



UN-GGIM-AP

REGIONAL COMMITTEE OF
UNITED NATIONS
GLOBAL GEOSPATIAL
INFORMATION MANAGEMENT
FOR ASIA & THE PACIFIC

UN-GGIM-AP

Working Group on Geodetic Reference Frame

Basara Miyahara
Chair, UN-GGIM-AP WG on Geodetic Reference Frame

**Geodesy Capacity Development Workshop for Asia-Pacific
on Transitioning to a Modern Geospatial Reference System**

30 June – 4 July 2025

Bangkok, Thailand



Regional Committees

Each UN-GGIM regional committee plays a vital role liaising with the UN-GGIM Secretariat on topics of interest and major developments between meetings of the Committee of Experts, facilitating regional development and discussion, and formally feeding into the Committee of Experts. The five regional committees provide a mechanism for a strong and streamlined regional infrastructure that brings important regional perspectives to the global level and for the outcomes and benefits of the global activities to be disseminated to all Member States in each region.

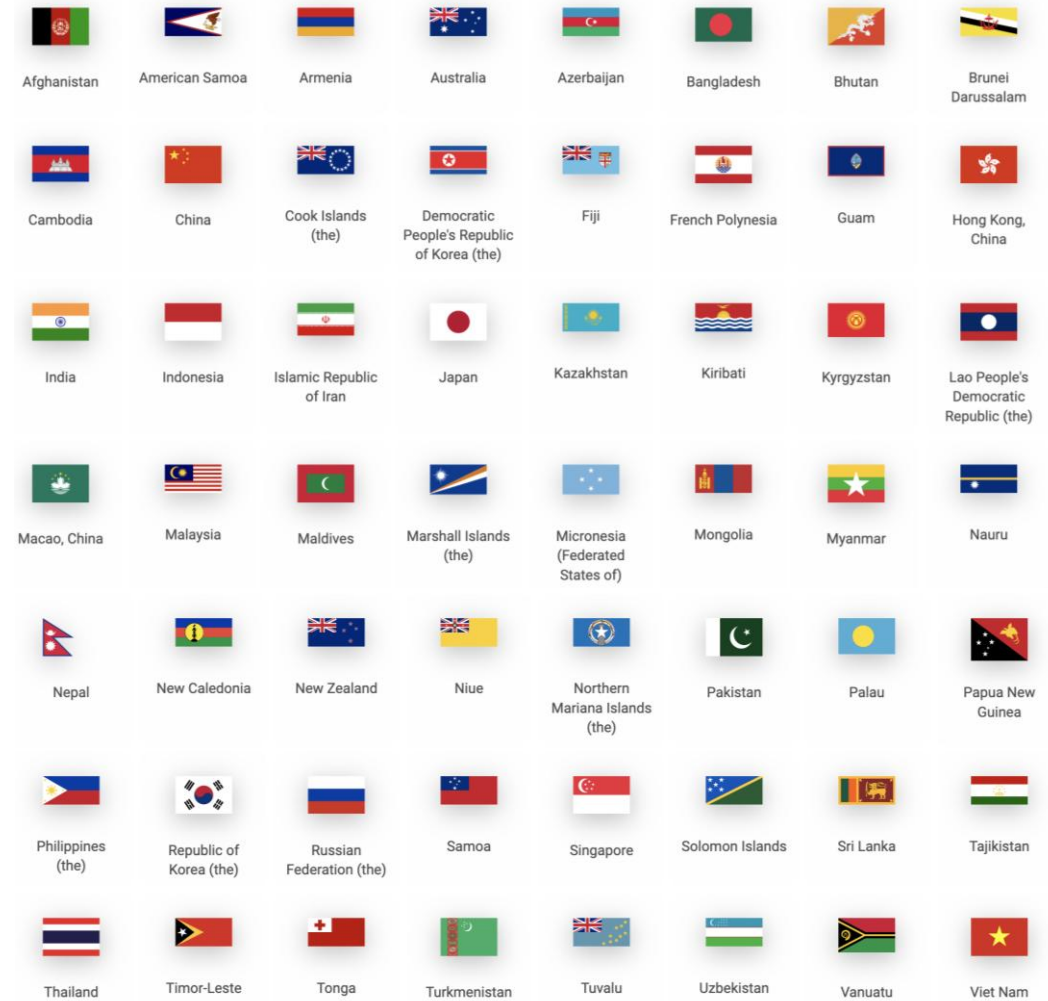
[UN-GGIM-AP](#)[UN-GGIM: Americas](#)[UN-GGIM: Arab States](#)[UN-GGIM: Europe](#)[UN-GGIM: Africa](#)

UN-GGIM-ASIA-PACIFIC

Countries

Afghanistan, Armenia, Australia, Azerbaijan, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Democratic People's Republic of Korea (the), Fiji, France, Georgia, India, Indonesia, Iran (Islamic Republic of), Japan, Kazakhstan, Kingdom of Tonga, Kiribati, Kyrgyzstan, Lao People's Democratic Republic (the), Malaysia, Maldives, Marshall Islands (the), Micronesia (Federated States of), Mongolia, Myanmar, Nauru, Nepal, Netherlands (the), New Zealand, Pakistan, Palau, Papua New Guinea, Philippines (the), Republic of Korea (the), Russian Federation (the), Samoa, Singapore, Solomon Islands, Sri Lanka, Tajikistan, Thailand, Timor-Leste, Turkey, Turkmenistan, Tuvalu, United Kingdom of Great Britain and Northern Ireland (the), United States of America (the), Uzbekistan, Vanuatu, Viet Nam, American Samoa, Cook Islands (the), French Polynesia, Guam, Hong Kong, China, Macao, China, New Caledonia, Niue, and, Northern Mariana Islands (the).

MEMBER STATES: GEOGRAPHICAL DISTRIBUTION



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

UN-GGIM-AP Working Group 1

- Geodetic reference frame -

Chair

Mr. Basara Miyahara, Japan

Vice Chairs

Dr. Guorong Hu, Australia

Dr. Yamin Dang, China

Mr. Asakaia Tabu, Fiji

Mr. Neeraj Gurjar, India <- Mr. Upendra Nath Mishra

Mr. Sidik Tri Wibowo, Indonesia

Mr. Seyed Abdoreza Saadat Mirghadim, Islamic Republic of Iran

Mr. Ahmad Sanusi bin Che Cob, Malaysia

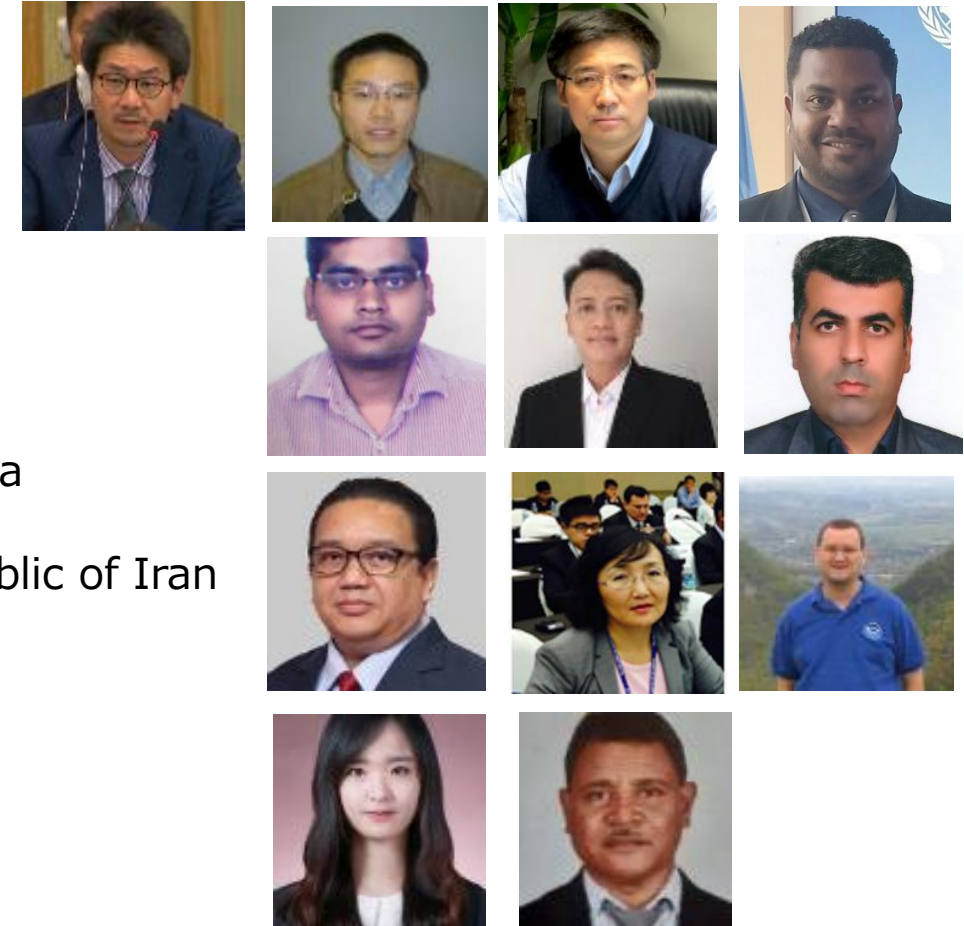
Ms. Dalkhaa Munkhtsetse, Mongolia

Dr. Nic Donnely, New Zealand

Ms. Seohee Park, Republic of Korea

Members

Mr. Paulino Dacruz, Timor-Leste



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

UN-GGIM-AP Working Group 1 – Focus 2022 - 2025

**UN-GGIM
Geodesy**

**Height System
Modernization**



**Regional
Reference Frame
(APREF, APRGP)**

**Regional
Capacity
Building**



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

UN-GGIM-AP Working Group 1 – Focus 2022 - 2025

**UN-GGIM
Geodesy**

**Height System
Modernization**



**Regional
Reference Frame
(APREF, APRGP)**

**Regional
Capacity
Building**



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

UN-GGIM Global Geodesy

- **Participate/Contribute to activities of the UN-GGCE & the Subcommittee on Geodesy**
 - ✓ WG chair, vice-chairs and members attend meetings of the UN-GGCE & SCoG
 - 3rd Meeting of the UN-GGCE International Advisory Committee & 5th Plenary Meeting of the Subcommittee on Geodesy
 - Expert Consultation meeting on Strengthening the Global Geodesy Supply Chain
 - UN-GGCE - International Workshop on Joining Land and Sea with BIG Indonesia
- **Report the activities** of UN-GGCE/SCoG to the UN-GGIM-AP
- **Invite speakers** from UN-GGCE/IAG/FIG to the UN-GGIM-AP meetings
 - ✓ UN-GGIM-AP geodetic WG annual meetings; UN-GGIM-AP/IAG/FIG capacity development workshops/seminars



Act as a contact point / gateway to the global geodetic community



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

3rd Meeting of the UN-GGCE International Advisory Committee

5th Plenary Meeting of the Subcommittee on Geodesy

- Participation from the geodetic working group of UN-GGIM-AP
Australia, China, Fiji, India, Japan, Mongolia, Singapore, New Zealand, Republic of Korea



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

UN-GGIM-AP Working Group 1 – Focus 2022 - 2025

**UN-GGIM
Geodesy**

**Height System
Modernization**

**Regional
Reference Frame
(APREF, APRGP)**



**Regional
Capacity
Building**



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

Asia Pacific Reference Frame (APREF)

- Joint initiative between UN-GGIM-AP and IAG
- Regional geodetic reference frame
- Realized by continuous GNSS observation of over **1,100 stations over 70 organizations across 39 different countries/regions**
- Densify ITRF and improve access to ITRF
- Data are routinely processed by 3 Local Analysis Centres*
- Station coordinates and long-term velocities made openly available
- APREF solutions have been transitioned to **ITRF2020/IGB20** since 02 Feb. 2025 (GPS week 2352)
- Report on APREF available at
<https://www.un-ggim-ap.org/wg/working-group-1-geodetic-reference-frame>

* Geoscience Australia
Office of Surveyor-General Victoria, Australia
Institute of Geodesy and Geophysics, Chinese Academy of Sciences
Geospatial Information Authority of Japan (under evaluation)



APREF webpage



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

APREF Project - Background

- The use of positioning technology is growing rapidly in industries such as mining, agriculture, and construction and there is an increasing demand for positioning services to inform emergency services, hazard modelers, and land, utility and asset managers.
- These users have a need for centimeter level or better geodetic infrastructure. To provide this, the Asia-Pacific region needs **a consistent, continually refined and easily accessible reference frame**.
- APREF was mandated by Resolution 1 (Regional Geodesy) of the 18th UN Regional Cartographic Conference (UNRCC) for Asia and the Pacific in October 2009, Bangkok, Thailand. APREF is also endorsed by the IGS, UNOOSA, and the FIG.
- The broad objective of APREF is to create and maintain a densely realized and accurate geodetic framework, based on continuous observation and analysis of GNSS data.
- In the short term, the project aims to encourage the sharing of GNSS data from CORS in the region providing authoritative coordinates, and their respective velocities. Joint initiative between UN-GGIM-AP and IAG

R. Ruddick, A. Riddle and G. Hu (2025): Asia-Pacific Reference Frame Project - fifteen years of regional geodetic collaboration (Reference Frame in Practice Seminar)



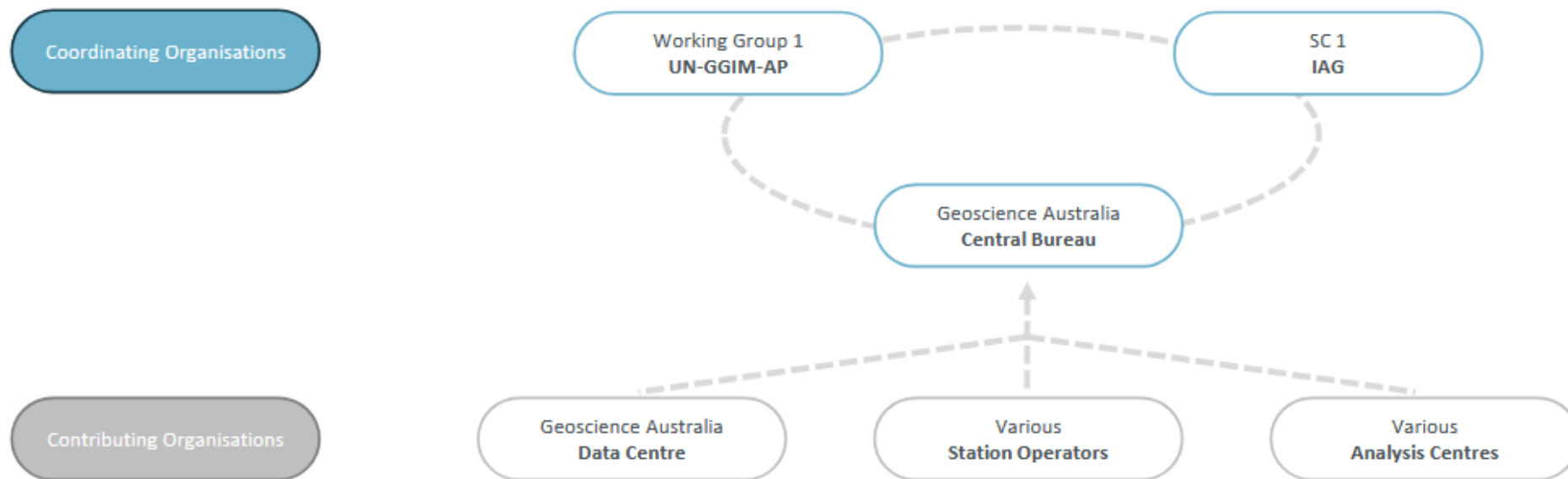
UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

APREF Organisational Structure

- APREF is a collaboration of the Geodetic Reference Frame Working Group of the United Nations Global Geospatial Information Management for Asia and the Pacific (UN-GGIM-AP) and the Reference Frame Sub-Commission of the International Association of Geodesy (IAG).
- **The Central Bureau, within Geoscience Australia**, functions as the “day-to-day” coordinating body. Specifically, the Central Bureau ensures that APREF products are made available to the global geodetic community.



R. Ruddick, A. Riddle and G. Hu (2025): Asia-Pacific Reference Frame Project - fifteen years of regional geodetic collaboration (Reference Frame in Practice Seminar)



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

Asia Pacific Reference Frame (APREF)

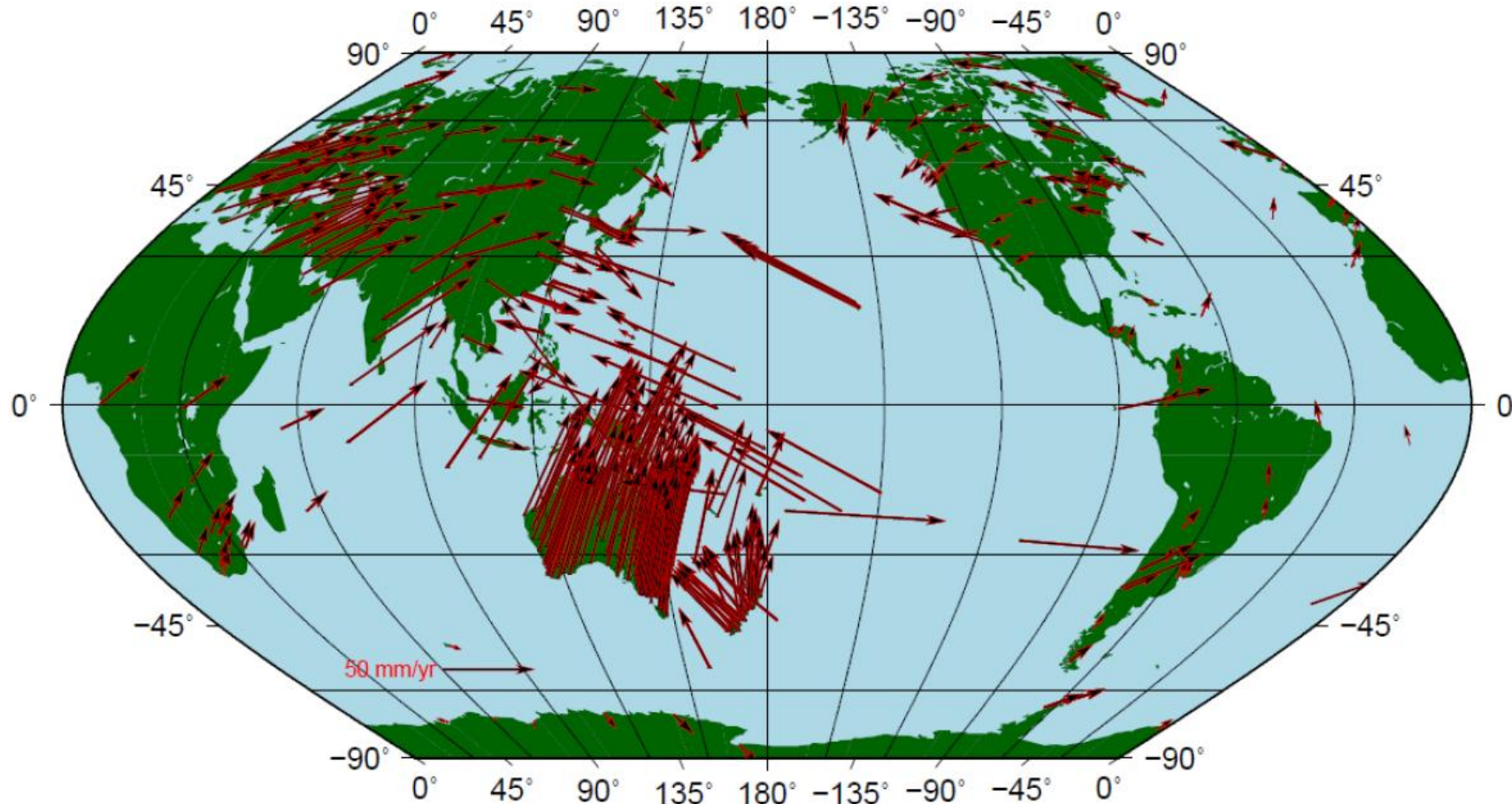


Figure 1. The distribution of APREF CORS network along with the IGS core stations. The arrows represent the GPS-derived velocity field.

G. Hu, M. Moore and J. Dawson (2019): Report on the Asia Pacific Reference Frame (APREF) Project



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

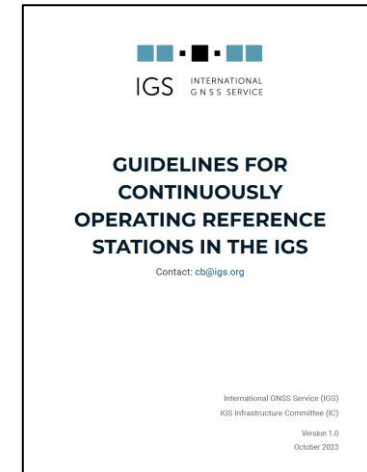
www.un-ggim-ap.org/

APREF Stations (Things to Consider)

- Stations should, where possible, align with [the Guidelines for Continuously Operating Reference Stations in the International GNSS Service \(IGS\)](#). To support inclusion, diversity, equity and accessibility the IGS provide translated versions of these guidelines in multiple languages (currently French and Spanish).

Key Considerations

- Stations should be well monumented with strong and stable foundations.
- Stations should have clear sky view and avoid sources of interference.
- Records of stations information and changes should be documented and well maintained.
- Data files/streams should be continuous and available.
- Encourage multi-GNSS and real-time.
- Data license and/or rights.



R. Ruddick, A. Riddle and G. Hu (2025): Asia-Pacific Reference Frame Project - fifteen years of regional geodetic collaboration (Reference Frame in Practice Seminar)



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

Value in Contributing to APREF



For Countries / Regions

- Supporting a stronger regional positioning capability (strengthening the supply chain).
- Alignment of national datums to the ITRF.
- Support understanding of Earth system processes in the Asia-Pacific (e.g. sea level, earthquakes).



For Agencies / Station Operators

- A framework to facilitate the open sharing of geodetic data.
- A framework to manage station information (metadata).
- Provides validation and verification (as a gateway for IGS acceptance).
- Station coordinates and uncertainties provided in alignment to ITRF.

R. Ruddick, A. Riddle and G. Hu (2025): Asia-Pacific Reference Frame Project - fifteen years of regional geodetic collaboration (Reference Frame in Practice Seminar)



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

How to contribute

To contribute to APREF you need to contact Geoscience Australia on gnss@ga.gov.au and GA will guide you through the process. This will typically start with **providing a letter of intent to contribute**.

Types of contributions:

- Contribute data from a GNSS station on an ongoing basis (Station Operator).
- Provide access to GNSS data from GNSS stations across a region (Data Centre).
- Routinely analyze some, or all, of the APREF GNSS station data (Analysis Centre).



R. Ruddick, A. Riddle and G. Hu (2025): Asia-Pacific Reference Frame Project - fifteen years of regional geodetic collaboration (Reference Frame in Practice Seminar)

UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

Data Licenses

Problem

- To ensure APREF products and services provide maximum value they are shared under an open Creative Commons license (CC BY).
- To generate these products and services, Geoscience Australia (as Central Bureau) may share, adapt, and reuse the GNSS data contributed by the Station Operators.
- To support the open sharing of the APREF products, station operators / data custodians need to consider and clearly communicate the license or restrictions under which data is shared with APREF.

Solution

- To help with this, we have developed **a simple letter of intent** that we will use to capture information on the data licenses and restrictions.

R. Ruddick, A. Riddle and G. Hu (2025): Asia-Pacific Reference Frame Project - fifteen years of regional geodetic collaboration (Reference Frame in Practice Seminar)

Recommendation

- **Establish a letter of intent between Geoscience Australia and the contributing countries** and ensure roles and responsibilities around the management and use of the GNSS Data contributed to the APREF project



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

Take Home Messages

- Information on APREF and how to participate can be found online at:
<https://www.ga.gov.au/scientific-topics/positioning-navigation/positioning-australia/geodesy/asiapacific-reference-frame>
- There are over 1100 GNSS continuously operating reference stations in the APREF weekly analysis, contributed from over 70 organizations across 39 different countries/regions. The data from these stations can be accessed at:
<https://data.gnss.ga.gov.au/docs/home/index.html> (RINEX and RTCM)
- APREF derived products include weekly coordinates, long-term timeseries (coordinates and velocity estimates with uncertainties) for all contributing stations. The derived products can be accessed at: <https://data.gnss.ga.gov.au/docs/home/index.html> (SINEX)
<https://portal.gnss.ga.gov.au> (timeseries)



R. Ruddick, A. Riddle and G. Hu (2025): Asia-Pacific Reference Frame Project - fifteen years of regional geodetic collaboration (Reference Frame in Practice Seminar)

UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

Future Direction

The focus for the next 15 years is around maturing APREF to be a sustainable and resilient operational capability for the region.

Future Steps

- Reprocessing campaign.
- Increase participation and build communities of practice (share knowledge and build capacity).
- Build resilience within the components (more data centers, more analysis centers).
- Address issues around open data sharing.
- Demonstrate impact.

Discussion Points

- How do you sell the value of participation?
- How to you benefit from APREF?
- What are the blockers to participation?

R. Ruddick, A. Riddle and G. Hu (2025): Asia-Pacific Reference Frame Project - fifteen years of regional geodetic collaboration (Reference Frame in Practice Seminar)



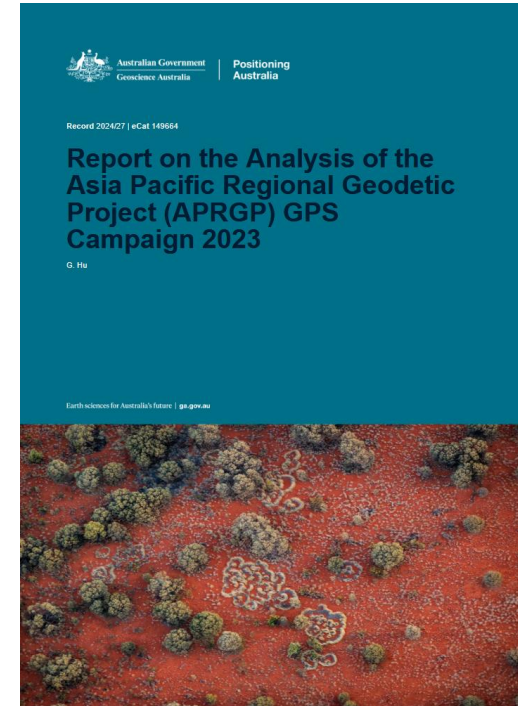
UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

Asia Pacific Regional Geodetic Project (APRGP)

- Annual GNSS campaign
 - Densify ITRF and improve access to ITRF
 - Data are analysed by Geoscience Australia
 - Analysis report is distributed each year
-
- **APRGP2023:** 10 to 16 September 2023
 - Processed by Guorong Hu, Geoscience Australia
 - Participation from Brunei, India, Korea (Republic of), Laos, Mongolia, Philippines, Singapore, Tonga and Vietnam
 - Final report is available at UN-GGIM-AP website
-
- **APRGP2024:** 8 to 14 September 2024
 - Under processing by Guorong Hu, Geoscience Australia
-
- **APRGP2025:** Planned in later this year (TBD)



APRGP2023



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

Asia Pacific Regional Geodetic Project (APRGP)

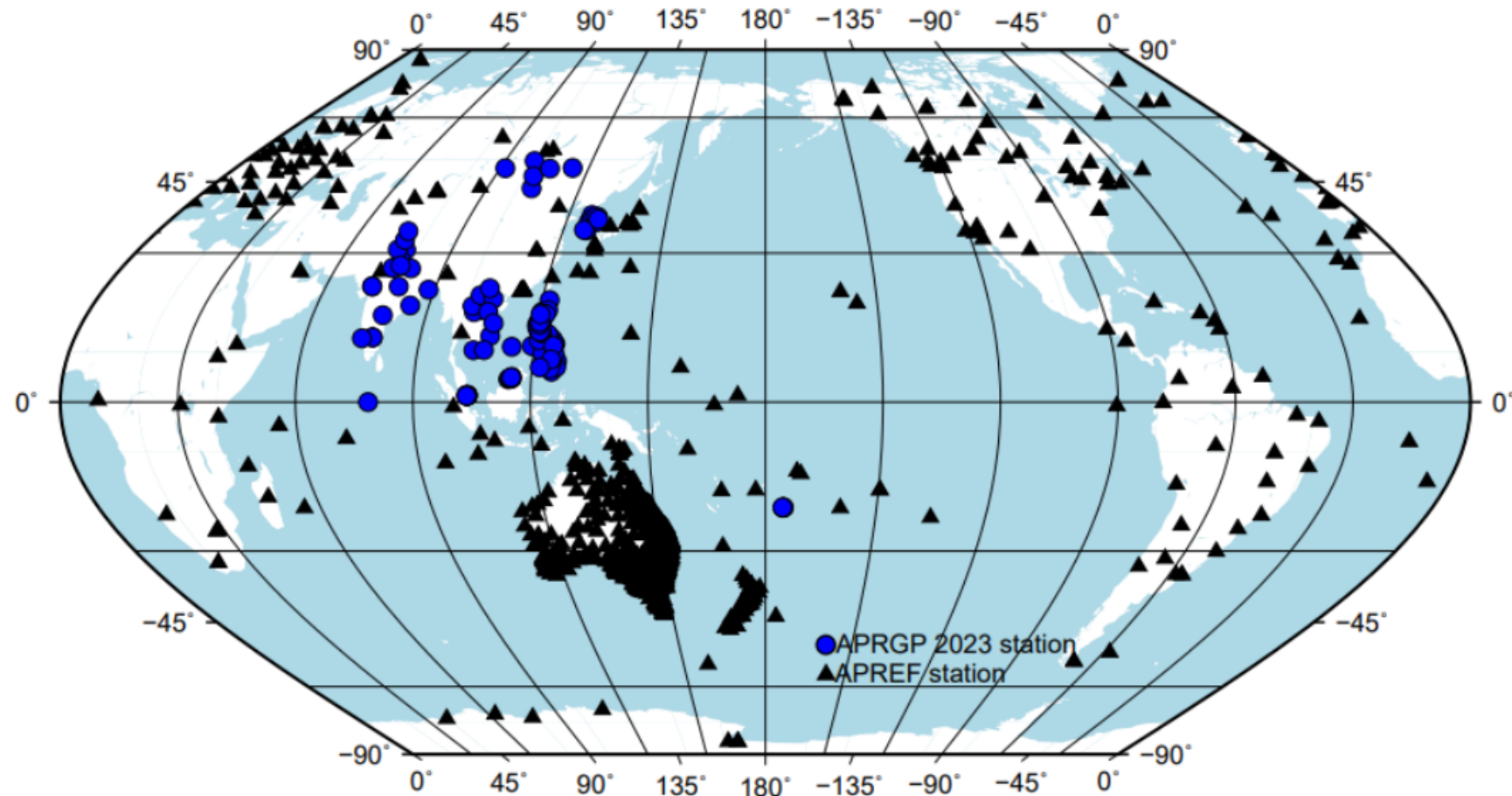


Figure 1 APRGP stations in the APRGP 2023 GPS campaign analysis along with the APREF stations and IGS stations, blue circles are APRGP campaign sites, and black triangles are APREF stations.

G. Hu: Report on the Analysis of the Asia Pacific Regional Geodetic Project (APRGP) GPS Campaign 2023



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

UN-GGIM-AP Working Group 1 – Focus 2022 - 2025

**UN-GGIM
Geodesy**

**Height System
Modernization**



**Regional
Reference Frame
(APREF, APRGP)**

**Regional
Capacity
Building**

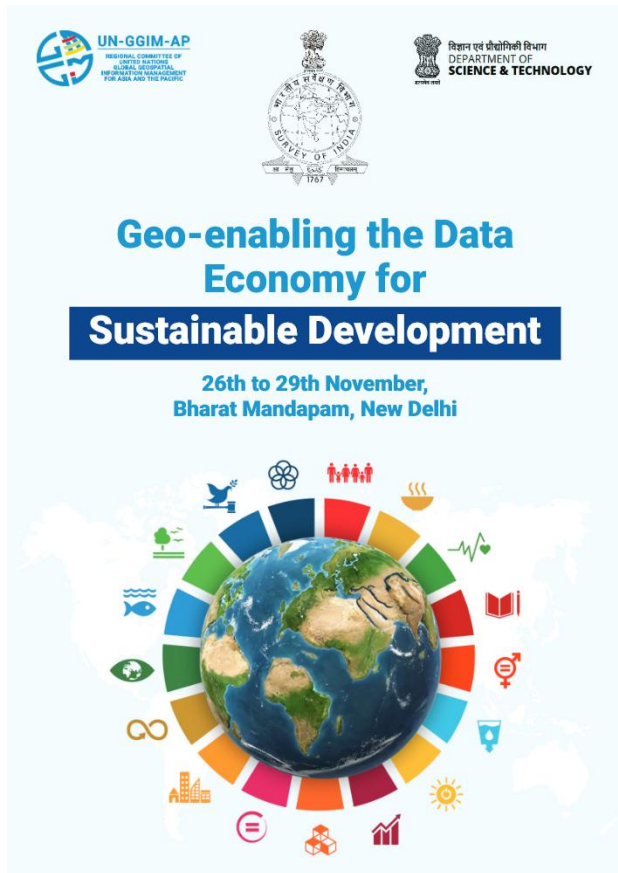


UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

UN-GGIM-AP 13th Plenary – New Delhi, India



- Capacity Development Workshop on Sustainable Operation of GNSS CORS Network
- UN-GGIM-AP 13th Plenary Meeting
 - Annual Session of the UN-GGIM-AP Working Group on Geodetic Reference Frame



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

Capacity Development Workshop on Sustainable Operation of GNSS CORS Network

- Half day workshop on November 27, 2024
- Co-organized by UN-GGIM-AP/IAG/FIG/SoI
- Approximately 300 participants from 40 countries



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

Capacity Development Workshop on Sustainable Operation of GNSS CORS Network

Presentations

- Country cases (Australia, India, Japan, New Zealand, Tonga)
- Support of international bodies to capacity development on GNSS CORS (APREF, IAG, IGS, FIG)
- 1st Joint Development Plan for Global Geodesy (UN-GGCE)



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

Reference Frame in Practice Seminar in Brisbane, Australia

- April 5-6, 2025 in conjunction with FIG Working Week 2025 / Locate 25
- Co-organized by FIG/IAG/UN-GGIM-AP
- Reference Frame theory, best practices and challenges in countries especially in the Pacific
- Sessions
 - ✓ Session 1: International Geodesy Initiatives (ICG, UN-GGIM-AP, IGS, UN-GGCE)
 - ✓ Session 2: Introduction to Geodetic Reference Frame Theory (IAG, Univ. Otago, LINZ)
 - ✓ Session 3: Reference Frames in Asia-Pacific Region (Australia, NZ, Japan, Nepal, Trimble)
 - ✓ Session 4: Reference Frames in the Pacific (SPC, PNG, Fiji, Cook Islands, Tonga..)



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

Geodesy Capacity Development opportunities in 2025

- UN-GGCE Geodesy Capacity Development Workshop for Asia-Pacific on Transitioning to a Modern Geospatial Reference System
 - ✓ 30 June - 4 July 2025, Thailand, Bangkok
- Geodesy Side Event in conjunction with UN-GGIM-AP 14th Plenary Meeting
 - ✓ September 2025 in Republic of Korea
 - ✓ Topics and Focus will be discussed with the host (NGII)
- UN-GGIM-AP WG1 annual session in UN-GGIM-AP 14th Plenary Meeting
 - ✓ Annual reports from the member countries
 - ✓ Discussion on issues/challenges and possible activities
- Always welcome any opportunities for geodetic capacity development in the region

We are Here !



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/

UN-GGIM-AP Working Group 1 – Focus 2022 - 2025

**UN-GGIM
Geodesy**

**Height System
Modernization**



**Regional
Reference Frame
(APREF, APRGP)**

**Regional
Capacity
Building**



UN-GGIM-AP

Regional Committee of United Nations
Global Geospatial Information Management
for Asia and the Pacific

www.un-ggim-ap.org/



UN-GGIM-AP

REGIONAL COMMITTEE OF
UNITED NATIONS
GLOBAL GEOSPATIAL
INFORMATION MANAGEMENT
FOR ASIA & THE PACIFIC

THANK YOU!

