Quasi-Zenith Satellite System
Service Performance Report
MADOCA-PPP
(Trial service, November 2022)

May 2023

Cabinet Office

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1. Service Performance Evaluation Conditions

1.1. Evaluation Period

From November 1, 2022 to November 30, 2022 (UTC)

1.2. Evaluation Item

- Convergence Time
- Positioning Accuracy after convergence
- Availability

1.3. Evaluation Points

IGS monitoring stations as shown in Table 1.3-1 and Figure 1.3-1

Table 1.3-1 IGS monitoring stations used as evaluation points (*)

#	Station Name	Latitude [deg]	Longitude [deg]	Notes
1	HKSL00HKG	22.372	113.928	
2	KAT100AUS	-14.376	132.153	
3	KIRI00KIR	1.355	172.923	
4	MIZU00JPN	39.135	141.133	
5	NNOR00AUS	-31.049	116.193	
6	OUS200NZL	-45.869	170.511	
7	SGOC00LKA	6.892	79.874	
8	URUM00CHN	43.808	87.601	

(*) Refer to igs22P22383.snx (2022/11/30)

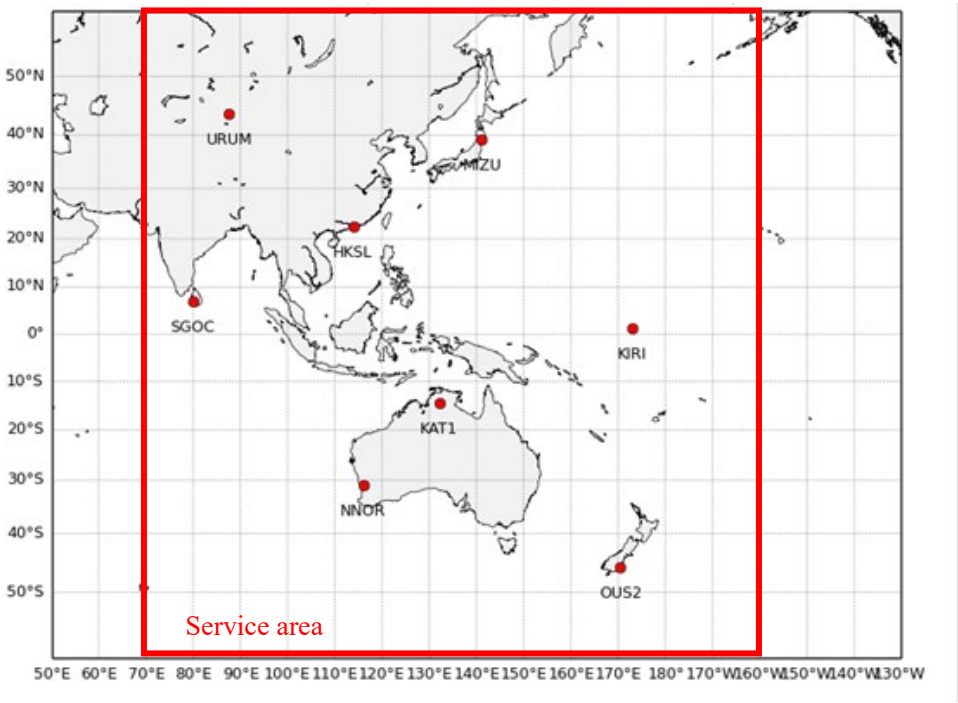

Figure 1.3-1 Evaluation points

1.4. Augmented GNSS

- GPS+QZSS+Galileo+GLONASS

1.5. Calculation Conditions

1.5.1. PPP Conditions

- Observation Data Frequency
  - GPS：L1+L2
  - QZSS：L1+L5
  - Galileo : E1+E5a
  - GLONASS : G1+G2
- Tool and Data

  The MADOCA-PPP test library (MADOCALIB; Multi-GNSS Advanced Orbit and Clock Augmentation - Precise Point Positioning Test Library), and the archived L6 messages are utilized (*1).
  - MADOCALIB: version 1.0b
  - Main parameter setting: See Table 1.5-1 (The other parameters are default parameters.)

Table 1.5-1 Parameter setting

pos1-posmode=ppp-kine	pos2-siggpsIIR-M=0
pos1-frequency=l1+2	pos2-siggpsIIF=0
pos1-soltype=forward	pos2-siggpsIIIA=0
pos1-elmask=10	pos2-sigqzs1_2=0
pos1-tidecorr=on	stats-eratio1=300
pos1-ionoopt=dual-freq	stats-eratio2=300
pos1-tropopt=est-ztd	stats-errphase=0.003
pos1-navsys= 29	stats-errphasebl=0
pos2-armode=off	misc-rtcmopt=-RTCM_DRAFT
pos2-slipthres=0.05	file-satantfile=igs14.atx (*2)
pos2-rejionno=30	file-rcvantfile=igs14.atx (*2)
pos2-rejgdop=30	file-dcbfile= (blank)

(*1) MADOCALIB is available at the following web address:
https://qzss.go.jp/en/technical/dod/madoca/madoca_test-library.html (English)
https://qzss.go.jp/technical/dod/madoca/madoca_test-library.html (Japanese)

Archives are available at the following web address:
https://sys.qzss.go.jp/dod/en/archives/agree_madoca.html

(*2) The antenna phase information file was obtained on the IGS Web site.
https://cddis.nasa.gov/Data_and_Derived_Products/GNSS/GNSS_product_holdings.html

1.5.2. Initial Convergence Time

- The PPP calculation was performed every 15 minutes during the evaluation period.
- By using each calculation result, the positioning accuracy (95%) was statistically calculated every 30 seconds.
- Initial convergence time was calculated as the time for the positioning accuracy (95%) to reach below 30 cm horizontally and 50 cm vertically from the start of PPP calculation.

1.5.3. Positioning Accuracy after Convergence

- The PPP calculation started at 00:00:00 every day.
- By using each calculation result, the positioning accuracy (95%) was statistically

calculated every 30 seconds.

- Positioning Accuracy after convergence was the horizontal and vertical positioning accuracy (95%) from 00:30:00 to 23:59:30 every day.

1.5.4. Availability (Reference)

The availability is the time ratio that the healthy (*) L6E signal utilized in MADOCA-PPP from a specific satellite is available. The availability is not defined in any specification and is for reference only.

(*) Unhealthy conditions are described in PS-QZSS.

2. Evaluation Results

2.1. Initial Convergence Time

See Figure 2-1.

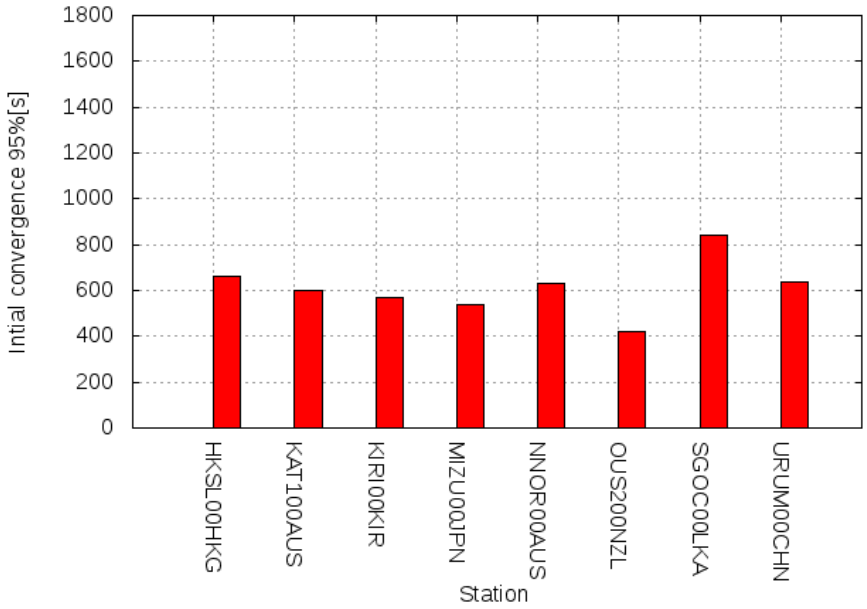

Figure 2-1 Initial Convergence Time

2.2. Positioning Accuracy after Convergence

See Figure 2-2.

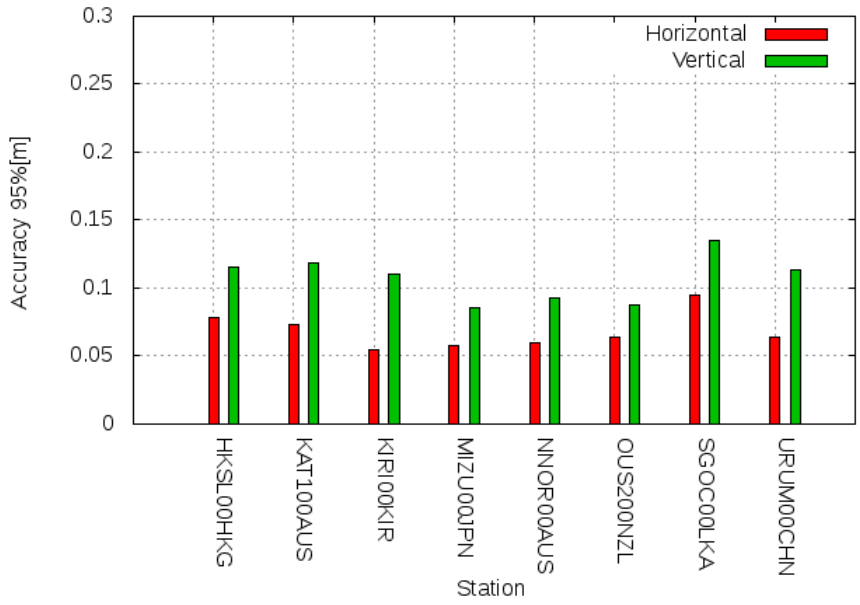

Figure 2-2 Positioning Accuracy after Convergence

2.3. Availability (Reference)

See Table 2-3.

Table 2-3 Availability (Reference)

Satellite	SVN	PRN code	Availability (Reference)
QZS-1R	005	206	1.000
QZS-2	002	204	1.000
QZS-3	003	209	1.000
QZS-4	004	205	1.000