP
T	:	coordinates estimated by MAUPRP (triple diff. solution)
P	:	coordinates estimated by GPSEST
F	:	coordinates were kept fixed in the estimation procedure (GPSEST and ADDNEQ).
M	:	coordinates which were estimated by ADDNEQ.
W	:	coordinates which were weighted (ADDNEQ).
N	:	coordinates which were used for no-net translation and rotation conditions (ADDNEQ).
others	:	sites which are marked manually (Menu 1.4.1) with a special flag in the a priori coordinate file (e.g. G in the Figure 23.23 means GPS-derived ITRF coordinates).

23.8.2 Station Eccentricity Elements

Type	:	ASCII
Directory	:	Campaign-specific directory `STA`.
Content	:	Station eccentricities.
Created by	:	User-defined, assistance using Menu 1.4.4.
Used by	:	All processing programs.

```
ITRF94 EPOCH 1993.0: ITRF94.SSCA+B+C+Z                                  15-FEB-96
--------------------------------------------------------------------------------
LOCAL GEODETIC DATUM: WGS - 84          EPOCH: 1993 01 01  0:00:00

NUM  STATION NAME           X (M)          Y (M)          Z (M)     FLAG

151  GRAZ 11001M002     4194424.040    1162702.484    4647245.282     G
151  GRAZ 11001M002B    4194424.040    1162702.484    4647245.282     G
152  HERS 13212M007     4033470.281      23672.691    4924301.176     G
153  KOSG 13504M003     3899225.315     396731.752    5015078.302     G
154  MADR 13407S012     4849202.504    -360329.194    4114913.044     G
155  MATE 12734M008     4641949.798    1393045.205    4133287.278     G
155  MATE 12734M008B    4641949.798    1393045.205    4133287.278     G
156  TROM 10302M003     2102940.420     721569.352    5958192.079     G
157  WETT 14201M009     4075578.657     931852.618    4801570.002     G
158  ZIMM 14001M004     4331297.242     567555.666    4633133.789     G
158  ZIMM 14001M004A    4331297.242     567555.666    4633133.789     G
159  ONSA 10402M004     3370658.732     711876.975    5349786.833     G
...  ....                   ...            ...            ...
```

Figure 23.23: Coordinate (.CRD) File

Example : Figure 23.24.

Further Information : With an eccentricity file it is possible to have receivers at eccenter points with a known position relative to the center station. Introducing the eccentricity elements as given, only the coordinates of the center station will be estimated in GPSEST. In some cases it is easier to estimate the eccenter coordinates (where the GPS receiver/antenna is located) and to handle the eccentricity problem outside of the Bernese programs (especially if the eccenter values are not precisely known). In that case no eccenter file is needed.

The eccenter file may also be used to estimate one set of coordinates for two receivers by introducing the known vector between the two sites into an eccentricity file.

This file contains:

- eccenter station number
- eccenter station name
- name of center station belonging to the eccenter station
- eccentricities (DN, DE, DH) in the local geodetic datum specified in the third line of the file if you set SYSTEM to “L” (L:LOCAL) or the (DX, DY, DZ) eccentricities in the geocentric system (G:GEOCENTRIC). The datum must be equal to the datum in the coordinate file used. The eccentricities are added to the coordinates of the center station to obtain the eccenter station coordinates.

The end of the list is indicated by a blank line.

The following strategy is used to obtain the coordinates of a given list of station names:

(1) If there is no eccentricity file name specified in the menu programs all the stations in the list are assumed to be center stations and the coordinates are directly taken from the coordinate file used.

(2) If an eccentricity file is specified, this file is screened for station names in the list, first.

- If a station name is found in the eccentricity file the station is assumed to be an eccenter and the eccentricities (DN, DE, DH) or (DX, DY, DZ) are added to the coordinates of the corresponding center stations which in turn, must be included in the coordinate file.
- If a station name is not found in the eccentricity file the station is assumed to be a center station and the coordinates will be taken from the coordinate file.

```
CODE: ITRF SITE ECCENTRICITY FILE (IGSMAIL 263)                 24-SEP-93 21:04
--------------------------------------------------------------------------------
LOCAL GEODETIC DATUM: WGS - 84           SYSTEM : G (G: GEOCENTRIC, L: LOCAL)
                                                 CENTER --> STATION
NUM  STATION NAME      CENTER NAME          DX (M)     DY (M)     DZ (M)

151  GRAZ 11001M002    GRAZ 11001S002      -2.5590     8.5160    -1.3210
152  HERS 13212M007    HERS 13212S001       6.5050    10.2780    -3.9450
153  KOSG 13504M003    KOSG 13504M002     -12.4610   -37.5030    23.0240
154  MADR 13407S012    MADR 13407S010    -134.2460   159.6640   164.2750
155  MATE 12734M008    MATE 12734S001     -15.1730   -24.8270    24.9650
156  TROM 10302M003    TROM 10302M002      36.2880   -33.1150    -9.2150
157  WETT 14201S020    WETT 14201S004      38.6970   117.4170   -59.3220
158  ZIMM 14001M004    ZIMM 14001S001      13.6800     6.0120    -6.2420
...  ....              ....                  ...        ...        ...
```

Figure 23.24: Station Eccentricity (.ECC) File

23.8.3 Station Velocities

Type : ASCII

Directory : Campaign-specific directory STA.

Content : Station velocity information.

Created by : User-defined, created by ADDNEQ (Menu 4.8.1), or created by the non-menu program NUVELO. The format is identical with the coordinate file. Therefore you may use Menu 1.4.1 as assistance for editing the file.

Used by : ADDNEQ: as a priori velocity information or as output file for the velocity estimates.

Example : Figure 23.25. The file is also available in the distribution. ITRF velocity files (ITRF93, ITRF94, etc.) for most of the global permanent sites are available in the anonymous CODE ftp area (see Section 7.4).

Further Information :

- Station names have to be identical to the station names of the coordinate files (or center name of the eccentricity file).
- The information concerning the local geodetic datum has to be identical to the one in the coordinate file used.
- Velocity information (VX, VY, VZ in meter per year) has to be given in the geocentric coordinate system.
- Velocity flags are almost identical to the coordinate flags:

  F : velocities which were fixed to a certain value (ADDNEQ).
  W : velocities for which a priori weights were used (ADDNEQ). Because the velocity estimation is activated using weights, the velocities will get this flag type, even if large a priori sigmas are specified (e.g. 1000 mm/yr).
  N : coordinates which were used for no-net translation and rotation conditions (ADDNEQ).
  others : sites which were marked manually (Menu 1.4.1) with a special flag in the a priori coordinate file (e.g. G in Figure 23.25 means GPS-derived ITRF velocities).

- The tectonic plate information is important for the non-menu program NUVELO to derive a new NNR-NUVEL1 or NNR-NUVEL1A velocity file. Specifying this file in Menu 4.8.1 (option `PLATE TABLE NUVEL1`) of the program ADDNEQ means to apply the NNR-NUVEL1 model instead of using the numerical values given in the velocity file (velocity values are not necessary in this case).

```
ITRF94 VELOCITY FIELD: ITRF94.SSCA+B+C+Z                              15-FEB-96
--------------------------------------------------------------------------------
LOCAL GEODETIC DATUM: WGS - 84

NUM  STATION NAME          VX (M)         VY (M)         VZ (M)     FLAG   PLATE

151  GRAZ 11001M002           -.0166          .0184          .0098    G    EURA
151  GRAZ 11001M002B          -.0166          .0184          .0098    G    EURA
152  HERS 13212M007           -.0107          .0175          .0110    G    EURA
154  MADR 13407S012           -.0062          .0199          .0127    G    EURA
155  MATE 12734M008           -.0191          .0202          .0121    G    EURA
155  MATE 12734M008B          -.0191          .0202          .0121    G    EURA
156  TROM 10302M003           -.0193          .0107          .0051    G    EURA
157  WETT 14201M009           -.0169          .0173          .0056    G    EURA
158  ZIMM 14001M004           -.0131          .0180          .0121    G    EURA
```

Figure 23.25: Site Velocity (`.VEL`) File.

23.8.4 Station Name Translation Table

Type : ASCII

Directory	:	Campaign-specific directory `STA`.
Content	:	Station name translation table for the transfer programs.
Created by	:	User-defined, assistance using Menu 1.4.2.
Used by	:	RXOBV3 and RXMBV3 (Menu 2.7.1 and Menu 2.7.3).
Example	:	Figure 23.26. The file is also available in the distribution.
Further Information	:	The translation table may be used in the transformation programs creating Bernese observation files to obtain standardized station names for an entire campaign. If this file is specified in the menu programs all station names found in the raw data (RINEX) will be translated according to the translation table. Wildcards are allowed!

```
CODE: SITE NAME TRANSLATION TABLE                                 6-APR-93 12:12
--------------------------------------------------------------------------------

NUM  OLD STATION NAME  NEW STATION NAME

111  *NALL*            NYAL 10317M001
111  *NY*              NYAL 10317M001
122  *MAS1*            MASP 31303M001B
123  *BOR1*            BOR1 12205M002
153  *KOSG*            KOSG 13504M003
153  *KOOT*            KOSG 13504M003
154  *DSS60*           MADR 13407S012
154  *DSCC60*          MADR 13407S012
154  *MADR*            MADR 13407S012
156  *TROM*            TROM 10302M003
157  *WETTZELL-1200*   WETT 14201M009
157  *WETTZELL PILLAR* WETT 14201M009
```

Figure 23.26: Station Name Translation (`.STN`) File.

23.8.5 Variance-Covariance Matrix

Type	:	ASCII
Directory	:	Campaign-specific directory `OUT`.
Content	:	Variance-covariance matrix of the least square adjustment.
Created by	:	GPSEST (Menu 4.5), ADDNEQ (Menu 4.5), and COMPAR (Menu 5.4.1).
Used by	:	COMPAR (Menu 5.4.1) for combination of solutions.
Example	:	Figure 23.27 for type 1.
Further Information	:	There are two different file types that may be created.

(1) Variance-covariance matrix of the station coordinates and velocities only (may be used as input together with the coordinate files in the program COMPAR).

(2) The full variance-covariance matrix including a parameter characterization list at the beginning of the file. We do not recommend to specify this type of output, because this file cannot be used in other Bernese programs and a big file may be created. An example file is given in the distribution.

This file (type 1) may e.g. be used to combine GPS solutions with terrestrial geodetic network solutions using different adjustment software tools. The combination of different (GPS) solutions may be performed using the program COMPAR (coordinates only, no datum transformations possible) or using the program ADDNEQ (all parameter types supported, based on normal equations (`NEQ` format according to Section 23.8.8)). Furthermore it is possible to extract from these files the necessary information for plotting error ellipses (see Figure 18.6).

```
COMBINATION GPSWEEK 0862, EUROPE                                06-AUG-96 16:34
-------------------------------------------------------------------------------

UPPER TRIANGULAR PART OF VARIANCE-COVARIANCE MATRIX FOR COORDINATES/VELOCITIES:
-----------------------------------------------------------------------------

RMS OF UNIT WEIGHT:  0.0023  # OBS:     670404  # UNKNOWNS:     9309


STATION 1        XYZ    STATION 2        XYZ FLG    MATRIX ELEMENT

BOR1 12205M002    X     BOR1 12205M002    X         0.9024207094D-01

BOR1 12205M002    Y     BOR1 12205M002    X         0.2689456956D-01
BOR1 12205M002    Y     BOR1 12205M002    Y         0.1096727406D-01

BOR1 12205M002    Z     BOR1 12205M002    X         0.1169366832D+00
BOR1 12205M002    Z     BOR1 12205M002    Y         0.3615627381D-01
BOR1 12205M002    Z     BOR1 12205M002    Z         0.1628096272D+00

KOSG 13504M003    X     BOR1 12205M002    X         0.2910501004D-02
KOSG 13504M003    X     BOR1 12205M002    Y         0.3126282733D-03
KOSG 13504M003    X     BOR1 12205M002    Z         0.3401657909D-02
KOSG 13504M003    X     KOSG 13504M003    X         0.1630786764D-01
....
```

Figure 23.27: Variance-Covariance (`.COV`) File of Type 1.

23.8.6 Residual Files

Type : binary

Directory : Campaign-specific directory `OUT`.

Content : Residuals stemming from the processing programs.

Created by : CODSPP (Menu 4.2), MAUPRP(Menu 4.4.2), GPSEST (Menu 4.5), IONEST (Menu 4.7), and ORBGEN (Menu 3.3).

Used by	:	REDISP (Menu 5.3.1) to browse residuals of different programs in a window of 80 character widths, RESRMS (Menu 5.3.2) to check residuals for outliers. The Graphic Tool GT (see Chapter 20; Menu 5.3.3) allows a graphical presentation of the residuals, to create an edit file (see Section 23.8.14) containing the data to be marked and also informations to set up additional ambiguities.
Example	:	-
Further Information	:	ASCII versions of a residual file may be created using Menu 5.3.1 if you specify a list file (see Section 23.8.9).

23.8.7 Program Output Files

Type	:	ASCII
Directory	:	Campaign-specific directory `OUT`.
Content	:	Job output of the main GPS programs GPSEST and ADDNEQ.
Created by	:	GPSEST (Menu 4.5) and ADDNEQ (Menu 4.8.1).
Used by	:	GPSXTR (Menu 5.6.5) to extract information from the output files. Suited for a summary file extraction in an automated processing using the BPE.
Example	:	-
Further Information	:	If no file name is specified in (Panel 4.5–1 (GPSEST) or in Panel 4.8.1–1 (ADDNEQ), respectively, option `GENERAL OUTPUT`) the job output is routed to the default output file name `PGMNAM.Lnn` (`nn` = 01 - 99) or `PGMNAM.nnn` (`nnn` = 001 - 999) (see Section 3.6.2). If a file name is specified, the output is routed to that file with the default extension `OUT`. Using the menu system (`JOB` or Menu 5.9) it is also possible to create a list file (`.LST`; see also Section 23.8.9) from a program output file `PGMNAM.Lnn` or `PGMNAM.nnn`, respectively.

23.8.8 Normal Equation Files

Type	:	binary (default) or ASCII (*both* formats are handled by ADDNEQ, but only binary is economical).
Directory	:	Campaign-specific directory `OUT`.
Content	:	Normal equations and important a priori information.
Created by	:	GPSEST (Menu 4.5) and ADDNEQ (Menu 4.8.1).
Used by	:	ADDNEQ (Menu 4.8.1) to combine sequential solutions.
Example	:	-
Further Information	:	Normal equation files contain important information concerning the a priori values used as well as the normal equations computed in the main parameter estimation program GPSEST. It is possible to store all GPS parameter types in the normal equations (even if that is not recommended). For more information on normal equations we refer to Chapter 18).

To transform binary normal equations (NEQs) into ASCII files (necessary if you have to change the computer platform), you may use the program NEQFMT (no menu system support) which is also suited to transform ASCII NEQs into binary NEQs.

23.8.9 List Files

Type	:	ASCII
Directory	:	Campaign-specific directory `OUT`.
Content	:	Contains special output information (sometimes a pure copy of output information which is usually removed automatically).
Created by	:	CRRCANT (Menu 1.4.5): Output of the translation table, DEFXTR (Menu 5.6.2): Output of extraction results, HELMER (Menu 5.4.2): Output file JOB (Menu 5.9): Create a list file from a program output (see Section 23.8.7), ORBIMP (Menu 3.9.3): Summary file of the job output used as input for program, PREWEI (see below), PREWEI (Menu 5.6.7): Input file (containing quality information for each satellite), REDISP (Menu 5.3.1): Save binary residual file to ASCII list file.
Used by	:	Operator to save e.g. important job output information.
Example	:	-
Further Information	:	-

23.8.10 Plot File

Type	:	ASCII
Directory	:	Campaign-specific directory `OUT`.
Content	:	Plot information.
Created by	:	ADDNEQ (Menu 4.8.1) and COMPAR (Menu 5.4.1): to store coordinate residuals (N, E, U). POLXTR (Menu 5.3.1): to store Earth rotation parameter estimates. STDDIF (Menu 3.6): to store differences between orbits (radial, along, and out of plane).
Used by	:	The operator to produce plots of residuals (using an arbitrary plot program).
Example	:	-
Further Information	:	The plot files only contain the data to be plotted. You may import this information into any plot program.

23.8.11 Pole File in IERS Format

Type	:	ASCII
Directory	:	Campaign-specific directory `OUT`.
Content	:	Pole coordinates and UT1-UTC together with some statistical information on these estimated parameters.
Created by	:	Parameter estimation program GPSEST (Menu 4.5) or ADDNEQ (Menu 4.8.1) or by other IGS Analysis Centers.
Used by	:	Extraction programs POLUPD (Menu 5.5.1), POLXTR (Menu 5.5.2), submission format of Earth rotation parameters for IERS.
Example	:	Figure 23.28. Also available in the distribution.
Further Information	:	This file is only used to send pole, UT1-UTC, and nutation information from global earth rotation parameter estimations to the IERS Bureau. It is probably not of interest for the general user.

```
ADDNEQ: 3-DAY 193, AMB. FIXED, POLE: 2 PAR/3 DAYS ABS           16-JUL-96 05:24
--------------------------------------------------------------------------------------------
CELESTIAL POLE OFFSET: NO                              SUBDAILY POLE MODEL: RAY
  MJD        X-P     Y-P   UT1UTC   LOD  S-X  S-Y S-UT S-LD  NR  NF  NT  X-RT  Y-RT S-XR S-YR
                E-5"      E-6S  E-6S/D    E-5"  E-6S E-6S/D              E-5"/D    E-5"/D
50274.00   21191   52431  175281  1002    2    3    0    1  69  11  24   350  -299    1    1
50274.04   21205   52419  175239  1002    2    3    0    1  69  11  24   350  -299    1    1
50274.08   21220   52406  175197  1002    2    3    0    1  69  11  24   350  -299    1    1
50274.08   21220   52406  175197  1002    2    3    0    1  69  11  24   350  -300    1    1
50274.13   21235   52394  175156  1002    2    3    0    1  69  11  24   350  -300    1    1
....
50276.88   22196   51570  172758   774    3    3    2    1  69  11  24   350  -300    1    1
50276.92   22211   51557  172726   774    3    3    2    1  69  11  24   350  -300    1    1
50276.92   22211   51557  172726   774    3    3    2    1  69  11  24   350  -299    1    1
50276.96   22225   51545  172693   774    3    3    2    1  69  11  24   350  -299    1    1
50277.00   22240   51532  172661   774    3    3    2    1  69  11  24   350  -299    1    1
```

Figure 23.28: Example File (`.IEP`). Here we present Subdaily Earth Rotation Estimates (2 hour Time Intervals) in the `IEP` Format stemming from a 3-Days Arc. The right-most Columns Listing the Correlations and Nutation Estimates are not reproduced.

23.8.12 SINEX File

Type	:	ASCII
Directory	:	Campaign-specific directory `OUT`.
Content	:	Coordinates and velocities in the Software INdependent EXchange format (SINEX) Version 1.00.
Created by	:	ADDNEQ (Menu 4.8.1).
Used by	:	IGS Global Network Associated Analysis Centers (GNAACs) to combine global solutions with regional GPS solutions. Also the official format for the coordinate and velocity submissions to IERS.

Example	:	Example files are available in the anonymous CODE ftp area (see Section 7.4; weekly European combined solutions as well as the weekly global solutions) or at CDDIS for different other IGS Analysis Centers. At the IGS Information Center an ASCII description of the SINEX 1.00 format is available (address see Section 7.4).
Further Information	:	A milestone for the development of the SINEX format was the 1994 IGS Workshop on the *Densification of the IERS Terrestrial Reference Frame through Regional GPS networks* (JPL, Pasadena, Dec. 1994). There it was decided to start an IGS pilot project to prove the concept for a *distributed processing* of GPS data. A test format of a Software INdependent EXchange format (SINEX Version 0.05) [1995], was defined by a working group. The SINEX format contains - besides the coordinate estimates and the corresponding covariance information - other important information like site names, DOMES numbers, antenna types, antenna eccentricities, phase center values, receiver types, and information on apriori weights (a priori values and a priori covariance matrix). Now the “final” SINEX version 1.00 [1996] is the official exchange format within the IGS for all contributions later than July 1996. The information of the elevation-dependent antenna phase center model used is “hard-wired” in the source code of the subroutine `SINSAV`. Please change the source code (see Section 22.6) if you intend to specify a special model name. General information is included in the SINEX files with help of a general file (see Section 23.4.9).

23.8.13 Normal Equation Rescaling File

Type	:	ASCII
Directory	:	Campaign-specific directory `OUT`.
Content	:	Normal equations rescaling information.
Created by	:	User-defined or as output of ADDNEQ (Menu 4.8.1) or SNXNEQ (no menu program).
Used by	:	ADDNEQ to rescale normal equations for the computation of combined solutions.
Example	:	Figure 23.29. Examples also available in the distribution.
Further Information	:	Rescaling of normal equations for the combination of solutions is usually NOT necessary, if you combine your own normal equations. If you combine solutions from different processing centers (using different program systems) rescaling the associated variance-covariance matrices may be mandatory. The example in Figure 23.29 shows the rescaling values for different European Analysis Centers (all using Bernese) [*Brockmann and Gurtner*, 1996], which were computed using the information on the sampling rate, only.

With program SNXNEQ transforming SINEX files into normal equation files (see Section 7.3.3) you may also estimate a priori rescaling values. These values are derived from comparing the rms values of the coordinate estimates of individual solutions.
The intention behind this file is to allow in future also the generation of an output file of estimated rescaling factors using the methods of *variance-covariance component estimation*. These methods are NOT activated in the present Version 4.0 . Some further comments:

- The mentioned rescaling values refer to the normal equations (< 1 means down-weighting, 0.25 e.g. means down-weighting by a factor of 2 ($1/2^2 = 1/4 = 0.25$)).
- You may specify a rescaling value for each file separately by specifying `FILE NAME`s (e.g. with use of the input file list from the F-file).
- You may also specify a GRP name (please leave the `FILE NAME` blank in this case). The GRP name specified here is compared to the normal equation input file names (first 3 characters disregarding the directory path). That makes it possible to handle files in groups.
- The `NUM` column is not used, at present.
- The information of the `HELMERT PAR` enables the estimation of Helmert parameters between individual solutions (or groups of solutions) and the combined solution. We do not recommend to use this test version, at present.

```
COVARIANCE COMPONENTS
PROGRAM SNXNEQ OUTPUT - COVARIANCE COMPONENT ESTIMATION AND HELMERT PARAMETERS
--------------------------------------------------------------------------------
NUM  VALUE                 FILE NAME                         GRP HELMERT PAR.   HELMERT VALUES ....
**  *******************  *******************************  ***  * * * * * * * ******** ******** ..

 1  0.10000000000000E+01                                  COE  0 0 0 0 0 0 0   0.0000   0.0000 ..
 2  0.10000000000000E+01                                  BEK  0 0 0 0 0 0 0   0.0000   0.0000 ..
 3  0.10000000000000E+01                                  IFG  0 0 0 0 0 0 0   0.0000   0.0000 ..
 4  0.66000000000000E+00                                  ROB  0 0 0 0 0 0 0   0.0000   0.0000 ..
 5  0.16000000000000E+00                                  WUT  0 0 0 0 0 0 0   0.0000   0.0000 ..
 6  0.16000000000000E+00                                  OLG  0 0 0 0 0 0 0   0.0000   0.0000 ..
```

Figure 23.29: Normal Equation Rescaling (`.WGT`) File.

23.8.14 Observation Editing File

Type	:	ASCII
Directory	:	Campaign-specific directory `OUT`.
Content	:	Observations file editing information (outliers, cycle slips, ambiguities, etc.) information.
Created by	:	User-defined or as output file from RESRMS (Menu 5.3.2).

Used by	:	SATMRK to mark outliers according the editing file.
Example	:	Figure 23.30 (showing all possible options to handle observations in a specific file or in all files.
Further Information	:	It is recommended in the automated processing to use the program RESRMS to detect outliers in the residuals of GPSEST. The outliers found by RESRMS may then be marked in the observation files using program SATMRK (Menu 5.1, option "M"). The Graphical Tool GT (see Chapter 20) also writes an observation editing file. The example file Figure 23.30. stems **not** from the program RESRMS because the program is not able to remove totally all data (`1 - 99999`) of a particular satellite if observations are bad. It marks only a maximum number of continuous observations (to be specified in Panel 5.3.2–1, option `DELETE DATA PIECES SMALLER THAN`), so that a little number of observations may remain for a bad satellite.

23.8.15 Delete Files

Type	:	ASCII
Directory	:	Campaign-specific directory `OUT`.
Content	:	Specification which campaign-specific files (e.g. observation files, orbit files, ...) should be deleted, when using Menu 5.8
Created by	:	User-defined or created automatically using MPRXTR (Menu 5.6.3).
Used by	:	DELFIL_P (Menu 5.8) to delete the files specified in the delete file. This is especially well-suited for the automated processing using the BPE, but is rarely used in an interactive processing mode.
Example	:	Figure 23.31.
Further Information	:	Problematic observation files (too many ambiguities, bad triple difference solution, etc. checked by MAUPRP) may be deleted automatically using the program MPRXTR together with program DELFIL_P. You may also prepare a delete file manually and execute the deletion using DELFIL_P. Please note that this is sometimes quite comfortable ($-variables defined in Panel 1.5.1 and wildcards are supported).

23.8.16 Summary Files

Type	:	ASCII
Directory	:	Campaign-specific directory `OUT`.
Content	:	Summaries of program output.
Created by	:	COMPAR (Menu 5.4.1): weekly summary file, DEFXTR (Menu 5.6.2): summary file of ORBGEN output file, GPSXTR (Menu 5.6.5): summary file of GPSEST and ADDNEQ output file(s),

```
MANUAL TEST TO MARK OBSERVATIONS                                     19-AUG-94 10:26
-------------------------------------------------------------------------------

FILE INFORMATION:
----------------

FILE  SESS SESF  REFERENCE EPOCH   DTOBS TYPE STATION1         STATION2
-------------------------------------------------------------------------------

  1   0226  1    94-08-14  0:00:00   30   P   ALGO 40104M002   WES2 40440S020
  2   0226  1    94-08-14  0:00:00   30   P   ALGO 40104M002   YELL 40127M003B
  3   0226  1    94-08-14  0:00:00   30   P   AREQ          B  EISL 41703M003
 ..   ....  .    ........  .......   ..   .   .............    .............

-------------------------------------------------------------------------------

EDITING INFORMATION:
--------------------
(EDITING TYPES: MARK=1, RESET=-1, ELIM.=2, SLIP=3, NEW AMB.=4, RESET AMB.=-4,
                SET CYC.SLP. FLAG=5, RESET CYC.SLP FLAGS=-5)
                     EPOCH NUMBERS
FILE  SAT  TYPE  FRQ  START  END    SLIP SIZE  REASON  #EPOCHS
-------------------------------------------------------------------------------

 99    99   -5    3       1 99999                  1    99999
  1    99   -5    3       1 99999                  1    99999
  1     7    5    3     225                        1
  1     5    1    3     442   448                  1        7
  1     5    1    3     474   480                  1        7
  1     6   -1    2    1922  1928                  1        7
  2     1    1    3      42    48                  1        7
  2    16    3    1    2158           -234567.     1
  2    16    3    2    2158              4568.     1
 99    99   -4    3       1 99999                  1    99999
  3    99   -4    3       1 99999                  1    99999
  3    17    4    3     180                        1
  3    99    4    3     230                        1
  3    25   -4    3    2001                        1
```

Figure 23.30: Editing (.EDT) File.

```
$X_$Y$D1  PGMOUT
TESTFILE  CZHED
%%%%$CD1  STDORB
```

Figure 23.31: Delete (.DEL) File.

MPRXTR (Menu 5.6.3): summary file of MAUPRP output file(s),
PREPRX (Menu 6.2): summary file of RINEX headers,
RESRMS (Menu 5.3.2): summary file of the quality of the checked observations.

Used by : The user for quality control, to have available short summary files with the most important information from different programs.

Example : Example files `EXAMPLEn.SUM`, n=1,8 are included in the distribution.

Further Information : -

23.8.17 Single Point Positioning File

Type : ASCII

Directory : Campaign-specific directory `OUT`.

Content : Contains the CODSPP summary of geocentric coordinates (`.SMC`) or of ellipsoidal coordinates (`.SME`).

Created by : CODSPP (Menu 4.2).

Used by : May be useful as a history of coordinate estimations using pseudorange observations.

Example : Figure 23.32 (example for a `.SMC` file). An example file for a `.SME` file is available in the distribution.

Further Information : The advantage of the `SMC` (and `SME`) files compared to the usual coordinate files (see Section 23.8.1) has to be seen in the circumstance that the rms information is also stored. This file type cannot be re-introduced into any other Bernese program, however. If you specify always the same file in all CODSPP runs, the new results are appended to all previous results, instead of overwriting the previous results. The maximum number of lines for this file is 10,000 lines.

```
SINGLE POINT POSITIONING SOLUTIONS: GEOCENTRIC COORDINATES IN WGS-84
--------------------------------------------------------------------

STATION NAME     SESS F FR C T I EL NS  DT   #OBS   RMS(M)        X (M)      SX(M)         Y (M)   ..
----------------------------------------------------------------------------------------------------..

BOGO             1871 1 L3 E S N 10  1  30  17069   24.16     3633737.5551  0.5732     1397434.0088..
CAGL 12725M003   1871 1 L3 E S N 10  1  30  17794   23.90     4893377.4074  0.6725      772649.9964..
HFLK 11006S003   1871 1 L3 E S N 10  1  30  18369   24.44     4248502.3201  0.5802      855575.6391..
KIRU 10403M002   1871 1 L3 E S N 10  1  30  17168   24.15     2251419.1083  0.4398      862817.7277..
MEDI 12711M003   1871 1 L3 E S N 10  1  30  17135   24.13     4461399.6582  0.6481      919593.9116..
NOTO 12717M003   1871 1 L3 E S N 10  1  30  17981   24.08     4934527.3605  0.6760     1321262.8881..
..............
----------------------------------------------------------------------------------------------------..
```

Figure 23.32: CODSPP Summary (`.SMC`) File

23.8.18 Meteo and Water Vapor Radiometer Data

Type : ASCII

Directory : Campaign-specific directory `ATM`.

Content : Station surface meteorological data or water vapor radiometer data.

Created by	:	RXMBV3 ($\boxed{\text{Menu 2.7.3}}$), GPSSIM
Used by	:	GPSEST as a priori troposphere information.
Example	:	Figures 23.33 (type 1) and 23.34 (type 3). Example files are available in the distribution.

Further Information :

- There is one meteo file per station (session-independent). The time difference between subsequent epochs is not essential. If the subroutine `METEO` gets a request to calculate tropospheric refraction at time T, this value is calculated by linear interpolation of the table values in this file, where the two nearest meteo recording times are used.
- File structure:
  The first record characterizes the campaign. The second record defines the station name, the difference local time - UTC (meteorological data may be recorded in local time), and the data type. The following types of meteo files are allowed:

  Type 1 : Pressure (mbar), temperature (Celsius), humidity (%).
  Type 2 : Pressure (mbar), dry temperature, wet temperature (both in Celsius).
  Type 3 : dr (m), where dr is the total tropospheric zenith delay.
  Type 4 : Tropospheric zenith delays from GPSEST or ADDNEQ (see remark below).
  Type 5 : Pressure (mbar), temperature (Celsius), humidity (%), and zenith wet delay.
  Type 6 : Pressure (mbar), temperature (Celsius), humidity (%), and precipitable water vapor.

  The following models (mapping functions) are allowed for type 3:

  Model 0 : 1/cos(zenith angle) mapping
  Model 1 : simplified Herring mapping
- The meteo file has to end with a blank line (or a line starting with -1).
- It is also possible to include troposphere values estimated from GPS data (`.TRP` files according to Section 23.8.19, e.g. tropospheric estimates derived at CODE for many globally distributed GPS sites). This option is suited especially for densification purposes (distributed processing according to Section 18.4). To create the station-specific meteo files (required as input for GPSEST) from `.TRP` files, please use the program PRPMET (not menu-supported). The direct use of `TRP` meteo files is realized only in version 4.1 .
- It would be desirable to have a program converting .TRP files into RINEX meteo files, to distribute troposphere zenith delay estimates derived from GPS in a software-independent format. Such a program does not exist at present (not supported by program RXMETEO).

23.8.19 Troposphere Parameter File

Type : ASCII

```
SLR                  BERNESE MET.FILES FOR SLR CAMPAIGN
STATION : 8834 WETT           UTC-LOCAL TIME(HOURS) =  0 TYP= 1  #VALUES=  3  MOD=  0
  JJ MM DD HH MM SS  PPP.PP  TT.TT  HH.HH
  95 12 14 18 23 34  946.00  -3.50  84.00
  95 12 14 18 26 42  946.00  -3.50  84.00
  .. .. .. .. .. ..    ...    ...    ...
```

Figure 23.33: Meteo (.MET) File of Type 1

```
D: L1, DAY ALL, STA.SPE. 24/DAY ., ELE. 20                       29-DEC-94 16:36
STATION : AGAR GPS            UTC-LOCAL TIME(HOURS) =  0 TYP= 3  #VALUES=  1  MOD=  1
 JJJJ MM DD HH MM SS  CCCC.CCCC
 1994  9  6 10  0  0     1.9412
 1994  9  6 11  0  0     1.9412
 ....  .  .  .  .  .     ...
```

Figure 23.34: Meteo (.MET) File of Type 3

Directory : Campaign-specific directory ATM.

Content : Tropospheric zenith delays (estimated).

Created by : GPSEST (Menu 4.5) or ADDNEQ (Menu 4.8.1).

Used by : Non-menu program PRPMET (conversion to meteo files .MET; see previous section). The meteo files may then be introduced as known into the processing of other (smaller) networks as a priori troposphere information.

Example : Figure 23.35. Example files are available in the distribution.

Further Information : The troposphere files contain the following information:

(1) Title.
(2) A priori model (SAASTAMOINEN = -1, HOPFIELD (REMONDI) = -2, ESSEN + FROOME = -3, SAASTAMOINEN DRY PART ONLY = -11, HOPFIELD DRY PART ONLY = -12) which was used to correct for the main effect of the tropospheric delay (see also the standard atmosphere model definition in the CONST. file of Section 23.4.1).
The positive model numbers (1 up 12) correspond to the same models but with *observed* meteorological values used for the computation of the a priori troposphere zenith delay.
(3) Station name.
(4) Station flag (see Section 23.8.1).
(5) Time window.
(6) Zenith delay (total effect) from the a priori model (zero, if observed meteo used) in m.
(7) Estimated value (correction to the a priori zenith value) in m.
(8) Estimated formal rms of the correction in m.

(9) Total zenith delay (sum of a priori value and estimated correction) in m.

(10) Total delay in m (in geocentric coordinate components X, Y, Z (not displayed in Figure 23.35).

```
ADDNEQ: 3-DAY 211, AMB. FIXED, POLE: 2 PAR/3 DAYS ABS          03-AUG-96 06:36
-----------------------------------------------------------------------------------------------
 A PRIORI MODEL:   -1

     STATION      FLG   JJJJ MM DD HH MM SS   JJJJ MM DD HH MM SS    MODEL   CORR. SIG_CORR  TOTAL

 KOSG 13504M003    W    1996  7 28 23 59 56   1996  7 29  6  0  0   2.3725  0.0948  0.0008  2.4673
 KOSG 13504M003    W    1996  7 29  6  0  0   1996  7 29 12  0  0   2.3725  0.0945  0.0008  2.4670
 KOSG 13504M003    W    1996  7 29 12  0  0   1996  7 29 17 59 59   2.3725  0.0970  0.0007  2.4695
 KOSG 13504M003    W    1996  7 29 17 59 59   1996  7 30  0  0  3   2.3725  0.0945  0.0009  2.4670
 ZIMM 14001M004    M    1996  7 28 23 59 56   1996  7 29  6  0  0   2.0957  0.1172  0.0011  2.2129
 ZIMM 14001M004    M    1996  7 29  6  0  0   1996  7 29 12  0  0   2.0957  0.1066  0.0012  2.2023
 ZIMM 14001M004    M    1996  7 29 12  0  0   1996  7 29 17 59 59   2.0957  0.1012  0.0012  2.1968
 ZIMM 14001M004    M    1996  7 29 17 59 59   1996  7 30  0  0  3   2.0957  0.1245  0.0013  2.2201
```

Figure 23.35: Troposphere Estimates in `.TRP` File Format.

23.8.20 Ionosphere Models

Type	:	ASCII
Directory	:	Campaign-specific directory `ATM`.
Content	:	Ionosphere models.
Created by	:	IONEST (Menu 4.7, model type 1 only) and GPSEST (Menu 4.5) (type 1 (not supported by the menu system) and type 2) as output file.
Used by	:	MAUPRP (Menu 4.4.2) and GPSEST (Menu 4.5) as a priori ionosphere information.
Example	:	Figure 23.36 (model type 1) and Figure 23.37 (model type 2). Example files also available in the distribution.
Further Information	:	We support two ionosphere model types:

Local : Local models (`ION` type 1 files) may be generated and used in the following way: estimated by program IONEST (using zero-difference L_4 observations) and introduced into programs MAUPRP and GPSEST. We do not recommend to estimate ionosphere type 1 models using GPSEST, because this feature is not supported by the menu system (the estimation of local ionosphere parameters has to be activated "manually" in the I-File). Furthermore you have to define the model parameters by specifying an a priori `ION` type 1 file (origin of development, applicability window, the other parameters may be copied from an arbitrary other `ION` type 1 file).

Regional : Regional / global ionosphere models (ION type 2 files) may be created much easier using GPSEST. The parameter types to be solved for may be specified directly in Panel 5.4.2–4.

More information concerning ionosphere models is given in Chapter 13).

```
IONOSPHERE MODELS FOR TURTMANN                                         8-FEB-93 10:59
--------------------------------------------------------------------------------
IONOSPHERE MODEL NUMBER                           :    1
TYPE OF IONOSPHERE MODEL                          :    1
ORIGIN OF DEVELOPMENT: TIME (UT)  (Y M D H)       : 1992 10 28 14.8
                       LATITUDE   (DEGREES)       :   46.8771
                       LONGITUDE  (DEGREES)       :    7.4651
                       HEIGHT OF LAYER (KM)       :  350
DEGREE OF DEVELOPMENT: TIME                       :    2
                       LATITUDE                   :    1
                       MIXED                      :    2
NORMALIZATION FACTORS: LATITUDE (DEGREES)         :   6.00
                       TIME (HOURS)               :   2.00
                       ELECTRON CONTENT           :       0.10D+18
APPLICABILITY          FROM EPOCH                 : 1992 10 28 12.0
                       TO EPOCH                   : 1992 10 28 17.5
COEFFICIENTS:
DEG. LAT   DEG. TIME  COEFFICIENT        RMS
    0         0        0.26313868E+01   0.18961230E-01
    0         1       -0.11226929E+01   0.82974723E-02
    0         2        0.90513909E-02   0.10480726E-01
    1         0       -0.53071964E+00   0.10746679E-01
    1         1        0.88148393E-01   0.15985126E-01
   -1
... additional models ...
```

Figure 23.36: Ionosphere File (.ION) of Model Type 1.

23.8.21 Ionosphere Maps

Type : ASCII (long format: up to 1000 columns wide)

Directory : Campaign-specific directory ATM.

Content : Ionosphere maps.

Created by : GPSEST (Menu 4.5).

Used by : Exchange format to compare ionosphere estimates derived by different techniques.

Example : Figure 23.38. Example files also available in the distribution.

Further Information : This ionosphere map format is only a temporary format for the exchange of ionosphere model information and will (hopefully) be replaced in future by IONEX (in analogy to RINEX and SINEX formats).

```
CODE: GLOBAL IONOSPHERE MODEL FOR DAY 073, 1996                   17-MAR-96 04:30
--------------------------------------------------------------------------------
IONOSPHERE MODEL NUMBER                            : 0731-00
TYPE OF IONOSPHERE MODEL (1=LOCAL,2=GLOBAL)        :    2
MAXIMUM DEGREE OF SPHERICAL HARMONICS              :    8
MAXIMUM ORDER                                      :    8
DEVELOPMENT WITH RESPECT TO
  GEOGRAPHICAL (=1) OR GEOMAGNETIC (=2) FRAME      :    1
  MEAN (=1) OR TRUE (=2) POSITION OF THE SUN       :    1
MAPPING FUNCTION (1=1/COS)                         :    1
HEIGHT OF SINGLE LAYER AND ITS RMS ERROR (KM)      :  400.00     0.00
COORDINATES OF EARTH-CENTERED DIPOLE AXIS
  LATITUDE OF NORTH GEOMAGNETIC POLE (DEGREES)     :
  EAST LONGITUDE (DEGREES)                         :
PERIOD OF VALIDITY
  FROM EPOCH / REFERENCE EPOCH (Y,M,D,H,M,S)       : 1996 03 13 00 00 00
  TO EPOCH                                         : 1996 03 13 23 59 59
LATITUDE BAND COVERED
  MINIMUM LATITUDE (DEGREES)                       :  -85.75
  MAXIMUM LATITUDE (DEGREES)                       :   87.09
ADDITIONAL INFORMATION
  NUMBER OF CONTRIBUTING STATIONS                  :   64
  TID INDICATOR (TECU)                             :    0.99
COMMENT / WARNING                                  :
COEFFICIENTS
DEGREE  ORDER    VALUE (TECU)   RMS (TECU)
   0       0       10.66643935     0.0322
   1       0       -0.98758858     0.0310
   1       1        4.64559206     0.0307
   1      -1        3.55668425     0.0292
  ...     ...       ...            ...
   8      -8        0.06239174     0.0105
```

Figure 23.37: Ionosphere File (.ION) of Model Type 2.

```
  70 145
   87.5   85.0   82.5   80.0   77.5   75.0   72.5   70.0   67.5  ....
 -180.0 -177.5 -175.0 -172.5 -170.0 -167.5 -165.0 -162.5 -160.0  ....
   2.8    2.8    2.8    2.8    2.8    2.8    2.8    2.8    2.8    2.8    2.8   ...
   2.4    2.4    2.4    2.4    2.4    2.4    2.4    2.4    2.4    2.4    2.4   ...
   ...    ...    ...
```

Figure 23.38: Ionosphere Map (.INX) File.

23.8.22 Satellite Clock Coefficients

Type	:	ASCII
Directory	:	Campaign-specific directory ORB.
Content	:	Satellite clock parameters (extracted from broadcast messages).
Created by	:	SATCLK (Menu 3.8) or PRETAB (Menu 3.2).
Used by	:	CODSPP (Menu 4.2), MAUPRP (Menu 4.4.2), GPSEST (Menu 4.5).

Example : Figure 23.39.

Further Information :
(1) In CODSPP a satellite clock file has to be specified if standard orbits are used as orbit information (no clock information stored in standard orbits).
(2) In MAUPRP and GPSEST this file is used to take into account the satellite clock corrections in the time interval between the measurements of the two receivers of a baseline. It is of importance only if different receiver types are combined that measure at significantly different epochs (> 20 millisec).
(3) It is also possible to store the clocks of several sessions in one file.

See Chapter 16 for more information.

```
SATELLITE CLOCKS FROM BROADCAST FILE                                   01-AUG-96 22:09
--------------------------------------------------------------------------------

SAT WEEK   TOC   #PAR     A0 (SEC)       A1 (SEC/SEC)    A2 (SEC/SEC**2)

  2  864   86400.  3  -0.276850071D-03 -0.318323146D-11  0.000000000D+00
  2  864   93600.  3  -0.276872888D-03 -0.318323146D-11  0.000000000D+00
  ...
  2  864  165600.  3  -0.277085230D-03 -0.318323146D-11  0.000000000D+00
  3  864   86400.  3   0.363565050D-04  0.375166564D-11  0.000000000D+00
  ...
```

Figure 23.39: Satellite Clock (`.CLK`) File.

23.8.23 Receiver Clock Coefficients

Type : ASCII

Directory : Campaign-specific directory `ORB`.

Content : Receiver clock corrections (for simulation purposes only).

Created by : User-defined.

Used by : GPSSIM (no menu support).

Example : Figure 23.40.

Further Information : Only used for simulations.

23.8.24 Antenna Height Translation Table

Type : ASCII

Directory : Campaign-specific directory `STA`.

Content : Old and new antenna heights for the transfer program RXOBV3.

Created by : User-defined.

```
RECEIVER CLOCKS AS POLYNOMIALS OF DEGREE N-1
POLYNOMIAL COEFFICIENTS IN SEC, SEC/DAY, SEC/DAY**2,...
 STATION         N     A0       A1       A2       A3       A4       A5
ZIMMERWALD       6 +0.016017-0.000123+0.000222-0.002000-0.012345+0.000555
CHASSERAL        6 -0.003002+0.001234-0.000000+0.010000-0.034556-0.023476
GENEROSO         6 +0.020000-0.010000+0.010000-0.005045-0.000345-0.123456
TITLIS           6 -0.013000+0.020000-0.001234+0.001000-0.006000-0.500000
```

Figure 23.40: Receiver Clock Corrections (for Simulation only).

Used by	:	RXOBV3 (Menu 2.7.1).
Example	:	Figure 23.41.
Further Information	:	This translation table may optionally be used in program RXOBV3. It is used if the antenna heights given in the RINEX files have to be changed to be consistent with the phase center offset values given in the phase center offset file (see Section 23.4.5) or if the RINEX files contain wrong antenna information (which may occur...).

```
CODE: ANTENNA HEIGHT TRANSLATION TABLE                        02-APR-96  10:00
-------------------------------------------------------------------------------

STATION NAME          RINEX FILE     BERNESE    (99.9999: TAKE VALUE FROM FILE)
****************       **.****       **.****
GRAZ 11001M002          2.0680        2.0680
GRAZ 11001M002B         1.9640        1.9640
GRAA 11001S007          0.0000        0.0000
HERS 13212M007          0.2002        0.2002
KOSG 13504M003          0.1050        0.1050
MADR 13407S012          0.0000        0.0000
MATE 12734M008          0.1350        0.1350
MATE 12734M008B         0.1010        0.1010
TROM 10302M003          2.4734        2.4734
WETT 14201M009          0.0000        0.0000
WTZR 14201M010          0.0710        0.0710
ZIMM 14001M004          0.0000        0.0000
```

Figure 23.41: Height Translation (`.HTR`) File.

23.8.25 Baseline Definition File

Type	:	ASCII
Directory	:	Campaign-specific directory `STA`.
Content	:	Pre-defined baselines.
Created by	:	User-defined, assistance using Menu 1.5.2, or written by SNGDIF (Menu 4.3).

Used by : SNGDIF (Menu 4.3), ADDNEQ (Menu 4.8.1), and COMPAR (Menu 5.4.1).

Example : Figure 23.42. Example files are available in the distribution.

Further Information : The baseline definition file may be used in the following cases:

(1) Pre-define baselines in the program SNGDIF.
This option is useful to force program SNGDIF to form specific baselines (e.g. baselines with identical antenna types) independently of the strategy used. Possible strategies are explained in Chapter 10. It is in addition possible to store the baseline definitions created by SNGDIF. That helps a lot in the case you have e.g. to form the same baselines for the pseudorange observations that you created for the phase observations (Melbourne-Wübbena combination in GPSEST. Another application is a combined half automatic, half manual baseline selection (e.g. to store the baselines of SNGDIF using the criterion of a maximum number of observations in a first step, to change the baselines in the file according to your wishes, and to run SNGDIF in a second iteration specifying your baseline definitions).

(2) Baseline repeatability values in the output file of ADDNEQ. If you specify a baseline definition file in Panel 4.8.1 you will get baselines repeatability results for the specified baselines in the ADDNEQ output file.

(3) Baseline repeatability values in the output file of COMPAR (works in analogy to ADDNEQ).
Note: the wildcard "*" is allowed in one (or both) columns to make sure that the results of all baselines with respect to a certain station are printed (This feature is only supported by ADDNEQ.

```
GOPE 11502M002   ZIMM 14001M004
GRAZ 11001M002B  KOSG 13504M003
HERS 13212M007   KOSG 13504M003
HERS 13212M007   MASP 31303M002C
HERS 13212M007   MADR 13407S012
JOZE 12204M001   ONSA 10402M004
KOSG 13504M003   ONSA 10402M004
KOSG 13504M003   POTS 14106M003
KOSG 13504M003   REYK 10202M001
....             ....
```

Figure 23.42: Baseline Definition (.BSL) File.

23.8.26 Cluster Definitions (Input)

Type : ASCII

Directory : Campaign-specific directory STA.

Content	:	Cluster definitions to be used within SNGDIF.
Created by	:	User-defined. No assistance by the menu system.
Used by	:	SNGDIF (Menu 4.3).
Example	:	Figure 23.43. Example files are available in the distribution.
Further Information	:	Using such a file it is possible to define clusters of sites. The intention is to handle all sites within a cluster with correct correlations in program GPSEST. If the correct handling of the correlations is not required (not the highest accuracy requirements) a subdivision into clusters is not necessary. Due to memory and computer time limitations it is not possible to handle more than about 30 sites with correct correlations. If your network consists of considerably more sites, you may use the cluster definition file to form clusters of baselines with the program SNGDIF, then process the individual clusters (with correct correlations), and finally combine the cluster normal equation to a complete network solution (see e.g. the BPE processing example of the distribution or see Chapter 4 or Section 18.4). It only makes sense to specify a cluster definition file, if you also specify a cluster definition **output** file in SNGDIF (see next section). **Note:** The maximum number of clusters allowed is 100 (00-99).

```
SNGDIF: CLUSTER DEFINITION FILE                              19-APR-1995
----------------------------------------------------------------------
STATION NAME      CLU
****************  ***

BOR1 12205M002      1           ! EUROPE
HERS 13212M007      1           ! 23 STATIONS
JOZE 12204M001      1
KOSG 13504M003      1
KIRU 10403M002      1
TROM 10302M003      1
ZIMM 14001M004      1
....
STJO 40101M001      2           ! NORTH AMERICA
ALGO 40104M002      2           ! 20 STATIONS
....
KIT3 12334M001      3           ! ASIA & AFRIKA
POL2 12348M001      3           ! 22 STATIONS
....
```

Figure 23.43: Cluster Definition Input (.CLU) File.

23.8.27 Cluster Definitions (Output)

Type	:	ASCII
Directory	:	Campaign-specific directory STA.
Content	:	Cluster definitions to be used in connection with GPSEST.
Created by	:	SNGDIF (Menu 4.3).

Used by	:	GPSEST (Menu 4.5).
Example	:	Figure 23.44. Example files are available in the distribution.
Further Information	:	If you specify a cluster definition input (CLU) file in SNGDIF (see previous section) containing e.g. n clusters, you should also specify a cluster definition output (CLB) file name (e.g. CLUST_). SNGDIF then creates, according to the cluster numbers cc specified in the CLU file, n files with the file names CLUST_cc. In each of these files the baselines belonging to the cluster number cc are stored. **Trick:** To process the observations of one cluster with GPSEST, only, copy the baseline cluster file CLUST_cc to your working directory ($U/WORK (UNIX) / U:[WORK] (VMS) / U:\WORK (DOS)) using the name PHSFILE.SEL (e.g. for UNIX: cp $P/MYCAMP/OUT/CLUST_cc.CLB $U/WORK/PHSFILE.SEL), and then write in Panel 4.5, option PHASE S.DIFF.: SELECTED

```
BOKO2111
BSKO2111
GPZI2111
GZKO2111
........
```

Figure 23.44: Cluster Definition Output (.CLB) File for one particular Cluster: European Cluster (Number 1) of the Cluster Definition File (Figure 23.43). This File has exactly the same Format as the Observation Selection File used by the Menu System (GPSEST_P) to select Observation Files.

23.8.28 Special Fixed (and Constrained) Station File

Type	:	ASCII
Directory	:	Campaign-specific directory STA.
Content	:	Specification of fixed sites and sites with a priori sigmas (constraints).
Created by	:	User-defined. Assistance using Menu 6.3.2.
Used by	:	GPSEST (Menu 4.5) and ADDNEQ (Menu 4.8.1).
Example	:	Figure 23.45 with an example to fix sites (a) and an example to constrain sites (b). Example files are available in the distribution.
Further Information	:	This so-called FIX file has been developed mainly to be used in an automatic processing mode. The file may contain two types of entries:

(1) Entry to fix sites to their a priori coordinates (23.45 (a)):
This file is used in GPSEST (Panel 4.5–1, option Fixed Station(s), input SPECIAL_FILE) and ADDNEQ (Panel 4.8.1–1, option FIXED STATIONS, input SPECIAL_FILE) to fix a site to the given a priori coordinates. Keep in mind that fixing

sites in GPSEST means NOT to set up any coordinate parameters for the fixed sites, whereas in ADDNEQ fixing is identical to specify a priori constraints of 0.001 mm for the site coordinates.
Only the entries in the `FIX` file with blank sigmas are read and the corresponding sites are fixed.

(2) Entry to constrain a site with a priori sigmas to its a priori coordinates (23.45 (b)):
This file is used in GPSEST (Panel 4.5–2, option `Special Requests`, input `YES`, (Panel 4.5–2.4, option `A PRIORI SIGMAS FOR SITE COORDINATES`, input `YES`, (Panel 4.5–2.4.B, option `STATIONS`, input `SPECIAL_FILE`) to apply a priori constraints for site coordinates (given in the local coordinate system north-east-up).
In ADDNEQ you may activate the constraint file using Panel 4.8.1–1, option `A PRIORI SIGMAS`, input `YES`, Panel 4.8.1–1.7, option `STATIONS`, input `SPECIAL_FILE`. Only the entries in the constraint (`FIX`) file with non-blank sigmas are read and the corresponding sites are constrained.

Note: The same `FIX` file may be used to fix **and** to constrain sites. The menu system only accepts one "SPECIAL FILE" for both options.

```
153 KOSG 13504M003
154 MADR 13407S012
156 TROM 10302M003
157 WETT 14201M009
```

(a) Entries to fix sites.

```
153 KOSG 13504M003   0.0001 0.0001 0.0001
154 MADR 13407S012   0.0001 0.0001 0.0001
156 TROM 10302M003   0.0001 0.0001 0.0001
157 WETT 14201M009   0.0001 0.0001 0.0001
```

(b) Entries to constrain sites.

Figure 23.45: Special Fixed Station (`.FIX`) File. Both Entry Types may also be used in the same File.

23.8.29 Special FTP File

Type	:	ASCII
Directory	:	Campaign-specific directory `STA`.
Content	:	Station names (4-character abbreviations: the first 4 characters of the RINEX file name) of the sites to be downloaded from a global IGS Data Center.
Created by	:	User-defined. Assistance using Menu 6.3.1 or output file of the RINEX check program Menu 6.5.2.
Used by	:	FTP script preparation Menu 2.0.1.
Example	:	Figure 23.46.
Further Information	:	FTP scripts (the FTP script names are defined in Menu 0.4.1) are available (for `UNIX` systems only) to download RINEX observation files by FTP from a global IGS Data Center. See also Menu 2.0.2 to download IGS precise orbits automatically. To download other important informations (not supported by the menu system yet) see Section 7.4.

```
KOSG
MADR
TROM
WETT
....
```

Figure 23.46: Special FTP (`.FTP`) File.

23.8.30 Special Fixed Troposphere File

Type	:	ASCII
Directory	:	Campaign-specific directory `STA`.
Content	:	Absolute and relative constraints for the estimation of site-specific troposphere parameters.
Created by	:	User-defined. Assistance using Menu 6.3.2 (about the same format as the `FIX` files of Section 23.8.28).
Used by	:	GPSEST (Menu 4.5).
Example	:	Figure 23.47.
Further Information	:	This so-called `SIG` file has been developed to be used mainly in an automatic processing mode (e.g. with the BPE). Instead of specifying the troposphere constraints manually for all the sites you may use option `Special Station Selection` in Panel 4.5–2.4.0 to select a `SPECIAL_FILE`. The file may contain two types of entries:

(1) Entry not to set up troposphere parameters for a site (site name and *no* absolute and relative constraints specified)
(2) Entry to constrain the troposphere parameters with absolute and relative sigmas.

The format of this file is (with the exception of the last column) identical with the `FIX` file of Section 23.8.28.

```
153 KOSG 13504M003   0.1000 0.0050
154 MADR 13407S012   0.1000 0.0050
156 TROM 10302M003   0.1000 0.0050
157 WETT 14201M009   0.1000 0.0050
453 GOLD 40405S031
454 KOKB 40424M004
458 YELL 40127M003   0.1000 0.0050
458 YELL 40127M003B  0.1000 0.0050
461 SANT 41705M003   0.1000 0.0050
551 TIDB 50103M108
```

Figure 23.47: Special Troposphere (`.SIG`) File.

23.9 Program-Specific Files

We mentioned already in the introduction to this chapter, that we will not put much emphasis on the program-specific files, because they have a more technical meaning for the user. The menu programs (see Chapter 3) write into these files all necessary information (options, file names, etc.) needed to start the GPS main programs.

Name	Content
N-FILE	Table to access general file names
F-FILE	File containing list(s) of observation file names
M-FILE	File containing list of meteo file names (GPSEST only)
I-FILE	Program options
T-FILE	Text file (GPSEST only)

Table 23.2: Program-specific files.

Table 23.2 lists the program-specific files. Skeleton files in the directory `SKL` (see Figure 23.1) with the extension `SKL` are used by the menu system as templates to generate those files. The I-, N-, and F-files are generated in the user-specific input directories (`INP`) with the extension `.INP`. The names of the program-specific files are composed in the following way: `pgmnamX.INP`, where `pgmnam` stands for the 6-character name of the program and `X` for either “I”, “N”, or “F”.

N-File : is important to access file names (*general* files, input and/or output file names). All the files used in the Bernese GPS Software Version 4.0 are accessed through an N-file of the above type. There is one exception, however: the N-file itself never shows up in the file list – the problem is related to the philosophical question of the "set of all sets" . . . .
N-files are program-specific and computer system dependent.

F-File : contains one or more rows of file names of the same type (e.g. observation file names, orbit file names, ...) that cannot be included in the N-file. In a few cases (as the F-file of GPSEST) some file-dependent options are also specified in the F-file.

M-File : contains names of the meteo files to be included in a GPSEST run (there may be more meteo files defined here than actually used in the program).

I-File : contains the program options.

T-File : contains most of the text to be printed during a program run. The idea: translation of the text files would allow a program output file in a different language (only realized for GPSEST).