BDS Service Performance Assessment

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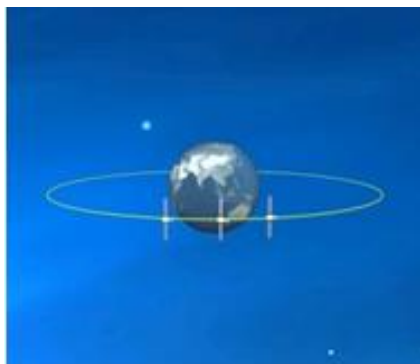
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Developing Roadmap

Global Service

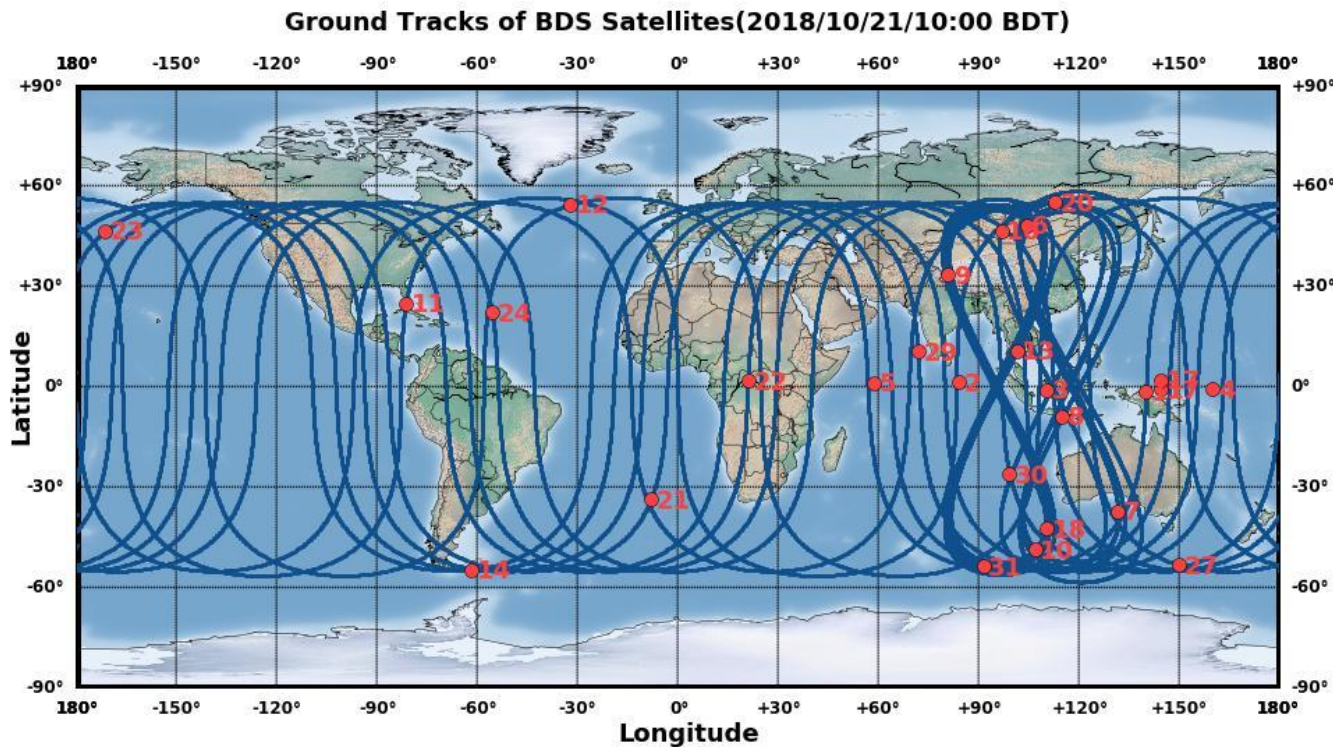Regional Service

Demonstration System

2020

2012

2000

Satellites in Orbit

- In total, 40 satellites in orbit at present (by the end of October 2018)

- 19(BDS-2)+16(BDS-3)+5(BDS-3S) satellites (35 transmitting signals)

Ground Tracks of BDS Satellites(2018/10/21/10:00 BDT)

For more details, visit
www.csno-tarc.cn

Characteristics of BDS-3 Satellites

- Newly designed onboard hydrogen maser clock and rubidium clock

- Crosslink between satellites for self-maintenance

- New signals (B1C, B2a) compatible with GPS L1/L5, Galileo E1/E5a, old signals(B1I, B3I) still reserved

Construct a constellation with more than 3 GEO, 3 IGSO, 24 MEO by the end of 2020.

- Improved signal-in-space URE , availability and continuity

- New SBAS, RDSS, SAR capability, and so on (not covered in this report)

# New Signals, Modulation and Parameters

- B1C, central frequency: 1575.42MHz ,with band width 32.736MHz. B1C_data, BOC(1,1), B1C_pilot, QMBOC(6, 1, 4/33)

- B2a, central frequency: 1176.45MHz, with band width 20.46MHz, BPSK(10)

- Both new signals modulated with new navigation messages – B-CNAV1, B-CNAV2(GF(64) LDPC)

- New ephemeris parameters in B-CNAV

- New ionosphere model using Spherical Harmonic Function(9 parameters) for global ionosphere representation
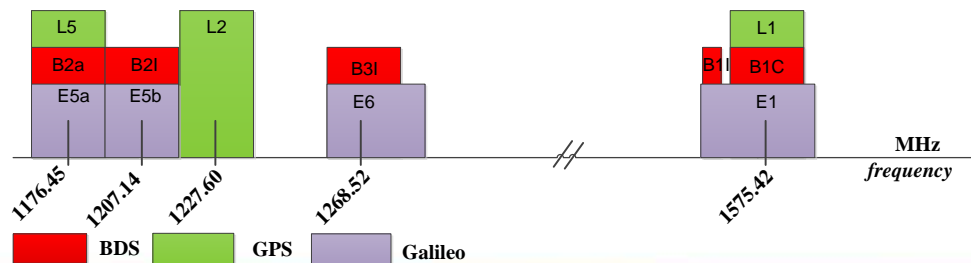
Carrier to Noise Ratio of Different Signals

Magnitude of B1C, B2a C/N0 is comparable with B1I, B3I
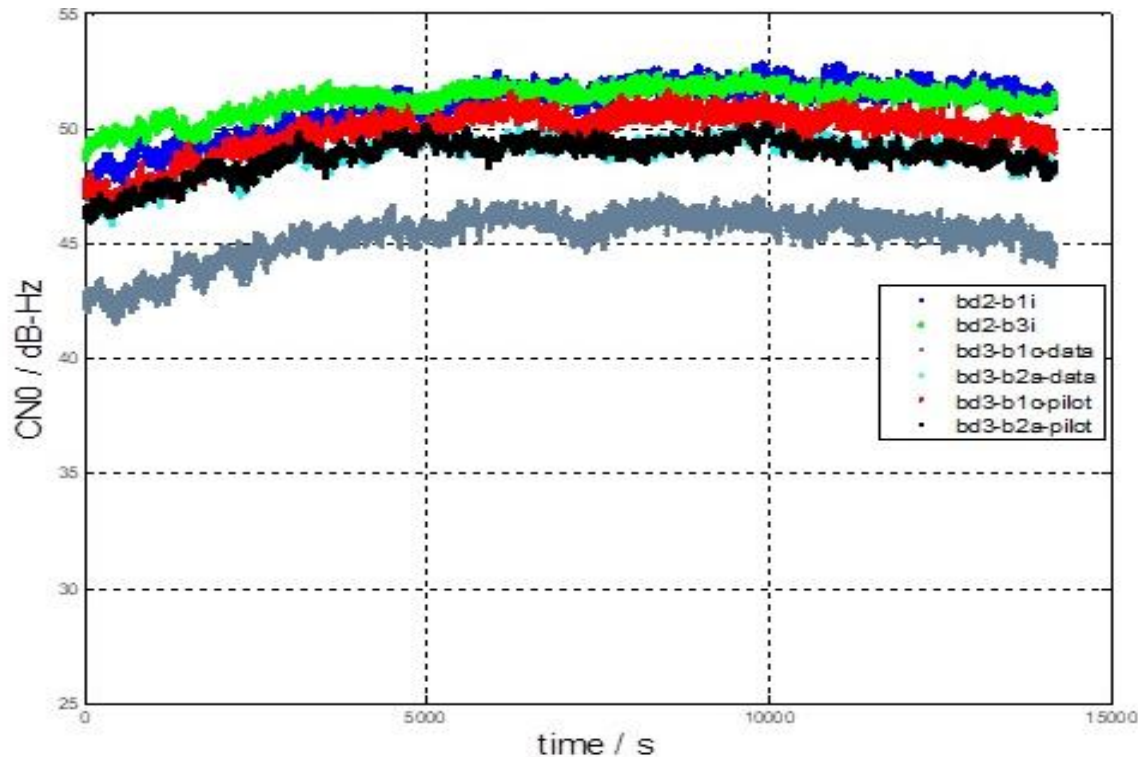
PRN19(BDS-3), 2017.11

Signal Transition

PRN	SVN	TYPE	B1I	B2I	B3I	B1C	B2a
01	GEO-01	BDS-2	✓	✓	✓	—	—
02	GEO-06	BDS-2	✓	✓	✓	—	—
03	GEO-07	BDS-2	✓	✓	✓	—	—
04	GEO-04	BDS-2	✓	✓	✓	—	—
05	GEO-05	BDS-2	✓	✓	✓	—	—
06	IGSO-01	BDS-2	✓	✓	✓	—	—
07	IGSO-02	BDS-2	✓	✓	✓	—	—
08	IGSO-03	BDS-2	✓	✓	✓	—	—
09	IGSO-04	BDS-2	✓	✓	✓	—	—
10	IGSO-05	BDS-2	✓	✓	✓	—	—
11	MEO-03	BDS-2	✓	✓	✓	—	—
12	MEO-04	BDS-2	✓	✓	✓	—	—
13	IGSO-06	BDS-2	✓	✓	✓	—	—
14	MEO-06	BDS-2	✓	✓	✓	—	—
16	IGSO-07	BDS-2	✓	✓	✓	—	—

PRN	SVN	TYPE	B1I	B2I	B3I	B1C	B2a
19	MEO-01	BDS-3	✓	—	✓	✓	✓
20	MEO-02	BDS-3	✓	—	✓	✓	✓
21	MEO-03	BDS-3	✓	—	✓	✓	✓
22	MEO-04	BDS-3	✓	—	✓	✓	✓
23	MEO-05	BDS-3	✓	—	✓	✓	✓
24	MEO-06	BDS-3	✓	—	✓	✓	✓
25	MEO-11	BDS-3	✓	—	✓	✓	✓
26	MEO-12	BDS-3	✓	—	✓	✓	✓
27	MEO-07	BDS-3	✓	—	✓	✓	✓
28	MEO-08	BDS-3	✓	—	✓	✓	✓
29	MEO-09	BDS-3	✓	—	✓	✓	✓
30	MEO-10	BDS-3	✓	—	✓	✓	✓
32	MEO-13	BDS-3	✓	—	✓	✓	✓
33	MEO-14	BDS-3	✓	—	✓	✓	✓
34	MEO-15	BDS-3	✓	—	✓	✓	✓
35	MEO-16	BDS-3	✓	—	✓	✓	✓

31 satellites are transmitting B1I, B3I signals, 16 satellites are transmitting B1C and B2a signals.

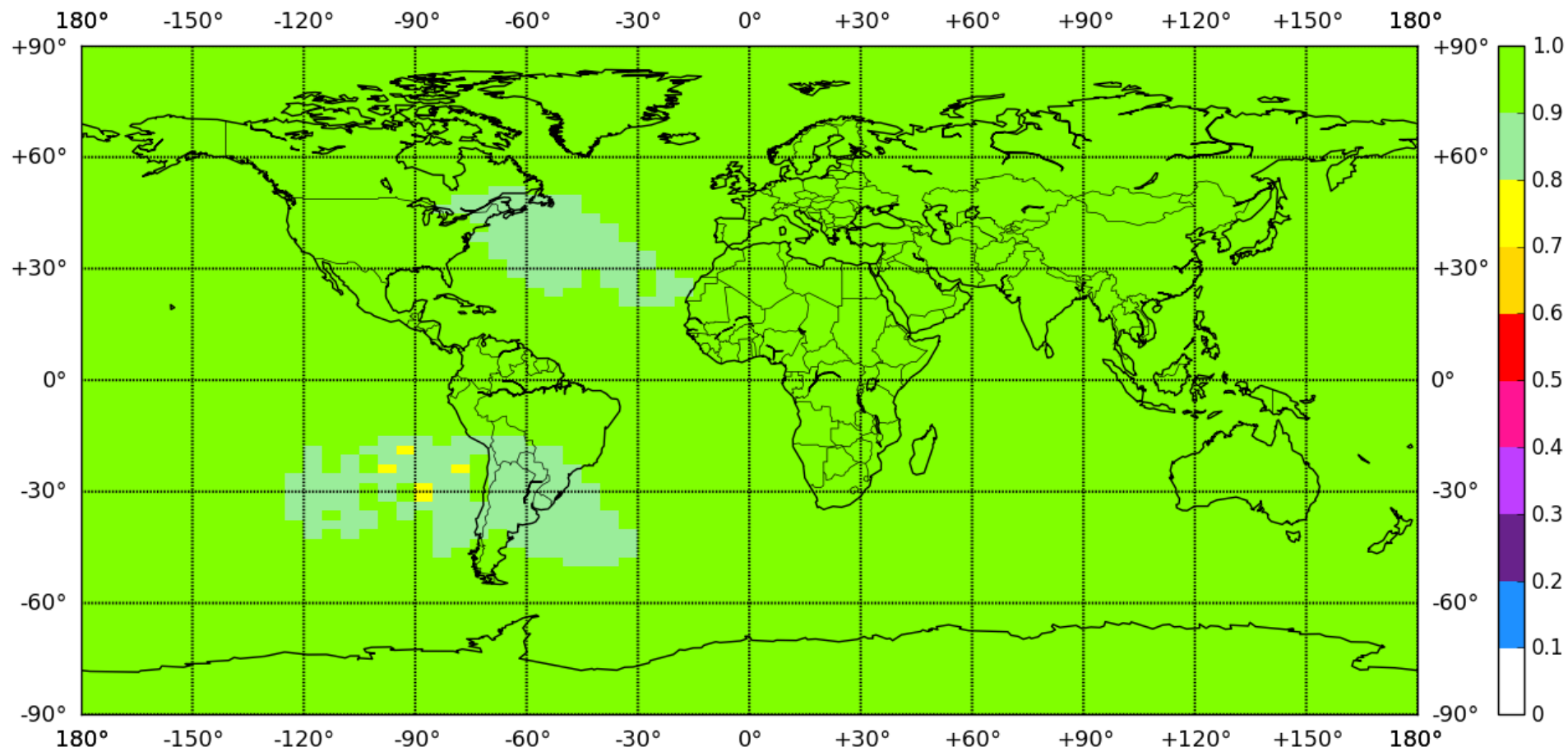# Coverage of Satellites in orbit(B1I，B3I)

Both BDS-2 and BDS-3 satellites could transmit B1I and B3I signals

Number of BDS Satellites Visible(2018/10/16/00:00 BDT)(5 Degree Elevation Angles)

BDS PDOP(2018/10/16/00:00 BDT)(5 Degree Elevation Angles)
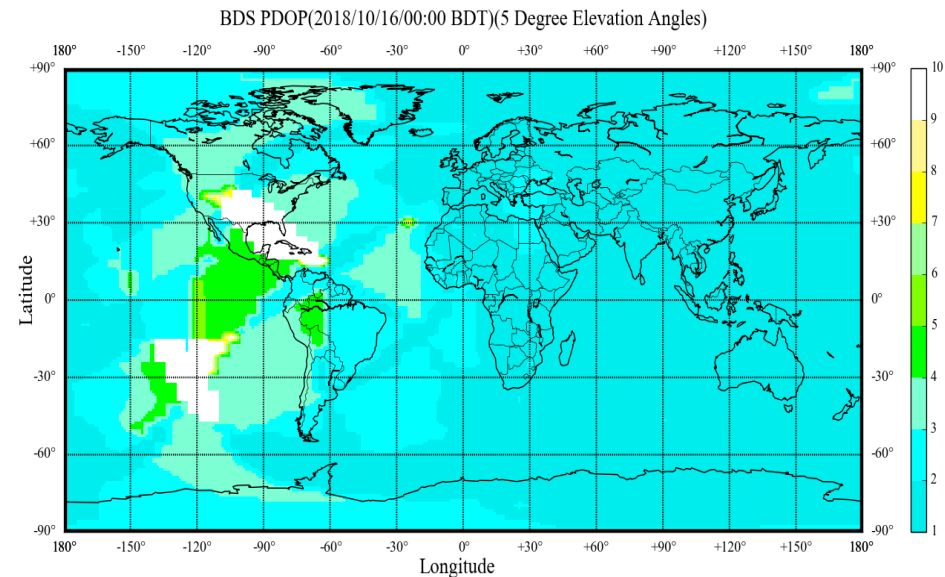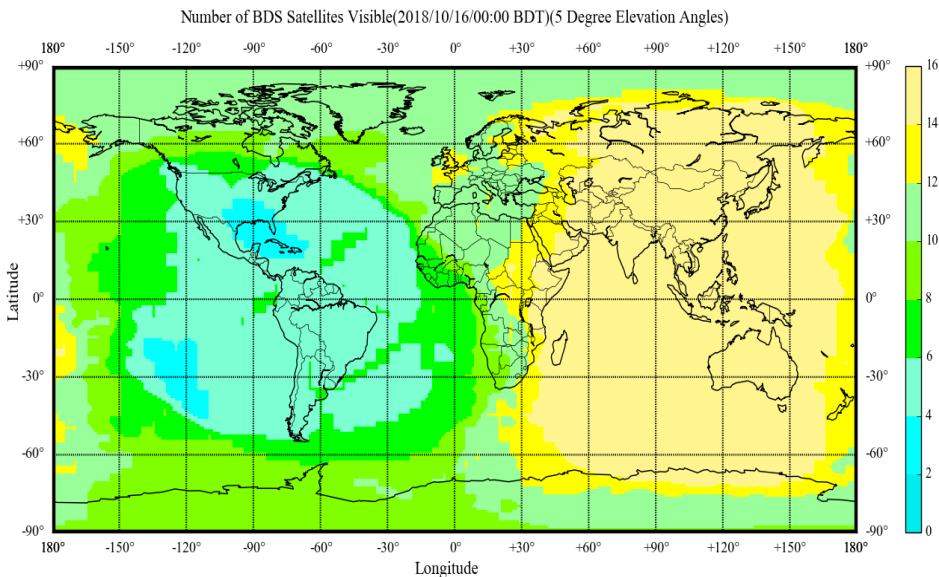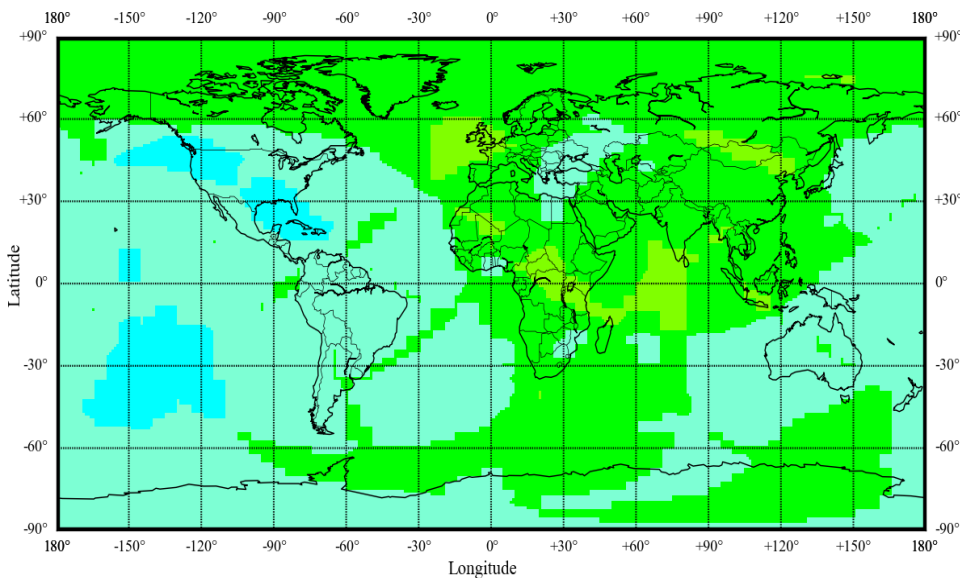
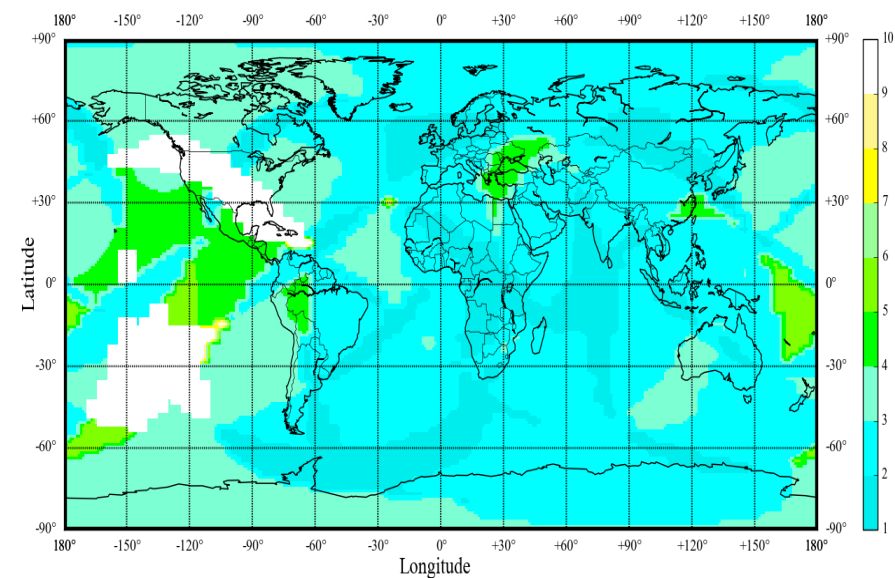# Coverage of Satellites in orbit(B1I，B3I)

DPOP Availability(PDOP≤6) for B1I/B3I users (2018.10.16)

Coverage of Satellites in Orbit(B1C，B2a)

B1C and B2a as the new signals took by BDS-3 satellites, will be long-term supported in the future and would be recommended signals for global BDS users

Number of BDS Satellites Visible(2018/10/16/00:00 BDT)(5 Degree Elevation Angles)

BDS PDOP(2018/10/16/00:00 BDT)(5 Degree Elevation Angles)

Coverage of Satellites in Orbit(B1C，B2a)

DPOP Availability(PDOP≤6) for B1C/B2a users (2018.10.16)
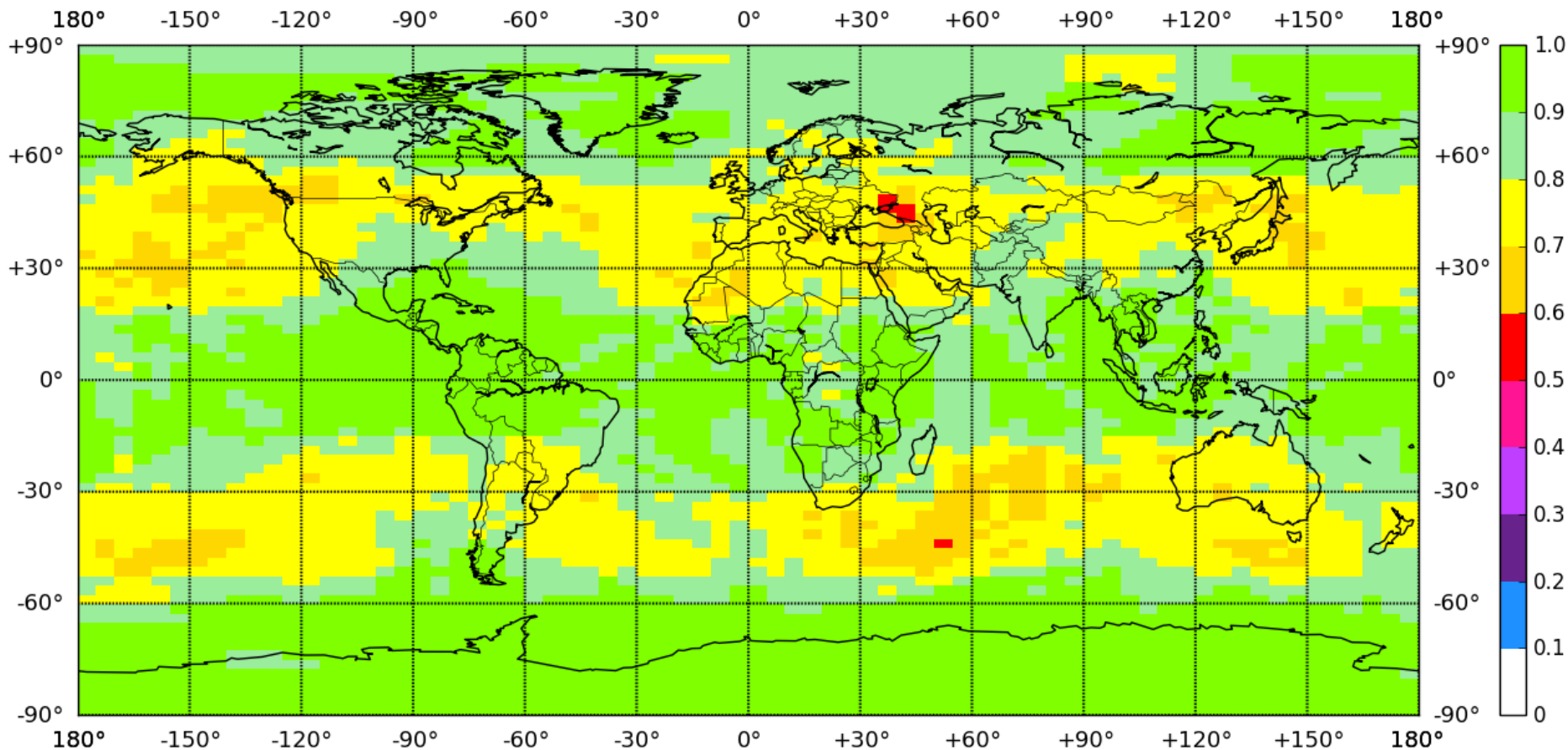
Performance of Static Positioning & Velocity
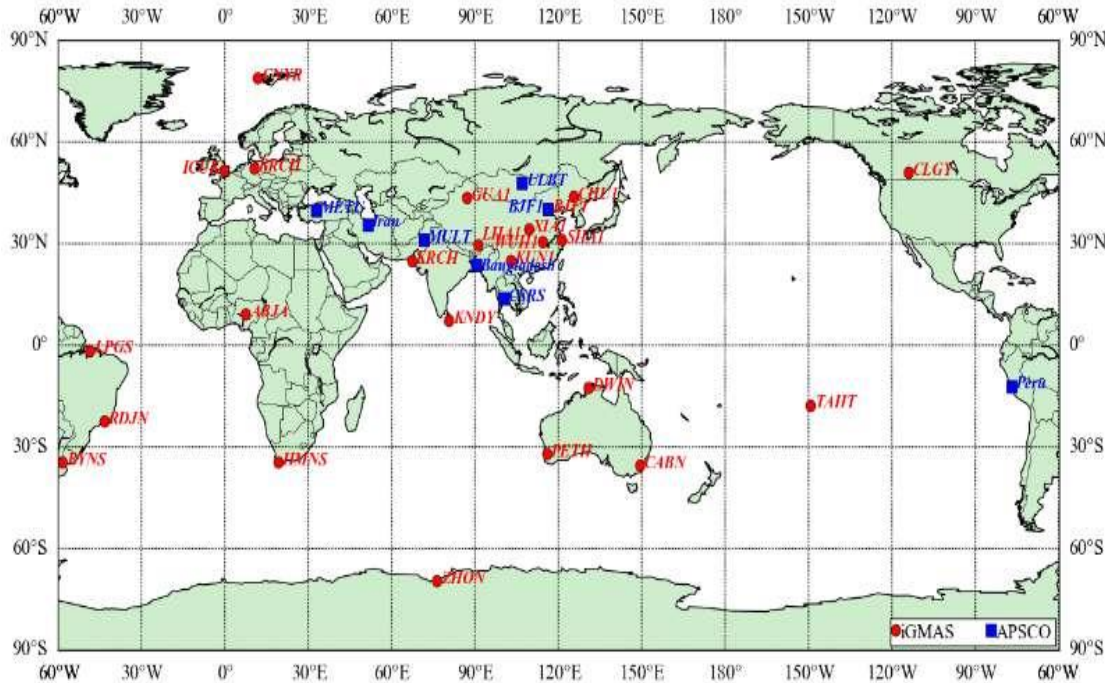
APSCO-IGMA system is a joint project of APSCO (Asia-Pacific Space Cooperation Organization) with goal of monitoring GNSS performance in member states for promoting GNSS applications

There are 24 stations of iGMAS (international GNSS monitoring and assessment system), in which 18 stations have been updated for BDS-3 B1C/B2a signals tracking capability.
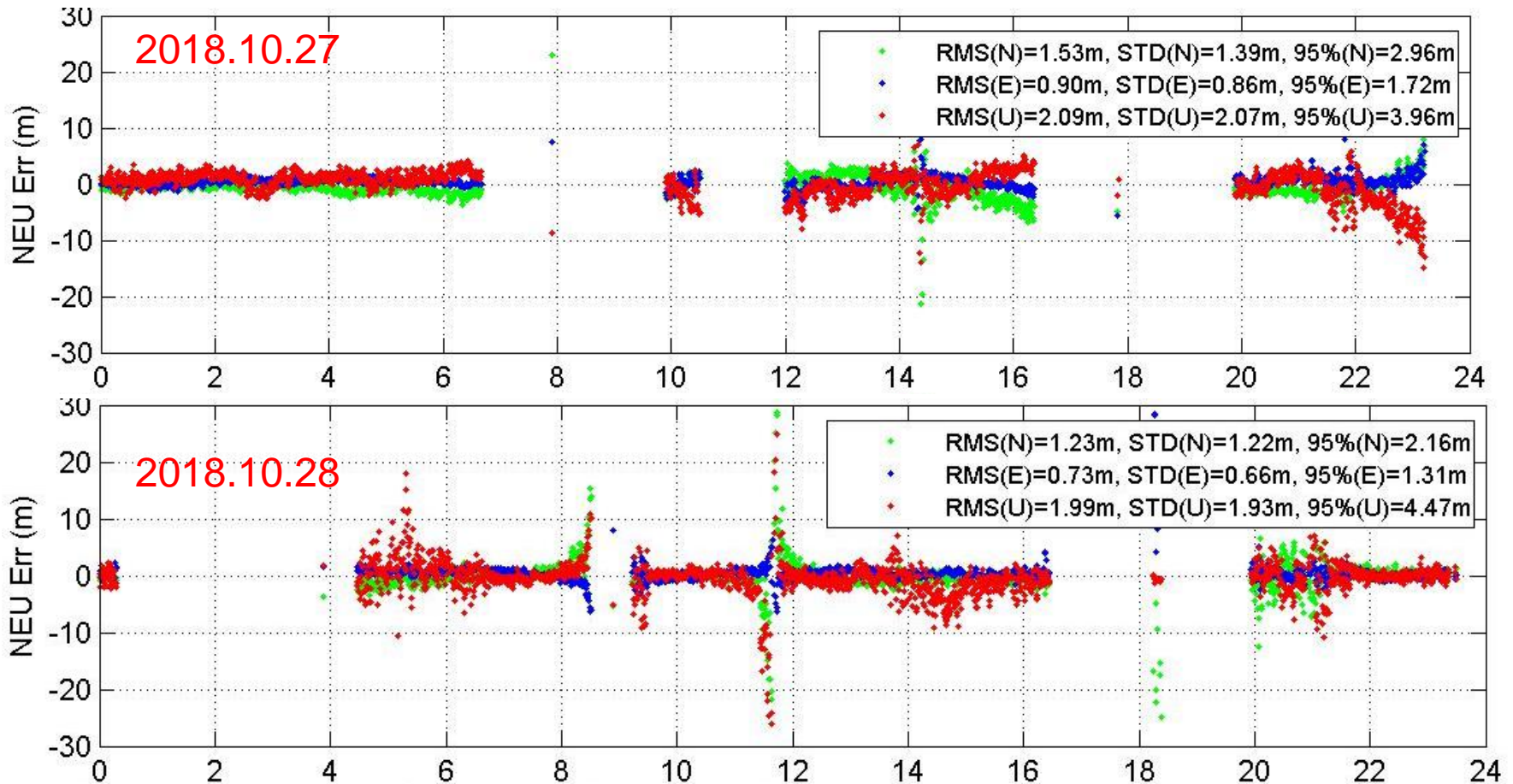
Analysis Results – B1I

- Positioning accuracy for B1I single frequency is better than 7m
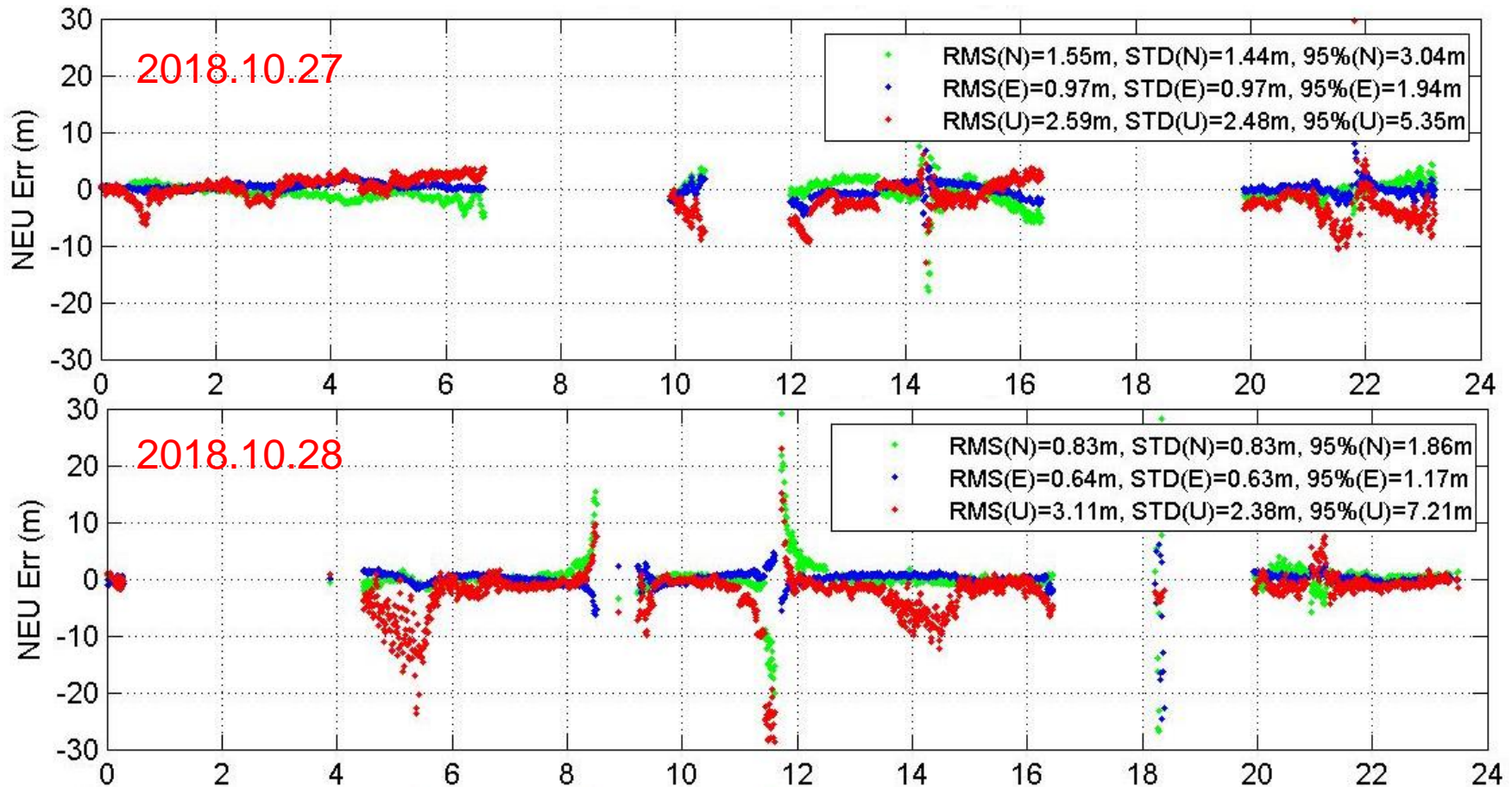- Velocity accuracy for B1I single frequency is better than 0.2m/s

Positioning Accuracy (95%)

Velocity Accuracy (95%)
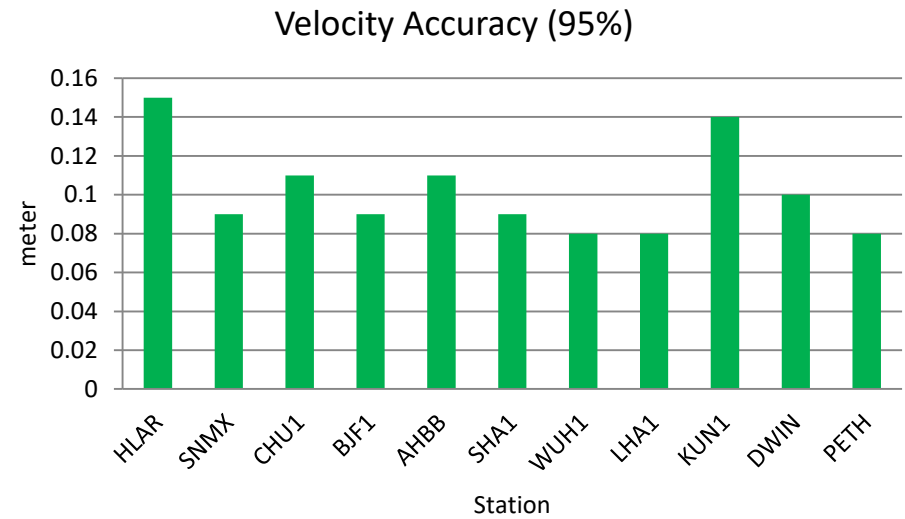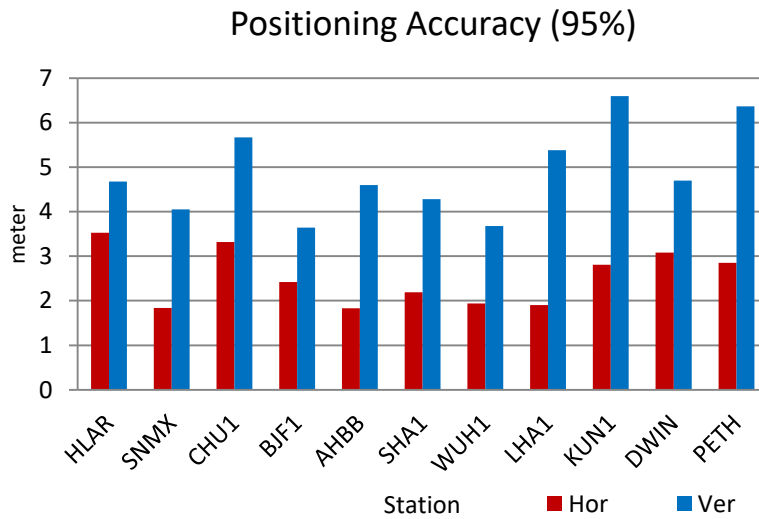
Analysis Results – B1C

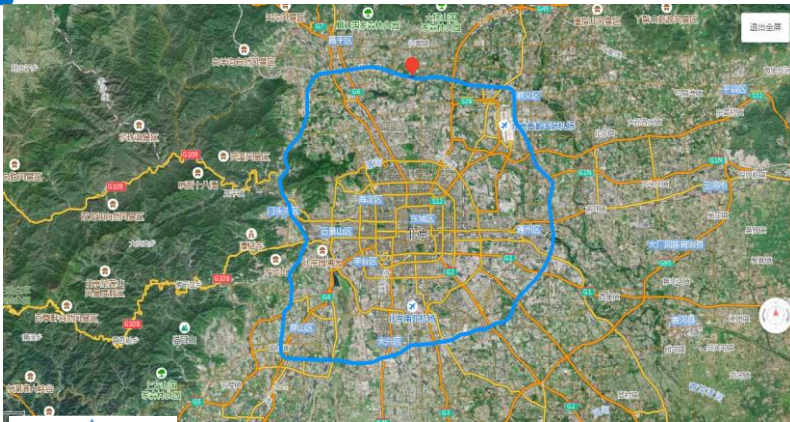- Beijing station, 2018.10.27-28(BDT), with 14 BDS-3 satellites broadcast navigation signals
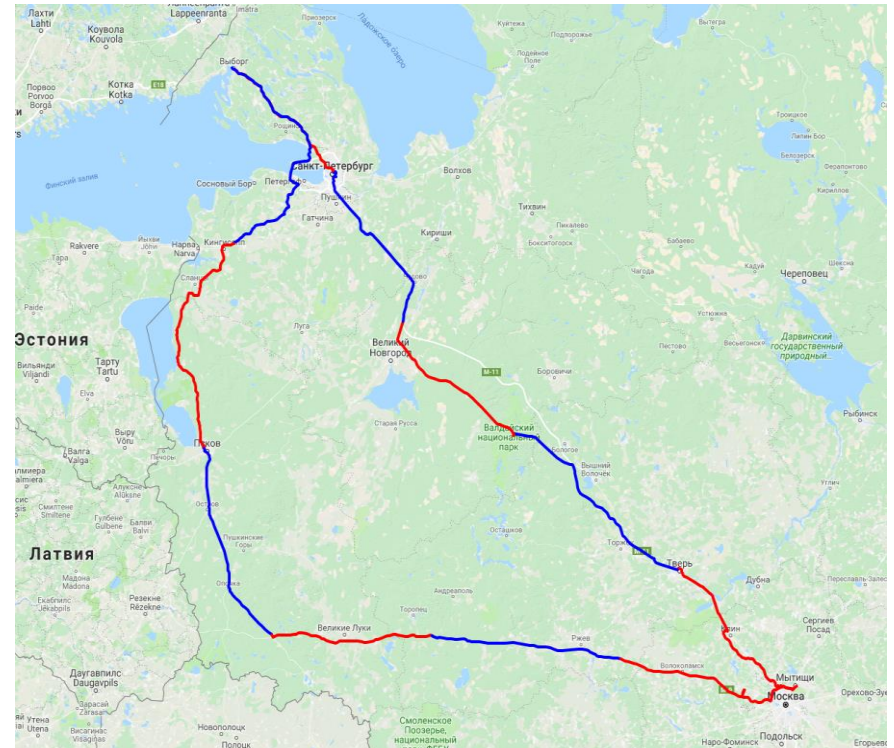
Analysis Results – B2a

- Beijing station, 2018.10.27-28, with 14 BDS-3 satellites broadcasting navigation signals

Performance of Kinematic Positioning & Velocity

TARC organized several

kinematic testing

Joint BDS/GLONASS

Experiment under the frame

of China-Russia Cooperation

We launched "BDS User Evaluation Plan"
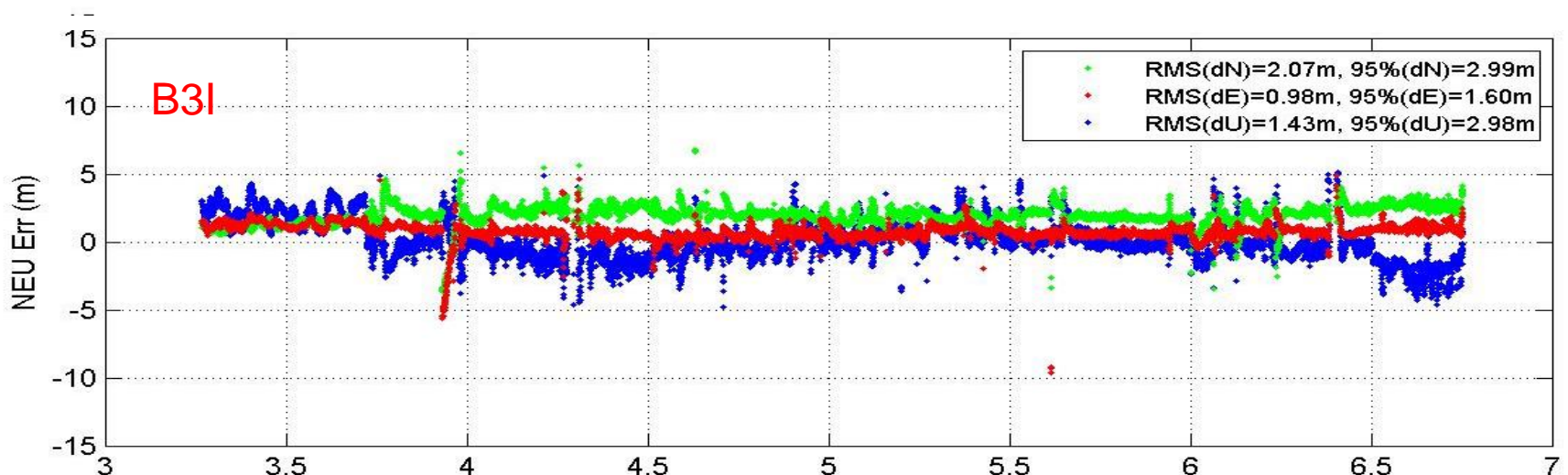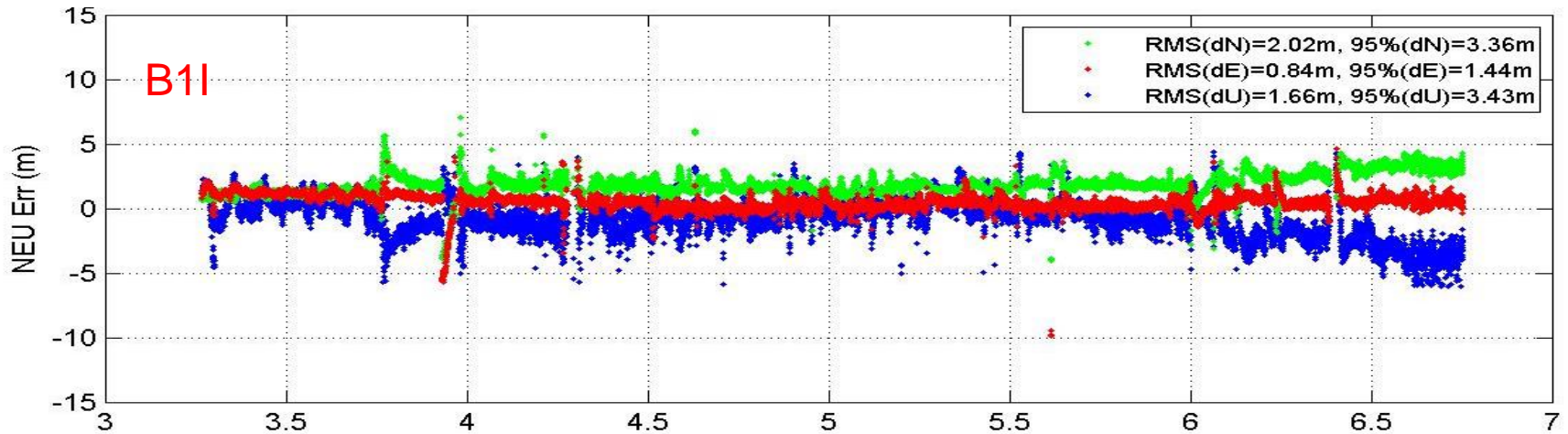
worldwide, lots of institutions would join in

Devices Used in Kinematic Testing

Initial Results – B1I/B3I

6th ring road of Beijing, tested in 2018.09.10

Summary

- Current BDS constellation consists of 2 types of satellites:

  — BDS-2 satellites transmit 3 signals(B1I, B2I, B3I)

  — BDS-3 satellites transmit 4 signals(B1I, B3I, B1C, B2a), in which B1C and B2a compatible with GPSL1/GALE1, GPSL5/GALE5a

- Both static and kinematic performance of BDS are analyzed:

  — Positioning accuracy of B1I single frequency is better than 7m

  — Velocity accuracy of B1I is better than 0.2m

  — Initial results show good performance of B1C/B2a/B3I signals

THANKS!

BDS User Support: www.csno-tarc.cn