

Broadening of SLR Network in Chinese Mainland

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Abstract

Chinese mainland should broaden its SLR network ,to determine and check up the orbits of its Compass/Beidou satellites. At least 3 new stations should be located in west China's Urumqi, Xining and Lhasa. Three broadening plans of SLR network can be thought about ,and more mobile systems may be designed .Three methods can be used in overcoming its main difficulty.

Satellite laser ranging, as a space technology to achieve the highest absolute accuracy of the distance measurement , has developed nearly half a century .

In mainland China , geodesy, geodynamics , seismology and astronomy research departments , satellite laser ranging technology sustained attention to nearly four decades .In the distribution of China, satellite laser ranging stations , relative to its vast recovery , it is too sparse .This situation not only restricted the use of satellite laser ranging technology and development in these sectors , but also stagnated others' technology sector pace.

In Yousaf Butt's literature(2007), China has five fixed stations and two mobile stations . Unfortunately , their operation is not entirely.

In mainland China, the development of satellite laser ranging technology, on the last number , there are ups and downs and volatility , its rate of expansion and global positioning technology can not be in the same breath . Relative lack of talent, relatively backward technology, and economic constraints of the amount invested , are not conducive to widespread use of this technology.

China, should be appropriately expanding its network of satellite laser ranging , to get this technique wider attention , more use and further development.

1. Brief history of Chinese SLR Network

China began its SLR research in early 1970s.Chinese Academy first got SLR data, in meter accuracy(ZHANG and CHEN). Early 1980s, Chinese SLR network observed LAGEOS Satellite. By the end of 1980s, 7 observatories may be seen in table 1(ZHU,1989). It is a pity that some SLR stations (Zheng zhou, Guang zhou) stop their work.

A score later, at least 3 Chinese SLR stations realize GEO satellite, KHz and daylight SLR tracking.

2. Current SLR satellites and observatories

Until 2013, China have sent its 4 kinds of SLR spacecraft, for example Shenzhou-4, Hy-2, zy-3, COMPASS satellites. All the LRAS were designed and made by Chinese themselves. The three LEO satellites catch the similar LRA as CHAMP satellite. Table 2 show 7 stations in 2010s.

Table 1
Chinese SLR Observatories in 1988

Name	Long(deg.)	lat(deg.)
Shanghai	121.2	31.1
Xi'an	109.0	34.2
Zhengzhou	113.6	34.7
Beijing	116.3	40.1
Wuhan	114.3	30.5
Changchun	125.4	43.8
Urumqi	87.6	43.8

Table 2
Chinese SLR Observatories
in SLRF2005

Name	Long(deg.)	lat(deg.)
Shanghai(7821)	121.2	31.1
Lhasa	91.0	29.6
Kunming	113.6	34.7
Beijing	115.9	39.4
Wuhan(7236)	114.3	30.5
Changchun	125.4	43.8
Urumqi	?	?

In table 2 (ZHU, 2008), Zhengzhou, Guangzhou and Xi'an are replaced by Lhasa, Kunming and Changchun. The Beijing observatory in table 1 is not the same as in table2. One is in the north suburbs of Beijing, the other is in the southwest.

Fig 1 is the LRA on Compass-G2 (YANG and ZHANG, YANG and HONG)



Fig.1 Corner cubes on Compass-G2 satellite

March 19 2013, Zhitao ZHOU reported: The biggest mobile SLR system in the world was built in wuhan at Institute of Seismology, China Seismological Bureau.

The instrument, which is 10 meters long, 2.5 meters wide, 3.9 meters high, reached one meter aperture receiving telescope, ranking first in the world of similar equipment, the use of semi-trailer carrying, with daytime observation capabilities.

Project leader, researcher at the Chinese Institute of Seismology Bureau, Tangyong Guo introduced, developing the range finder is a major national scientific project "construction environmental monitoring network in China" projects. It can be used to observe 36,000 kilometers away geostationary satellites, ranging accuracy of millimeters. End of 2012,the instrument began its mobile observation in middle China's Xian'ning , and successfully observed geosynchronous satellites.



Fig.2 Chinese new mobile SLR system with 1-meter-aperture receiving telescope

3. China should broaden its SLR Network

Table 1 and 2 show that China's SLR observatory mount almost had stopped its steps for quarter a century. In contributions of space geodesy, geodynamics and orbit determination for Compass satellites. Three plans or steps can be thought.

First, west China's Urumqi and Lhasa should become fixed SLR station. New system installation at Xining may be better.

Then, Zhengzhou, Xi'an and Guangzhou come back to the SLR observatory list .In west China, such as Xinjiang, one new station is not more than SLR data necessary.

Third, new mobile SLR instrument may be designed and made out. Perhaps , Beijing had put in use another SLR system, with 1 meter aperture receiving telescope, in its north suburbs (YANG and ZHANG et al.) .

Fig. 3 show that 12 SLR fixed stations are to be operating in Chinese mainland.



Fig3 : 12 red points mean 12 SLR fixed station.

4. Difficulties and countermeasures

Feet are longer than roads; methods are more than difficulties. Main difficulty is less professional and expense problem. Only near 50 scientists and engineers devoted in SLR event. The more observatories, the more workers and expenses. A long term plan may be helpful; and great influences from famous scientists and geodesists to the government will win better policy decision . In addition, younger colleagues can be introduced and encouraged to SLR career.

5. Summary

Till 2020, Compass satellites will become a global navigation satellite system, they need SLR technology to check their orbit .As above, Beijing and Xinjiang may fulfill two SLR systems, Xining, Lhasa, Wuhan, Guangzhou , Changchun, Kunming, Xi'an, Zhengzhou may settle a fixed instruments. 2~3 mobile SLR Systems could be thought out.

Thus, Chinese mainland should use 14~15 fixed or mobile SLR instruments.

References

ftp://cddis.gsfc.nasa.gov/pub/slr/products/resource/reanalysis_2007/SLRF2005_POS+VEL.snx.txt
<http://www.gfy.ku.dk/~iag/prchina03/PROGRESS%20IN%20SLR%20AND%20VLBI%20ACTIVITIES%20IN%20CHINA.htm>

<http://ctdsb.cnhubei.com/html/ctdsb/20130319/ctdsb1996493.html>(by Zhitao ZHOU)
YANG Fumin and HONG Xiaoyu, Progress in SLR and VLBI Activities in China,
Yang Fumin, Zhang Zhongping, Chen Juping, Chen Wanzhen, Zhang Haifeng, Wu Zhibo, Meng
Wendong, SLR observations of Compass-G2
Yousaf Butt (Union of Concerned Scientists, Cambridge, MA, USA), Satellite Laser Ranging in
China , January 8, 2007
ZHANG zhongping and CHEN wanzhen,(2012) Construction and progression of Satellite Laser
Ranging system and technology
,http://www.shao.ac.cn/tq/zgxy/201207/t20120726_3621846.html
ZHU wenyao et al,(1989)An Estimation of Possible Accuracies in Determining LAGEOS Orbit and
ERP independently by the Chinese SLR Network, Acta
Geodatica et Cartographica Sinica
ZHU yuan-lan (2008),Analysis of Orbit Determination Accuracy of Chinese SLR Regional Network,
Annals of Shanghai Observatory Academia Sinica