

Utility Software for Web-Based PPP Applications for Automated Data Processing

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SUMMARY

Recently Web-based PPP (Precise Point Positioning) applications have been widely used by many researchers. Principle of the applications depends on uploading the observation data to the servers and receiving the results after the processes. However, when sequential and batch process is necessary to generate daily GNSS time series, the user have to spend a lot of time for organizing and uploading data and summarizing estimated coordinates from results files generated by online PPP software. In addition, if the observation data from the IGS sites or national CORS sites, such as CORS-TR, available are necessary, such data should be downloaded from many different websites which takes a lot of time. To overcome these problems, a software which provides batch process has been developed by the authors. This utility software downloads the observation files from the SOPAC (Scripps Orbit and Permanent Array Center) servers for IGS sites and RINEX files from any webserver/ftpserver or folder in PC defined by the users and then prepares them for uploading the CSRS-PPP software. After receiving the solution files produced by CSRS-PPP, software extracts the estimated point coordinates and their RMS lists. Final step of the software is creating a text file including site name, date, estimated coordinates and RMS and fullness percentage of RINEX file.. In this study, this utility software developed by the authors was introduced extensively.

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1. INTRODUCTION

Precise Point Positioning (PPP) is a positioning method that employs Global Navigation Satellite System (GNSS) products, e.g. obtained via the international GNSS service (IGS), to perform point positioning using single GNSS receiver (Rizos et al. 2012). Whilst the PPP technology was first introduced in 1976 (Anderle, 1976), since 1990s it was extensively researched and several online PPP services and software packages have been developed. CSRS-PPP, Magic GNSS and GAPS are the examples of web based GPS/GNSS-PPP software's. GIPSY-OASIS, Bernese and GrafNav can be given examples of software packages. Detailed information about software packages and web based PPP software's can be found in Huber et al. 2010. While using web based softwares, it is necessary to upload the observation data to the systems. If the observation data of IGS stations are used, such data should be downloaded from many different websites. However during the batch process, systems limit the users in terms of file sizes. Thus downloading and uploading processes take a lot of time. To overcome this problem a software was developed by authors. In the present study the features of the software, which is called Quick PPP Software, was introduced in a detailed way.

2. GRAPHICAL INTERFACE AND FEATURES OF THE QUICK PPP SOFTWARE

This utility software, developed by authors, facilitates the usage of the PPP based applications that makes the process steps fast and automated. It is written in C# programming language and requires .Net framework 4.5 (URL-1). Basic principle of the software is to getting the observation files from defined server, such as the SOPAC , or folder in PC, uploading them to the CSRS-PPP servers and creating estimated coordinates list file based on the process results from CSRS-PPP. Figure 1 shows how to work the current version of the Quick PPP software.

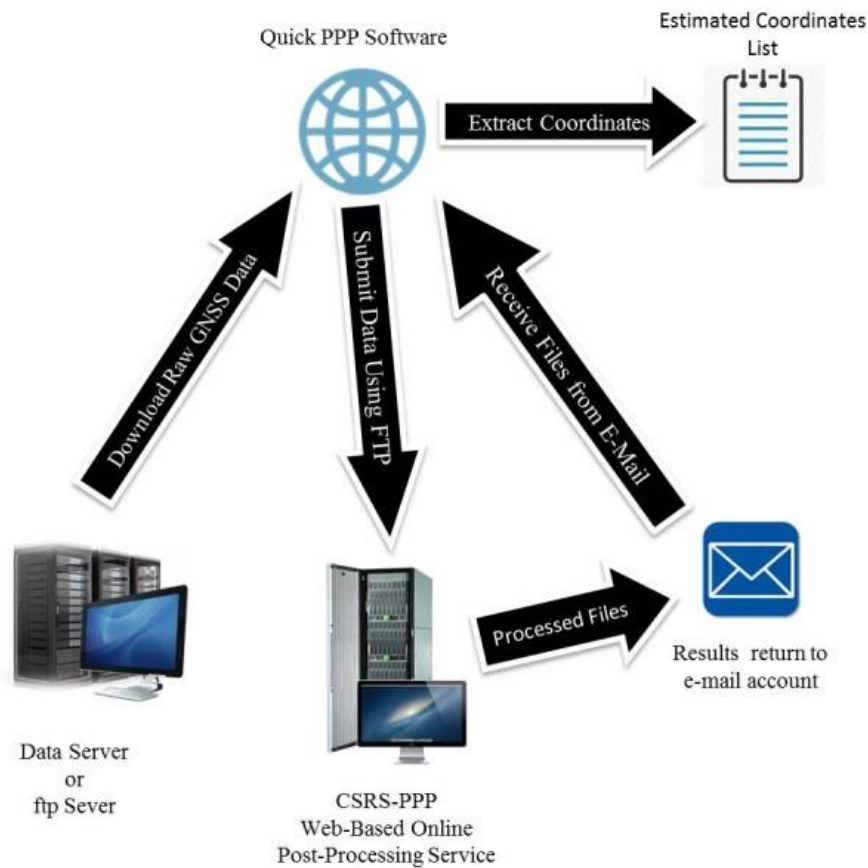


Figure 1 The main working illustration of the current version Quick PPP Software

Main screen of the software has three menu items including Process, Help and Go To options (Figure-2). In the “Help” menu, user can find required information about the software. “Go To” menu provides shortcuts to the SOPAC and CSRS-PPP websites.

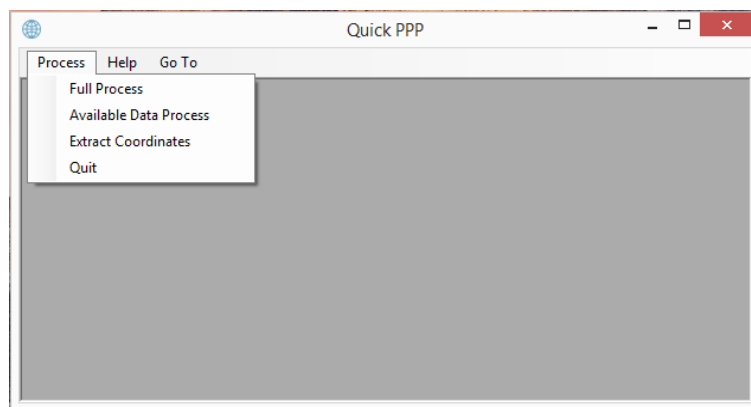


Figure-2 Main Screen of the Software

“Process” menu have three different process options including “Full Process”, “Available Data Process” and “Extract Coordinates”. These process options are described in detail below.

“Full Process” consists of five main sections as given in Figure-3. These are Input field, Activity Log, Site List, GNSS Selection and Site Map. User is required to fill the input field to start the process. Activity Log displays the process steps. While Site List includes all IGS stations, Site Map represents the location of the stations. This map is provided by OpenStreetMap (URL-1), which is widely used as an open source map provider. GNSS Selection part is used in order to filter the stations according to the GPS or GPS+GLONASS receivers.

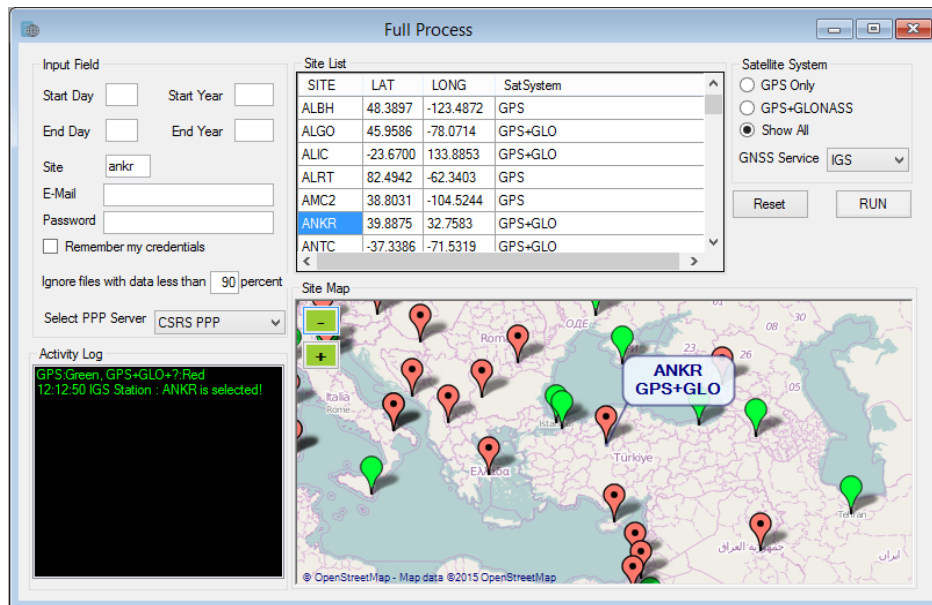


Figure-3 Full Process Screen Sections

In order to RUN the program user can either enter the four digit site code in the Site box or pick a station from the Site Map (Figure-3). While hovering the cursor to a marker, the site name and the corresponding satellite systems is displayed. In addition user can filter the sites according to the satellite system in the Site Map choosing the GNSS selection part. GPS receivers are shown as Green markers and GPS+GLONASS receivers are represented by red markers. If the user select the site code from the site list, site map zooms and focuses on the selected site location (Figure-4).

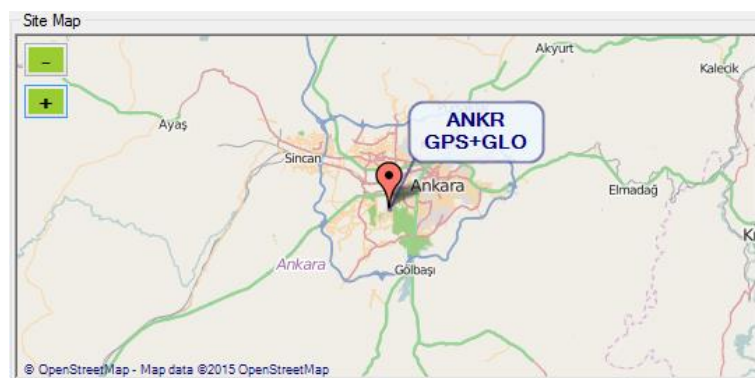


Figure-4 Focused on ANKR Station

After selecting the station, user should input the start day, start year, end day and end year values to the corresponding boxes in the input field. Besides, user may prefer entering a minimum value according to the fullness of the observation data in the “Ignore files with data less than ... percent” part to prevent uploading observation file to the PPP server. It is possible to start either a simple process with single day data or choose multiple observation data to start a batch process. Run button starts the process if the input data is entered correctly. After this step, no user interaction is required. Software connects to the SOPAC servers to check observation files and downloads them if available. Each observation file is extracted from zip and hatanaka format after downloading process. To avoid overloading the CSRS-PPP servers, extracted files are grouped 20 files per folder and compressed to a zip file. After this step, files are ready for uploading to the CSRS-PPP servers. While this process sends the zipped files one by one, next observation files in the queue are continue to be downloaded. When the first file sent to the server a new process starts in the background to check the Google mail servers via given e-mail address and password to check the results every five minutes and receive the result files if it is received. Then received data are unzipped and coordinates are read from extracted *.sum file. In addition to the estimated coordinates, a parameter associated with the health status of received data is created according to the epoch numbers. Saving the results to a text file is the final step of the “Full Process”.

Besides “Full Process”, user have an option to choose previously downloaded observation data from the “Available Data Process” sub menu (Figure-5). This will make possible a folder selection that includes already available observation files. By reading the folder content, software will start a similar process (Single or Batch) explained in the “Full Process”.

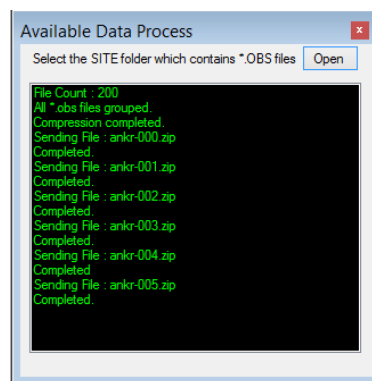


Figure-5 Available Data Process

As it can be seen in the Figure-6, “Extract Coordinates” option provides user to read and save the estimated coordinates, processed earlier by CSRS-PPP, by selecting a folder which includes *.sum files.

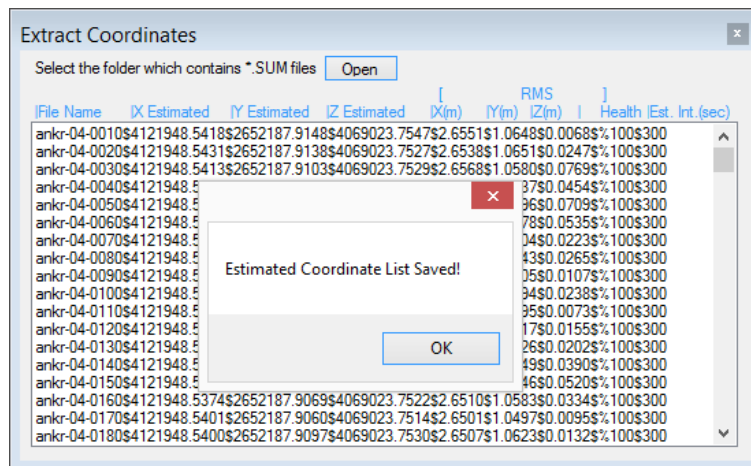


Figure-6 Extract Coordinates Screen

3. CONCLUSIONS AND FUTURE WORK

This software has been developed in order to simplify the usage of online PPP software and in order to generate daily GPS/GNSS time series, which is long-term, based on PPP method. The software is to accelerate the batch file process and provide more options to the users. By the help of the software, it is possible to process long-term observations of the GNSS stations that would allow the users to predict the velocity of the stations. Using long-term observation data, displacements in the points related to the many factors such as earthquake, could be determined. In the future work, besides CSRS-PPP, JPL Gipsy and Magic GNSS software is going to be included. We also aim to add time series analysis menu in order to estimate site velocity and to detect automatically a coordinate changes caused by possible earthquake or landslide. Therefore, this new version of the software can be used as natural hazard alert system for continuously monitoring project, such as landslide.

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URL-1 <http://www.microsoft.com/net>

URL-2 <http://www.openstreetmap.org/about>

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