Multi-GNSS Activities at the BACC iGMAS Analysis Center

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Coexistence and development of four kinds of Global Satellite Navigation System, GPS, GLONASS, BDS, and GALILEO have initially established.In order to benefit from Multi-GNSS applications, including increase in usable SVs, signals and frequencies, increase in availability and coverage, more robust and reliable services, and so on. In order to provide services of Multi-GNSS performance monitoring, promote service assurance, improve service performance, and ensure the interoperability of signals, the international GNSS Monitoring and Assessment Service (iGMAS) is established, which involves Tracking Stations network (TS), Operational Center (OC), Data Center (DC), Analysis Center (AC), Combination Center (CC), and Monitoring and Assessment Center (MAC). Beijing Aerospace Control Center (BACC) is doing the work about operation and maintenance the iGMAS AC using observation data from a network of Multi-GNSS capable receivers from the MGEX tracking network and a BDS station network operated by China, and the routine processing results involve the Multi-GNSS Ultra-Rapid/Rapid/Final precise satellite orbit and clock, tracking station coordinate and receiver clock, Ultra-Rapid/Final Zenith Total Delay (ZTD), Ultra-Rapid/Rapid/Final Earth Orientation Parameter (EOP) parameters, Multi-GNSS Rapid/Final ionospheric map and DCB, and Multi-GNSS real-time and global statistical integrity.

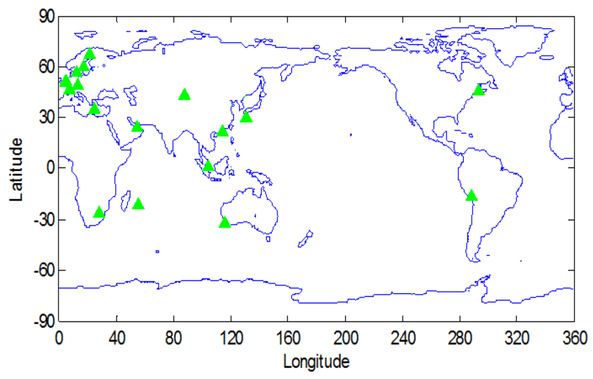
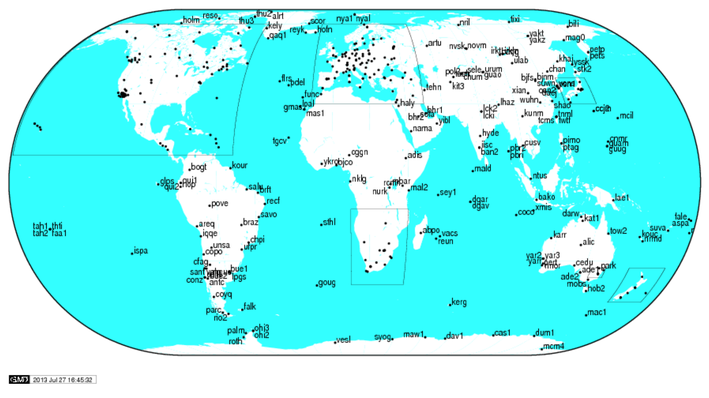


Fig.1 The Multi-GNSS capable ground tracking stations

The Multi-GNSS observation data from a network of multi-GNSS capable receivers from the MGEX tracking network and a regional BDS station network operated by China day 321 to 334 in 2013. There are about 17 tracking stations shown in Fig.1

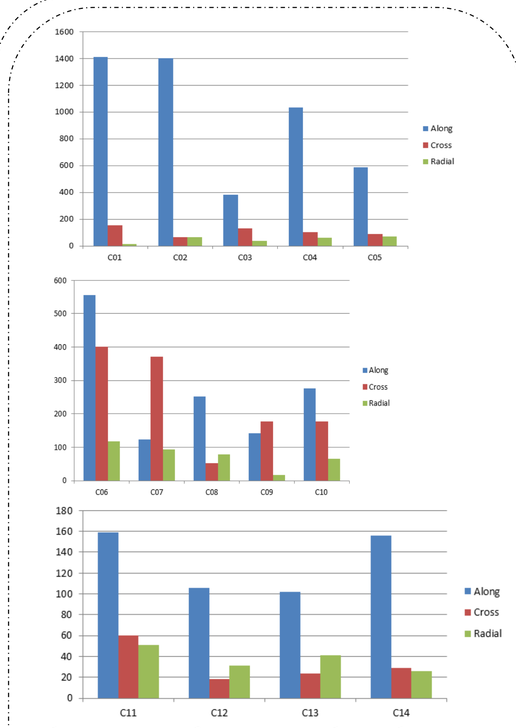
station name	systems	receiver type
unb3	G/R/C/E	Trimble NetR9
cut0	G/R/C/E	Trimble NetR9
dlf1	G/R/C/E	Trimble NetR9
zim3	G/R/C/E	Trimble NetR9
kri8	G/R/C/E	Trimble NetR9
mar7	G/R/C/E	Trimble NetR9
ons1	G/R/C/E	Trimble NetR9
reun	G/R/C/E	Trimble NetR9
gmsd	G/R/C/E	Trimble NetR9
areg	G/R/C/E	Trimble NetR9
brux	G/R/C/E	POLARX4TR
wtzz	G/R/E	JAVAD TRE_G3TH
jfng	G/R/C/E	Trimble NetR9
wark	G/R/C/E	Trimble NetR9
gua1	G/R/C	UNICORE UB4B0I
kun1	G/R/C/E	UNICORE UB4B0I
cny1	G/R/C/E	UNICORE UB4B0I

Table. 1 The Multi-GNSS capable ground tracking stations summary

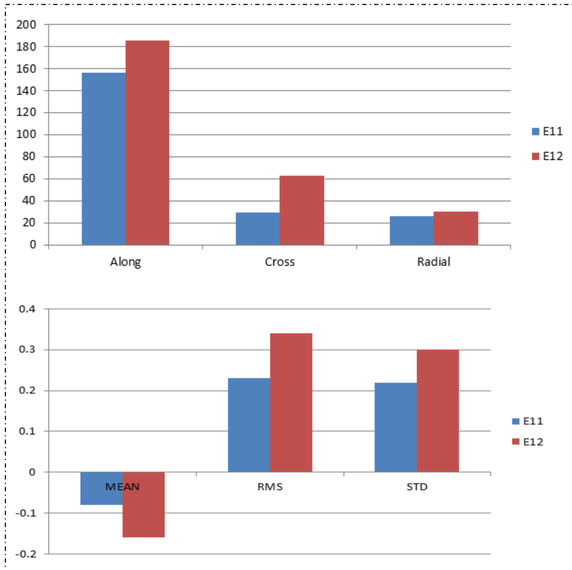


The Multi-GNSS ionospheric map and DCB processing using all IGS sites (~430 sites) combined GPS/GLONASS observation.

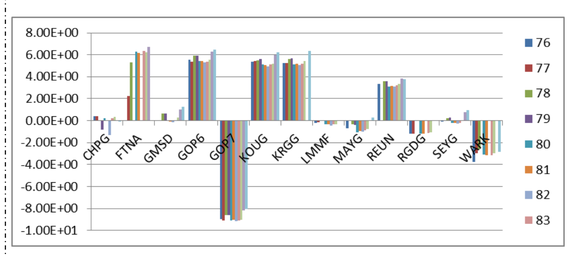
For impact analysis, we compare the GPS/GLONASS orbit and clock to IGS final orbit and clock products to evaluate the accuracy, and the accuracy of BDS/GALILEO orbit and clock and can be validated by checking the orbit differences of overlapping time span between two adjacent three-day. In addition, the characteristic on inter system biases parameters involved the four systems are investigated.



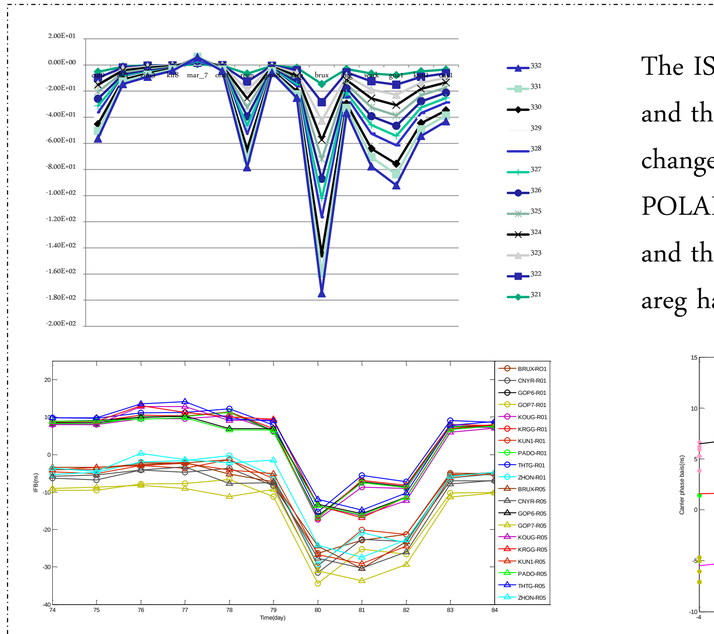
The accuracy for BDS in along direction is worse than in cross and radial direction, especially for GEO satellites. The mean 3D RMS of overlapping orbit reaches 300cm, 20cm and 10cm for GEO, IGSO and MEO respectively. And the radial RMS of BDS overlapping orbit can reach approximate and below 10cm for GEO, IGSO, and MEO.



The orbit assessment is done from overlaps from 3-day solution, and the orbit accuracy in radial direction of E11 and E12 can reach 2cm, and the mean STD is 0.25 ns for GALILEO satellite Clock.

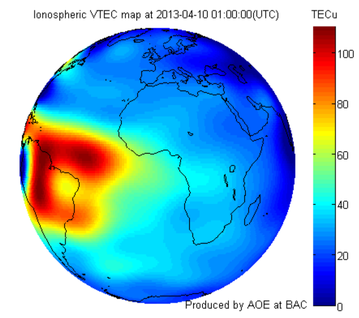


The ISB between of GPS and GALILEO (Unit: ns).



The ISB between of GPS and BDS for all stations, and the ISBs on different days have the same change trend. The BRUX station equipped with POLARX4TR has more variety than other stations, and the dlf1, zim3, kir8, mar7, ons1, gmsd, and areg have commendable stability.

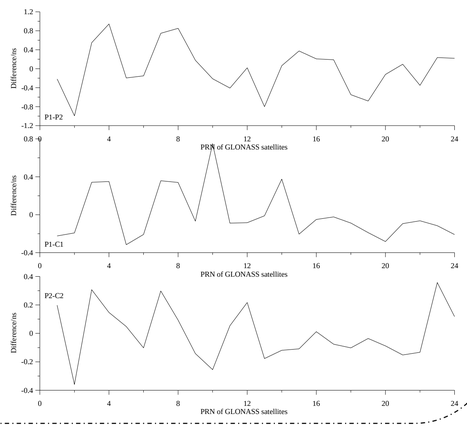
The IFB is similar to the GLONASS satellite having the same frequency number. There is the linear relationship between IFB and frequency number.



Combined GPS/GLONASS:

DCBs: Compared to CODE;

TEC: 1~2 TECU



The author would like to extend sincere gratitude to IGS and iGMAS for the observation data from their websites www.igs.org and www.igmas.org.

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