IGS 2026 WORKSHOP
SANTIAGO DE CHILE
33°26' S 70°39' O

1-5 June 2026

International Union of Geodesy and Geophysics
IUGG UGGI
Union Géodésique et Géophysique Internationale

OBSERVATOIRE DE LA CÔTE D'AZUR
— UNIVERSITÉ CÔTE D'AZUR —

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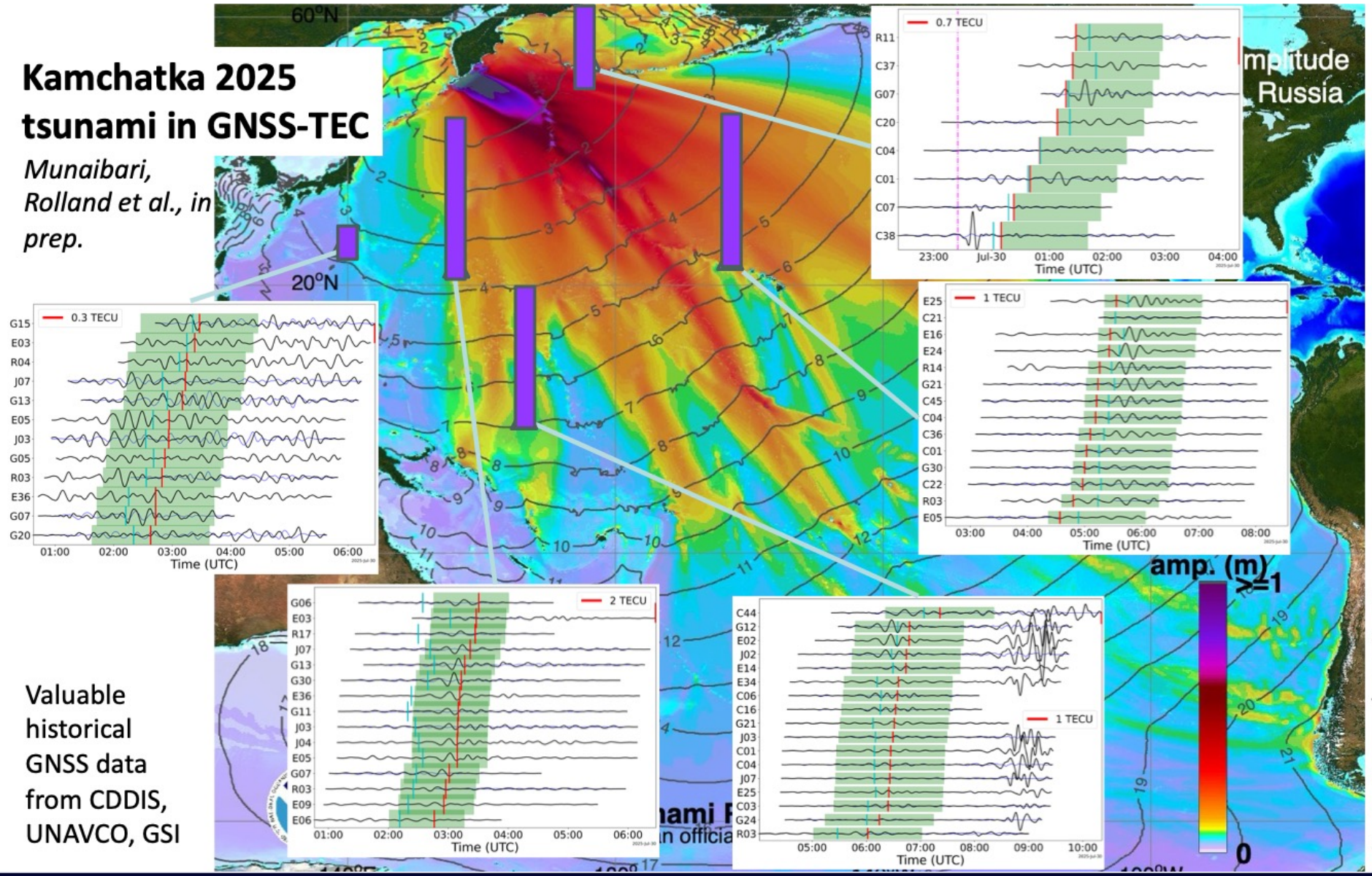
Strengthening Pacific Tsunami Early Warning through GNSS

Insights from Kamchatka 2025 event and the GeTEWS Oceania Initiative

Lucie Rolland, Viliami Folau, Noel Naki, Tim Melbourne, Ansela Paea, Virginie Durand, Andrick Lal, Perrine Drain, Ryan Ruddick, Camille Martire, Michela Ravanelli, Elvira Astafyeva, Dylan Mikesell, John LaBrecque and the GeTEWS Oceania Working Group

GNSS ionospheric monitoring of the 2025 Kamchatka tsunami event



Valuable historical GNSS data from CDDIS, UNAVCO, GSI

Clearer TEC signatures for larger tsunami wave heights. Expected arrival times (but large area sounded).

2025 Kamchatka Confirmed the utility and challenges of GNSS enhanced Tsunami Early Warning Systems (GeTEWS)

Utility Confirmed:

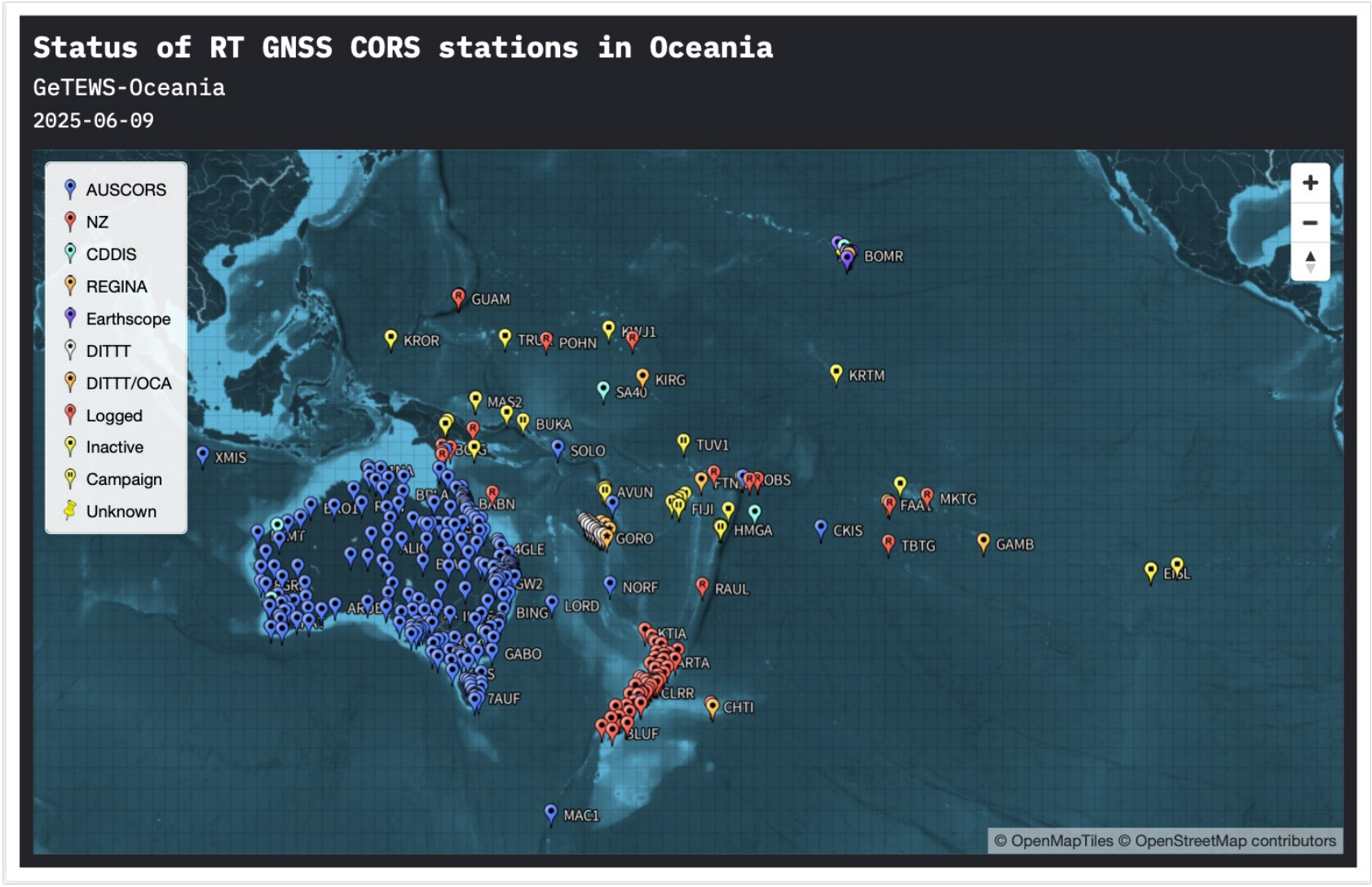
- GeTEWS observed Ionospheric TEC gravity waves during much of the tsunami propagation
- JPL's automated Guardian System demonstrated GeTEWS rapid detection and warning

Challenges Confirmed:

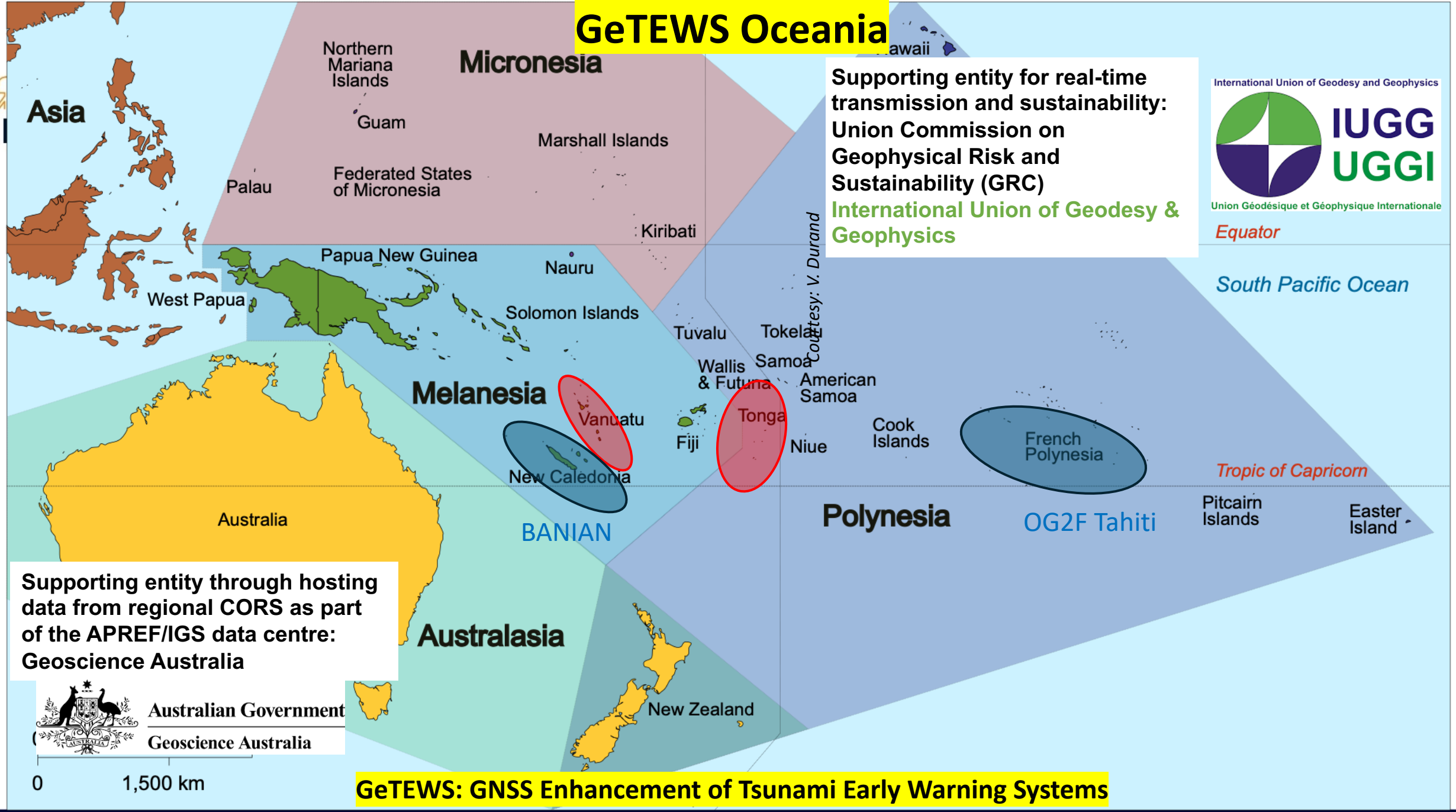
- Only one GNSS station provided crustal deformation at the source for finite fault models
- Poor distribution of GNSS stations and poorly supported analysis capability limits real time warning
- Kamchatka 2025 again demonstrated that International Cooperation and data sharing is essential

Pacific Islands Have Few Streaming GNSS CORS Stations

- **Note: Yellow sites are non CORS streaming**
- **300-500 Km spacing is best**
- **Priority: Refurbish non CORS stations and networks**



GeTEWS Oceania



Supporting entity for real-time transmission and sustainability: Union Commission on Geophysical Risk and Sustainability (GRC)
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Supporting entity through hosting data from regional CORS as part of the APREF/IGS data centre: Geoscience Australia

Australian Government
Geoscience Australia

GeTEWS: GNSS Enhancement of Tsunami Early Warning Systems

Challenges to the GeTEWS Oceania Project

- Multi-national collaboration

  Resource sharing (data, software, analysis, training)

- Improved GNSS network infrastructure

  Real time multi-GNSS with assured and active maintenance, national governmental support critical

- Regional Broadband Access

  Satellite Broadband for remote areas (Starlink ?)

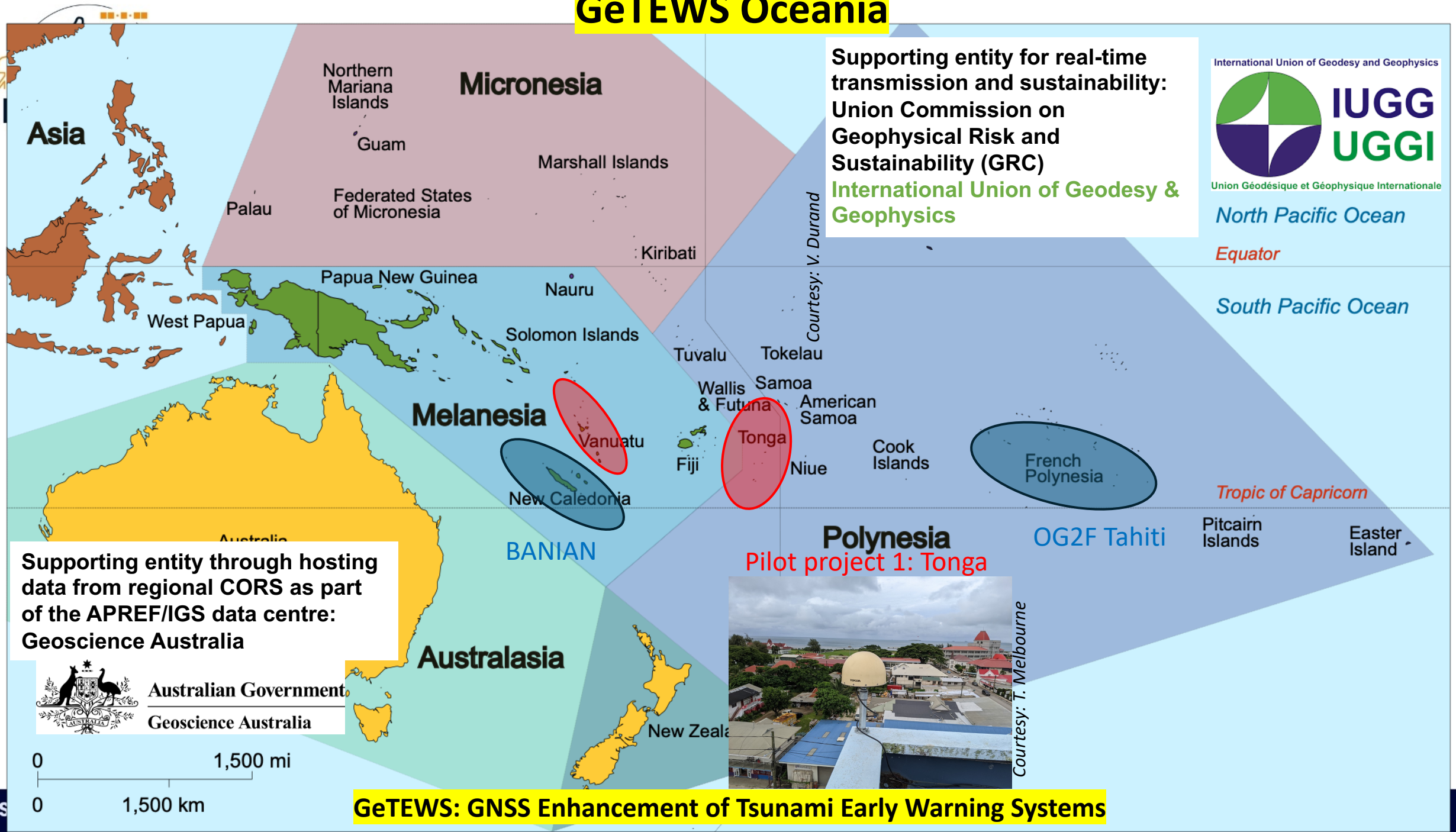
- Integrated computational infrastructure

  Regional and multi-national analysis infrastructure

  (based e.g. on GUARDIAN, ALTRUIST, and/or GO-EUREKA systems)

Main ongoing efforts

GeTEWS Oceania



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Pilot project 1: Tonga

Courtesy: T. Melbourne

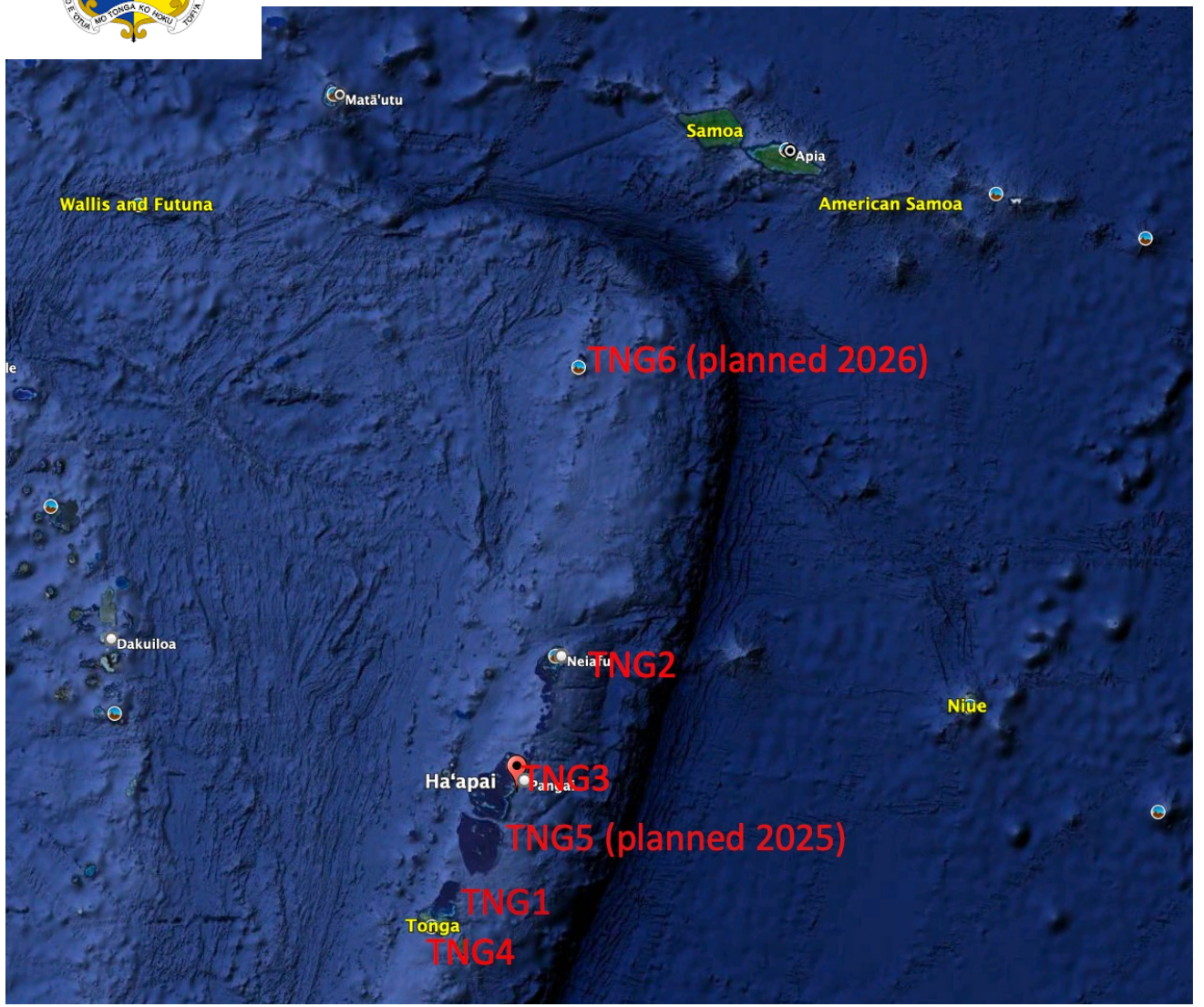
GeTEWS: GNSS Enhancement of Tsunami Early Warning Systems

The Tonga pilot project

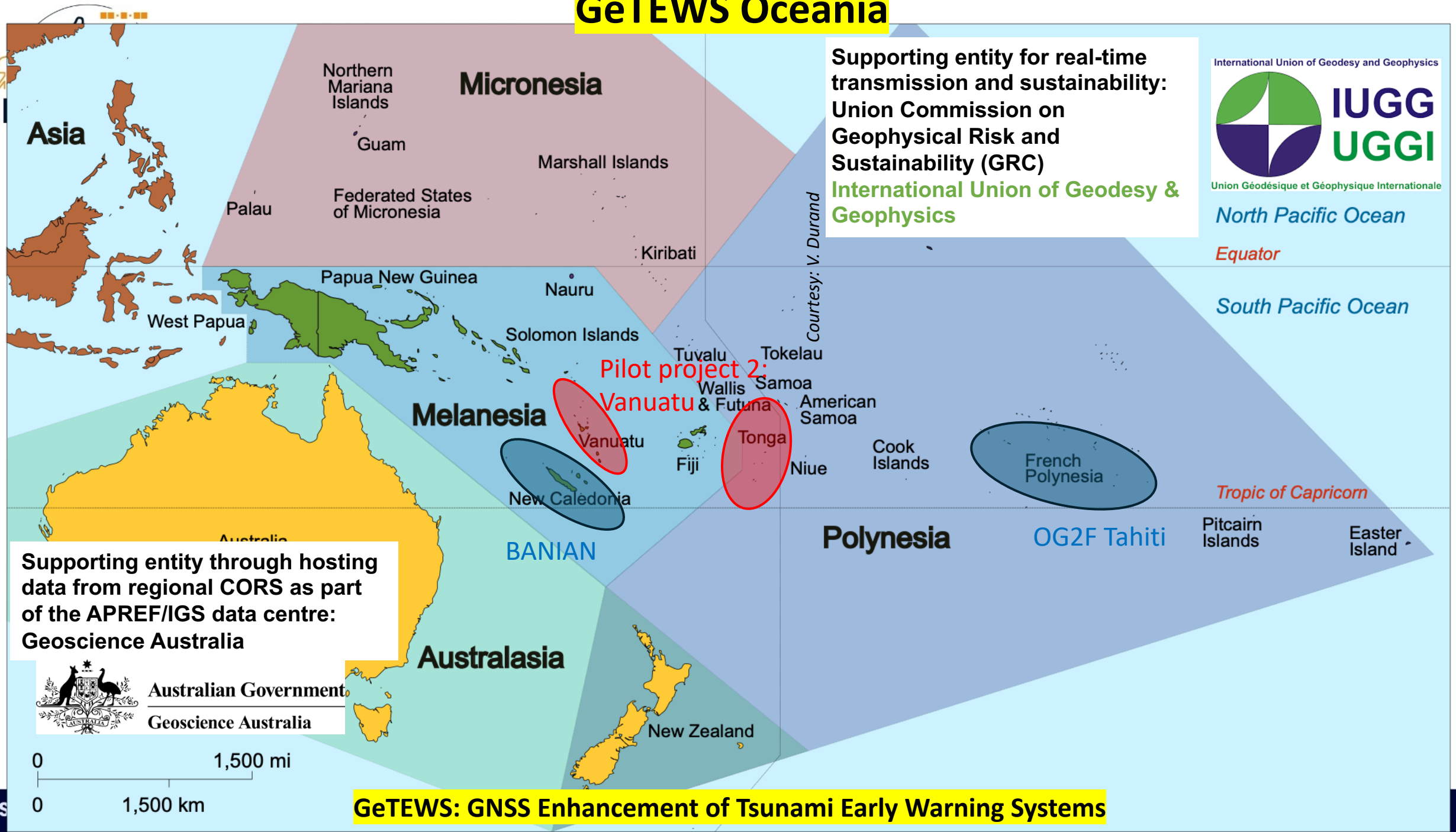
Viliami Folau et al.

Letter Of Agreement signed between Tonga Ministry of Lands, Central Washington University and IUGG for the **installation** of 9 GNSS CORS stations (5 installed), long-term **maintenance** and **operation**.

Initial funding (2 years) provided by CWU (contact: T. Melbourne) and IUGG (contact: J. LaBrecque) for material **and personnel** (salary and travel for 1 network manager and 1 network engineer)



GeTEWS Oceania



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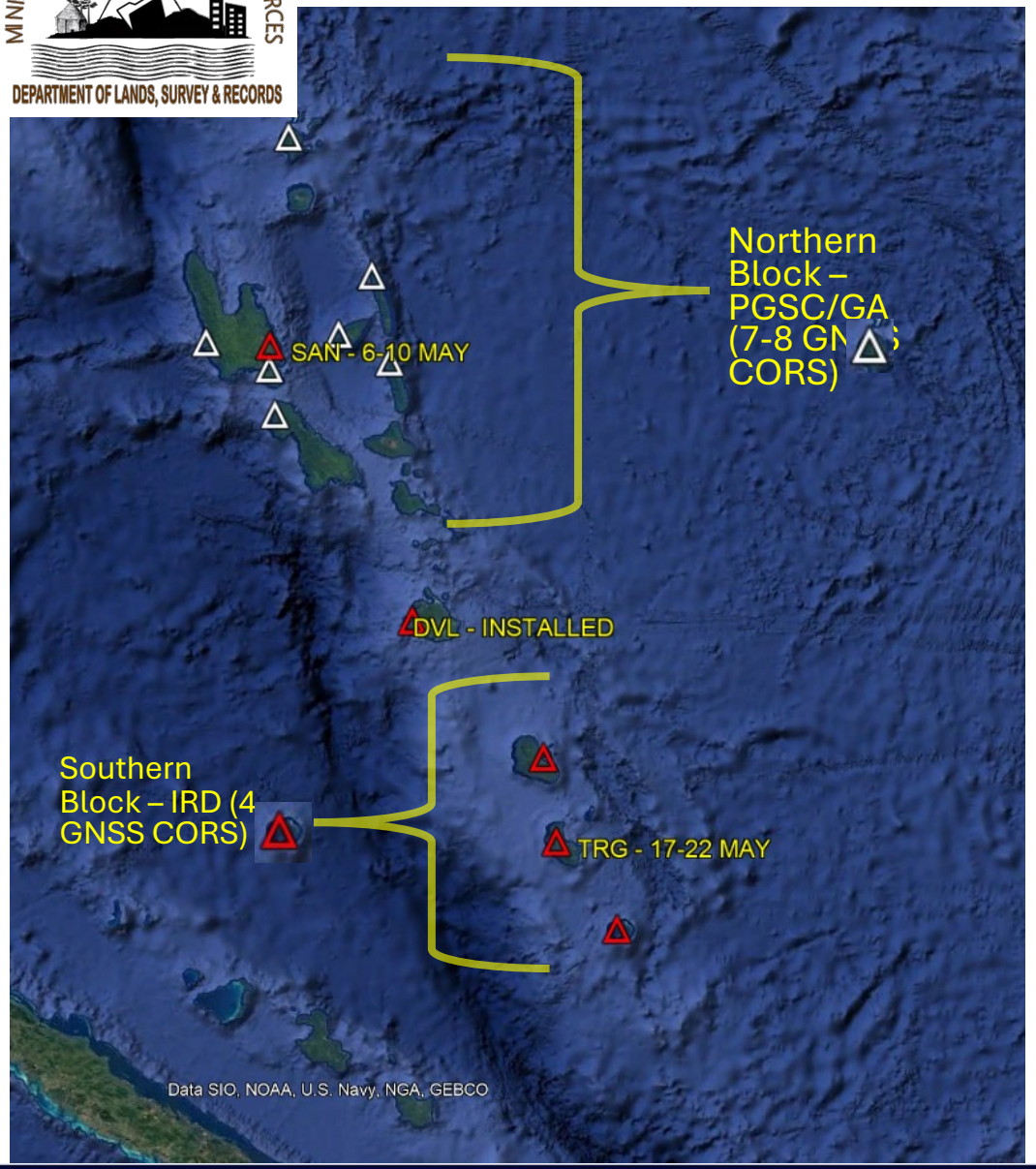
GeTEWS: GNSS Enhancement of Tsunami Early Warning Systems

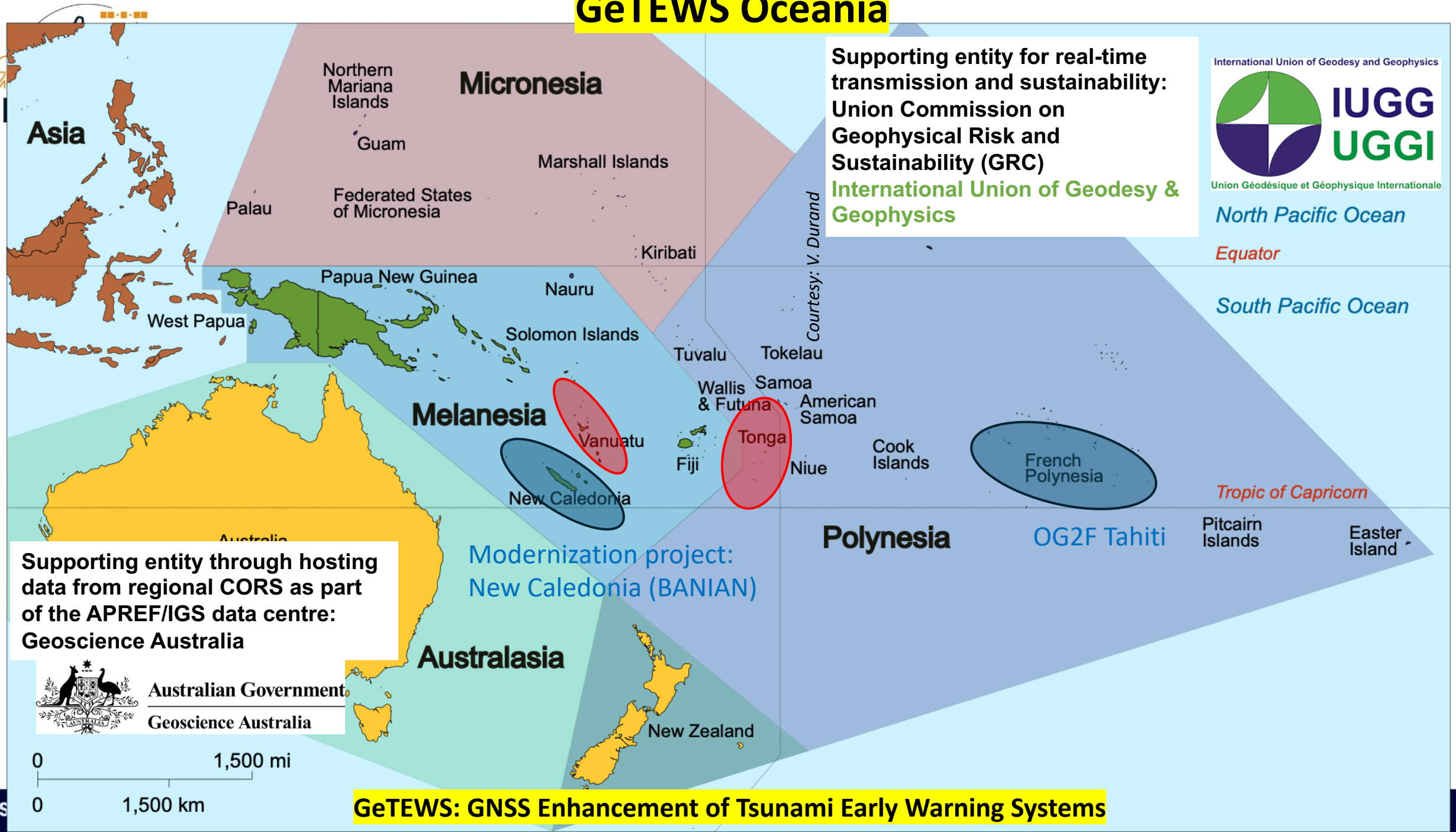
The Vanuatu pilot project

Noel Naki et al.

- For TEWS: 5-10 continuously working RT GNSS stations (Vanuatu North to South < 1000 km)
  - National effort lead by Ministry of Land and Natural resources (contact Noel Naki)
  - GA/IGS: PTVL
  - Southern block: IRD reinstall (2025-2026, contact: Virginie Durand) – CNES, IRD, UniCA suppor -> DVIL + TANA + SANC
  - Northern Block: PGSC supports re-establishment of CORS
- Co-location
  - With tide-gauges (in addition to PTVL): recommended
  - With seismic sensors (GEOSCOPE in Santo, future smartcable TAM-TAM linking New Caledonia to Vanuatu)



GeTEWS Oceania



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Modernization project:
New Caledonia (BANIAN)

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GeTEWS: GNSS Enhancement of Tsunami Early Warning Systems

New Caledonia: modernization plan

Perrine Drain et al.

DITTT
Direction des Infrastructures, de la Topographie et des Transports Terrestres

- DITTT progressively upgrades the BANIAN network (20 stations)

- GeTEWS/OCA provides 1-2 pairs of Trimble Alloy receiver + antenna for upgrading LPI1 (+YATE) – contact L. Rolland

- discussion of an agreement for IAAI, LPI1, MRTG, IDP1, YATE and HGHN real-time data sharing with GeTEWS

https://geodesie-nivellement.georep.nc/

Analysis infrastructure: ongoing efforts

1. access and select GNSS data (data sharing agreements and tools development)

GO-EUREKA

2. compute coseismic deformation or TEC in real-time

GPS-Cockpit, GUARDIAN, ALTRUIST

3. detect coseismic or tsunami waveforms in near real-time

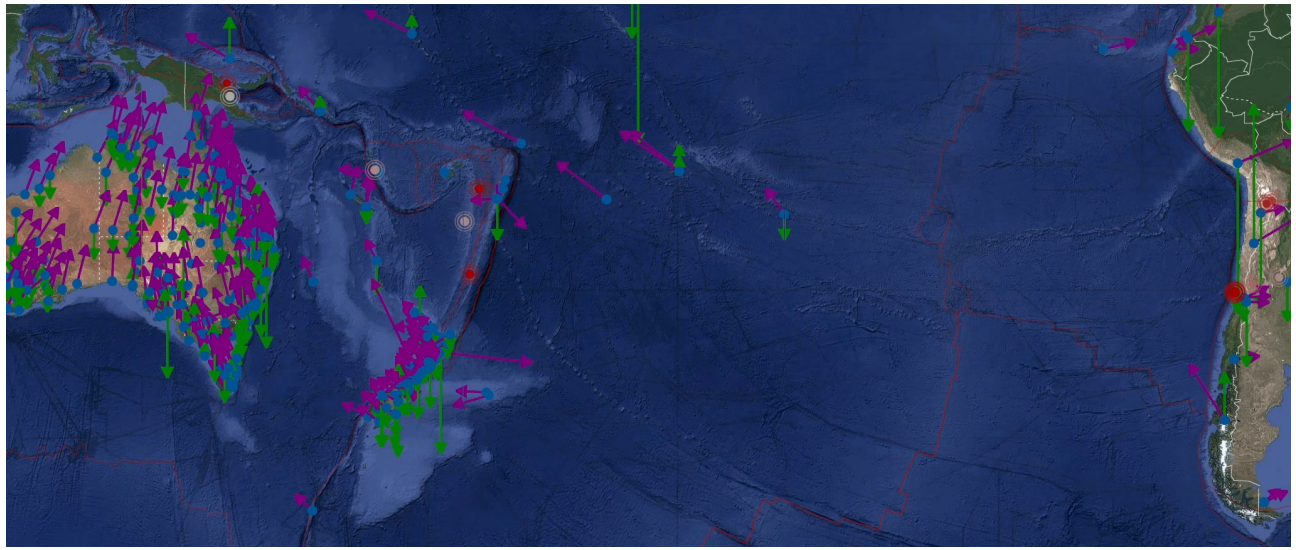
GUARDIAN, GO-EUREKA

4. Invert for the tsunami source and/or the tsunami wave height

Tsunami warning systems

GO-EUREKA/ITEC prototype (under developpement) go-eureka.eu

CWU GPS Cockpit *https://www.geodesy.org/realtime/gpscockpit/*



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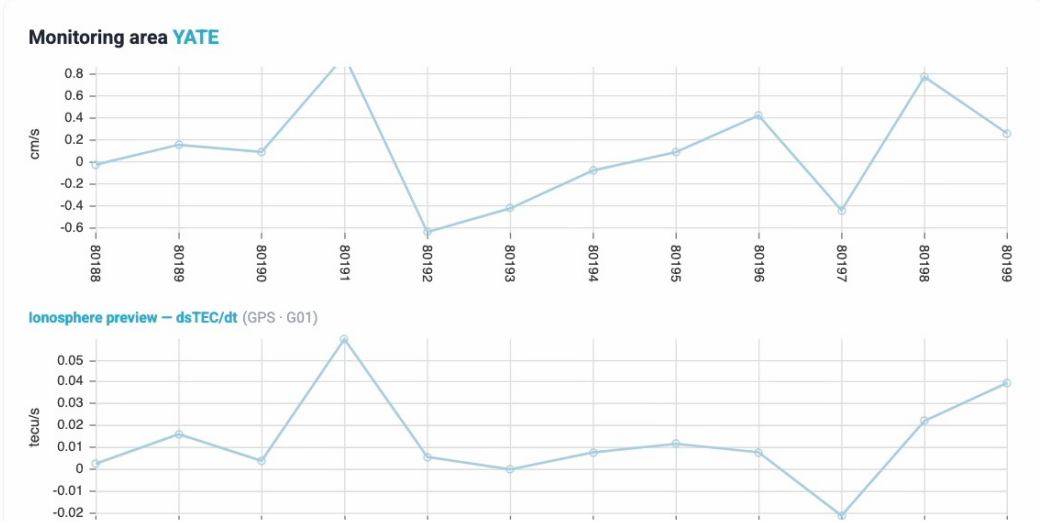
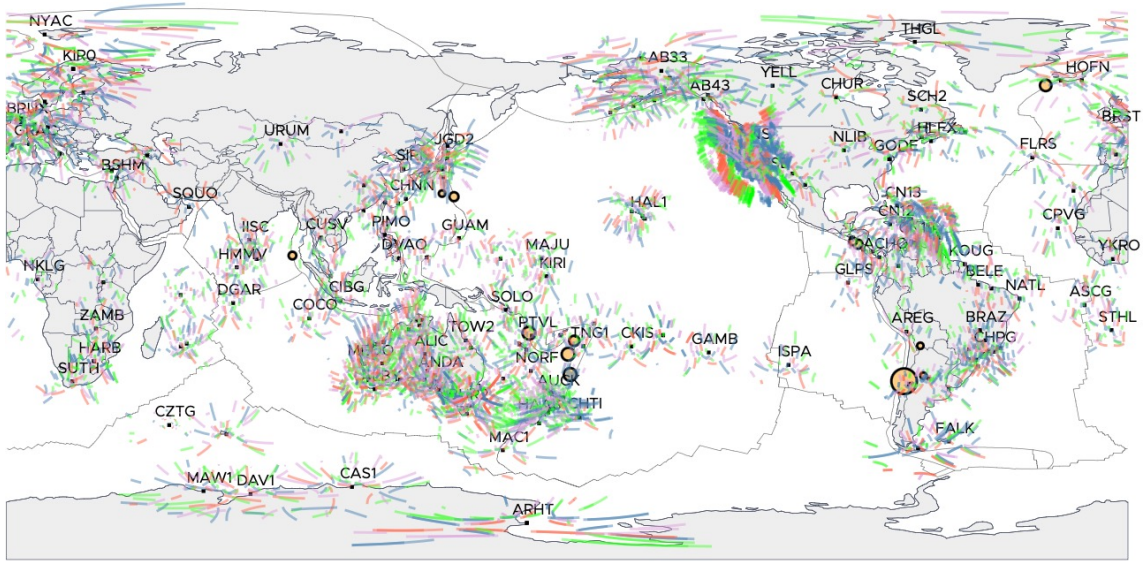
Tsunami warning systems

AXA-UNESCO ALTRUIST http://altruist-project.com



JPL GUARDIAN https://guardian.jpl.nasa.gov



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Please Join the GeTEWS Oceania Initiative !

Thank you!

Supplements

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- If you do not use this presentation template, please set your slide size to Widescreen or 16:9.
- Typography for optimal readability (virtual or in-person):
  - ❖ **Fonts:** Arial, Times New Roman, Calibri, Helvetica, Cambria
  - ❖ **Titles:** minimum 32 pt
  - ❖ **Content:** minimum 20 pt
- **Colors:** Do not use yellow, orange, or violet. Prefer black, dark gray, and red (the latter for emphasis only).
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