The development Plan of KASI GNSS Data Processing Software

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Abstract

We have processed the GPS data using several high quality GPS data processing softwares for last decade.   Bernes and GIPSY II are some of them. Though these programs have different characteristics in terms of structures and processing philosophies, high quality results from these are still comparable.   KASI Space Geodesy Research Division has developed several GNSS data processing softwares like the quasi real-time ionospheric parameter estimator, orbit propagator and estimator, and precision positioning estimator.   However, we are currently in needs of our own comprehensive GNSS data processing software with the European Galileo system on the horizon.   KASI team has worked on a preliminary pilot project for the software and is making block pieces for the software. The roadmap, the description, and brief results of KASIOPEA (KASI Orbit Propagator and EstimAtor) are presented in this paper.

Keywords: GNSS, POD, Space Geodesy

1. Introduction

Since linear filtering and estimation was introduced by Kalman[1,2] , a new chapter in the history of orbit determination has been written by a new breed of investigator equipped with statistical estimation theory and high powered electronic computers. See, for example, Tapley[3], Lear[4] , Wu[5] [Wu, 1990], and many more. Programs like MSODP1[6] , GYPSY/OASIS II, Bernese[7] , GAMIT[8], and GEODYN II[9] have been developed to process GPS observation data for ground use and space-born use. We have processed the GPS data using these high quality GPS data processing softwares for last decade.   Though these programs have different characteristics in terms of structures and processing philosophies, high quality results from these are still comparable.   KASI (Korea Astronomy & Space Science Research Institute) Space Geodesy Research Division has developed several GNSS data processing softwares like the quasi real-time ionospheric parameter estimator, orbit propagator and estimator, and precision positioning estimator.   However, we are currently in needs of our own comprehensive GNSS data processing software with the European Galileo system on the horizon.   KASI team has worked on a preliminary pilot project for the software and is making block pieces for the software.

2. KASI's Activity on GNSS

Since 1989 KASI Space Geodesy Division has begun research activities including, GPS space geodesy and its application. From 1995, The Space Geodesy Division has participated in IGS and IERS as a global station. We have introduced commercial/precise GPS data processing software for carrying out various GPS applications to Korea. Furthermore we have developed an automation technique for operating IGS Operational Data Center. Some memorable history of our division can be noted as;

- 1989.10. Introduction 3 set of 4000SDT Trimble GPS receiver (Now, 12 set including 4000SSI)
- 1992.07. KAO has Established GPS Station
- 1992.07. Joining international GPS campaign (ID: DAEN), named EPOCH 92
- 1995.11. Officially joining IGS (ID: TAEJ)
- 1996.06. IGS Global Station
- 1999.03. Moving IGS station from TAEJ to DAEJ
- 2001.11. Completion of establishing KAO GPS Network including DAEJ
- 2006.1. IGS GDC operation

2,1 IGS GDC

First proposed, constructed, and approved on 2003, 2004, 2006, world's fourth International GNSS Service Global Data Center (IGS GDC) has been open for public service since January 2006. It is an only GDC in Pacific Oceania region.   With the open of this center, the acquisition and the distribution of global and local GNSS data of this region became easy and fast.

2.2 Other GNSS Related Activities

Using the data from KASI GPS observation network, we has been involved and finished couple of dozen key GNSS research in Korea.   Currently we are working on several projects funded by numerous governmental and public sectors.   The spectrum of theme is wide from GNSS meteorology to space-borne GNSS POD.   The GNSS data processing softwares for these projects are specific to each subject.   However, the core technology and equation set is same.   Without our own comprehensive processing package, the effectiveness and consistency of our research cannot be achieved.

2.3 Needs for Analysis Center

All the GPS data type collected in IGS GDC are listed below.
- Daily and hourly files of GPS Data at a 30-second sampling rate
- High rate files of GPS Data at a 1-second sampling rate

- Daily files of GLONASS Data at a 30-second sampling rate
- Broadcast Ephemeris, Meteorological, and other auxiliary files

With this GPS data, dozen of GPS data analysis center are producing following products.

- Weekly solutions of classic IGS products from the IGS Analysis Centers
- Combined weekly solution from the IGS Analysis Center (AC) Coordinator
- Daily rapid and sub-daily ultra-rapid solutions from the AC Coordinator
- Combined station coordinates and velocities from IGS Reference Frame Coordinator
- Associate Analysis Center products for Pilot Projects or Working Group
- Regional and Global Network Analysis Center solutions in SINEX format from the Pilot Project
- for the Densification of the ITRF
- Zenith path delay files from the Troposphere Working Group
- Ionosphere parameters from the Ionosphere Working Group

Also, there are over 70 permanent GPS observation sites operated by government and research institutes over Korea as shown in Figure 1. Among these, two sites are registered as IGS reference site. Nine including one IGS site operated by KASI are well connected by fast dedicated line. We can use this observation data for DGNSS and various RTK or networked GBAS (ground based augmentation system). Purposes for these reference station role, we need to gather the data in real-time and process it in quasi real time. An well-tuned GNSS data processing software is needed for these real time services.
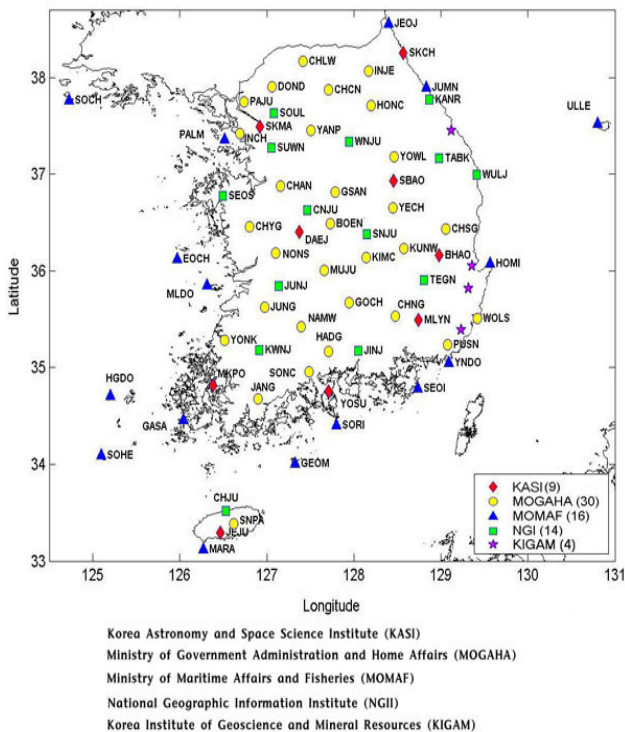

Figure 1. GPS permanent observation sites over Korea.[10]

3. Development Roadmap

We are developing a set of comprehensive roadmaps for POD program, GNSS data handling & processing program. However, currently only the detailed development plan for a POD part is completed. A brief roadmap of POD related development plan is presented in Figure 2. The GNSS data handling and processing for specific purpose like geodesy, tectonics, gravity, etc. will be implemented on KASIOPEA as progressed.
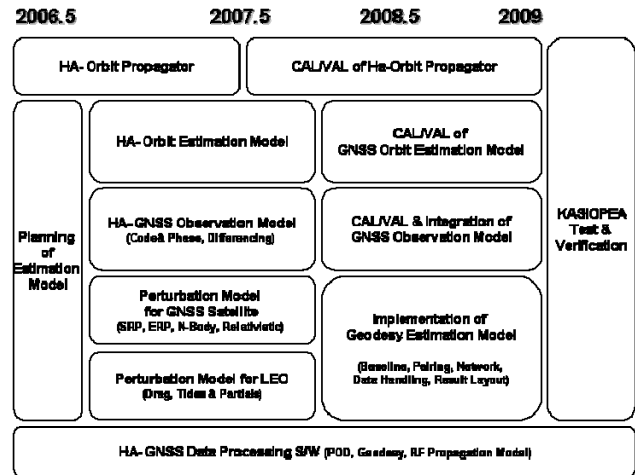

Figure 2. Development roadmap of POD part of KASIOPEA.

4. Conclusions

Recently promoted Space Geodesy Research Division in KASI is working on various GNSS research fields in absence of its own comprehensive GNSS data processing software. With the abundant operation experience of well known GNSS software tools, KASI is planning the development of a comprehensive GNSS data processing software.

Acknowledgement

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