Korean GPS Network (KGN) Activities

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Abstract

Korea Astronomy Observatory (KAO) has been operating an IGS station TAEJ (which was relocated to DAEJ in 1999) since 1994. National Geographic Information Institute has joined the global IGS network by installing an IGS site, SUWN, near the Seoul metropolitan area in 1999. Also, starting in the late 1990's, several governmental agencies began to install many permanent GPS tracking sites in South Korea, and the number of stations is growing fast and it is over 70 as of February, 2004. Most of the sites are operated as geodetic-quality sites and their data are used for atmospheric science and other geophysical studies such as plate tectonics around the Korean Peninsula. Some sites are being operated as reference stations for vehicle/marine navigation in DGPS (Differential GPS) and RTK (Real-Time Kinematic) applications. In this paper, we will introduce the Korean GPS Network (KGN) and research activities utilizing the KGN.

Korean GPS Network

The number of permanent GPS tracking stations in Korea is 73 as of February 2004. Table 1 lists the responsible agencies with the equipment details. **Korea Astronomy Observatory (KAO)** has a total of nine sites. Their data are used for studies on geodynamics and atmospheric science. Also, they are providing real-time DGPS and RTK service. **Korea Institute of Geoscience and Mineral Resources (KIGAM)** has four sites and its data are used for seismological studies within a specific area of Korea (their locations are not featured in Figure 1). **Ministry of Maritime Affairs and Fisheries (MOMAF)** is operating a total of 16 sites: 11 of them are reference stations and the rest are DGPS monitoring stations. MOMAF reference stations are sending out DGPS information for maritime navigation and their antennas and site configurations are very similar to United States Coast Guard (USCG) Continuously Operating Reference Station (CORS). **Ministry of Government Administration and Home Affairs (MOGAHA)** currently has 30 sites. They are mainly used for generating cadastral maps. **National Geographic Information Institute (NGII)** is operating 14 sites for land survey. Figure 1 shows the geographic locations of all permanent sites of KAO, MOMAF, MOGAHA, and NGII.

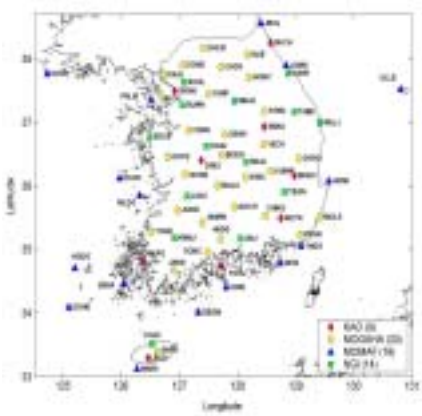


Figure 1. Map of Korean GPS Network

Agency	Application	Number of Sites	GPS Receiver	GPS Antenna	IGS
KAO	Space Geodesy DGPS/RTK	9	Trimble 4000SSi	TRM29659.00	DAEJ
KIGAM	Geological Study	4	Trimble 4000SSi	?	
MOGAHA	Cadastral Survey	30	Trimble 4000SSi	TRM33429.00	
MOMAF	Maritime Navigation	16	Trimble 4000SSi	TRM33429.00	
NGII	Survey Cartography	14	Trimble 4000SSi	TRM29659.00	SUWN

Table 1. Summary of Korean GPS Network

Geodynamics Research using KGN

The Korean peninsula is located inside the Eurasian Plate (EU), between China and the Japanese islands. For geodynamical studies on the area around the peninsula, the KGN GPS data were processed with GIPSY-OASIS II developed by Jet Propulsion Laboratory. We used the standard precise point-positioning technique. The estimated site positions are transformed into the International Terrestrial Reference Frame 2000 (ITRF2000). The average length of data we processed is about three years, starting from January 2000 through April 2003. Figure 2 shows the horizontal velocities of 52 selected sites), and they pretty much agree with the well-known EU velocity. In Figure 2, several sites show slightly different directions from the others, and possible causes are under investigation. Figure 3 depicts the relative velocity field of 51 sites with respect to the IGS site, DAEJ. From Figure 3, we see that the northern part is consistently moving counterclockwise direction at ~2 mm/yr. Using these GPS-derived velocity field, we are conducting stress/strain analysis of the internal structure of the, and initial studies agree very well with seismological and geological evidences.

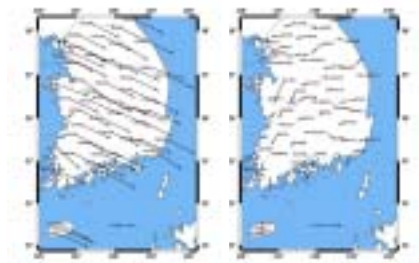
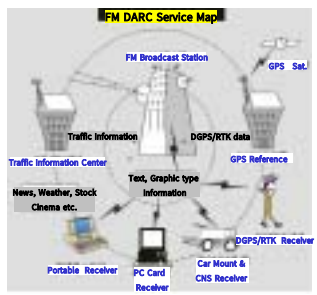
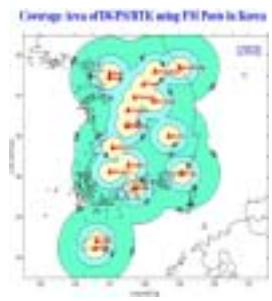


Figure 2. Absolute Velocity Field elative Velocity Field wrt DAEJ

Real-time Application, FM-DARC

As one of the many real-time applications using KGN, KAO is operating DGPS/RTK network for FM-DARC serviced by Munhwa Broadcasting Company (MBC). FM-DARC provides the news, traffic information, weather, stock information, etc. utilizing FM broadcasts. Nine DGPS sites are operational, and we are testing RTK service in Daejeon area. Currently, 19 FM posts are being used, but the network will increase to 30 transmitting posts in the near future. For RTK service, KAO is experimenting MultiRef developed by University of Calgary, Canada.





Proposal to Host IGS Global Data Center

Korea Astronomy Observatory is proposing to host the fourth Global Data Center (GDC). KAO is building three VLBI sites, which are to be completed by 2008, and proposing to have a SLR system. By adding VBLI and SLR, KAO will have three most important tools in space geodesy. We are aware that there are three GDCs in operation: two in USA and another in France. We regret that there is no GDC in Asia, even though there are ~1000 permanent GPS sites in Japan and ~400 in China. Considering the fact that Korea is geographically located between Japan and China and the eastern Asia is an important area in geophysical studies, we firmly believe that the IGS needs to have a new GDC in Korea. For details of KAO's plan to host the fourth GDC, please refer to another poster at this meeting titled "Proposing to host the fourth Global Data Center at Korea Astronomy Observatory".