

Status and prospects of SLR of Compass

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Abstract: Compass constellation, Chinese regional satellite navigation system, consists of MEO, GEO and IGSO satellites, with the orbital altitudes of from 21,500 to 36,000km at the first stage. Compass-M1, the first experimental satellite of Compass constellation, started being tracked by ILRS stations since December, 2008 and was also the first Chinese satellite admitted into the ILRS priority satellite list. In June 2012 Compass-G1,-I3,-I5 and-M3 successfully became the ILRS tracking satellites and Compass-M1 stopped being tracked. The data processing and analyzing departments from the Compass host have normally collected the global SLR data of the above satellites for the precise orbit determination (POD) and calibration of radio measuring techniques. At the second stage of Compass system in next decade years, more MEO/IGSO satellites will be launched. SLR measurement will be considered as one of the important and indispensable ways of POD. For support of laser tracking to Compass satellites, the large-scale SLR systems with the characteristics of small type, automatism, flexibility, stability will be designed and developed to meet the requirements of POD of Compass satellites within the domestic stations.

1. Introduction

Compass is the Chinese regional satellite navigation system, consisting of GEO, IGSO and MEO satellites with altitudes from 21,500 km (MEO) to 36,000 km (IGSO/GEO). Compass-M1, Chinese first experimental GNSS satellite launched in April 2007, started being tracked by ILRS stations since December 2008. In May and July 2012, Compass-G1/-I3/-I5/-M3 become ILRS missions for precision orbit determination (POD) and microwave measuring technique calibration. Fig. 1 shows the trace on ground of compass satellites.

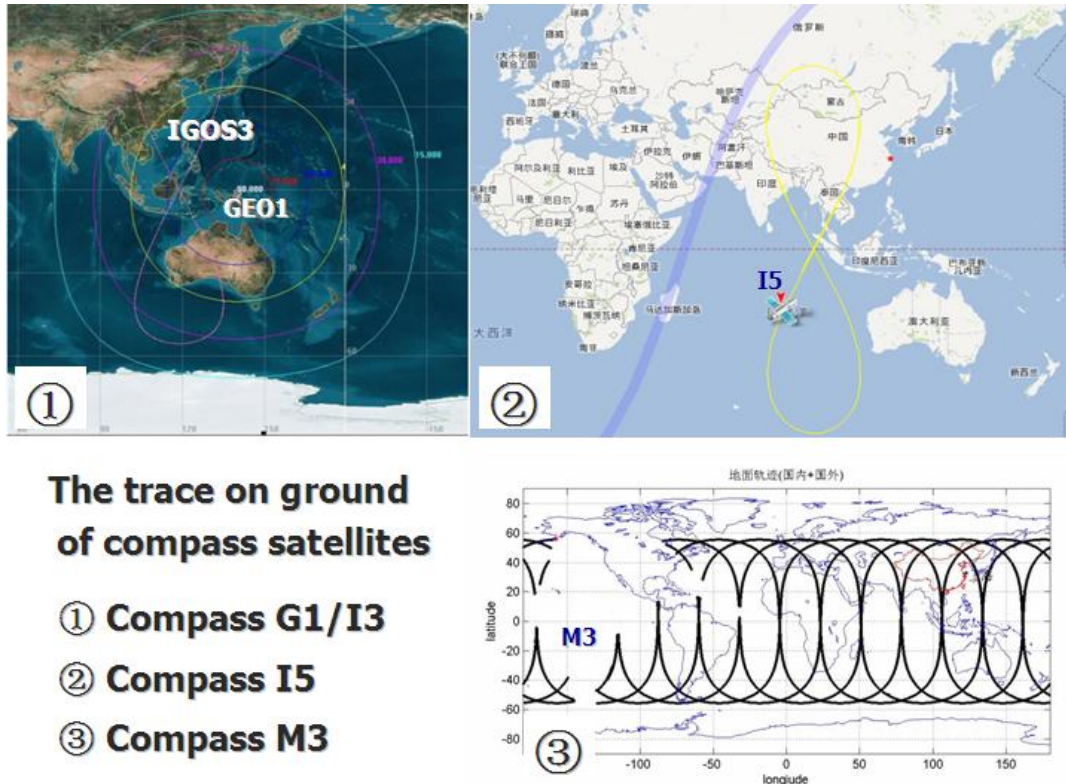


Fig.1 The trace on ground of Compass satellites

2. Laser Retro-reflector for Compass satellites

All Compass satellites are onboard laser retro-reflectors made by Shanghai Observatory for high precise laser measurement. Table1 shows the main performances of laser retro-reflectors of Compass satellites.

Table 1 The performances of laser retro-reflectors of Compass satellites

	MEO	GEO/IGSO
Size	32.6 x 28 x 3.0cm	49 x 43 x 3.0cm
Diameter of corner cube	33mm	33mm
Number of corner cubes	42	90
Reflective area	360cm ²	770cm ²
Material	Fused quartz	Fused quartz
Divergence	7±1"	6±1"
Weight	2.45kg	4.85kg

3. Laser measurement of Compass satellites

At the end of October 2012, there were 6 stations to track to Compass-G1, 7 stations to Compass-I3, 12 stations to Compass-I5, 19 stations to Compass-M3. Fig.2 and Fig.3 shows the distribution of stations to track to COMPASS satellites and the statistic of passes tracked by ILRS stations respectively.

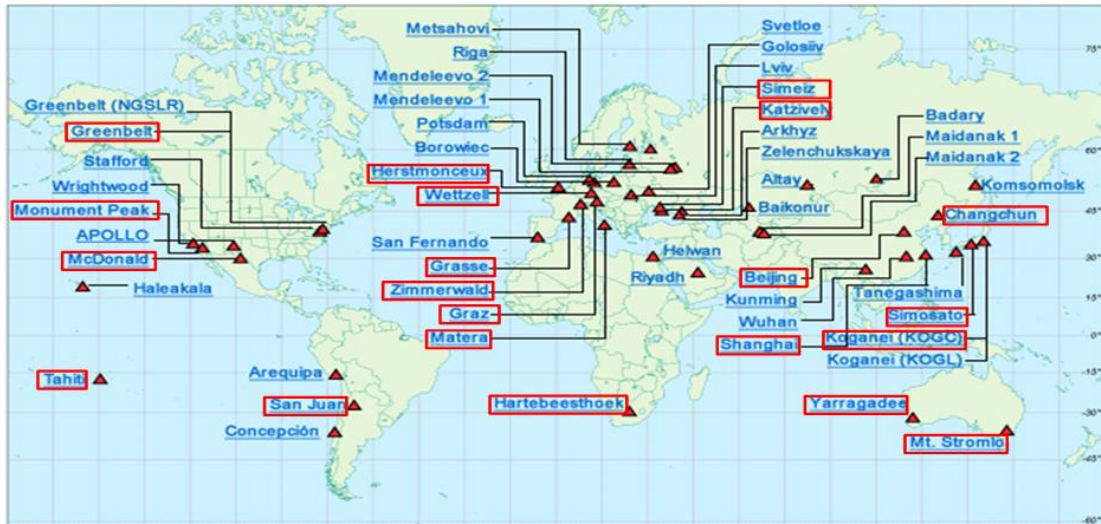


Fig.2 The distribution of stations to track to Compass satellites

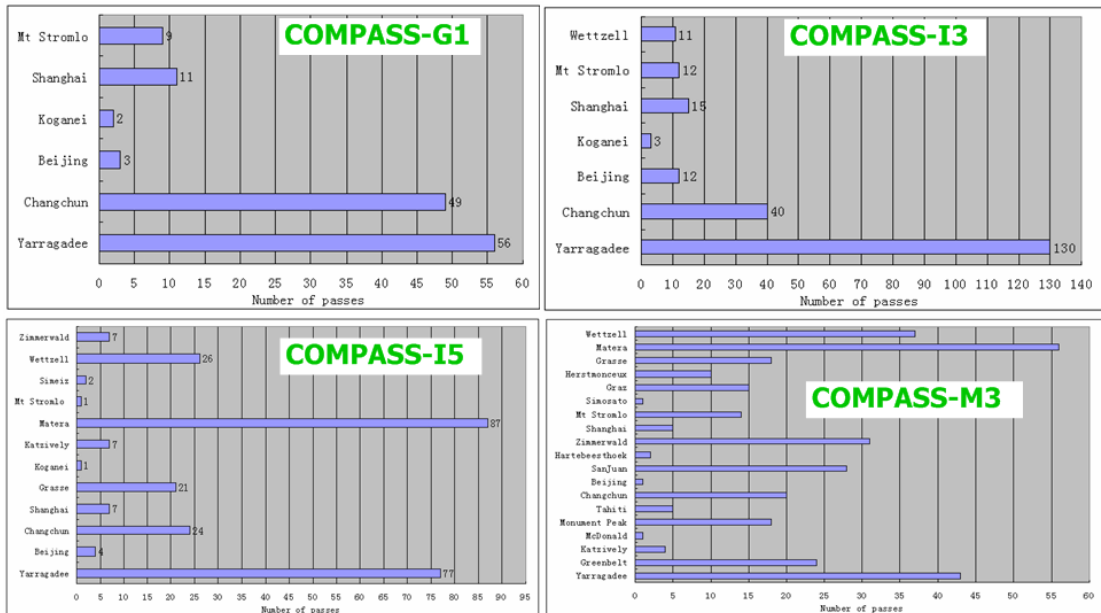


Fig.3 The statistic of passes tracked by ILRS stations

For Compass-G1/-I3/-I5, due to fewer stations, the SLR data are only as for calibration or the combined process with microwave data. For Compass-M3, the data process center of Shanghai Observatory has the ability of orbit determination, evaluation of SLR data and orbit predictions. The following gives the observations and the statistic of laser returns for Compass satellites by 1 kHz SLR system with laser power of ~ 1W at Shanghai SLR station. From the measuring results, the averages of laser returns of COMPASS-G1/-I3/-I5/-M3 are about 62, 98, 133 and 158 respectively.

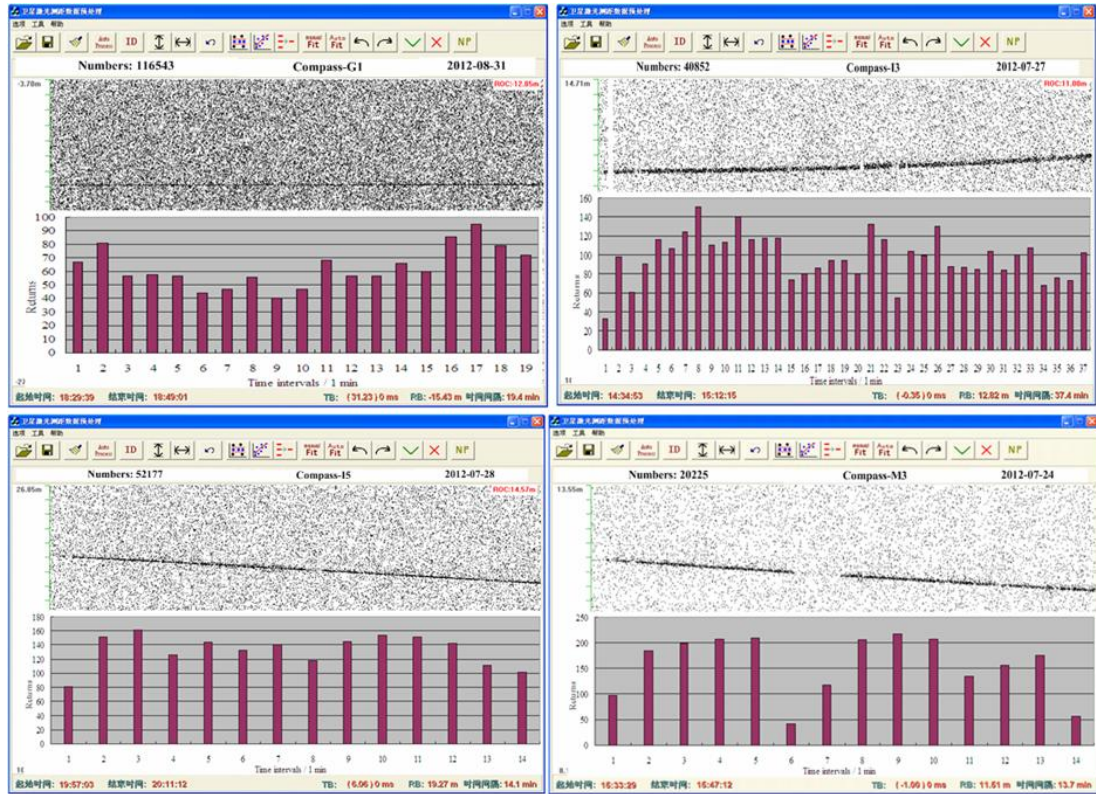


Fig.4 The laser measurement of Compass satellites at Shanghai SLR station

4. Prospect of SLR to Compass Satellites

At the end of 2012, Compass GNSS system will have the ability of the navigation services for the reign of Asia-Pacific area. By the year of 2020, the global navigation services will be provided for Compass GNSS constellation, including ~35 satellites. More Compass MEO/IGSO satellites will be launched and SLR technique will be considered as one of the important and indispensable ways of POD. For support of laser tracking to Compass satellites, the SLR systems with small type, automatism, flexibility, stability will be proposed within domestic regions to meet the requirements of POD for Compass satellites.

5. Summary

The International SLR observation on Compass satellites provides the opportunity for the ones who are interested in researching on different kinds of GNSS satellites. We hope more stations which can track Compass satellites to measure Chinese satellites to support its POD and calibration. More compass MEO/IGSO satellites will become in the ILRS campaign in future and the small type SLR system for Compass satellites will be proposed

