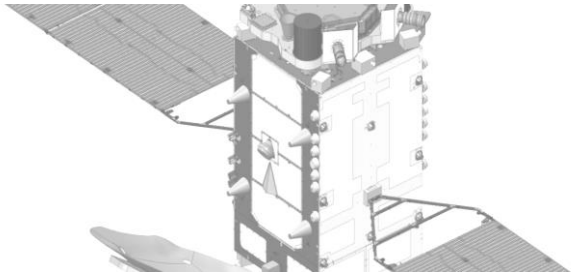
Cabinet Office
National Space Policy Secretariat



ICG-17 WG-S 3PITF

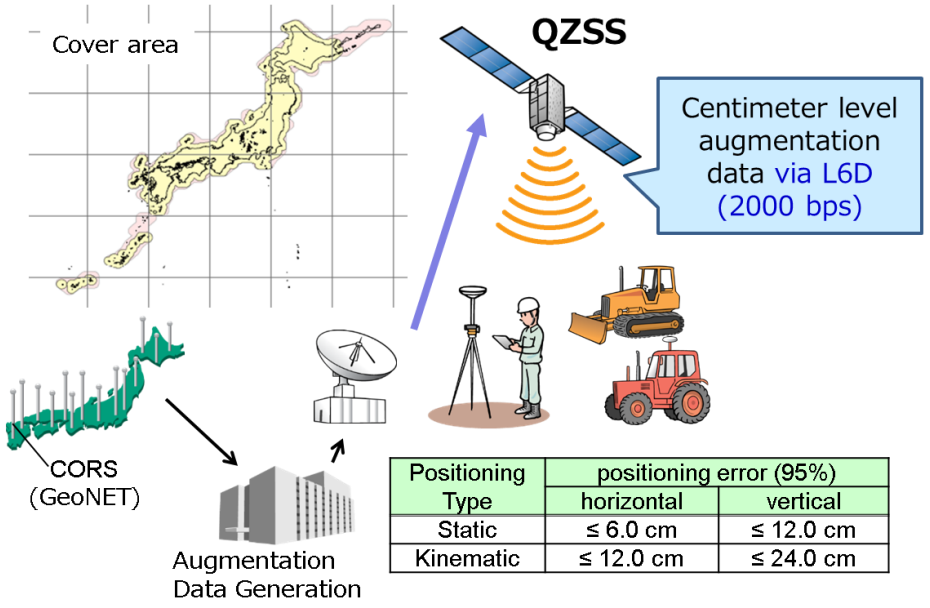
QZSS PPP/PPP-RTK Status

National Space Policy Secretariat
Cabinet Office, Government of Japan
Yoko SAKAI

Status of CLAS/MADOCA-PPP

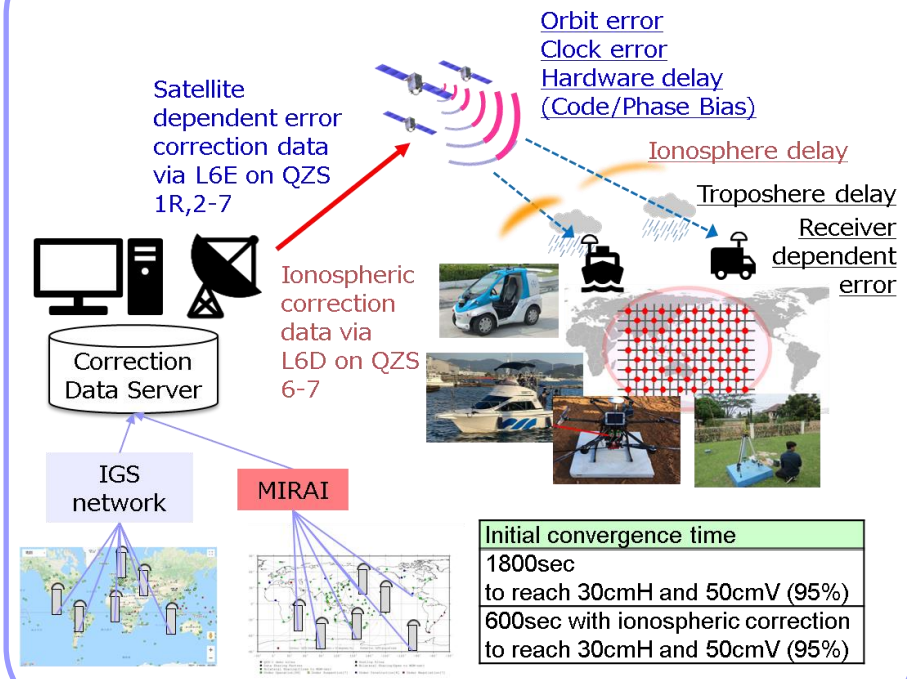
- CAO has been stably operating CLAS and trial service of MADOCA-PPP.
- CAO has started the development of CLAS message authentication.
- Evaluation of ionospheric correction for MADOCA-PPP is underway for the experimental transmission from QZS 6 and 7 to be launched.
- CAO is working for utilization expanding such as publicly solicited demonstration, leading to price down of L6 receivers.

CLAS (PPP-RTK)



Positioning Type	positioning error (95%)	
	horizontal	vertical
Static	≤ 6.0 cm	≤ 12.0 cm
Kinematic	≤ 12.0 cm	≤ 24.0 cm

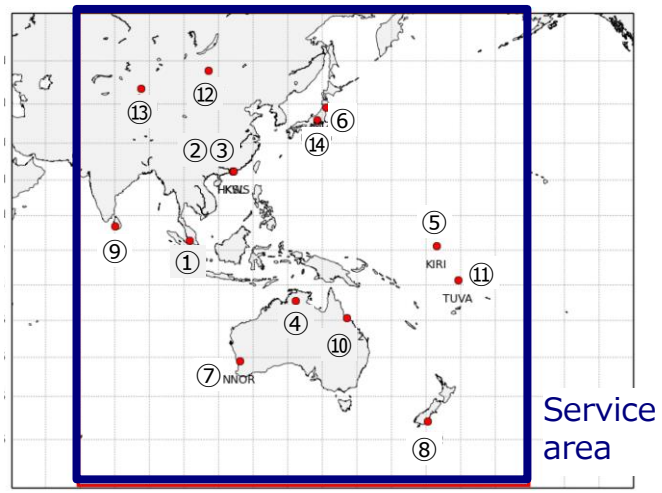
MADOCA-PPP



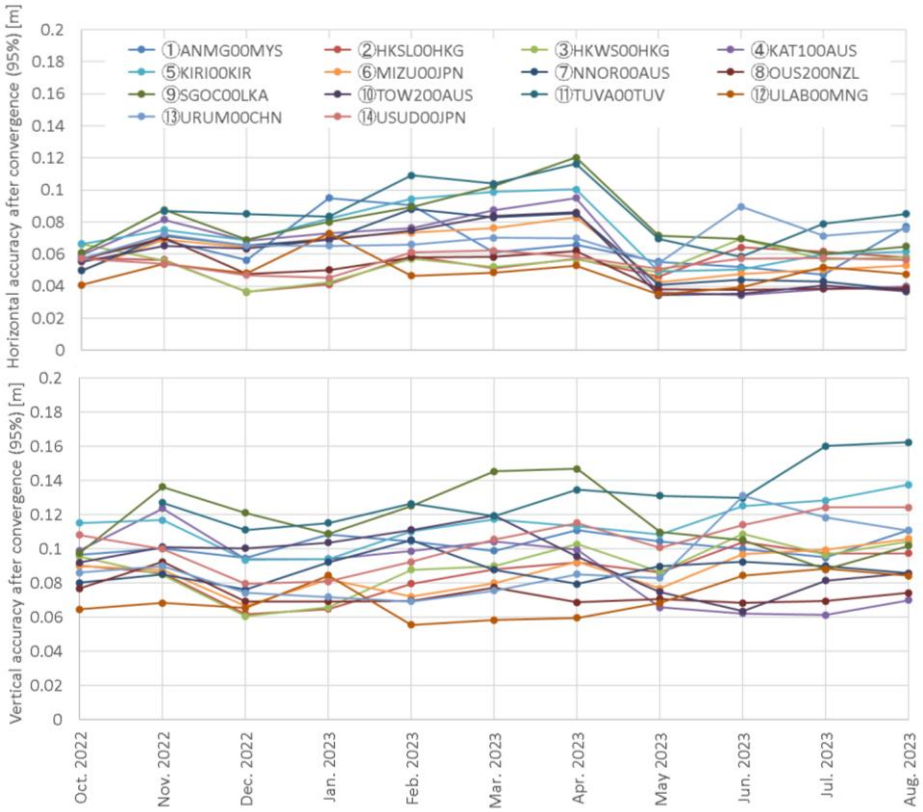
Initial convergence time
1800sec to reach 30cmH and 50cmV (95%)
600sec with ionospheric correction to reach 30cmH and 50cmV (95%)

MADOCA-PPP Performance

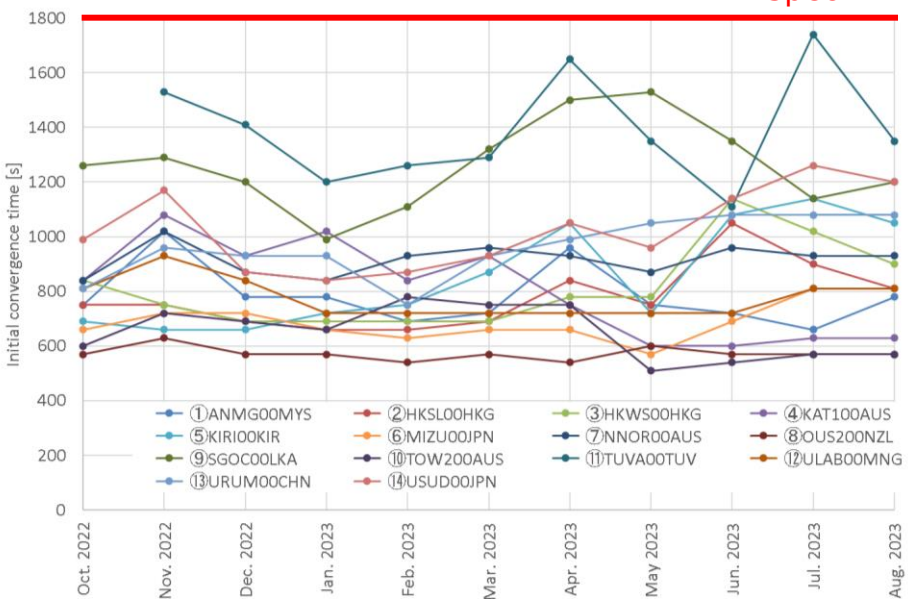
PPP results trends using IGS monitoring stations are as shown below.
Better initial convergence time than the defined specification and approximately 10 cm of accuracy are confirmed.



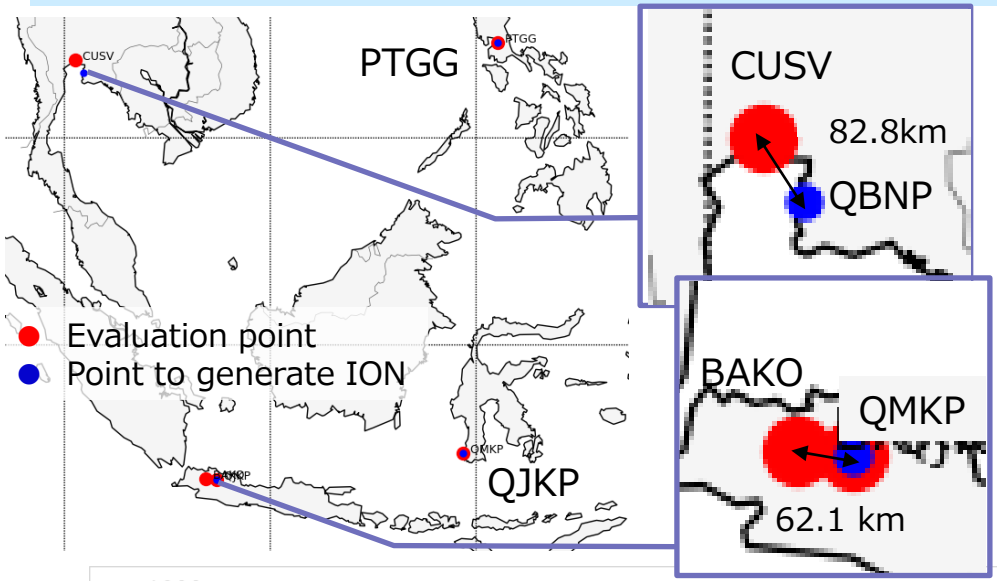
Accuracy after convergence



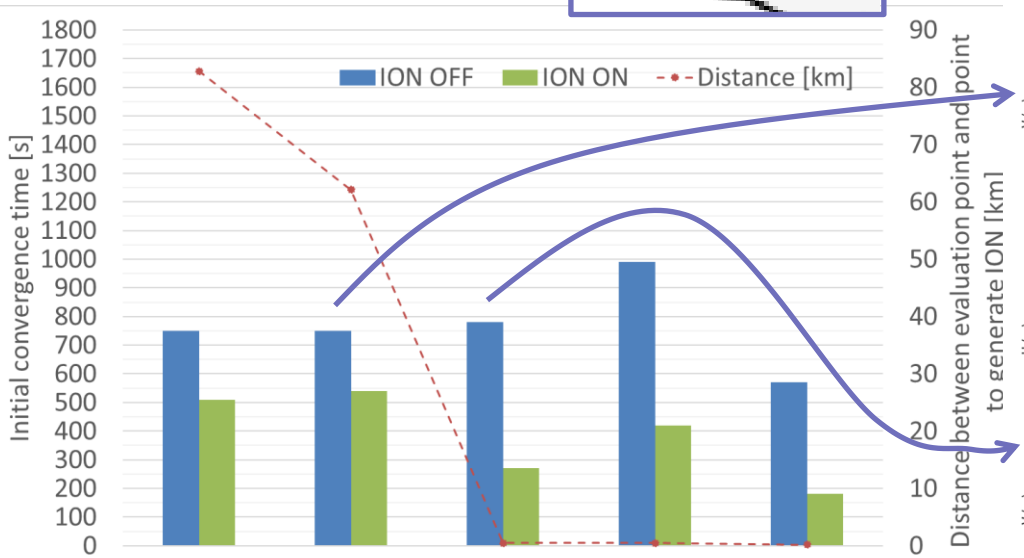
Initial convergence time

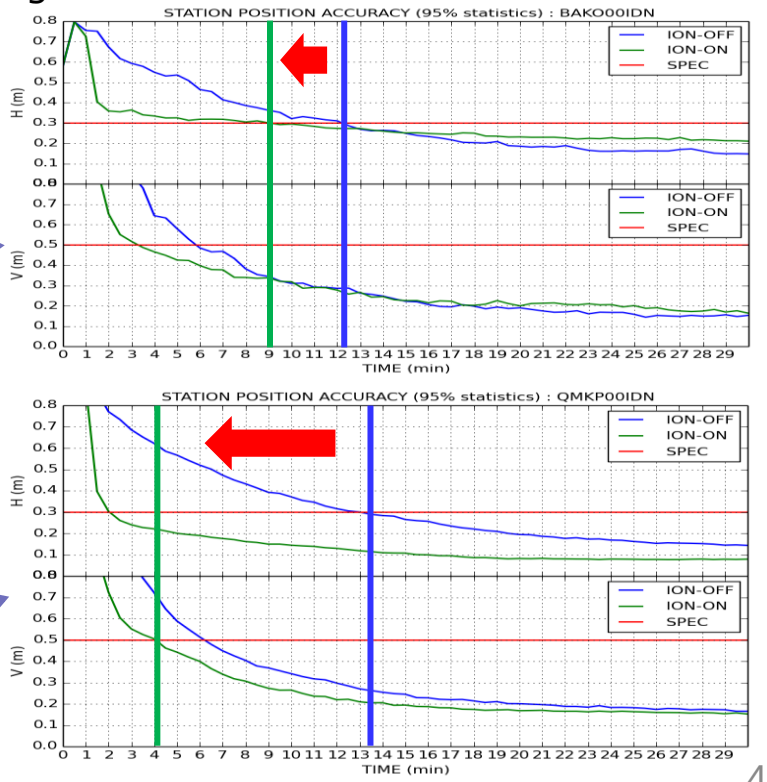


Demonstration of MADOCA-PPP initial convergence time with ionospheric correction



Results in Southeast Asia are introduced here. The evaluation has just been started. In addition to data here, in cooperation with BIG, CAO is now also evaluating performance with correction data generated by BIG.
The CAO is also developing relationships with countries to seek cooperation in providing CORS monitoring data so that local correction data can be generated more for further evaluation.

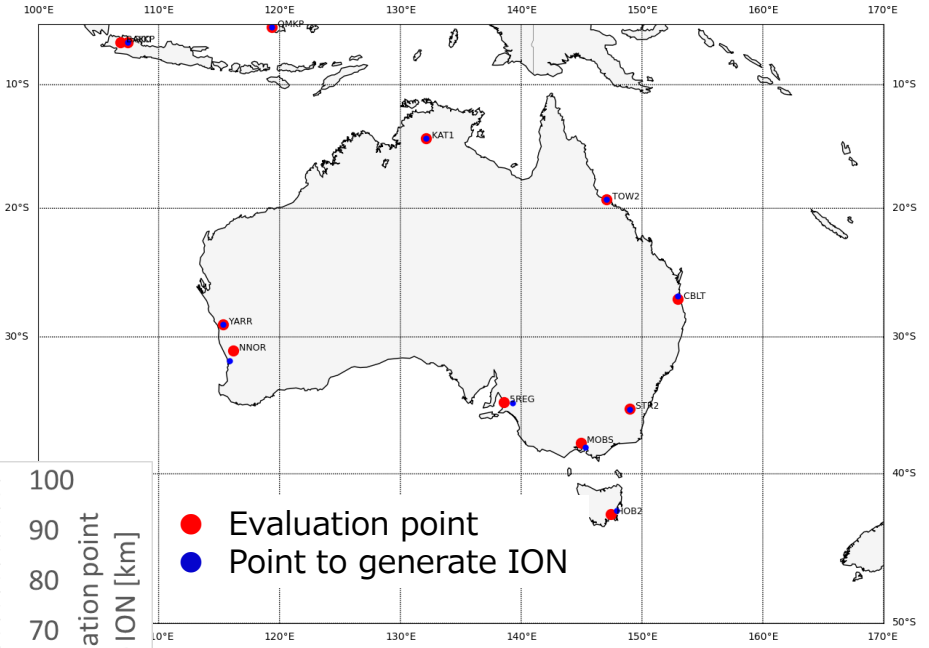


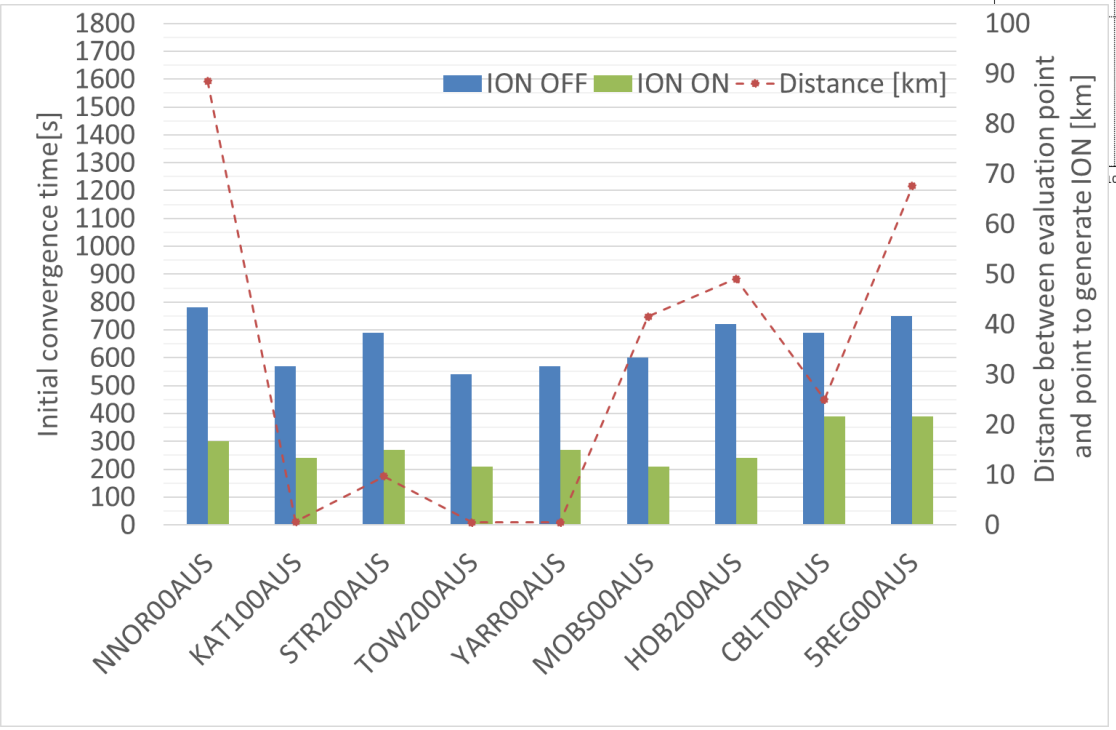


Error trend

Demonstration of MADOCA-PPP initial convergence time with ionospheric correction

Results in Australia are introduced here.
CAO really thanks the agencies, institutions, and universities that provide GNSS data to MIRAI.

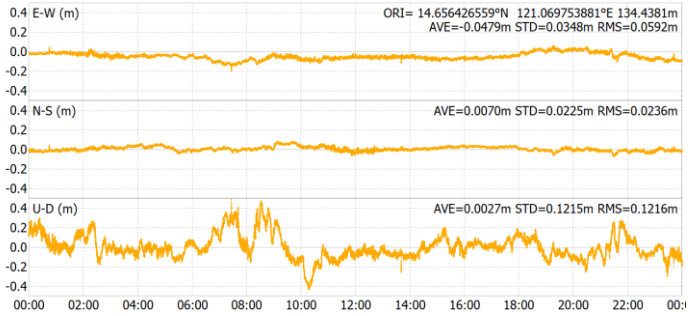




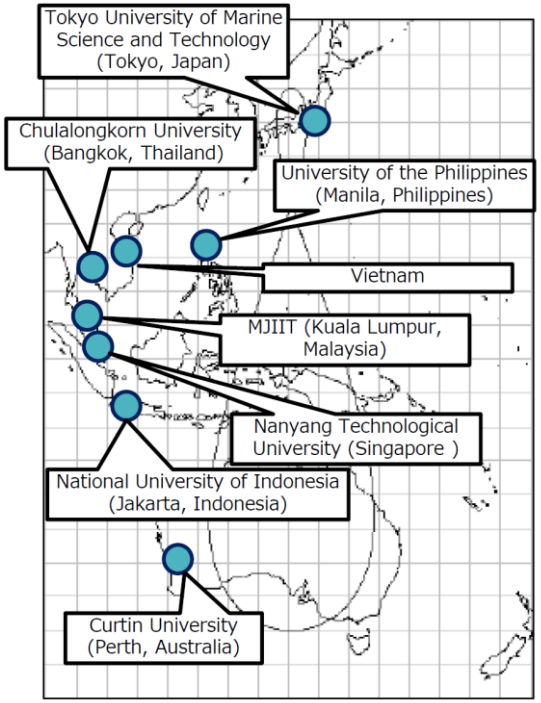
MADOCA-PPP Collaboration

- CAO is building relationships with countries in Asia-Oceania
  - to look for the needs and seeds of MADOCA utilization for application and conduct demonstration to confirm MADOCA applicability
  - to ask for cooperation in providing CORS data or generating ionospheric correction data
- MADOCA-PPP has advantage in high accuracy positioning in remote area because it does not require reference stations. We would like to promote MADOCA for surveying in remote area, maritime application, and so on.
- We have agreements with Australia (GA), Indonesia (BIG, BRIN), Thailand (GISTDA), the Philippines (NAMRIA), and Vietnam (VNSC).
- CAO also installed L6 receivers for MADOCA-PPP in some universities and conducts continuous monitoring. Stable positioning are confirmed so far. You can see data from the Web site (https://www.denshi.e.kaiyodai.ac.jp/gnss_tutor/madoca.html)

Performance demonstration in Indonesia



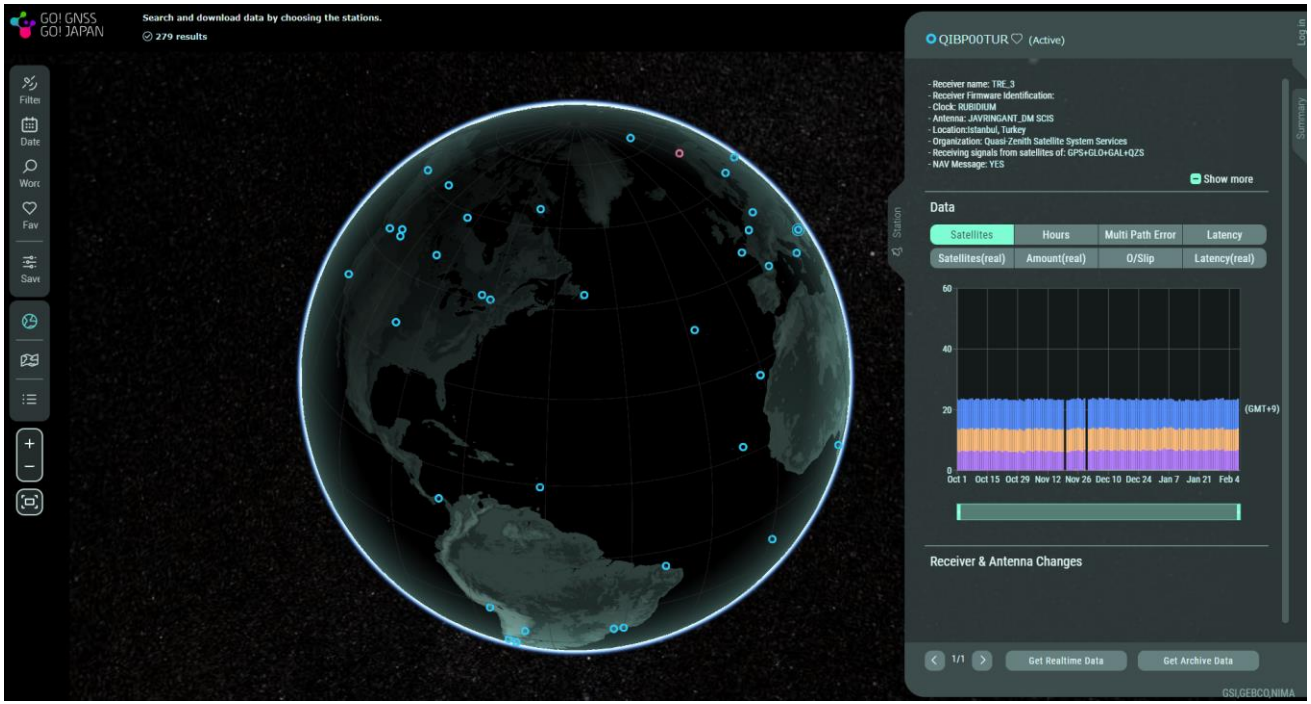
One of continuous monitoring results: May 1, 2023, real-time (RTKLIB used for analysis) at UP



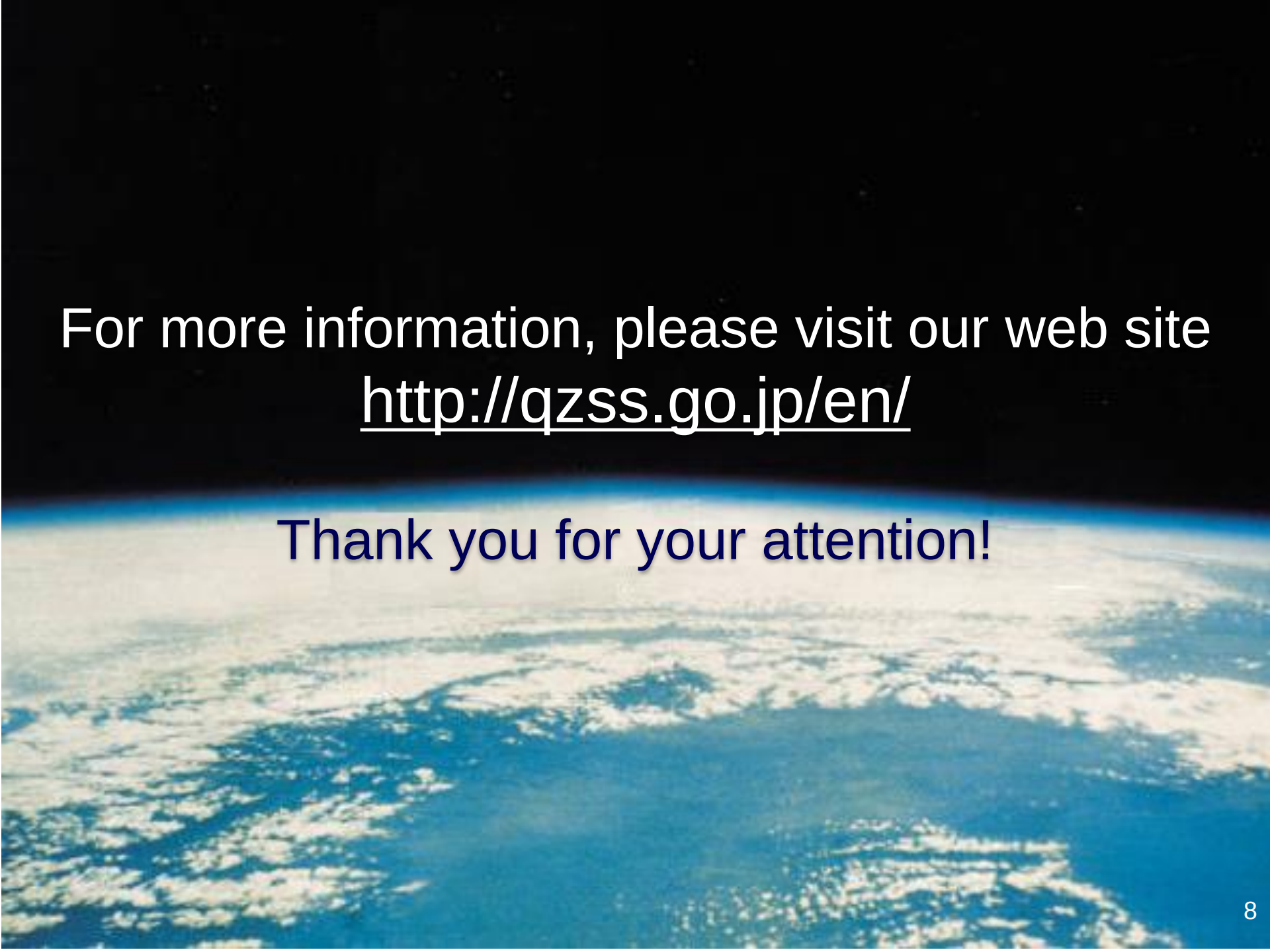
Cabinet Office
National Space Policy Secretariat

MADOCA-PPP Collaboration

- CAO is operating MultI-GNSS Integrated Real time and Archived Information system (MIRAI) with the intention to be a “redundant” data caster on the existing IGS RT infrastructure for operating MADOCA-PPP and also a source of ionospheric correction generation.
- Partners inside and outside Japan kindly provide their data to MIRAI.
- MIRAI shows both real-time data and archive data, and the MIRAI data are shared openly for the benefit of all scientific, educational, and commercial users for peaceful purposes only.



Cabinet Office
National Space Policy Secretariat



For more information, please visit our web site
http://qzss.go.jp/en/

Thank you for your attention!