

Performance Analysis of Guangxi CORS

Geomatics Center of Guangxi

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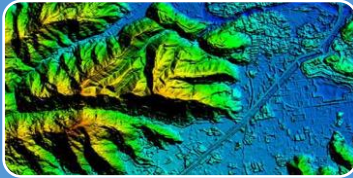
2017.8 Brunei



第 13 届中国—东盟博览会
THE 13TH CHINA-ASEAN EXPO
第 13 届中国—东盟商务与投资峰会
THE 13TH CHINA-ASEAN BUSINESS AND INVESTMENT SUMMIT



GEOMATICS CENTER OF GUANGXI



1-Guangxi Geographic Data Management

- DOM/DEM/DRG/DLG



2-Guangxi CORS Operation and maintenance



3-Digital Guangxi Geo-spatial Infrastructure

- MapWord·Guangxi



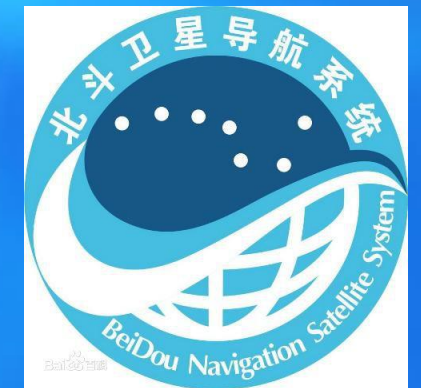
4-High-resolution Earth Observation System

- GF-01, GF-02, ZY-3, TH Satellite Remote Sensing Data







A world map is faintly visible in the background, rendered in a light blue color against the darker blue background. The map shows the continents of North America, South America, Europe, Africa, and Asia.

1 What is CORS?

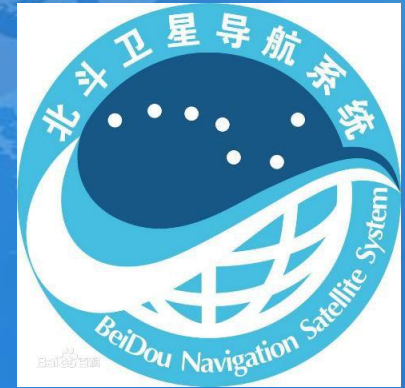
Global Navigation Satellite System (GNSS)



Global Navigation Satellite System (GNSS)

	GPS (Global Positioning System)	USA	1958	36/31
	GLONASS	Russia	1993	30/24
	BeiDou	China	2000	35/23
	GALILEO	European Union	2002	30/18
<hr/>				
	Quasi-Zenith Satellite System (QZSS)	Japan	2002	3/2
	Indian Regional Navigation Satellite System (IPNSS)	India	2012	7/7

BeiDou Navigation Satellite System (BDS)



- ❑ Space stations
- ❑ Ground control station
- ❑ User terminals

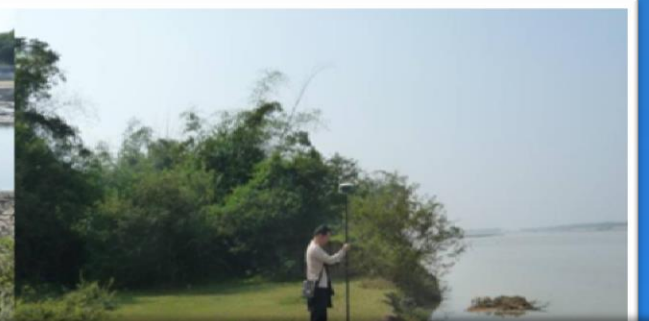
70°E to 140° E

5° N to 55° N

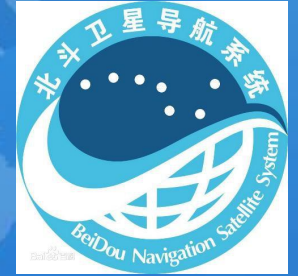
Timing: 20ns to 100ns

Positioning: 10m

Continuous Operational Reference System (CORS)

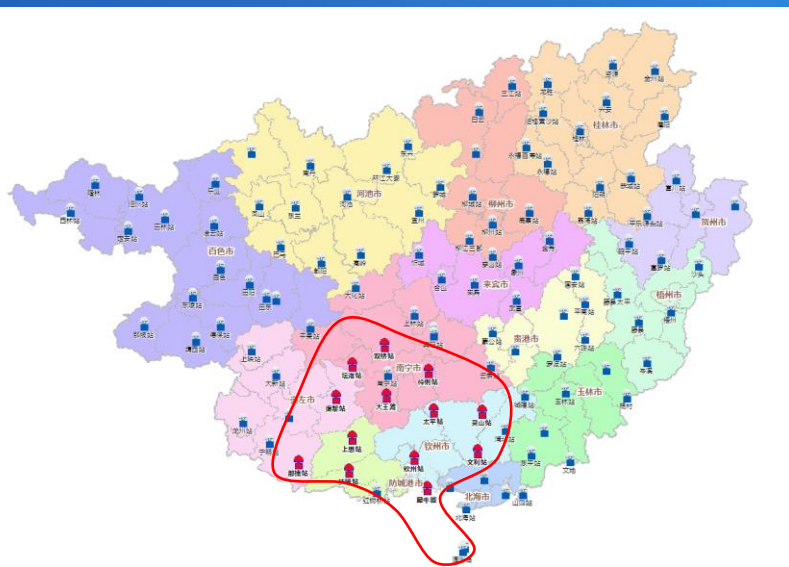


GUANGXI CORS

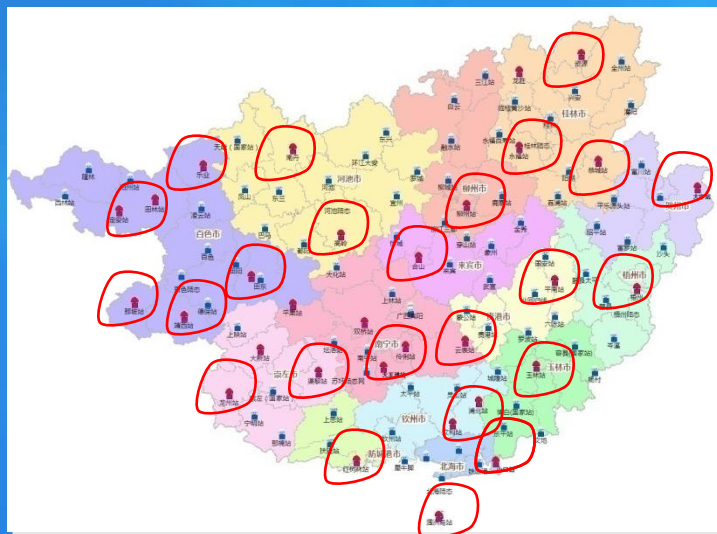


- 1 Data Control Center
- **169** Stations Connected
- Average distance=**50km**
- 236700 km² coverage
- **4000** professional users
- High Accuracy,
Full Coverage
All-Weather
Real-Time

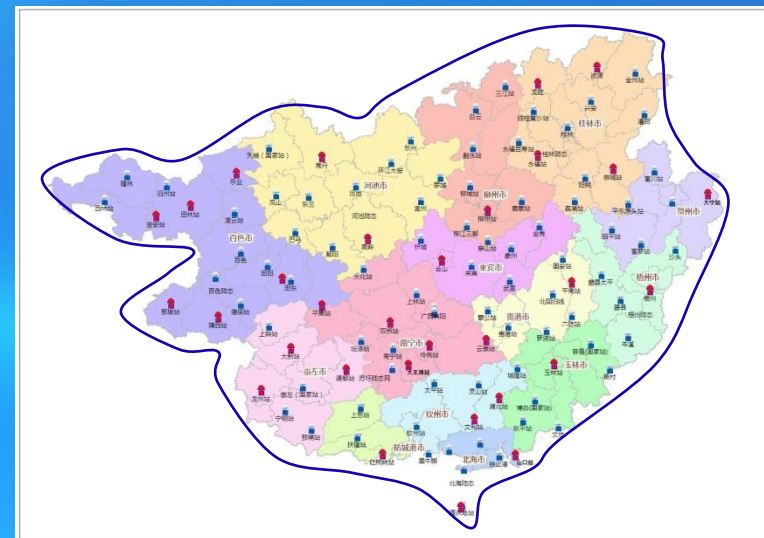
Construction of Ground-based Augmentation System of Guangxi Beibu Gulf



2015, Beibu Gulf



2016, Sub-meter level



2017, Centimeter level

Main Concerns

- ▶ 1-Can I receive signal anywhere anytime in any device?
- ▶ 2-Any significant improvements with Beidou imbedded?

Time Availability--Methodology

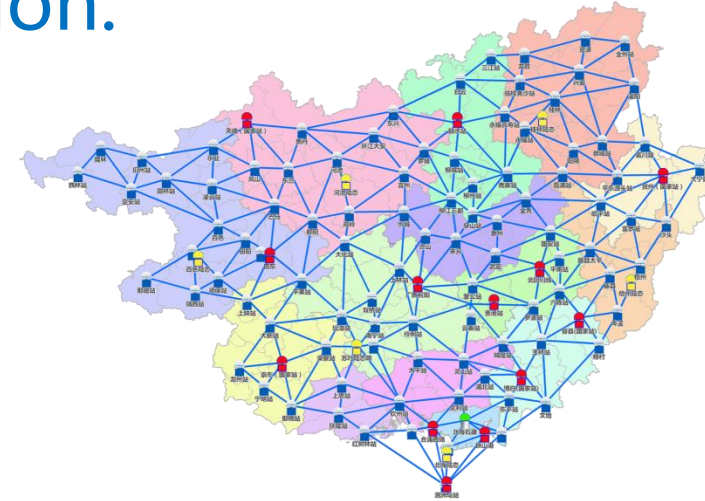
Select two testing points outside of covering region:

RTK1 (37 km away from network);

RTK3 (14 km away from network);

select two testing points within covering region:

RTK5, RTK7.



*Good operating condition;

*Good observation condition'

*Meets point position requirements of a static accuracy test.

Time Availability--Methodology

Continuous observation:

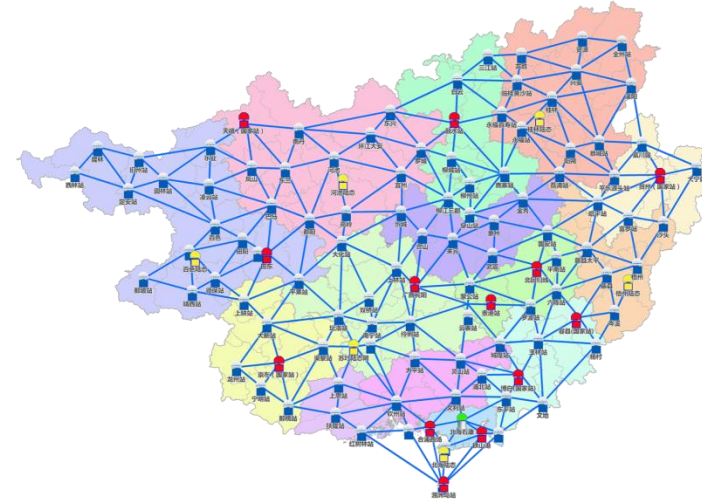
24 hours

1 second sampling frequency

□ records original continuous positioning results

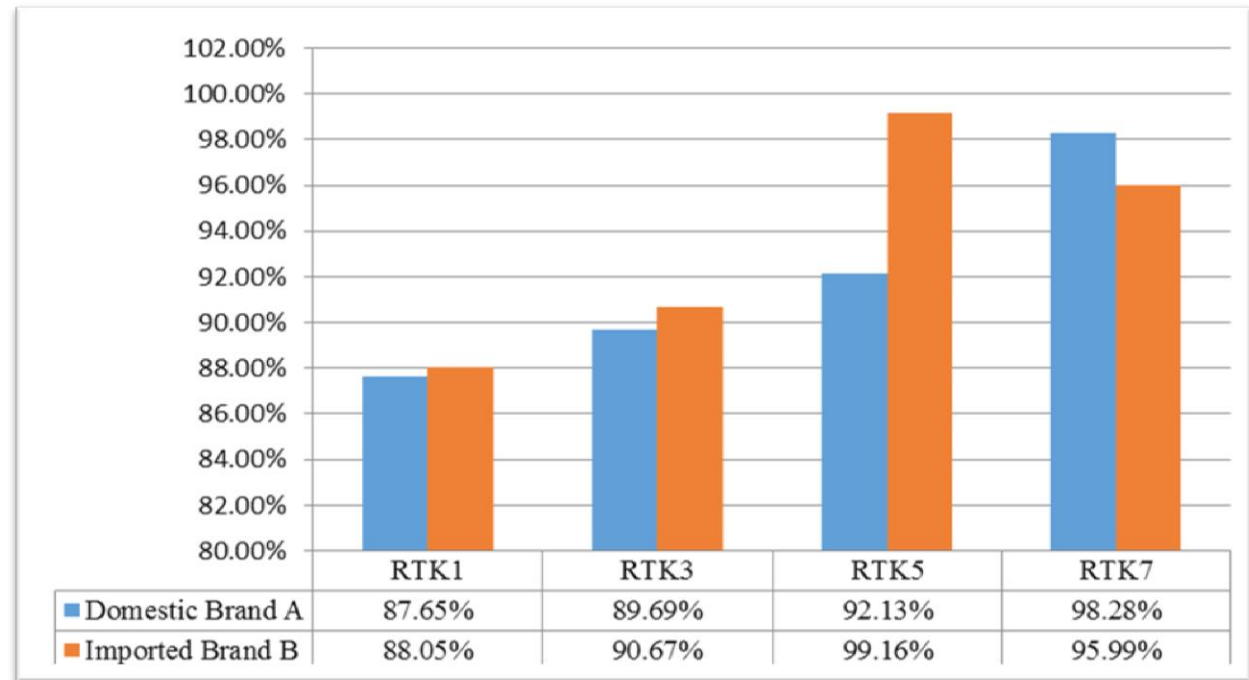
In theory: collect 86,400 epoch results.

□ Calculate the ratios of fixed solution number and entire observation number



Time Availability--Results

**Beibu Gulf Region:
92.7%**



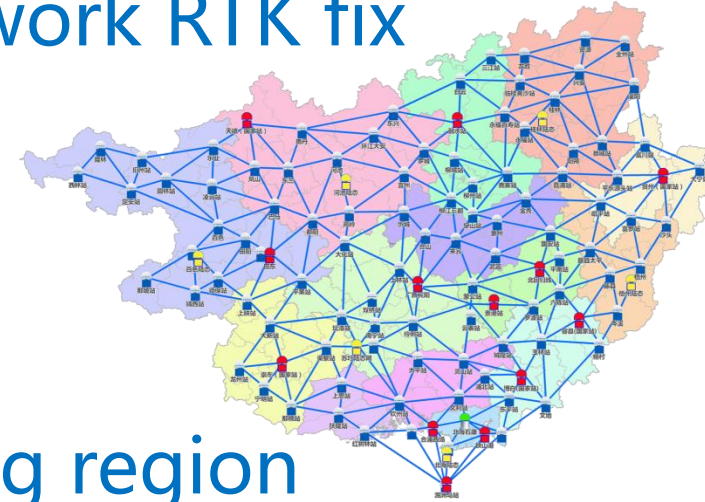
Space Usability-Methodology

Space usability: the scope users can receive network RTK fix solutions real timely

Method: **Vehicle-mounted RTK Test**

Hypothesis: points uniformly distributed in testing region

- Sampling frequency: 1s
- Driving Speed: 40-60 km/h



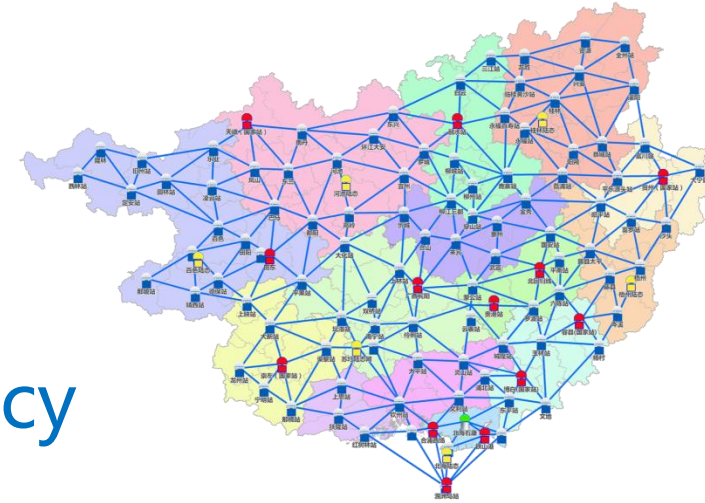
Space Usability-Results

Assessed System	Terminal Unit Type	Percentage of Fix Solution Points
Beidou System of Beibu Gulf	Domestic Brand A	85.6%
	Imported Brand B	89.0%
Average		87.3%

Positioning Accuracy-Methodology

Two-sat v.s. **Three-sat**
GPS, GLONASS BeiDou, GPS, GLONASS

- Goal: network RTK real-time positioning accuracy
- Testing points: 7
- Locations: mountain, flat lands, urban
- Receiver: Domestic Brand A
- Method: 30 epochs * 3 measurement/point,



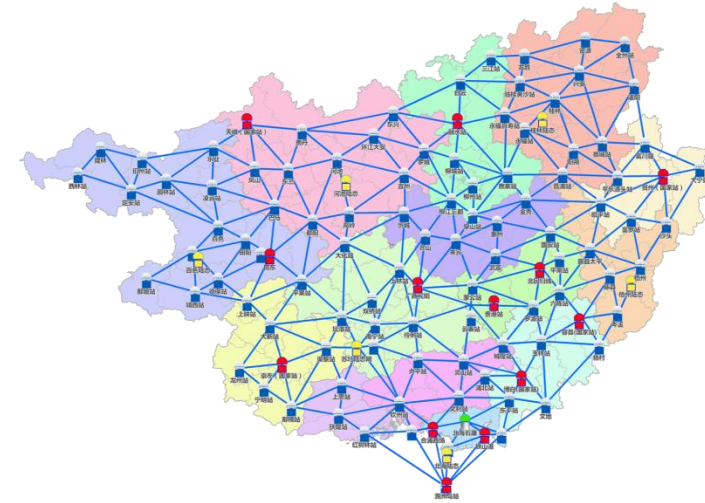
Positioning Accuracy-Evaluation

Internally Coincident Precision

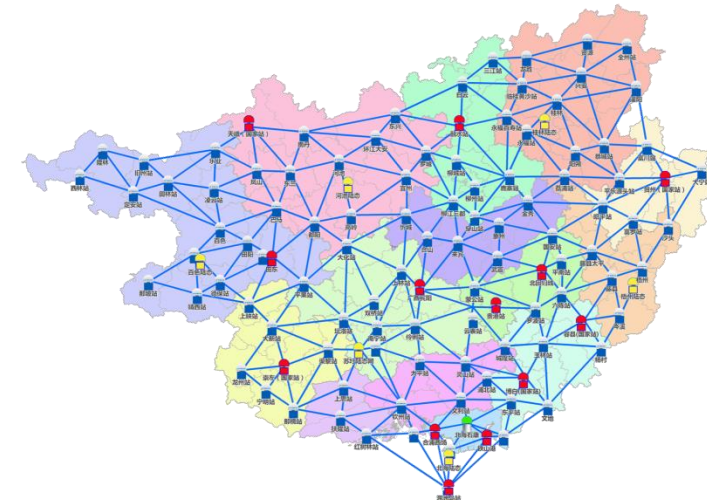
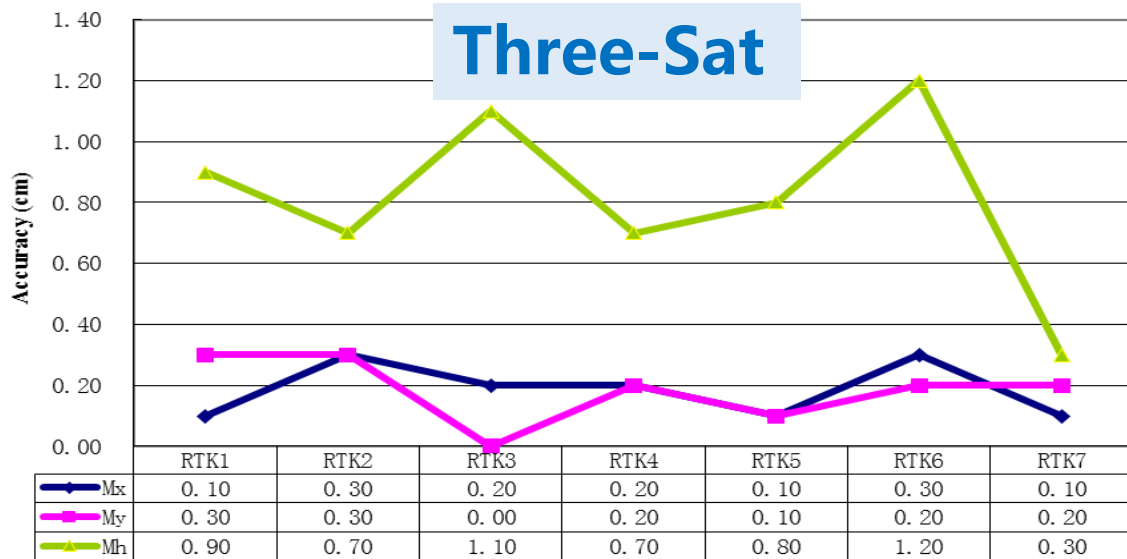
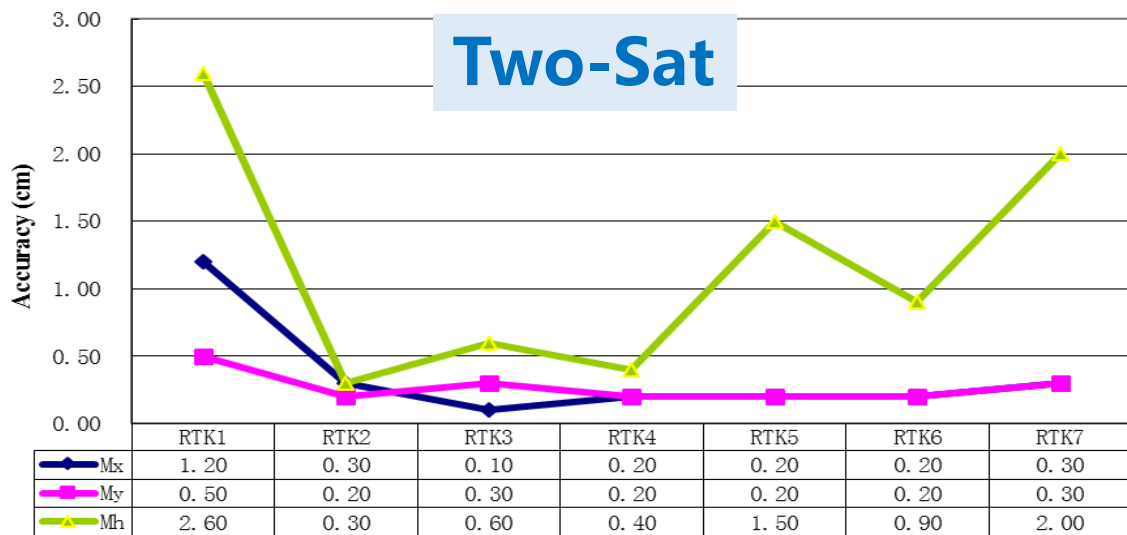
$$\mu = \sqrt{[VV]/(n - 1)}$$

Externally Coincident Precision

$$M = \sqrt{[VV]/(n - 1)}$$



Positioning Accuracy-Results

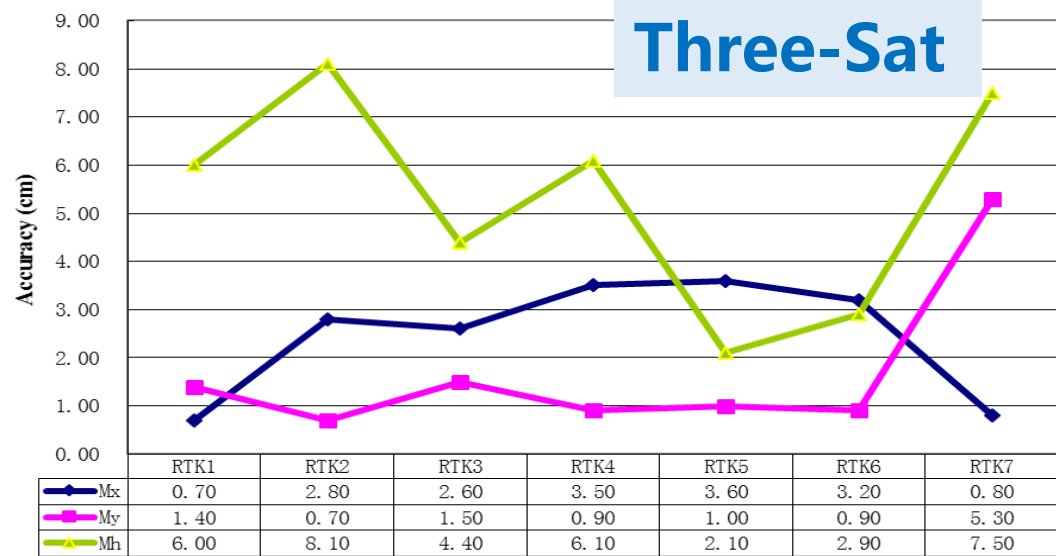
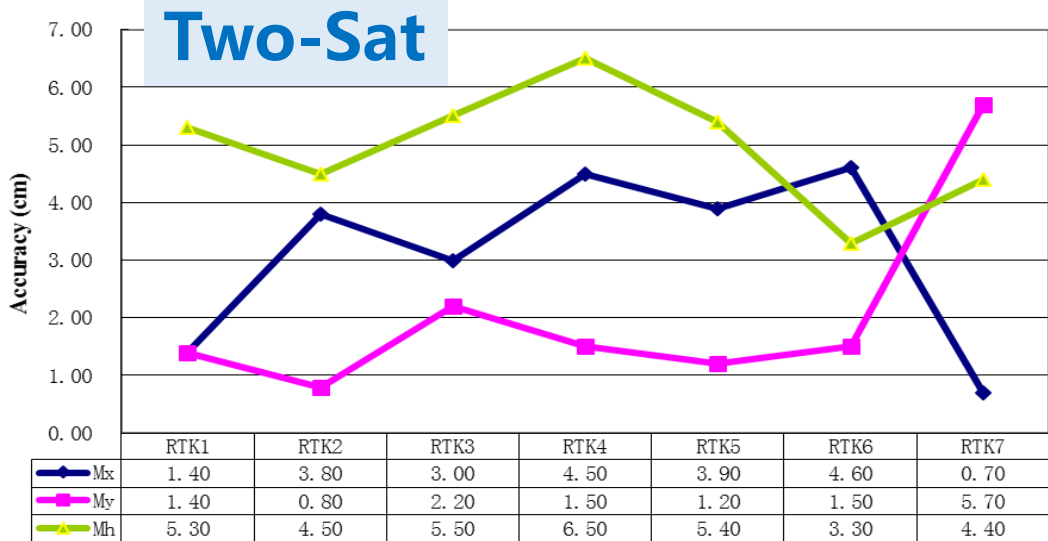
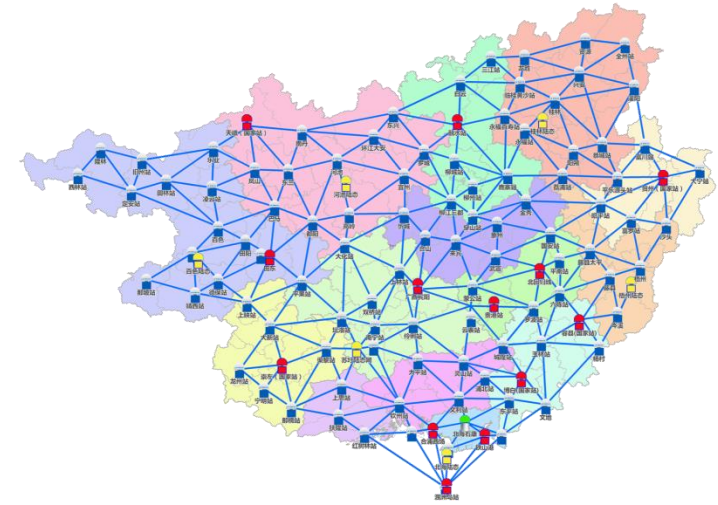


Internally Coincident Precision

$$\mu = \sqrt{[VV]/(n - 1)}$$

	Accessed System	Mx	My	Mh
Avg.	Two-Sat	0.40	0.20	1.20
	Three-Sat	0.20	0.20	0.80

Positioning Accuracy-Results



Externally Coincident Precision

$$M = \sqrt{[VV]/(n - 1)}$$

	Accessed System	Mx	My	Mh
Avg.	Two-Sat	3.13	2.04	5.00
	Three-Sat	2.46	1.67	5.30

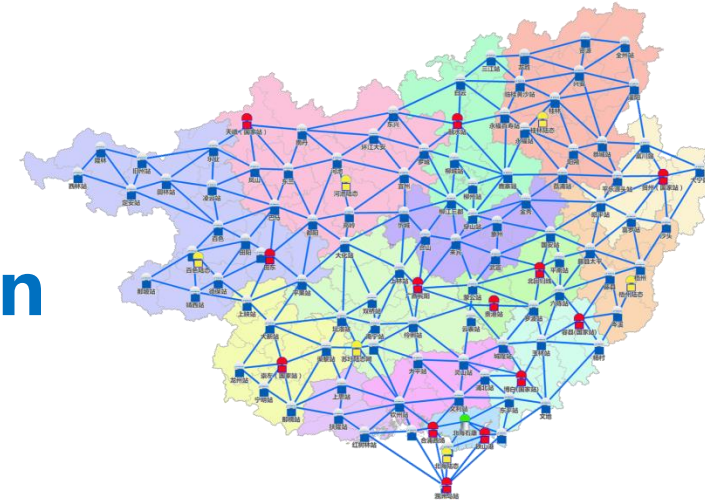
Conclusion

Time availability: **>87.65% external**
>92.13% internal
92.7% in Beibu Gulf Region

Space usability: **87.3%**

Positioning accuracy:

- ❑ Internally Coincident Precision: increase 37.7% horizontally
33.3% vertically
- ❑ Externally Coincident Precision: increase 20.6% horizontally
keep the same level vertically



Development



ASEAN Member Countries





Thank You!

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