

User Manual

GDP

An Open Source GNSS Data Preprocess Toolkit User Manual

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April 2020

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1 Introduction

Over the last decades, GNSS signals, frequencies and constellations become more and more abundant with the advent of BDS and Galileo as well as the modernization of GPS and GLONASS. The quality of GNSS raw observation are easily affected by several factors, such as the availability of satellite signal, transmission error, multipath, receiver performance and others. Due to the diversity of observation environment, GNSS data preprocessing plays an important role for subsequent data processing. Proper preprocessing of GNSS raw observations is the premise of high precision GNSS positioning or orbit determination. GDP is a multi-GNSS data parallelizable preprocessing software design to process raw GNSS observation data based on RINEX 2.x to 3.0x standard. Written and design in object-oriented programming language, it mainly includes multi-GNSS file or IGS products automatically acquisition, format conversion, file selection, data visualization and analysis on GNSS observation files. It is designed as a multi-platform application and provides both Window form interface and command shell interface in Windows, Linux or MacOS operating system. This document provides a brief operating guide. If there are higher requirements, welcome to join the developer sequence to further improve the program code.

2 List of GDP package

After downloading and unzip, the program list is as follows



Figure 1 list of GDP V1.0 program package

Among them, there are two runnable programs, a source code package and a protocol. Runnable programs include window interface program (in the GdpWinUI directory) and command window program (in the GdpShell-netcoreapp3.1 directory).

The sample data is stored in the "...\\GdpWinUI\\Data" directory, the program will automatically load "hers0010.18O" observation data after running. The sample data also stored in the source code package ("...\\Gdp_v1.0_src\\Gdp.WinForms\\bin\\Debug\\Data"), so that when debugging software code, the window interface will automatically load the data file (hers0010.18o) from this directory.

3 Operating environment of GDP

3.1 Operating system and environment

The window application of GDP need to run in a Windows .NET 4.7 environment, which you can obtain from the following URL. If you use windows 10, you can run it directly.

<https://dotnet.microsoft.com/download/dotnet-framework/net47>

The direct download link for the .NET 4.7 runtime as follow:

<https://dotnet.microsoft.com/download/dotnet-framework/thank-you/net47-web-installer>

Command line program of GDP can run on Windows, Linux, MacOS and other operating systems, but require support from .NET Core 3.1. You can get it from the following website.

<https://dotnet.microsoft.com/download/dotnet-core/3.1>

For the normal user, just download the .NET Core Runtime to run GDP, as shown in Fig.2.

Desktop Runtime 3.1.3

The Desktop Runtime enables you to run existing Windows desktop applications. **This release includes the .NET Core Runtime, you do not need to install it separately.**

OS	Installers	Binaries
Linux	Package manager instructions	ARM32 ARM64 x64 Alpine x64 RHEL 6 x64
macOS	x64	x64
Windows	x64 x86	ARM32 x64 x86
All	dotnet-install scripts	

SDK 3.1.103

Visual Studio support
Visual Studio 2019 (v16.4)

Included runtimes
.NET Core Runtime 3.1.3
ASP.NET Core Runtime 3.1.3
Desktop Runtime 3.1.3

Language support
C# 8.0
F# 4.7

OS	Installers	Binaries
Linux	Package manager instructions	ARM32 ARM64 x64 Alpine x64 RHEL 6 x64
macOS	x64	x64
Windows	x64 x86	ARM32 x64 x86
All	dotnet-install scripts	

.NET Core Runtime 3.1.3

The .NET Core Runtime contains just the components needed to run a console app. Typically, you'd also install either the ASP.NET Core Runtime or .NET Core Desktop Runtime.

OS	Installers	Binaries
Linux	Package manager instructions	ARM32 ARM64 ARM64 Alpine x64 Alpine x64 RHEL 6 x64
macOS	x64	x64
Windows	x64 x86	ARM32 x64 x86
All	dotnet-install scripts	

Figure 2 download interface for .NET Core Runtime

Once the environment is successfully installed, you can run the GDP program directly.

3.2 Program running interface

1) Window application program

In the GdpWinUI directory, double-click on the GdpWinUI.exe to run the desktop interface as shown in Fig.3.

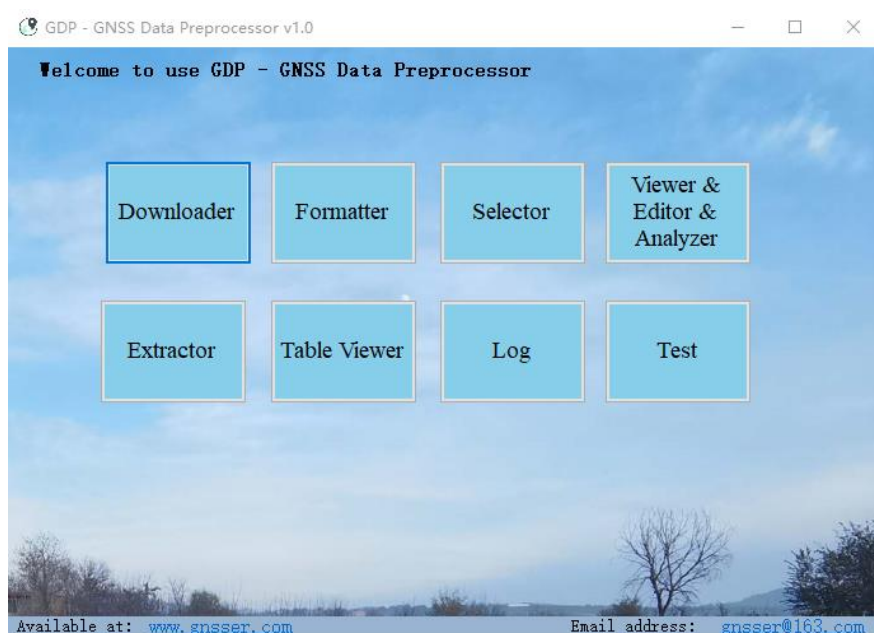


Figure 3 main interface on the desktop side

2) Command line program

After ensuring that the installation of .NET Core is completed, open the Shell window, under the directory “GdpShell-netcoreapp3.1”, type the following command. If the installation is correct, the interface of the command line program is shown in Fig.4.

```
dotnet gdp.dll -v
```

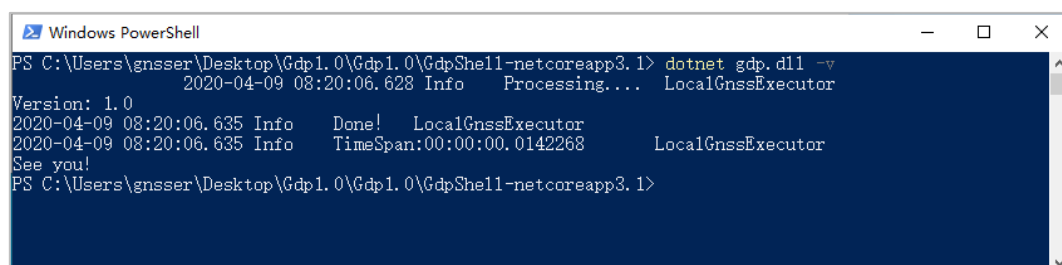


Figure 4 command line program

The sample data required for the GDP program come from IGS and is stored in the Data directory of the running program.

4 Function of window program and example

4.1 Downloader

Click “Downloader” in the main interface to open the “IGS products downloader” sub-interface, as shown in Fig.5. The interface consists of three parts of view, which are respectively setting,

executing and result showing.

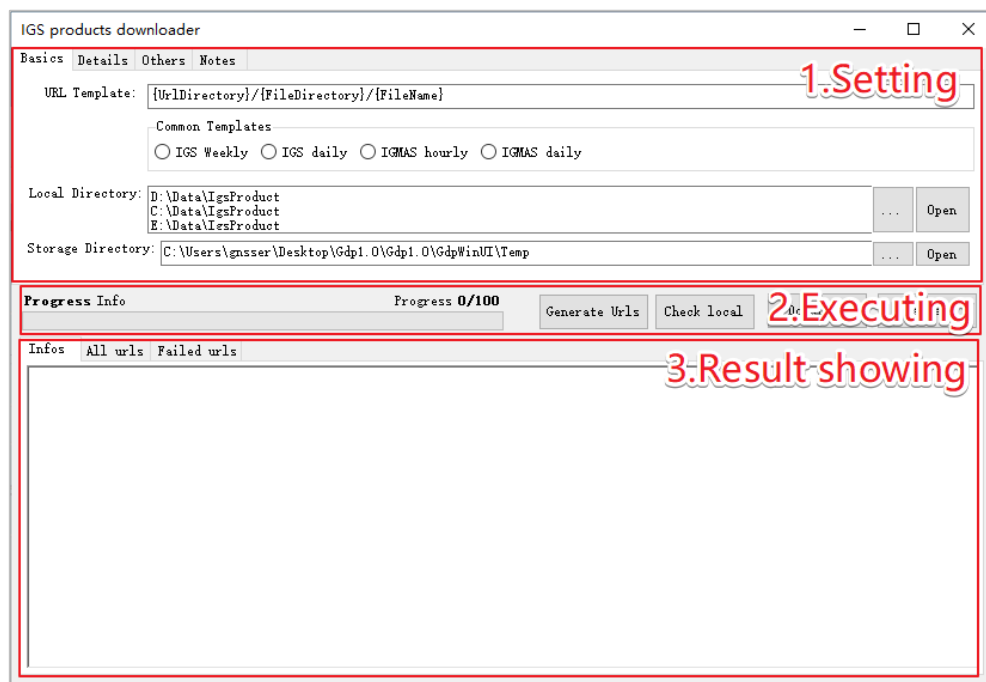


Figure 5 products downloader interface

Download the data according to the following steps:

Step1: Generate the URL of the resource to be downloaded

The URL is generated based on the content of the Setting page. The template EL (Expression Language) is adopted, and the template parameters are identified by the braces of “{}”. Parameters can be set manually. Supported parameters are as follows Tab.1, where the time variables, including {Year}, {Month}, {Day}, {week}, etc., are based on GPST (GPS time) as the same with IGS, which are start form the epoch of 1980.01.06.0; The variable marker of {SourceName} can be expressed as igs, igr, com, etc., which stands for different IGS analysis center; The variable marker {ProductType} can be expressed as sp3, clk, erp, etc., which stands for different product file type. With the EL templates and the variable, GDP can automatically build URLs, and store in one text file. Then you can download these resources by download tools in GDP or other downloaders.

Tab. 1 EL parameter name and meaning

parameter name	parameter description	parameter name	parameter description
{UrlDirectory}	internet resource directory	{Week}	GPS week
{SourceName}	data source identity	{DayOfWeek}	day of week
{ProductType}	product type	{DayOfYear}	day of year
{Year}	four digit year, such as 2000	{WeekOfYear}	week of year
{SubYear}	two digit year, such as 99	{Hour}	hour
{Month}	month	{Minute}	minute

{Day}	day	{Second}	integer seconds
{BdsWeek}	BDS week	{GpsWeek}	GPS week

The program provides four templates by default, which are IGS daily and weekly products and IGMAS daily and weekly products.

Note: these templates are time-sensitive. If they are not accessible, please replace them with available parameters. It can also be fed back to the developer for modifications.

In the detailed setting page, see Fig.6, UrlDirectory is the network directory to be download, such as IGS data center. SourceName is the parameter data identifier, such as the three glyphs of IGS analysis center. ProductType is the products type, such as sp3, clk, etc. The parameter of TimePeriod is the period of download. The Step parameter is the time step of products.

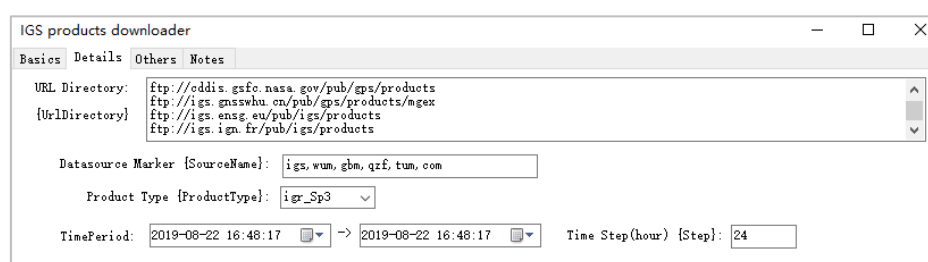


Figure 6 details setting view of products download

Once set up, click on “Generate Urls” to generate the address. The “All Urls” panel in the results area can be viewed, as shown in Fig.7.

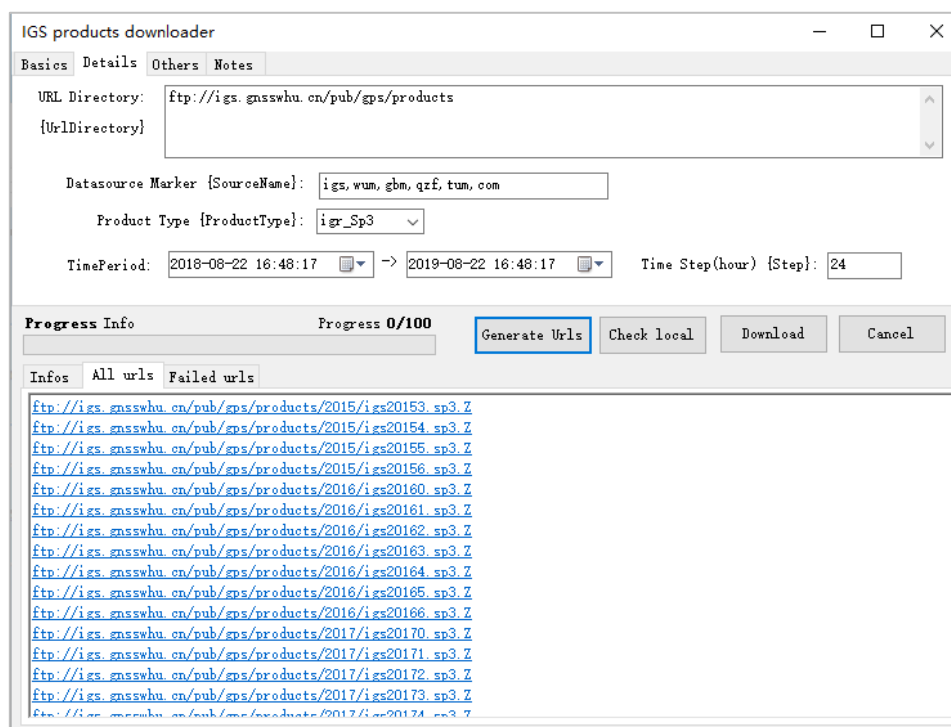


Figure 7 generate Urls

Step2: Check existing resources (avoid duplicate downloads)

In the “Basic” panel of setting page, you can set the local directory. Click the “Check local” button and the program will look for files with the same name in the specified local directory. Existing files will be removed from the “All urls” panel, as shown in Fig.8.

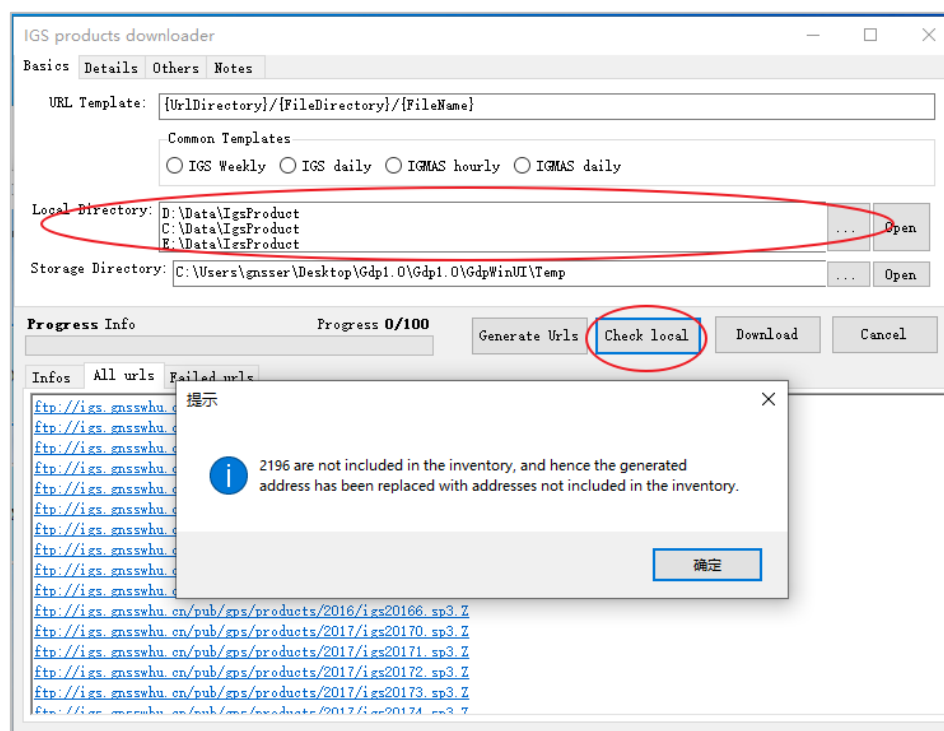


Figure 8 check existing resources

Step3: download

Set up the local storage directory and then click the “Download” button, the download progress is shown in the “Info” panel, and the failed addresses are viewed in “Failed urls”. The download process is shown in Fig.9.

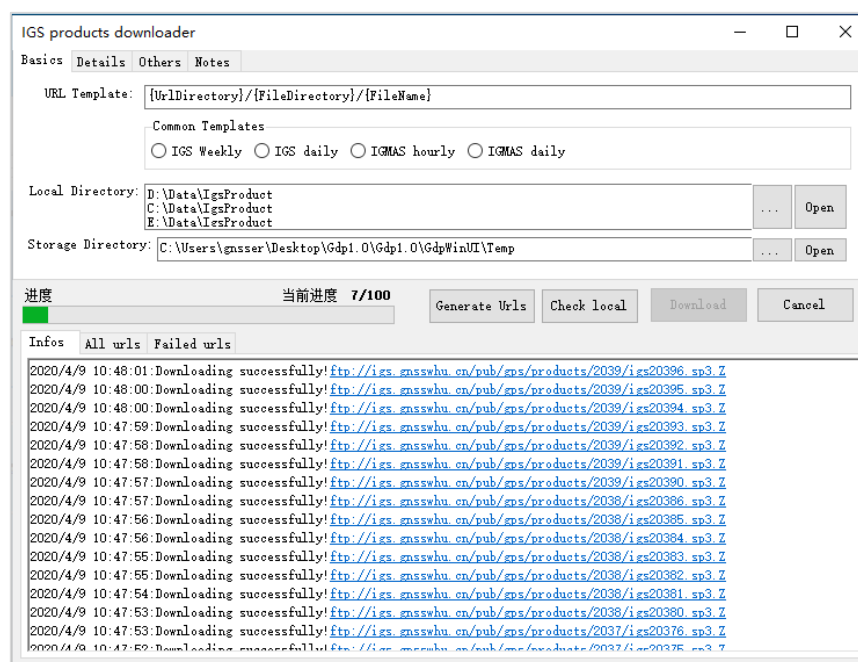


Figure 9 download the products

4.2 Formatter

The Formatter window of GDP is simple, as shown in Fig.10, but has complex formatting capabilities. The input/output panel can optionally specify the observation files (O or RNX) to format and determine the result output path.

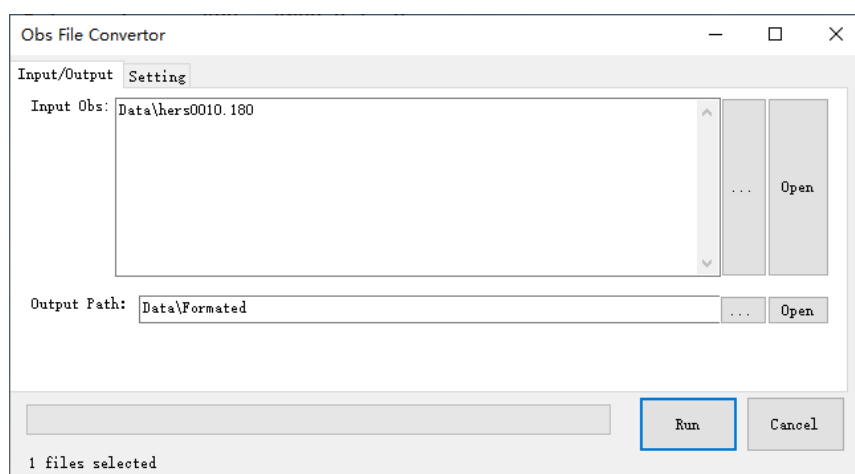


Figure 10 RIENX file format interface

Click the “Details” button in the Setting panel to set detailed formatting parameters, as shown in Fig.11. If you are interested in only a few satellite navigation systems in the multi-system files, select the corresponding navigation system in “Enabled System” and enable it. Similarly, the observation value type, observation period, sampling rate, version of output file, observation code and frequency can be set. In “Other”, details can be further set, such as deleting the data of some

satellites, removing the data whose arc segment is less than the threshold value, deleting observation value that cannot form the ionospheric combination, naming format of the station files, etc.

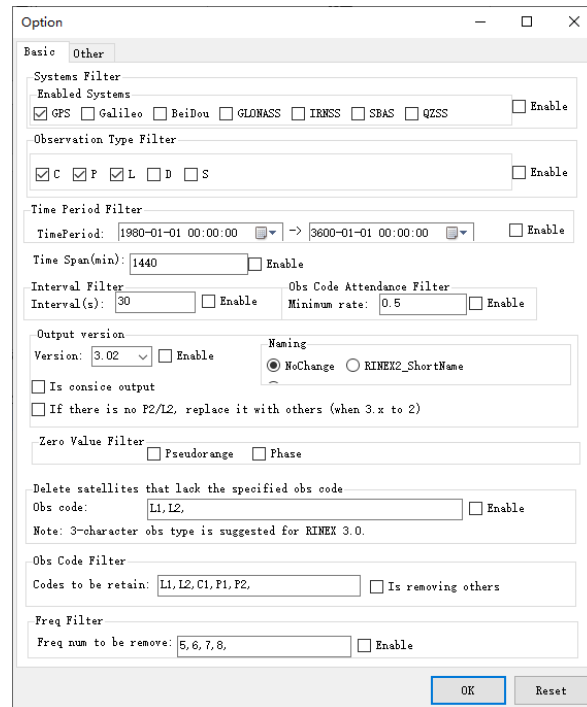


Figure 11 format options of observe file

4.3 Selector

Filter the observation files that meet the requirements in the “Selector” panel, which differs from the format panel in that the selector does not change the observation files itself. As shown in Fig.12, click “...” button, select input all GNSS files, specify the output directory through the “Output Folder”, and set the relevant selection parameters through the Details in Setting.

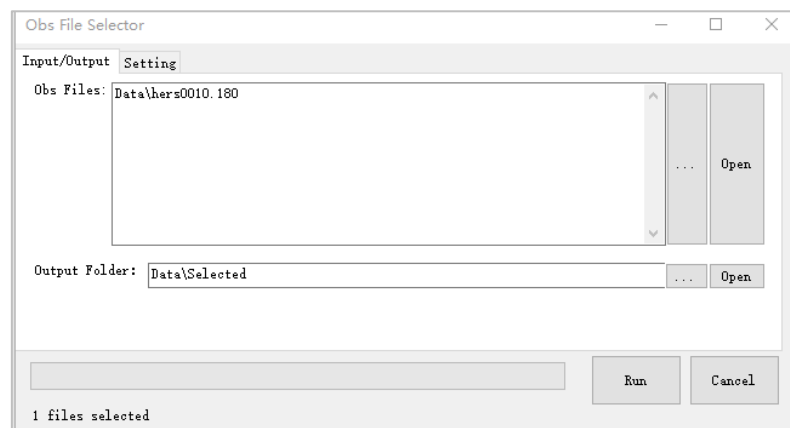


Figure 12 panel of select the observation file

The “Selector” panel does not make any changes to the observation files, but simply find and output the files that meets the requirements. The specific parameters settings are shown in Fig.13. You can

set the navigation satellite system, observation code, time period, station name, minimum observation epoch format, file size, number of satellites, frequency, etc.

Figure 13 Selection settings of observation files

4.4 Viewer&Editor&Analyzer

After clicking the “Viewer&Editor&Analyzer” button on the main page, you can open the observation file view and edit panel, under which you can conduct a detailed view and analysis of a specific observation data file. For example, click “Read” to open the sample data directly, as shown in Fig.14.

Epoch	L1	L2	P2	P1
2018-01-01 0...	130195768.783	101451272.665	24775433.846	24775429.664
2018-01-01 0...	130089046.483	101368112.476	24755122.842	24755121.064
2018-01-01 0...	129982421.237	101285027.772	24734831.204	24734830.374
2018-01-01 0...	129875893.974	101202019.601	24714558.339	24714559.967
2018-01-01 0...	129769465.775	101119088.634	24694304.594	24694307.14
2018-01-01 0...	129663138.139	101036236.014	24674070.69	24674073.508
2018-01-01 0...	129556911.965	100953462.333	24653857.426	24653859.334
2018-01-01 0...	129450788.33	100870768.594	24633663.132	24633665.218
2018-01-01 0...	129344768.536	100788155.782	24613488.964	24613489.618
2018-01-01 0...	129238853.577	100705624.712	24593334.722	24593334.84
2018-01-01 0...	129133044.609	100623176.07	24573200.512	24573200.153

Figure 14 reading interface of sample data

The lower left corner of the panel shows the satellites number observed in the file, and the lower right corner of the panel shows the data information of one satellite (G01 satellite, for example). The file name, antenna, sampling rate, number of satellites, observation code and other basic information of the file are displayed in “File Info”.

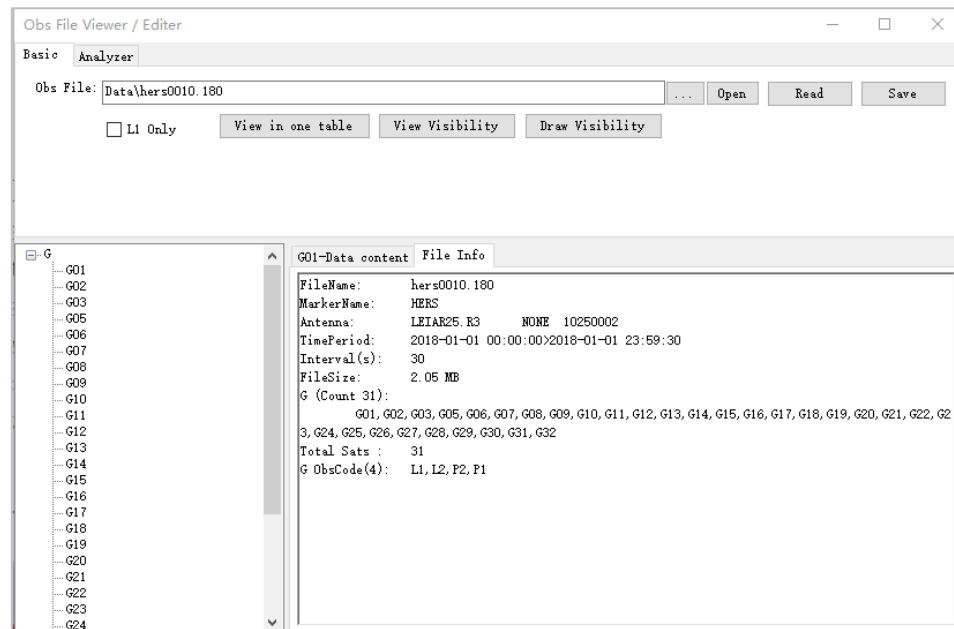


Figure 15 sample file information

Click “View in one table” to open the observation file in one table, as shown in Fig.16. The left side is the epoch, and the right side is the satellite corresponding data according the observation code. Click the “save as” button in the upper left corner of the interface to save the data as XLS file, which is very intuitive to read.

Epoch	G05_L1	G05_L2	G05_P2	G05_P1	G16_L1	G16_L2	G16_P2
2018-01-01 00:00:00	126821078.928	98821607.305	24133241.235	24133243.234	116900152.774	91091000.9	2224535
2018-01-01 00:00:01	126830555.368	98828991.553	24135044.171	24135046.036	116814814.888	91024503.841	2222911
2018-01-01 00:00:02	126840615.468	98836830.611	24136958.303	24136961.195	116729708.989	90958187.566	2221292
2018-01-01 00:00:03	126851259.233	98845124.471	24138983.912	24138986.467	116644836.503	90892053.159	2219676
2018-01-01 00:00:04	126862486.611	98853873.103	24141120.131	24141122.814	116560199.623	90826102.341	2218066
2018-01-01 00:00:05	126874297.323	98863076.246	24143368.213	24143370.259	116475799.621	90760336.109	2216460
2018-01-01 00:00:06	126886691.683	98872734.203	24145726.587	24145728.695	116391638.446	90694755.991	2214858
2018-01-01 00:00:07	126899669.285	98882846.616	24148195.785	24148198.169	116307717.905	90629363.356	2213261
2018-01-01 00:00:08	126913229.811	98893413.287	24150776.421	24150778.635	116224039.85	90564159.688	2211669
2018-01-01 00:00:09	126927373.106	98904434.043	24153467.752	24153470.76	116140606.131	90499146.405	2210081
2018-01-01 00:00:10	126942098.858	98915908.671	24156269.984	24156272.996	116057418.473	90434324.857	2208498
2018-01-01 00:00:11	126957406.916	98927837.039	24159182.826	24159185.972	115974478.798	90369696.547	2206920
2018-01-01 00:00:12	126973297.102	98940218.997	24162206.671	24162208.524	115891788.712	90305262.711	2205346
2018-01-01 00:00:13	126989768.667	98953054.006	24165341.677	24165343.308	115809350.069	90241024.802	2203778
2018-01-01 00:00:14	127006821.804	98966342.177	24168586.228	24168588.417	115727164.641	90176984.211	2202214

Figure 16 the sample data file is viewed as a table

Click the “View Visibility” button to view the number of arcs for each satellite, as shown in the Fig.

17. For example, the GPS satellite G01 has only one arc “2018-01-01 03:32:00>2018-01-01 10:10:00”, G02 has two observation arcs, which are “2018-01-01 09:10:30>2018-01-01 13:54:30” and “2018-01-01 19:06:00>2018-01-01 23:18:00”. Through this function, the arc length of the satellite can be quickly checked, and then the interested arc of the satellite can be selected for specific analysis.

Frn	Period1	Period2	Period3	Period4	Period5	Period6	Period7
G01	2018-01-01 0...						
G02	2018-01-01 0...	2018-01-01 1...					
G03	2018-01-01 0...	2018-01-01 0...					
G05	2018-01-01 0...	2018-01-01 1...	2018-01-01 2...				
G06	2018-01-01 0...	2018-01-01 1...					
G07	2018-01-01 0...	2018-01-01 0...					
G08	2018-01-01 0...	2018-01-01 1...					
G09	2018-01-01 0...						
G10	2018-01-01 0...	2018-01-01 1...					
G11	2018-01-01 0...						
G12	2018-01-01 1...						
G13	2018-01-01 1...						
G14	2018-01-01 0...	2018-01-01 1...					
G15	2018-01-01 0...	2018-01-01 1...					
G16	2018-01-01 0...	2018-01-01 1...	2018-01-01 2...				

Figure 17 view the number of arcs in table mode

Click the “Draw Visibility” button to view the satellite arc of the observation file in the form of a picture, as shown in Fig.18. It is very intuitive to see the arc information of each satellite.

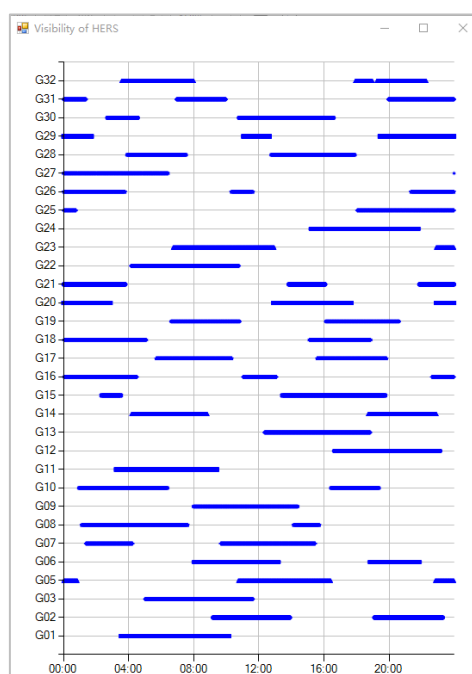


Figure 18 view the number of arcs in graph mode

Select the “Analyzer” panel to view and output cycle slip, multipath, etc. As shown in Fig.19, by entering the threshold value of LI or HMW cycle slip detection algorithm and click the

corresponding cycle slip detection button, the preliminary cycle slip detection can be conducted and the results can be displayed in table form.

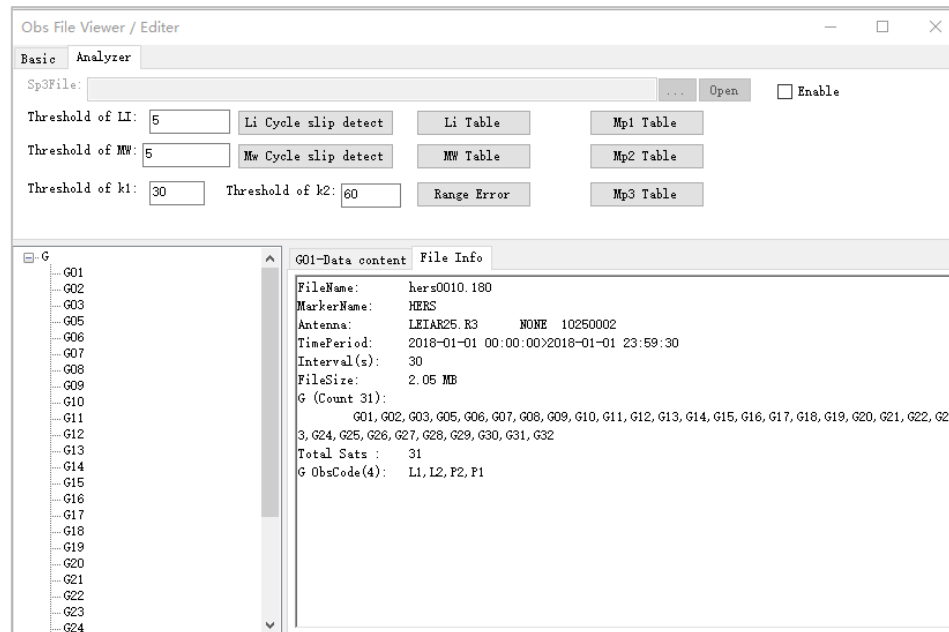


Figure 19 analyzer panel

Click the “Li Table” or “MW Table” button to display the LI or HMW combined values of all satellites in table form. Here, if an ephemeris file is specified, the corresponding satellite altitude angle information is also displayed. The following Fig.20 shows the LI combination value of the sample data. The leftmost column is the observation epoch, and the right column displays the data of each satellite observed by the current epoch one by one. This table can also be saved as XLS table, which is very convenient to use other drawing software, such as Origin or Excel, to draw the graph of LI value changing with height angle of each satellite. Similarly, you can also view the HMW combined value, multipath value of frequency 1, and so on. It is also possible to perform simple pseudorange coarse error detection by setting the k_1 and k_2 thresholds (units: meters) on the panel.

Obs File Viewer / Editor

Basic Analyzer

Sp3File: E:\igs19821.sp3 ... Open ☒ Enable

Threshold of LI: 5 Li Cycle slip detect Li Table Mp1 Table

Threshold of MW: 5 Mw Cycle slip detect MW Table Mp2 Table

Threshold of k1: 30 Threshold of k2: 60 Range Error Mp3 Table

LI values of HERS

另存为(S)

Epoch	G05_Li	G05_Ele	G16_Li	G16_Ele	G20_Li	G20_Ele	G21_Li
2018-01-01 0...	3.0865475125...	14.512271994...	6.6512078791...	34.243211354...	1.2765438705...	20.014951731...	1.86083742...
2018-01-01 0...	3.0843401066...	14.498203618...	6.6524225845...	34.458075729...	1.2714091129...	20.144206458...	1.85773563...
2018-01-01 0...	3.0796905979...	14.483058796...	6.6499963402...	34.673163543...	1.2742508314...	20.272895746...	1.85607373...
2018-01-01 0...	3.0755041353...	14.466838025...	6.6505640558...	34.888474150...	1.2688940688...	20.401012294...	1.85503980...
2018-01-01 0...	3.0692117586...	14.449541880...	6.6511539593...	35.104006881...	1.2677237577...	20.528548778...	1.85265796...
2018-01-01 0...	3.0714603960...	14.431171013...	6.6503420434...	35.319761046...	1.2594491578...	20.655497847...	1.84890283...
2018-01-01 0...	3.0680065676...	14.411726151...	6.6458574570...	35.535735933...	1.2590875998...	20.781852126...	1.84752955...
2018-01-01 0...	3.0652124211...	14.391208099...	6.6472370848...	35.751930805...	1.2575113326...	20.907604219...	1.84576933...
2018-01-01 0...	3.0623358152...	14.369617736...	6.6444968543...	35.968344903...	1.2582693397...	21.032746703...	1.84444679...
2018-01-01 0...	3.0607119761...	14.346956018...	6.6433899612...	36.184977443...	1.2589321956...	21.157272137...	1.84398374...
2018-01-01 0...	3.0567919239...	14.323223976...	6.6424892619...	36.401827617...	1.2579268068...	21.281173056...	1.84282929...
2018-01-01 0...	3.0540770627...	14.298422716...	6.6404911726...	36.618894593...	1.2575589045...	21.404441976...	1.84050137...
2018-01-01 0...	3.053266666...	14.272553418...	6.6411635465...	36.836177512...	1.2562363632...	21.527071390...	1.83868723...
2018-01-01 0...	3.0496400520...	14.245617338...	6.6424734033...	37.053675492...	1.2580536678...	21.649053776...	1.83795778...
2018-01-01 0...	3.0466365851...	14.217615803...	6.6419247239...	37.271387623...	1.2556845135...	21.770381588...	1.83557910...

1 / 2880 The number of Column is 63

Figure 20 the LI combined value of the sample data

4.5 Others

The GDP main interface provides some other functions, such as “Extractor” button can be quickly read the header information of mass observation files, extract the name of each file, latitude and longitude, geodetic height, XYZ, type of receiver, antenna type and other information. If “GMT LonLatFirst” is checked in the Setting panel, the output results can be directly used to drawing the station distribution map in the GMT software.

The “Table Viewer” button is used to open and view the “.xls” file that has been output saved.

The “Log” is a log file for the running of the code, which makes it easy to debug the code and see how the program is running.

5 Command line program

5.1 command line description

Command parameters are case insensitive in GDP, while whether the path is case sensitive depends on the operating system. For example, Windows systems are case insensitive, while most Linux systems are case sensitive.

```
usage: Gdp [options]
Gdp <module name> [<module-options>]
```

The following documentation can be viewed with the help command.



```

2020-04-09 14:49:22.211 Info    Processing... LocalGnssExecutor
Welcome to use GDP(GNSS Data Preprocessor) Version 1.0

GDP is distributed under the GNU LGPL License (http://www.gnu.org/licenses/lgpl.html).

The following shows the shell command rules. Command parameters are case insensitive in
GDP, while whether the path is case sensitive depends on the operating system. For exam
le Windows systems are case insensitive, while most Linux systems are case sensitive.

usage: Gdp  [options]
Gdp <module name> [<module-options>]

1. Common arguments:

This should be in the start of the command line.
-V #Version
-H #Help
-B #Urls builder
-D #download
-F #Format
-S #Select
-C #convert to one table text file
-E # extract site into

1.1 B:Build Urls

Build Urls by indicated condition.

Params:
-B #Process marker
-OutputPath MyUrls.txt
-StartTime 2020 1 1
-EndTime 2020 1 5
-ProductType Sp3
-Source igs
-IntervalSecond 36400
-UrlDirectories ftp://igs.ensg.eu/pub/igs/products
-UrlModels {UrlDirectory}/{Week}/{SourceName}{Week}{DayOfWeek}. {ProductType}.Z

For example:
-T B -OutputPath MyUrls.txt -StartTime 2020 1 1 -EndTime 2020 1 5 -ProductType Sp3 -Sour
ce igs -IntervalSecond 36400 -UrlDirectories ftp://igs.ensg.eu/pub/igs/products -UrlMode
ls {UrlDirectory}/{Week}/{SourceName}{Week}{DayOfWeek}. {ProductType}.Z

1.2 D:Download

Download urls in text line file from ftp server or web sites.

Params:
-D #Process marker
-DownloadDirectory ./Download
-UrlTextPath BuildUrl.txt
-IsOverWrite False
For example:

```

Figure 21 GDP command window with help information

The following shows the detail shell command rules of GDP.

5.2 Common arguments

This should be in the start of the command line.

```

-V #Version
-H #Help
-B #Urls builder
-D #download
-F #Format
-S #Select

```


-C #convert to one table text file

-E #extract site into

5.3 B:Build Urls

Build Urls by indicated condition.

Options:

-B #Process marker

-OutputPath MyUrls.txt

-StartTime 2020 1 1

-EndTime 2020 1 5

-ProductType Sp3

-Source igs

-IntervalSecond 86400

-UrlDirectories ftp://igs.ensg.eu/pub/igs/products

-UrlModels {UrlDirectory}/{Week}/{SourceName}{Week}{DayOfWeek}.{ProductType}.Z

For example:

-T B -OutputPath MyUrls.txt -StartTime 2020 1 1 -EndTime 2020 1 5 -ProductType Sp3 -Source igs -IntervalSecond 86400 -UrlDirectories ftp://igs.ensg.eu/pub/igs/products -UrlModels {UrlDirectory}/{Week}/{SourceName}{Week}{DayOfWeek}.{ProductType}.Z

5.4 D:Download

Download urls in text line file from ftp server or web sites.

Options:

-D #Process marker

-DownloadDirectory ./Download

-UrlTextPath BuildUrl.txt

-IsOverWrite False

For example:

-D -DownloadDirectory ./Download -UrlTextPath MyUrls.txt -IsOverWrite False

5.5 F:Convert/Format

Convert or format observation files that new files will be built.

Options:

```
-F #Process marker
-InputPath ./Data/hers0010.18O ./Data/Sample/
-OutputDirectory ./Data/Formatted/
-OutVersion 3.02
-Interval 30
-SatelliteType G R C E
-StartTime 2018 1 1 0 0 0
-EndTime 2018 1 1 12 0 0
```

For example:

```
-F -InputPath ./Data/hers0010.18O -OutputDirectory ./Data/Formatted/ -OutVersion 3.02 -
Interval 30 -SatelliteType G R C E -StartTime 2018 1 1 0 0 0 -EndTime 2018 1 1 12 0 0
```

5.6 S:Select

Select observation files to indicated directory, and do not change data content.

Options:

```
-S #Processing maker
-InputPath ./Data/hers0010.18O ./Data/Sample/
-OutputDirectory ./Data/Selected/
-IncludeSiteNames hers hert
-ExcludeSiteNames algo
-SatelliteType G R C E
-StartTime 2018 1 1 0 0 0
-EndTime 2018 1 1 12 0 0
-ObsCodes L1C L2W
-MinFileSizeMB 1.2
-MinEpochCount 1000
-MinFrequencyCount 2
```

For example:

```
-S -InputPath ./Data/hers0010.18O ./Data/Sample/ -OutputDirectory ./Data/Selected/ -
IncludeSiteNames hers hert -ExcludeSiteNames algo -SatelliteType G R C E -StartTime 2018 1
1 0 0 0 -EndTime 2018 1 1 12 0 0 -ObsCodes L1C L2W -MinFileSizeMB 1.2 -MinEpochCount
1000 -MinFrequencyCount 2
```

5.7 C:Convert to one table

Convert observation files to one table text file.

Options:

```
-C #Processing maker
-InputPath ./Data/hers0010.18O ./Data/Sample/
-OutputDirectory ./Data/OneTable/
For example:
-C -InputPath ./Data/hers0010.18O ./Data/Sample/ -OutputDirectory ./Data/OneTable/
```

5.8 E:extract site into

Extract observation files info to one table text file.

Options:

```
-E #Processing maker
-InputPath ./Data/hers0010.18O ./Data/Sample/
-OutputDirectory ./Data/OneTable/
For example:
-E -InputPath ./Data/hers0010.18O ./Data/Sample/ -OutputDirectory ./Data/Temp/
```

6 Declaration of further development of source code

GDP was developed in Visual Studio 2019 environment using C# programming language. Free IDE and developer tool Visual Studio Community are recommended. If you are developing under non-windows, you can use Visual Studio Code. The code of GDP software project is shown in Fig.22.

名称	修改日期	类型	大小
Gdp.Core	2020/2/26 23:31	文件夹	
Gdp.WinForms	2020/2/26 23:31	文件夹	
GdpShell	2020/2/26 23:31	文件夹	
GDP.sln	2020/2/20 10:33	Visual Studio Sol...	3 KB
LICENSE.txt	2020/2/6 7:35	TXT 文件	8 KB
README.md	2020/2/21 16:54	MD 文件	1 KB

Figure 22 GDP source code list

After Visual Studio 2019 is installed, double-click “GDP.sln” to open the project code on the VS platform, as shown in Fig.23. It contains three projects, among which Gdp.Standard is the core business logic project, including RINEX, sp3 and other files reading, matrix operation, etc.

Gdp.Winform is the form project, and GdpShell is the command line project.



Figure 23 GDP solution explorer

7 References

- [1]. IGS Formats. <https://kb.igs.org/hc/en-us/articles/201096516-IGS-Formats>, 2020-04-08.
- [2]. Kouba, J., A guide to using International GNSS Service (IGS) products, <http://kb.igs.org/hc/en-us/articles/201271873-A-Guide-to-Usingthe-IGS-Products>, 2015.