

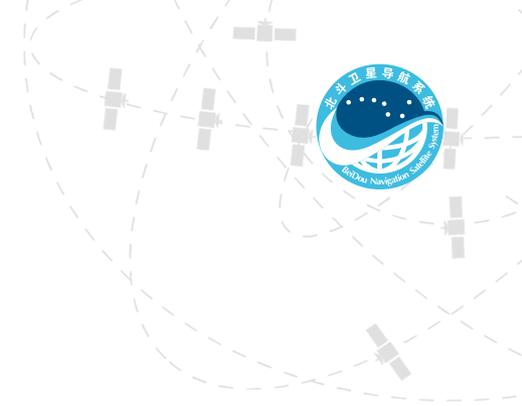
Development and update strategy of Beidou reference frame

13th Meeting of the International Committee on
Global Navigation Satellite Systems

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01 Introduction

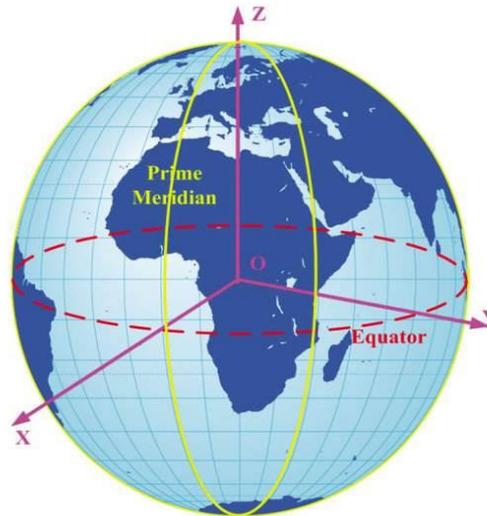
02 Development of BeiDou reference frame

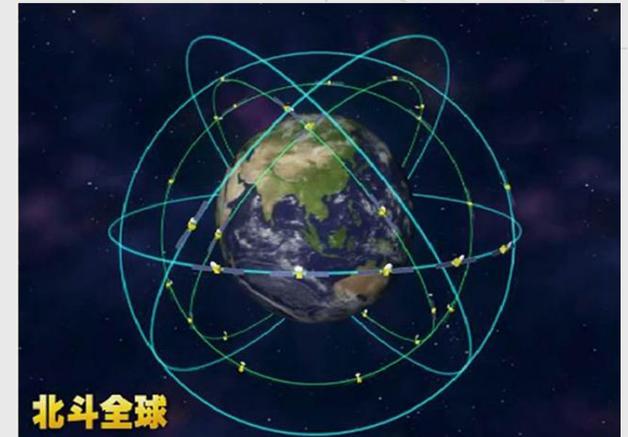
03 Realization and maintenance

04 Update strategy

05 Conclusion

- Reference frame is the realization of coordinate system
- Satellite navigation system: the reference frame can be reflected in broadcasted ephemeris through orbiting





XI'AN 80

BDS-1 established
in 2003

CGCS2000

BDS-2 established in
2012

BDCS

BDS-3 will provide global
service in 2020

■ BDS-1——XI'AN 80 coordinate system

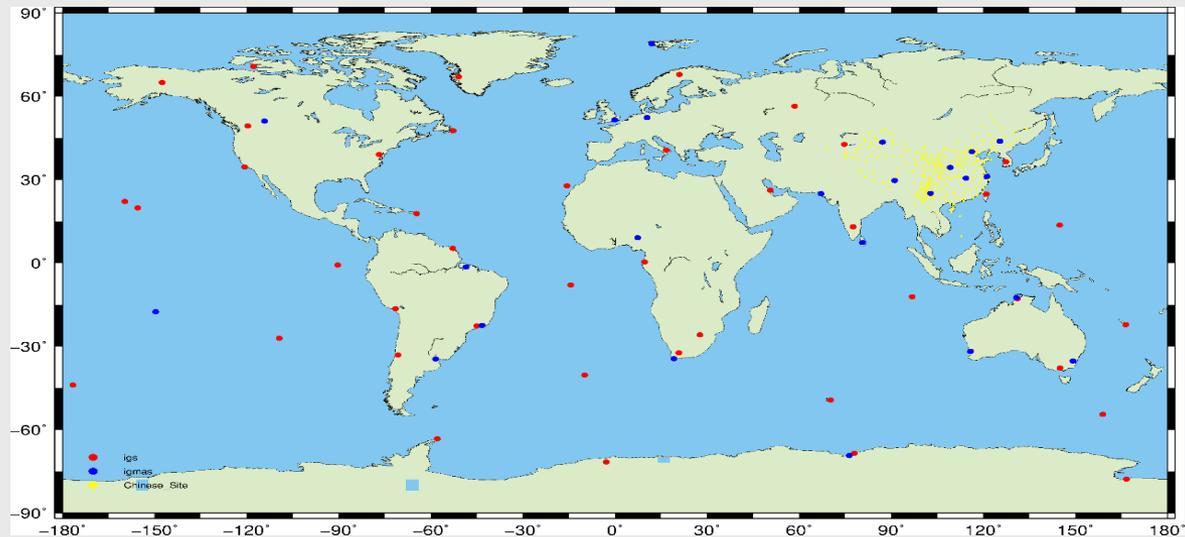
- **First realization :** About 20 monitoring stations were established to support the operation, and approximately 10 stations were used for orbit determination of GEO satellite
- **Update and maintain:** Position of monitoring station is determined by adjusting with frame points of XI'AN 80, the coordinates were updated according to requirement

■ BDS-2——CGCS2000

- **First realization:** About 30 monitoring stations were established for BDS-2, the coordinates of these stations were calculated by adjusting with high accuracy domestic stations and IGS stations
- **Update and maintain:** The coordinates of monitoring stations were updated once every 2-3 years, and will be updated yearly

■ BDS-3 — BDCS

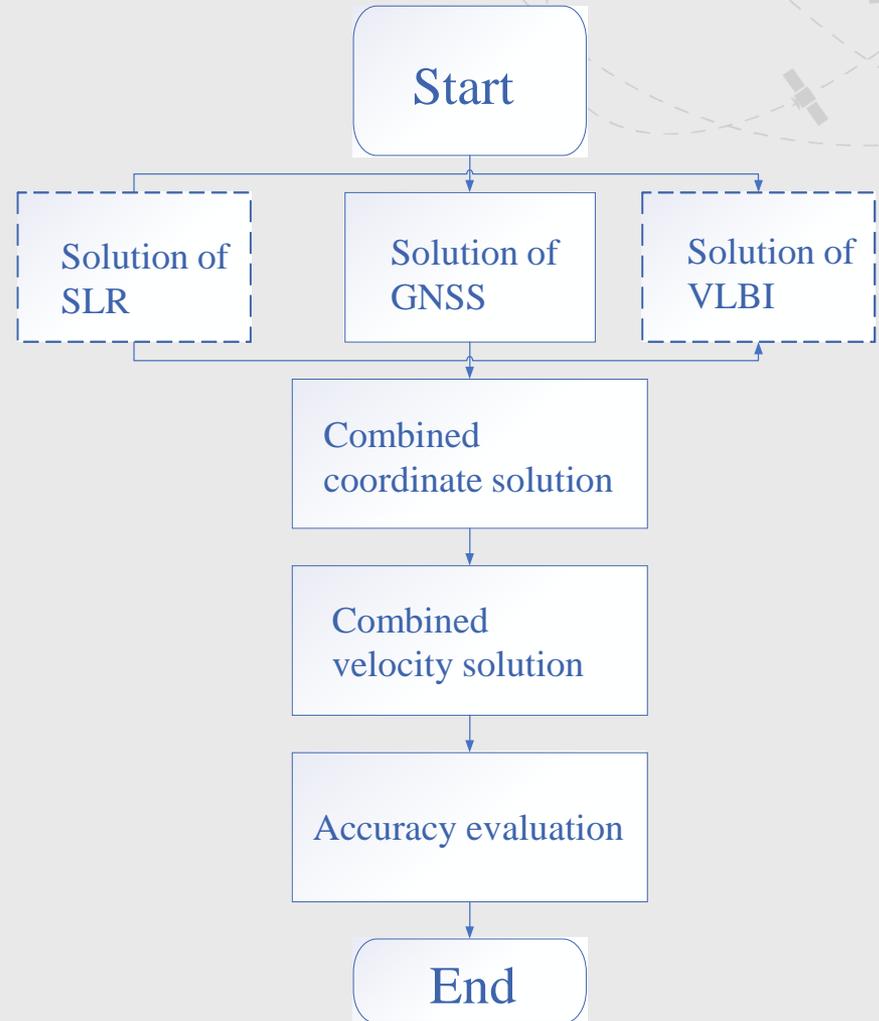
- **Station selection:** About 60 stations were selected, including about 10 monitoring stations, 3 IGS stations in China and approximately 50 IGS stations around the world.



03 Realization and maintenance of reference frame

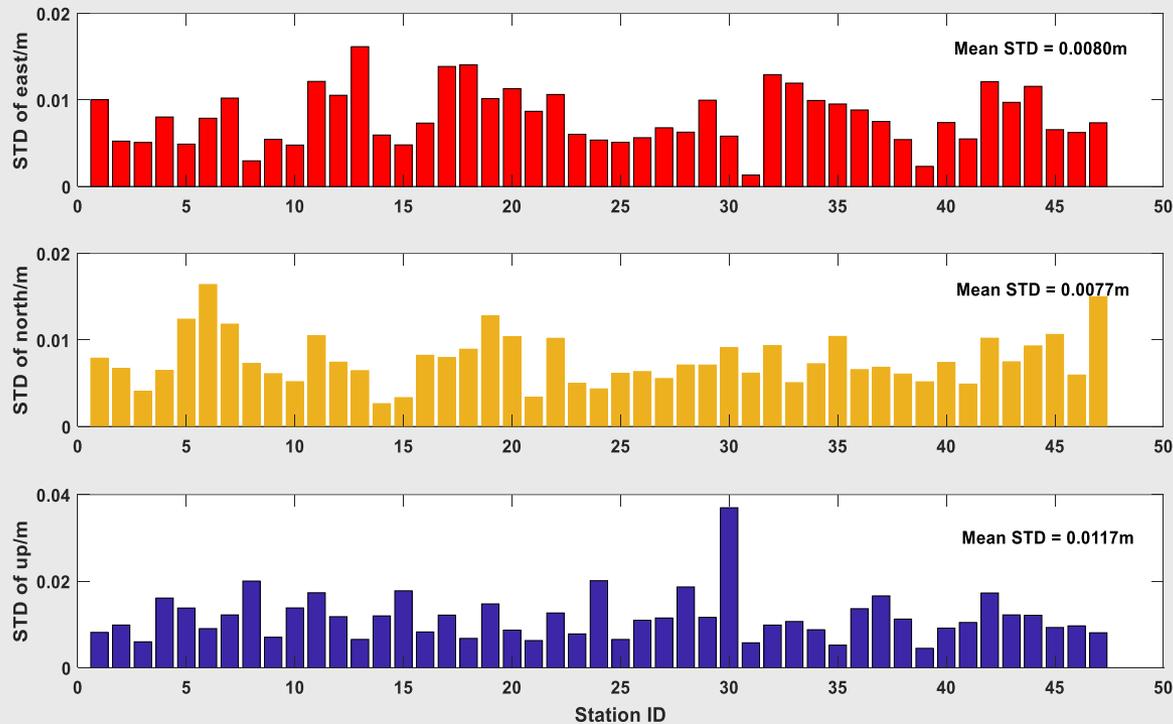
■ BDS-3 —— BDCS

- **Observation technology:** GNSS is mainly used at present, other observation technologies such as VLBI, SLR may also be used
- **Maintain:** The frame points are monitored continuously, and their coordinates are adjusted together with IGS stations. The coordinates and velocities of frame points will be determined regularly



03 Realization and maintenance of reference frame

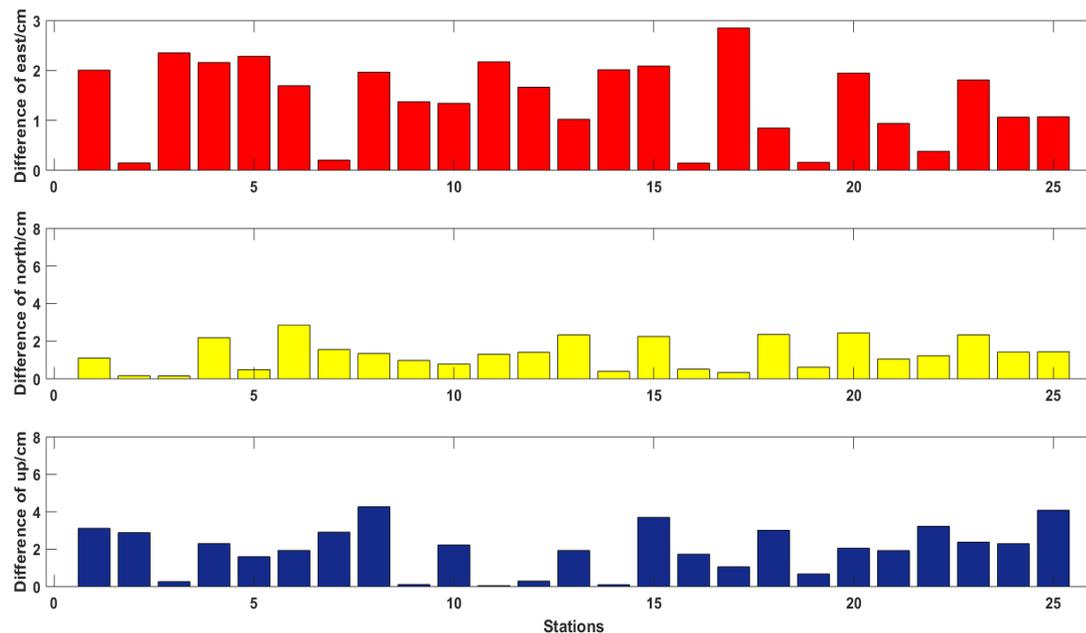
Test results—Coordinate repeatability



Repeatability in N, E and U directions are 0.77cm, 0.80cm and 1.17cm respectively.

03 Realization and maintenance of reference frame

■ Test results–Coordinate accuracy



Coordinate accuracy in N, E and U are 1.43cm, 1.32cm and 2.00cm respectively.

03 Realization and maintenance of reference frame

■ Test results-Transformation parameters

- **7-parameter transformation between BDCS and ITRF**
- **The common stations: 35 ITRF stations**

	X/cm	Y/cm	Z/cm	R1/mas	R2/mas	R3/mas	Scal/ppb
para	-0.2	0.4	-0.8	0.024	0.046	0.000	-1.790
σ	0.8	0.8	0.8	0.025	0.030	0.031	1.488

- **linear displacements: x, y smaller 0.5cm, about 1cm in z**
- **scale factor is -1.79 ppb (~ -1.1 cm)**
- **rotate elements are close to zero**

04 Update strategy

To satisfy the requirement of reference frame interoperation, terrestrial reference frame of BDS will be updated yearly.

- **Update strategy:** Update information will be released on 30 June of each year based on yearly solution of coordinate and velocity of frame point
- **Improvement of current frame point:** In order not to influence the orbiting and positioning accuracy, the position of current frame point will be corrected step by step

- **With development of BDS, its reference frame will also be improved gradually**
- **In order to realize the interoperation between BDS and other GNSS, the reference frame of BDS will be updated every year**
- **BeiDou terrestrial reference frame will keep close relation with ITRF**

THANK YOU!

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