



# **Development and Application of National BeiDou Ground Augmentation System (NBGAS)**

HaoYu Lou

China R&D Academy of Machinery Equipment

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NBGAS Development Plan

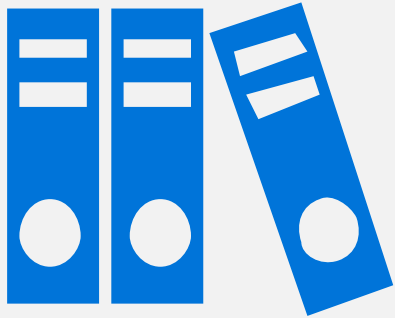
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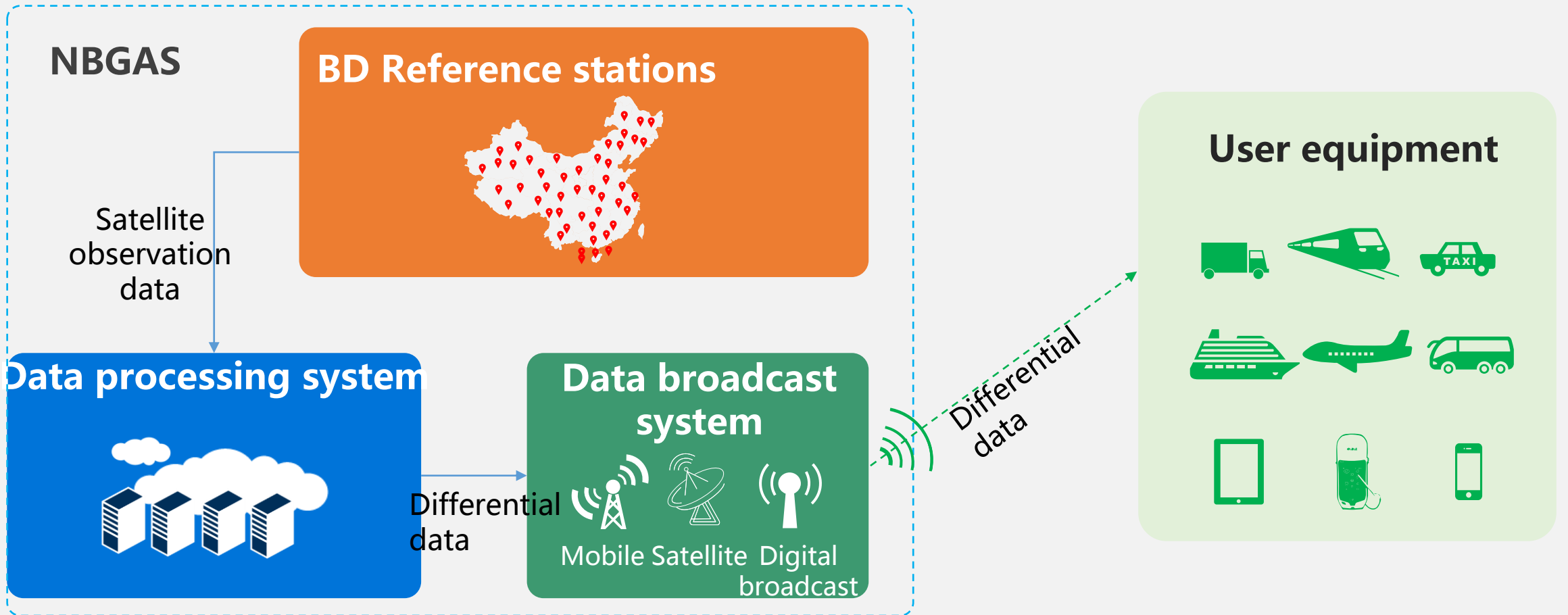
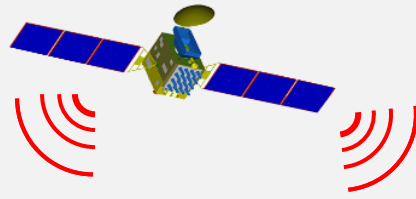
High Precision Application





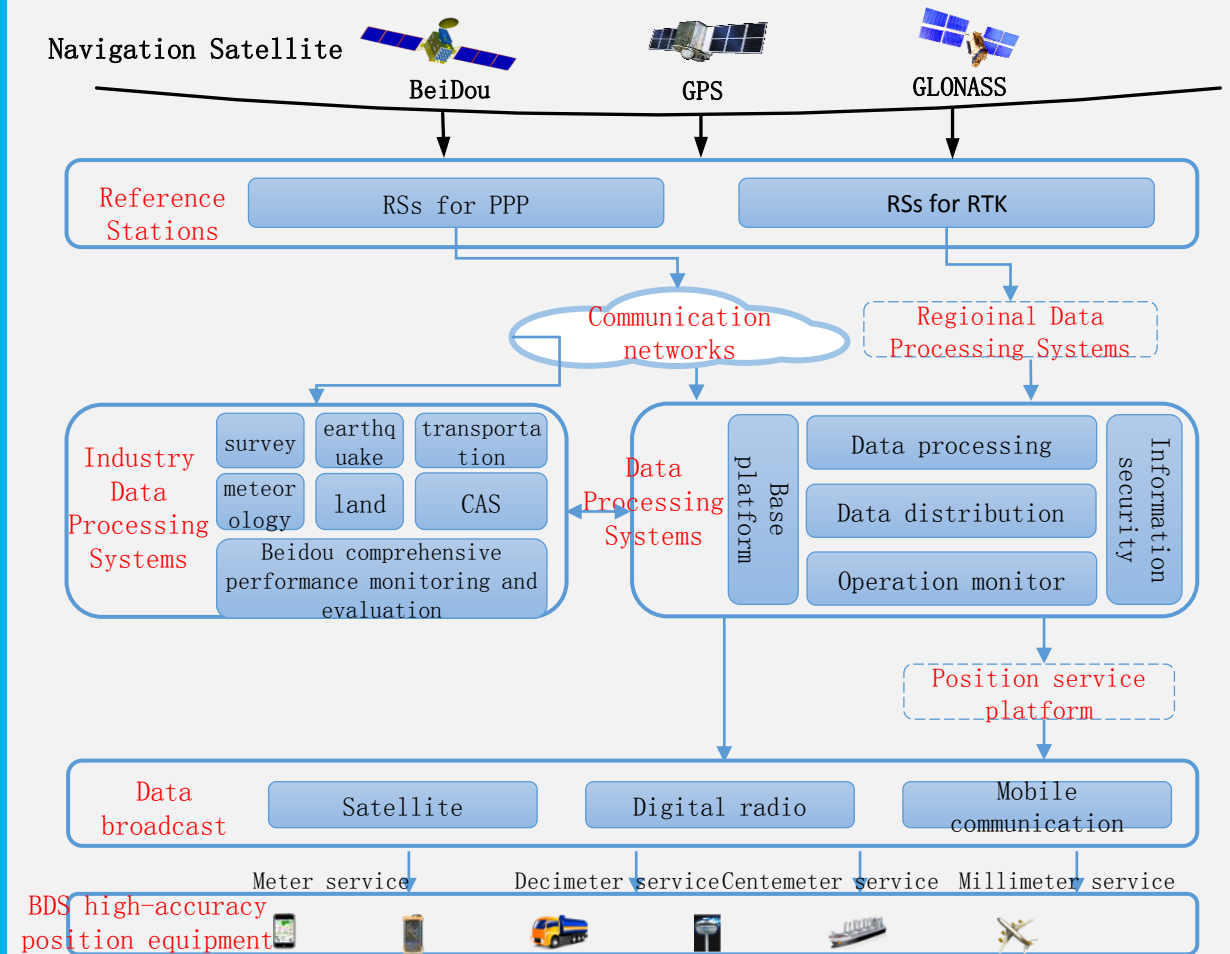
# NBGAS Development Plan

1



# NBGAS

- 150 BD Reference Stations For PPP & 1200 Reference Stations for RTK
- NBGAS Data Processing System & Data Backup System & Six Industry Data Processing Systems
- Mobile Communication & radio & Satellite Broadcasting
- Four Kinds Of High Precision Service





## First step ( 2014.4-2017.6 )

- Construct 150 RSs for PPP & 300 RSs for RTK
- Share the satellite original data from 6 national departments, and try to disseminate the differential data through satellites, digital broadcast and mobile communication.
- Construct the BDS Location Service Platform, and prop up the BDS high-precision Location Service Market.



## Second step ( 2017-2019 )

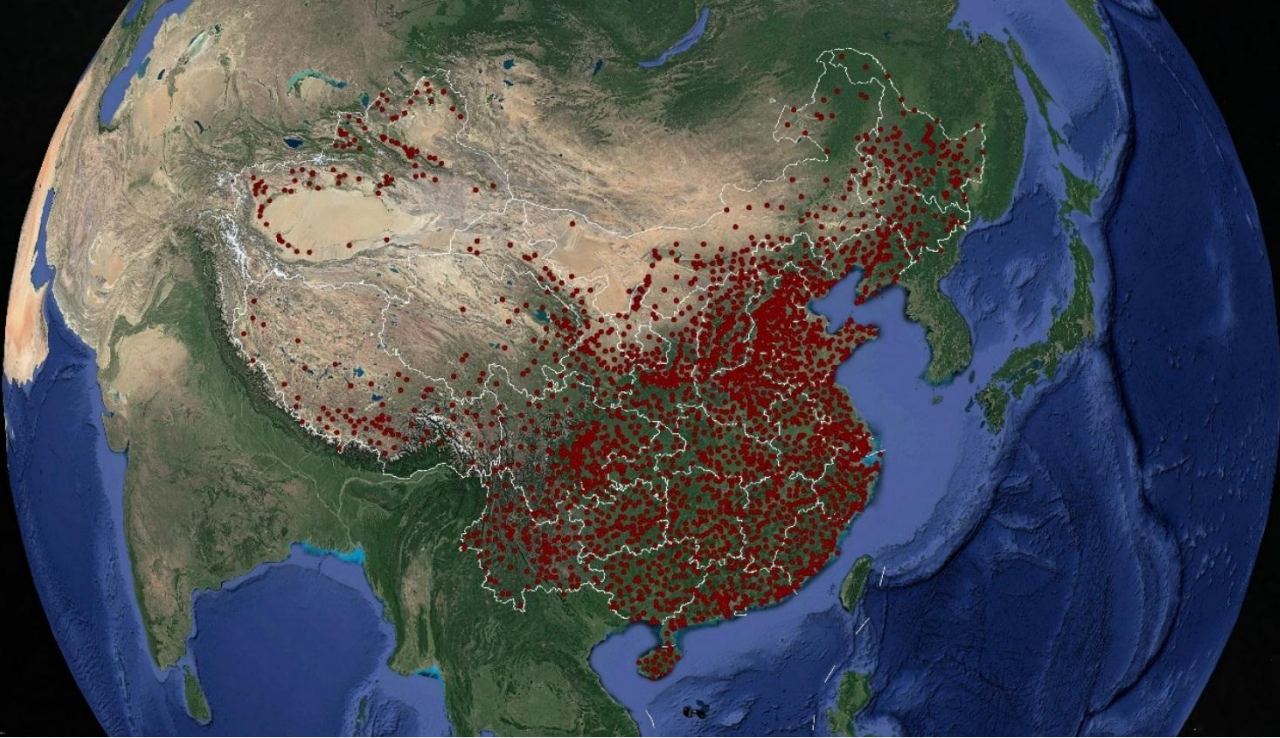
- Construct 900 reference stations.
- Finish the construction of NGBAS, and improve the system service performance.
- Provide the BDS high-precision location service in Chinese mainland and surrounding areas, to promote the popularity of BDS and accelerate the upgrade of BDS location service industry.



# Latest Progress

2



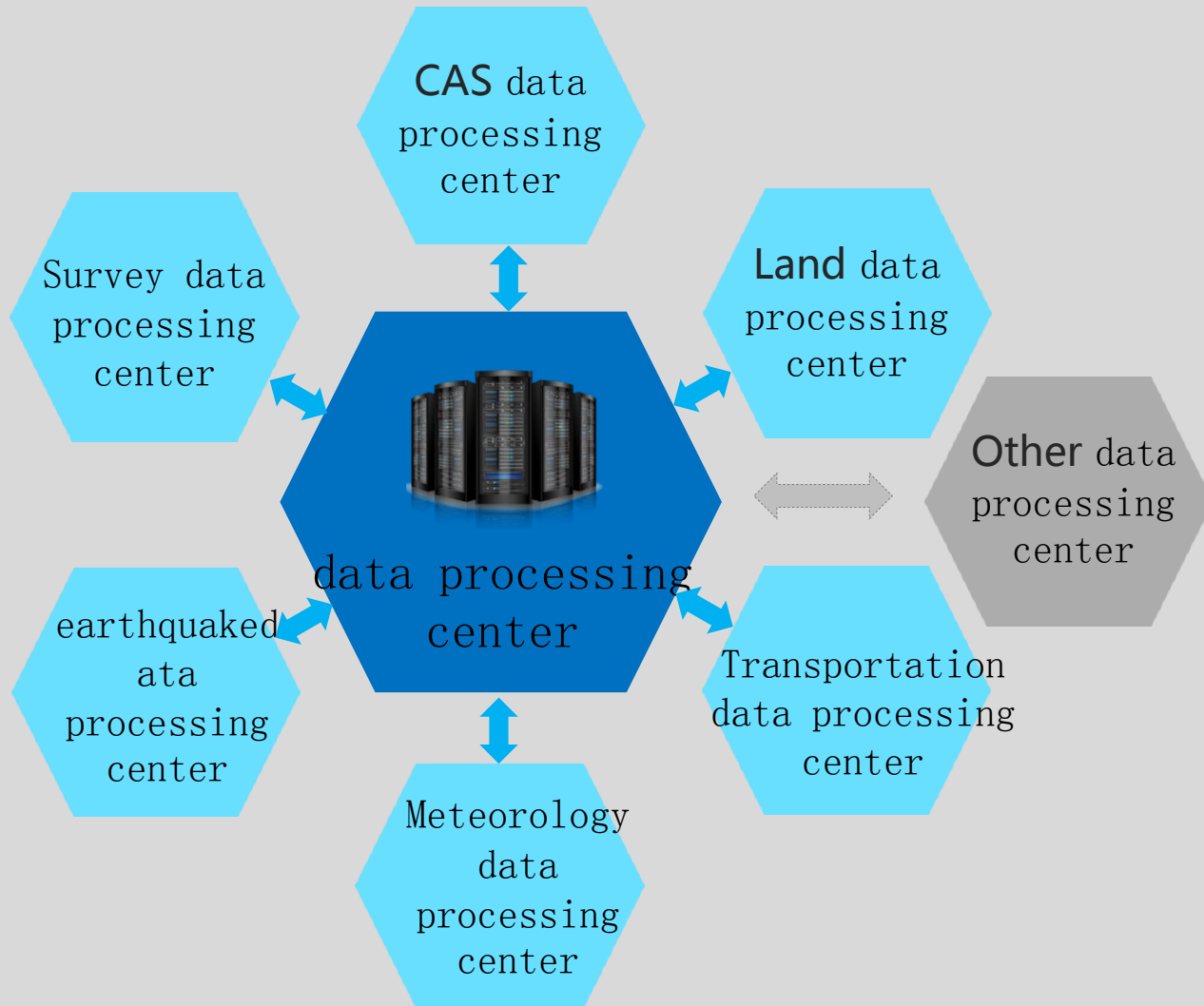


## Reference Station Networks

Finished the construction of 155 reference stations for PPP and 1543 reference (RTK) stations.







## Data processing center

- Completed NBGAS Data Processing Center, Which could provide high precision service of meter, decimeter, centimeter and millimeter level accuracy by several broadcast means.
- Finished construction of 6 sub-centers with different national departments





Mobile communication  
broadcast



C band satellite Broadcast



CMMB Broadcast

## Data Broadcast System

- Continuous broadcasting the differential message through mobile communication system.
- Testing the method of broadcasting the differential message through L band and C band satellite.
- Attempt to broadcast the differential message through digital radio of CMMB and CDR.



## Main Technical & Service index

Service	Position Accuracy (95%)	Broadcast
single frequency SPP(standard point positioning)	horizontal $\leq 2.0$ m, vertical $\leq 3.0$ m	Internet digital broadcasting satellite
single frequency PPP(precise point positioning)	horizontal $\leq 1.2$ m, vertical $\leq 2.0$ m	
dual frequency PPP	horizontal $\leq 0.5$ m, vertical $\leq 1.0$ m	
Network-RTK	horizontal $\leq 5.0$ cm, vertical $\leq 10$ cm (RMS)	Internet
Post-processing	horizontal $\leq 5.0$ mm $\pm 1$ ppm $\times D$ vertical $\leq 10$ mm $\pm 2$ ppm $\times D$	Internet

## Next Step



**Perfect**



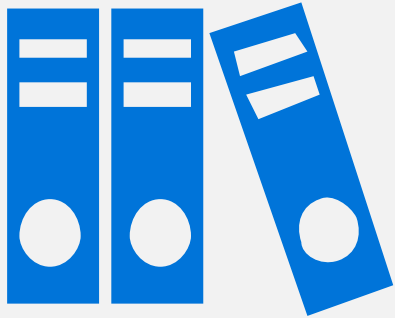
**Increase**



**Service**



**Application**

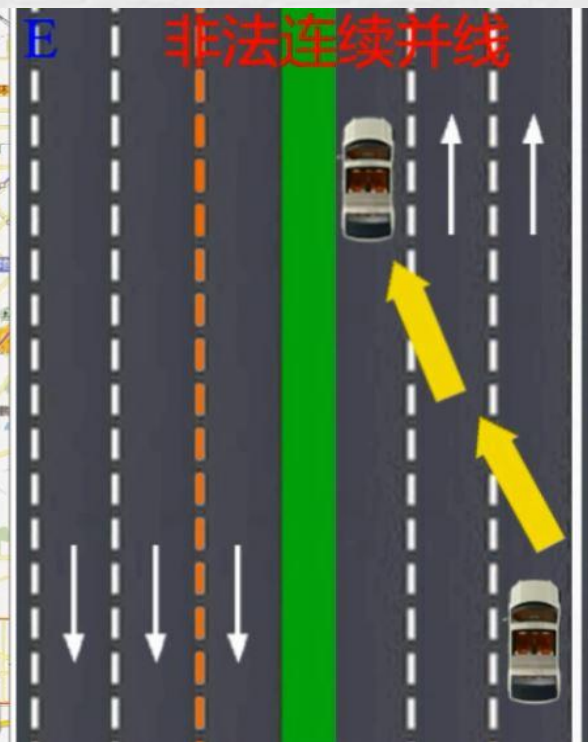
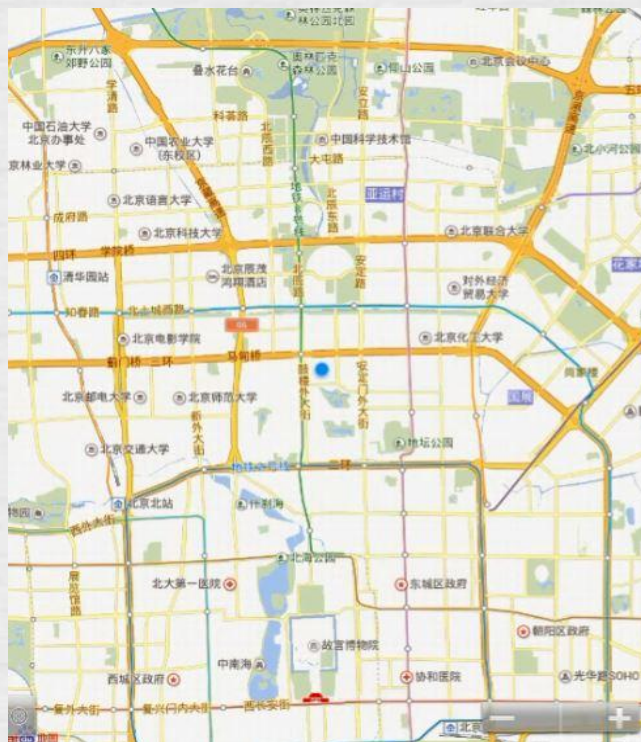


# High precision application

3

## Application in transportation

- Developed the application software and evaluation system.
- More than 30km high precision road lane navigation data has been made ,and the road land feature accuracy less than 20cm, illegal merging will be kept under constant surveillance.
- Support evaluation of high precision navigation.





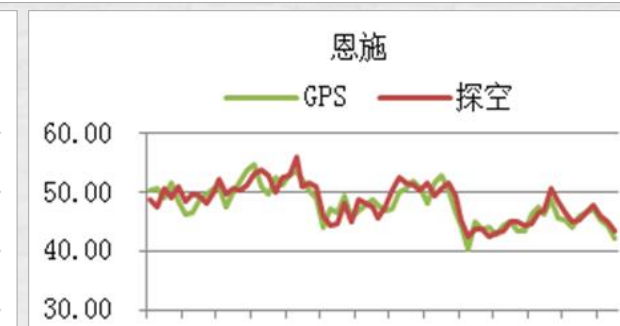
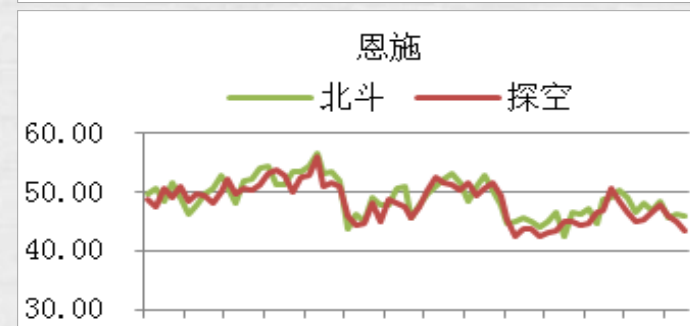
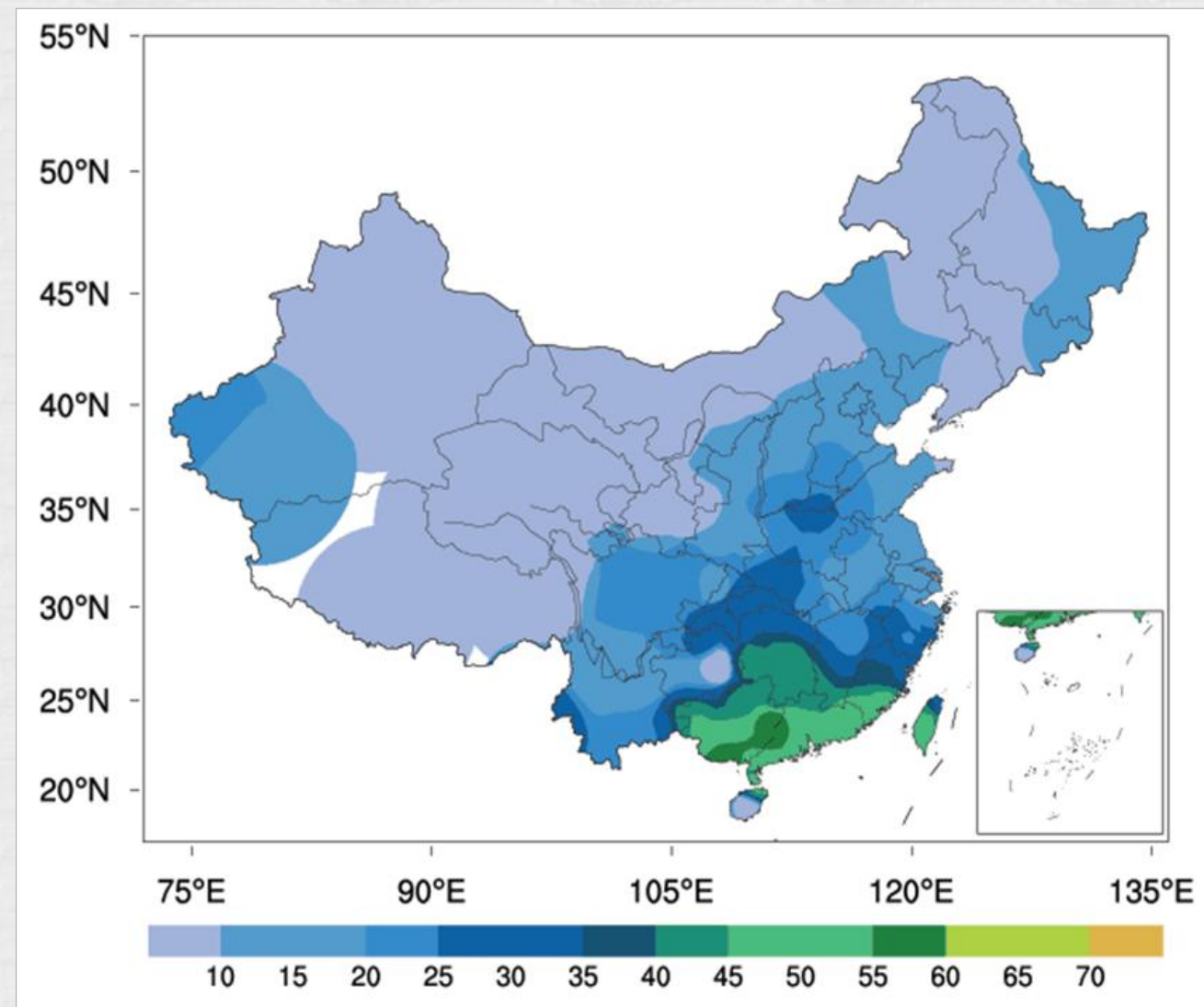
## Application in survey

The NBGAS data has been used in Geodetic survey.

No	item	Indicators	Measured value
1	number of reference stations of processing simultaneously	$\geq 400$	410
2	Coordinate precision	horizontal accuracy 3mm Vertical accuracy 5mm	Horizontal(E)1.91mm Horizontal(N)2.58mm Vertical(U)3.97mm
4	Orbit determination precision of MEO/IGSO	-15cm ~ 15cm	Average 14.25cm
	Orbit determination precision of GEO	-400cm ~ 400cm	Maximal 137cm
6	BD Satellite clock errors	$\leq 0.5\text{ns}$	0.17ns

## Application in meteorology

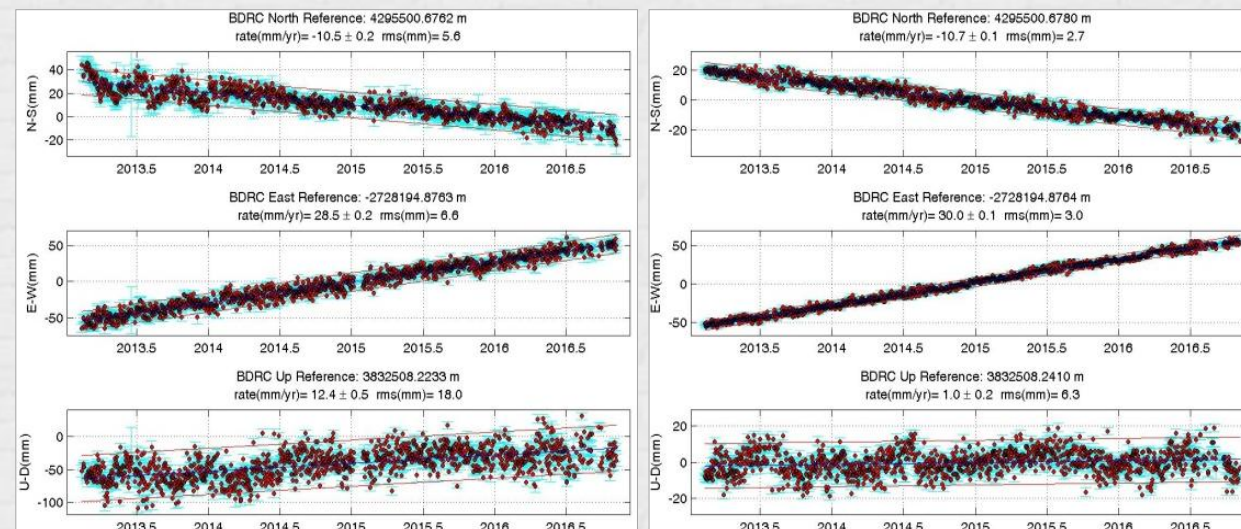
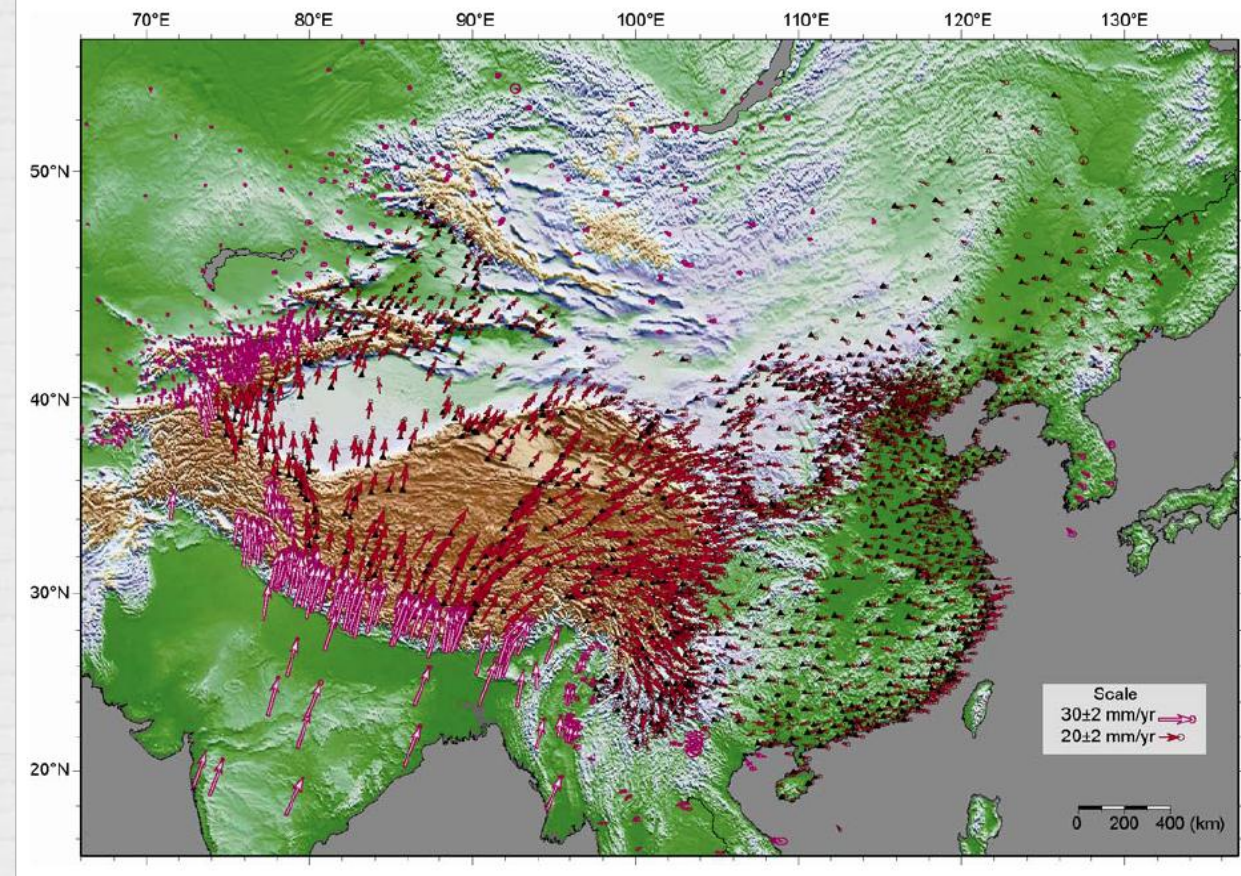
- Monitoring of the water vapor amount and ionospheric electron density
- The same results as the meteorologic radiosonde





## Application in earthquake

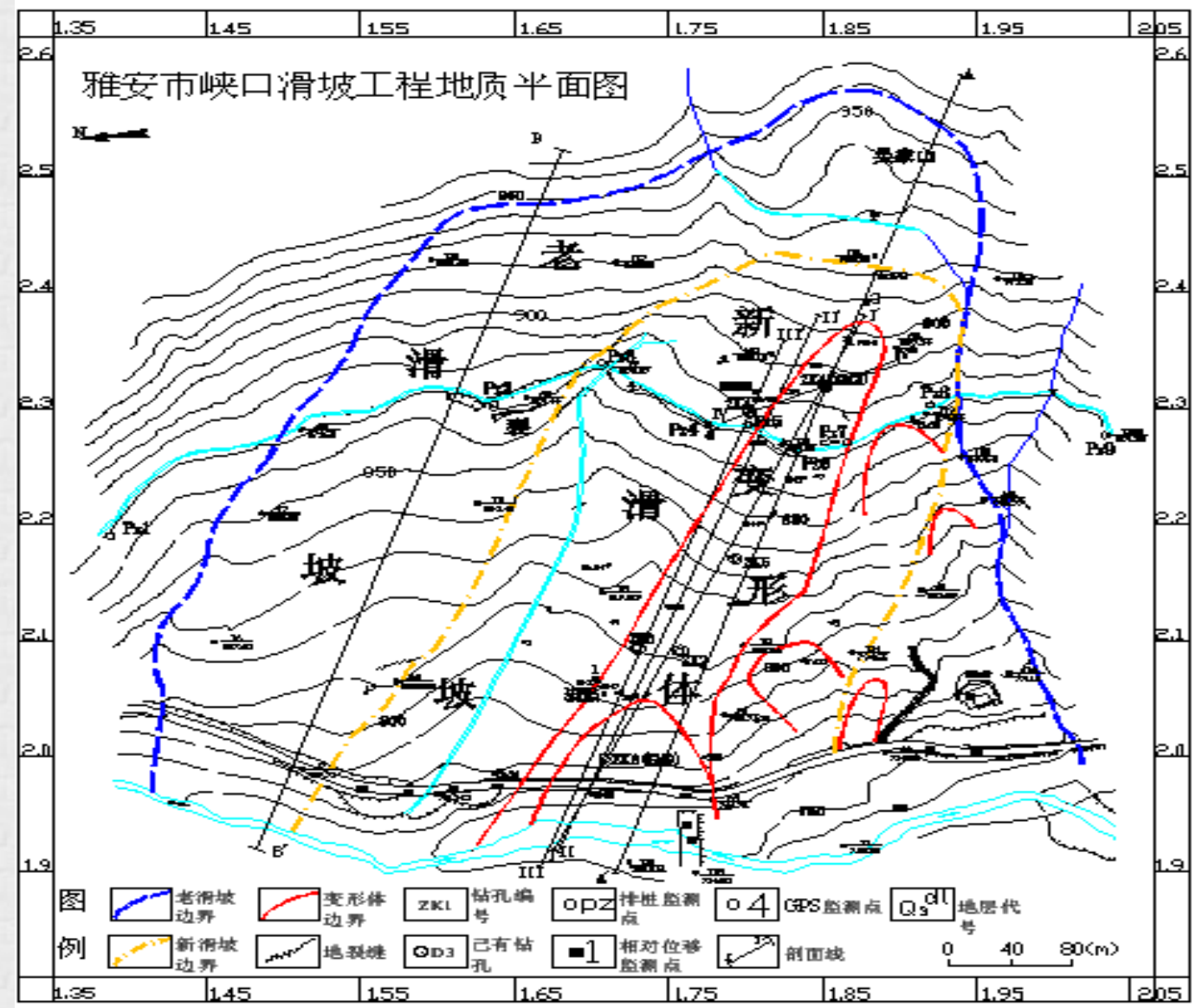
- We have carried on the experiment of reference station coordinates measurement in Shandong, Ningxia, Hebei etc.
- The results of the experiment show that the reference station can reach an accuracy of mm scale and can fully meet the demands of crustal movement monitoring.





## Application in land and resource

- We have carried on experiment on field navigation, geography datum acquisition, geological survey in the Sichuan.
- System service can fully meet the demands of geological survey .

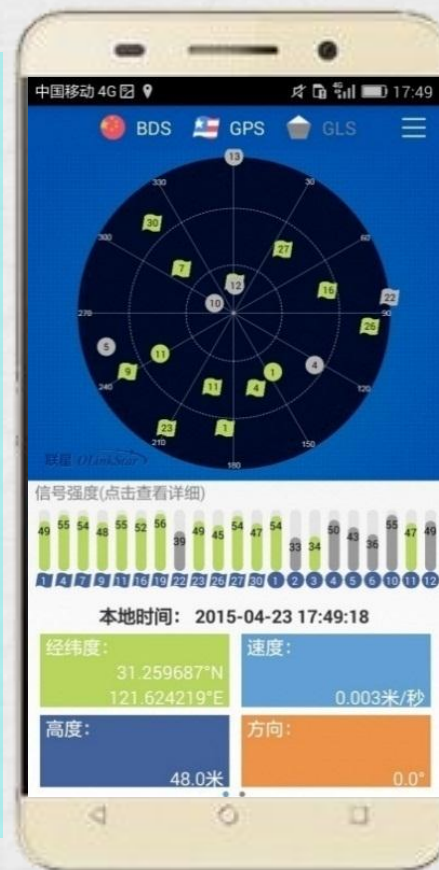




# high-precision Beidou positioning equipment



- BDS/GPS dual system
- Sing frequency RTK、RTD、SBAS
- MEMS IMU integrated position



- Receive BDS B1、GPS L1、GLONASS L1
- BDS/GPS Positioning
- Integrated with Bluetooth 、WiFi、RF & baseband
- BDS high-precision positioning、A-GNSS
- Low cost & power consumption



A gravel path leads from the foreground towards a row of five large, leafy green trees on a grassy hill. The sky is blue with scattered white clouds. The text "THANKS FOR Listening!" is overlaid in the center of the path.

THANKS FOR  
Listening!