



Pacific
Community
Communauté
du Pacifique

Positioning in the Pacific Islands

Andrick Lal

United Nations/Nepal Workshop on the Applications of Global
Navigation Satellite Systems

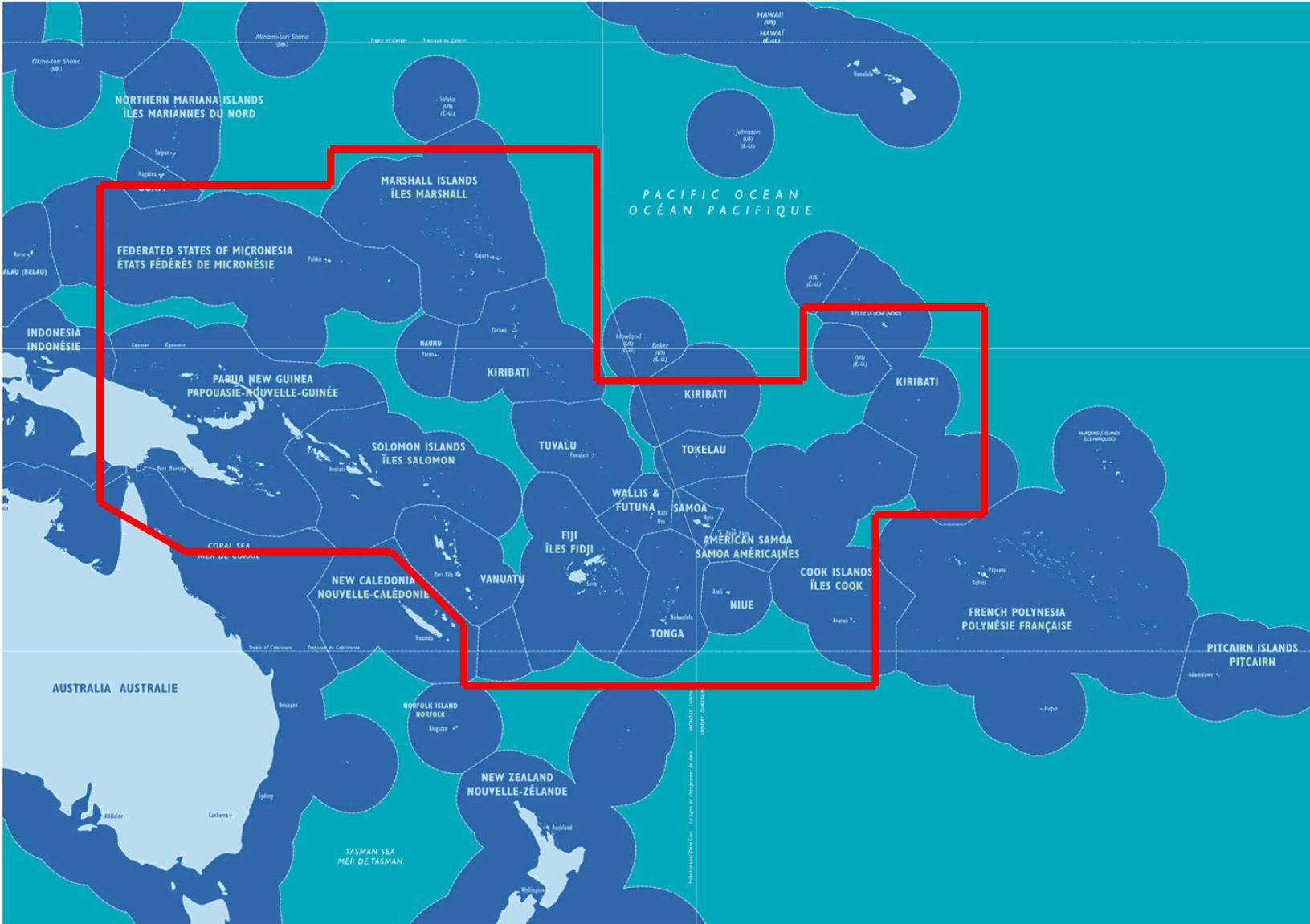
Kathmandu - Nepal

15th December 2016

Presentation Outline

- **Introduction**
- **History**
- **Positioning in the Pacific Islands**
- **Importance**
- **Building Capacity & Resilience**
- **Future Directions**
- **Pacific Geospatial & Surveying Council**

SPC Member Countries



SPC Geoscience Division Goal



“to apply geoscience and technology to realise new opportunities for improving livelihoods of Pacific communities.”



SPC Headquarters: Noumea. Regional Offices: Suva, Fiji Islands and Pohnpei, Federated States of Micronesia.

Country Office: Honiara, Solomon Islands.

For contact details – Website: www.spc.int Email: spc@spc.int

Global Geodetic Reference Frame

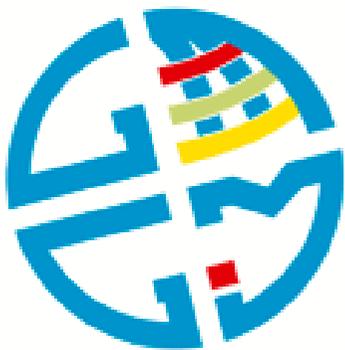


The UN-GGIM Roadmap...

In February 2015 the UN General Assembly adopted the resolution “A Global Geodetic Reference Frame for Sustainable Development” - the first resolution recognizing the importance of a globally-coordinated approach to geodesy.

As per UN Resolution A/69/L.53

In the Pacific...Australia, Fiji, New Zealand, Papua New Guinea, Samoa, Solomon Islands, Tuvalu, Vanuatu



UN-GGIM
UNITED NATIONS INITIATIVE ON
GLOBAL GEOSPATIAL
INFORMATION MANAGEMENT

United Nations
General Assembly
Sixty-ninth session
Agenda item 7
Report of the Economic and Social Council

Doc. No. A/69/L.53
Date: Limited
24 February 2015
Original: English

A global geodetic reference frame for sustainable development

The General Assembly,
Reaffirming the purposes and principles of the Charter of the United Nations,
Recalling also its resolution 46/84 of 4 December 1991, in which the Assembly endorsed the resolution entitled “The Space Millennium: Vision Declaration on Space and Human Development”, which included, inter alia, the intention to improve the efficiency and security of transport, search and rescue, geodesy and other activities by promoting the enhancement of universal access to and compatibility of space-based navigation and positioning systems, including Global Navigation Satellite Systems,
Recognizing further its resolution 72/251 of 20 December 2007, in which it endorsed the Plan of Implementation of the World Summit on Sustainable Development¹ and means of implementation, which included, inter alia, strengthening cooperation and coordination among global observing systems and research programmes for integrated global observations, taking into account the need for building capacity and sharing of data from ground-based observations, satellite remote sensing and other sources among all countries,

¹ Adopted by the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNEP/COPUS) in Vienna from 19 to 24 July 1999 (see A/CONF.181/L.1, chap. I, resolution 1).

² Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August to 4 September 2002 (UN Doc. ESD/P.2/Inf.1, paras. 1.13.13.1.1 and 1.13.13.1.2, annex, chap. I, resolution 1, annex).

Photo credits: CC

Newsletter 03 UN-GGIM – Global Geodetic Reference Frame Working Group

Will reduce flood losses

The Global Geodetic Reference Frame is key element in a project aiming to develop integrated flood management for the Pacific.

...It is highly susceptible to flooding, with severe flood and system that has substantial impact for the country, via rainfall, sea level rise, erosion of the Pacific Ocean.

...It is highly susceptible to flooding, with severe flood and system that has substantial impact for the country, via rainfall, sea level rise, erosion of the Pacific Ocean.

Flood preparedness

The surveyor general and his staff, through the national social and economic costs, Pacific island countries face a major challenge that is growing in complexity. Flood preparedness and response, however, this is changing in a project addressing flooding of the Pacific.

Topography model

Among the various data gathering procedures, the flood warning on-site, an advanced topography model for the low-lying areas of flood using light and elevation ranging (LEAP) survey. LEAP is a mobile ranging method used for mapping the topography of the Pacific.

Seamless with a Reference Frame

Having a Global Geodetic Reference Frame is a key for precise observation. The reference frame will allow the future work to be seamlessly combined with the local project dataset.

Sea level rise

Sea level rise is a major concern for many Pacific island countries.

Newsletter 06 UN-GGIM – Global Geodetic Reference Frame Working Group

Significant benefits to the study of our changing planet

The UN General Assembly resolution “A Global Geodetic Reference Frame for Sustainable Development” adopted in February 2015 has been an eye-opener for society to the understanding of the importance of global geodesy.

Geodesy is poorly understood by the public, but it is fundamental to sustainable development. In the navigation, geodesy provides the spatial reference system for global geodesy and other contributions will be for their work in the field of the changing planet.

Insulation space

Geospatial capacity building

The UN resolution has influenced the Pacific Island Countries to establish the Pacific Geospatial and Surveying Centre in the Pacific region. Available geospatial information provides a critical foundation for sustainable economic development.

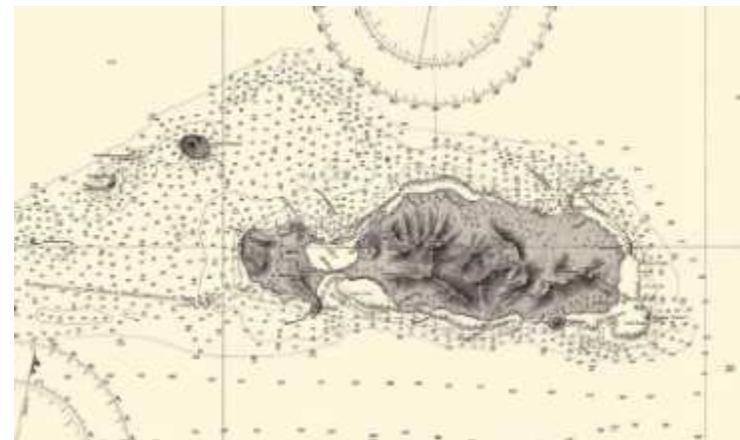
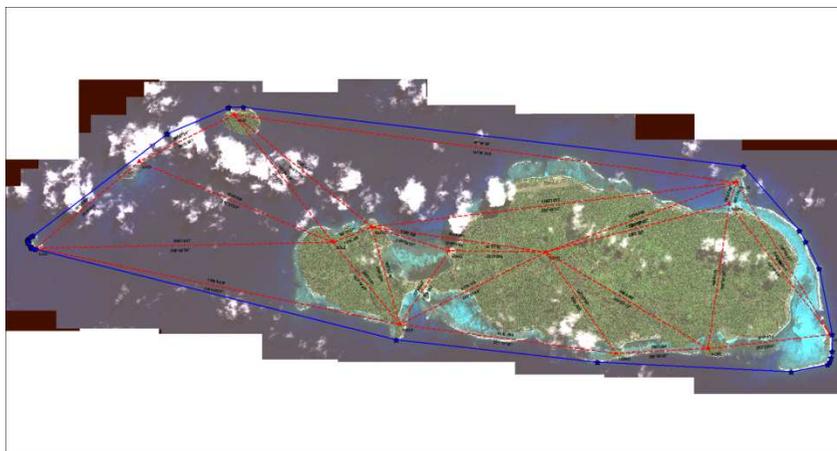
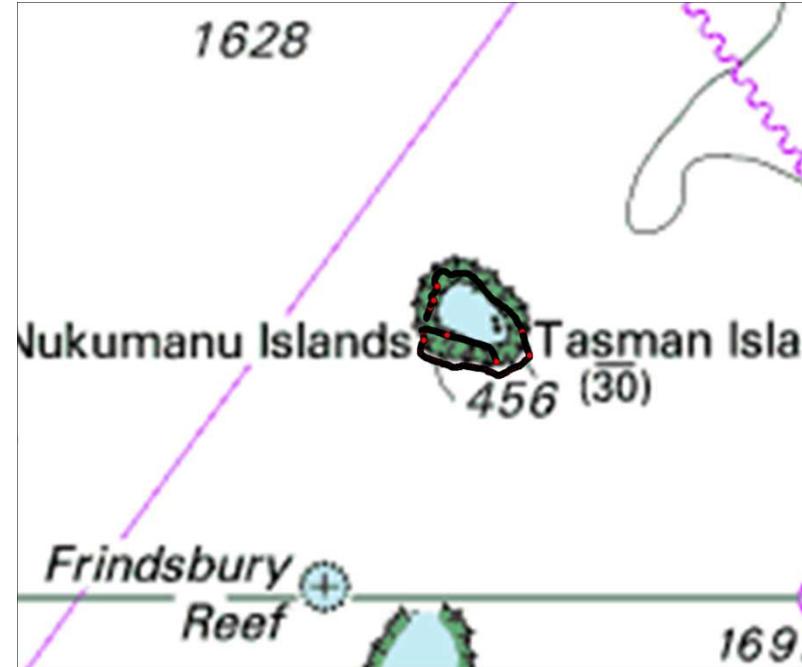
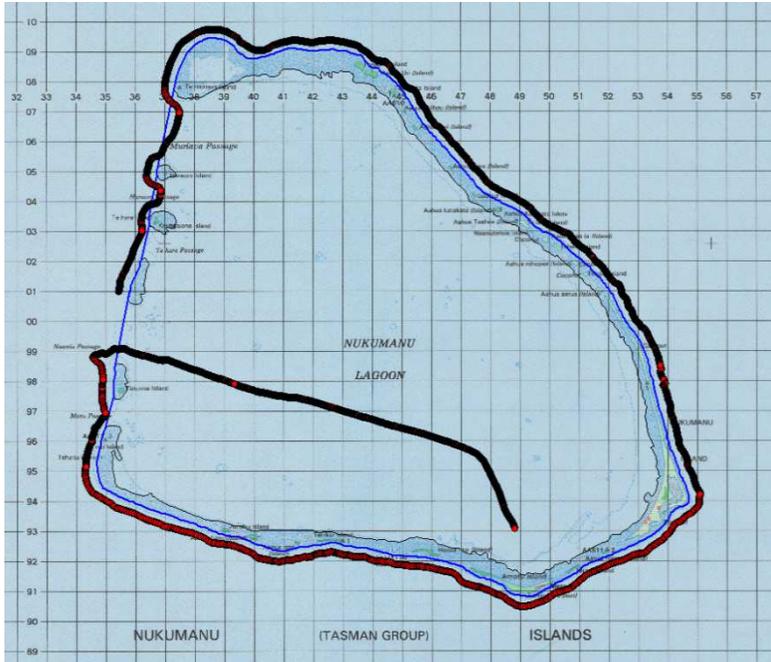
Clearing global change

The Global Geodetic Reference Frame is fundamental to monitoring global change, whether observed from the surface of the planet or from satellites in space. Our own research includes:

Positioning Infrastructure underpins ALL Infrastructure



Topographical Maps and Hydrographic Charts





Pacific Sea Level Monitoring Project (PSLMP)

- The Pacific Sea Level Monitoring (PSLM), operates under the Climate and Oceans Support Program in the Pacific (COSPPac). It is a continuation of the 20-year South Pacific Sea Level and Climate Monitoring Project (SPSLCMP)
- Comprises of a tide gauge network component and geodetic monitoring component
- To monitor sea level over a long time period, vertical crustal movement of the earth needs to be accounted for, to provide an absolute reading from the tide gauge
- Geodetic monitoring component is maintained by Geoscience Australia
 - Providing a long term height time series of data
 - Consistent, accurate, global geocentric terrestrial reference frame – ITRF2008
 - Meeting accuracy requirements to match the expected sea level rise determined from over a century previous global tide gauge measurements of 1mm/annum



Climate and Oceans Support
Program in the Pacific

Pacific Sea Level Monitoring Project



Pacific
Community
Communauté
du Pacifique



Tide Gauge Station

<http://www.bom.gov.au/pacific/projects/pslm/index.shtml>

<http://www.bom.gov.au/pacific/tuvalu/index.shtml>



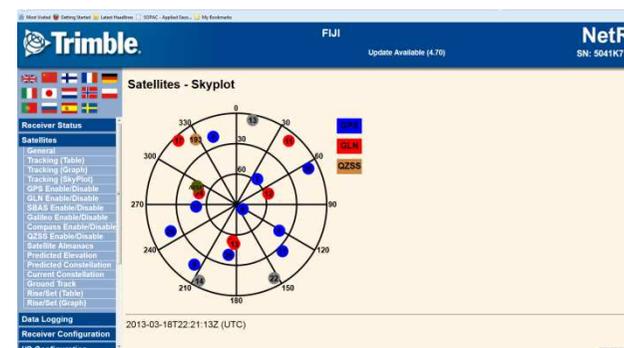
GNSS Station (CORs) – Lautoka, Fiji.

- Established in November 2002; Supported by Survey Department - Fiji



Index of /geodesy-outgoing/gnss/data/

Name	Size	Date Modified
[parent directory]		
campaign/		5/16/13, 12:00:00 AM
Creative_Commons_Copyright_Authorisation.txt	748 B	11/15/12, 12:00:00 AM
daily/		6/2/16, 1:38:00 AM
GA_NTRIPCaster_Info.txt	3.6 kB	1/18/13, 12:00:00 AM
GNSS_data_Readme.txt	4.7 kB	11/4/12, 1:00:00 AM
highrate/		1/1/16, 12:17:00 AM
hourly/		6/2/16, 1:36:00 AM
sprgn/		6/2/16, 1:42:00 AM



<ftp://ftp.ga.gov.au/geodesy-outgoing/gnss/data/>

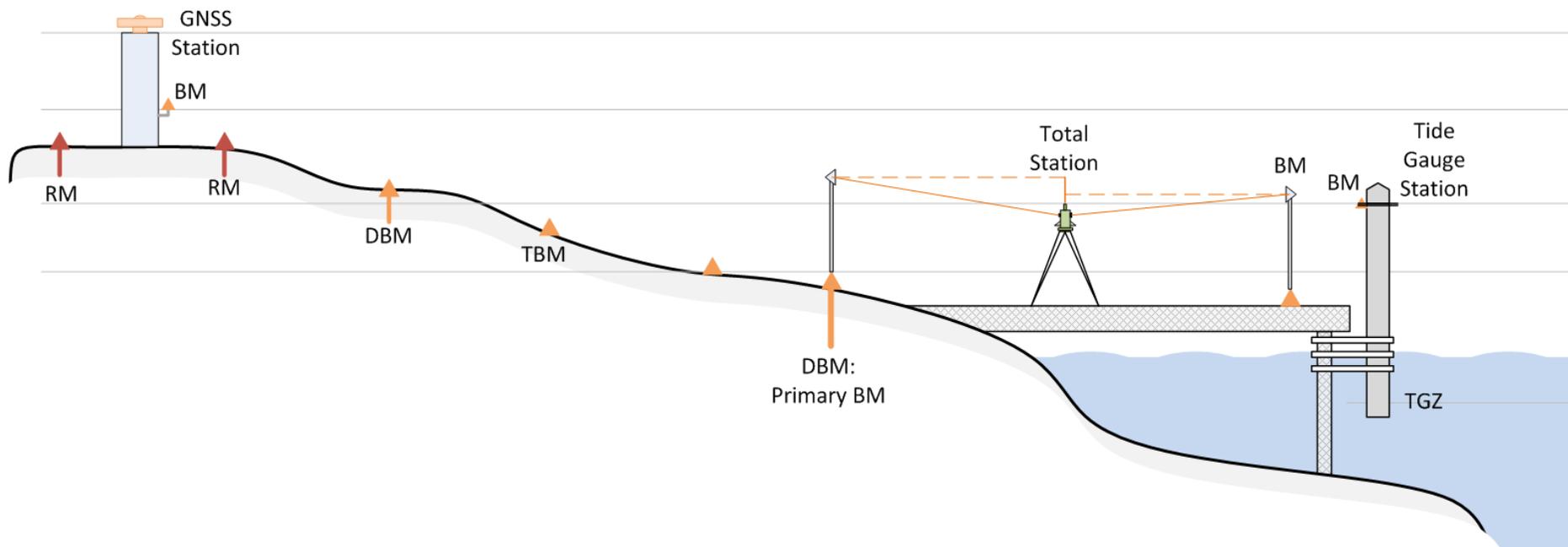
<http://auscors.ga.gov.au/status/>

<http://www.ga.gov.au/scientific-topics/positioning-navigation/geodesy/gnss-networks>



13 sites across the pacific

- 1 x permanent tide gauge at each, measuring local sea level
- 1 x Constant GNSS station at each, measuring local earth movement in an absolute coordinate system
- Regular levelling survey between the tide gauge and CGNSS station allow absolute determination of the vertical height of the tide





Map Satellite

00NA - Darwin Supreme Court (NT)
 01NA - Palmerston (NT)
 02NA - Darwin Hospital (NT)
 20NA - Alice Springs Plaza (NT)
 21NA - Alice Springs AZRI (NT)
 ALBY - Albany (WA)
 ALIC - Alice Springs (NT)
 ANDA - Andamooka (SA)
 ARD2 - Armidale (NSW)
 ARMC - Aramac (QLD)
 ARUB - Arubiddy (WA)
 AUCK - Whangaparaoa No 3
 BALA - Baladonia (WA)
 BARR - Barrack Heights (NSW)
 BBOO - Buckleboo (SA)
 BDLE - Bairnsdale (VIC)
 BDST - Beaudesert (QLD)
 BDVL - Birdsville (QLD)
 BEE2 - Beersleigh 2 (QLD)

Map data ©2016 Google, INEGI, SK telecom, ZENRIN | Terms of Use

Copyright Disclaimer Privacy Accessibility Information Publication Scheme Freedom of Information Contact us



GNSS Station (CORs) – Lautoka, Fiji.

- IGS Network

IGS INTERNATIONAL GNSS SERVICE

Network Products Working Groups Resources About Search

Network

Map

Map data ©2016 Google, INEGI, SK telecom, ZENRIN | Terms of Use

Options >>>

Show 25 entries

Copy CSV Excel PDF Print / View Entire Table

Site	Network(s)	Long Name	City	Country	Agency	Lat	Lo
ABMF	IGS	ABMF00GLP	Les Abymes	Guadeloupe	IGN	16.2622222	
ABPO	IGS	ABPO00MDG	Antananarivo	Madagascar	JPL	-19.0180556	
ADIS	IGS	ADIS00ETH	Addis Ababa	Ethiopia	BKG	9.0350000	
AIRA	IGS	AIRA00JPN	Aira	Japan	GSI	31.8238889	
AJAC	IGS	AJAC00FRA	Ajaccio	France	IGN	41.9272222	
ALBH	IGS	ALBH00CAN	Victoria	Canada	GSC	48.3897222	
ALGO	IGS	ALGO00CAN	Algonquin Park	Canada	NRCCan	45.9586111	
ALIC	IGS	ALIC00AUS	Alice Springs	Australia	GA	-23.6700000	

<http://www.igs.org/network>

IGS INTERNATIONAL GNSS SERVICE

Network Products Working Groups Resources About Search

Network

LAUT Station Information - Site Page

SiteID	Country	Station Log	DOME Number	Constellation	Data Center	Receiver	Antenna	Calibration	Clock	Collocation
LAUT	Fiji	laut_20160115.log	50804M002	GPS GLONASS Galileo BeiDou QZSS	GA	TRIMBLE NETR9	TRM59800.00 + NONE	ROBOT	INTERNAL	None

LAUT Quality

Daily RINEX observations

Expected 26.23 k • Recorded 26.02 k | November 16, 2016

Receiver + Firmware

Antenna

2001-11-23 ASHTECH UZ-12 - CJ00	2001-11-23 ASH701945C_M SCIS
2004-10-04 ASHTECH UZ-12 - ZC00	2012-04-25 TRM59800.00 NONE
2006-11-03 ASHTECH UZ-12 - CJ00	

Cycle Slips

Cycle Slips 24 | November 16, 2016

http://www.igs.org/igsnetwork/network_by_site.php?site=laut

Online GNSS Solutions

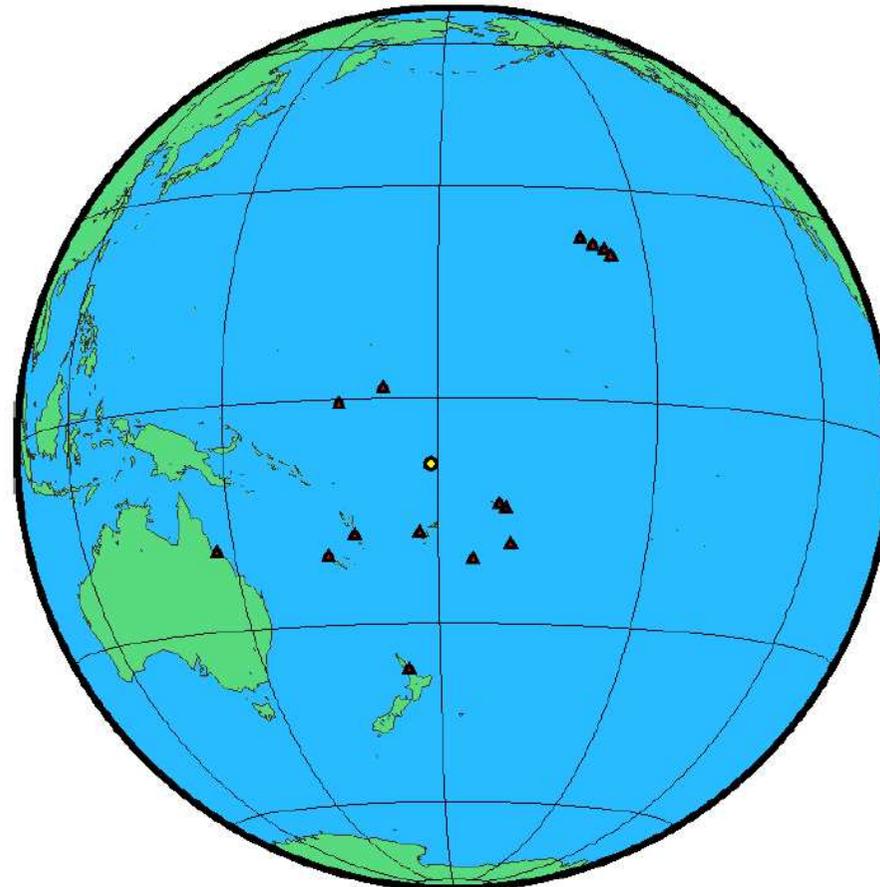
- AUSPOS, OPUS, PositionNZ, Canadian PPP



Australian Government
Geoscience Australia

↑ Topic Home

- Astronomical Information
- **Geodesy and Global Navigation Systems**
- Basics
- Geodetic Techniques
- Global Navigation Satellite System Networks
- Geodetic Datums
- Regulation 13 Certificates
- Asia-Pacific Reference Frame

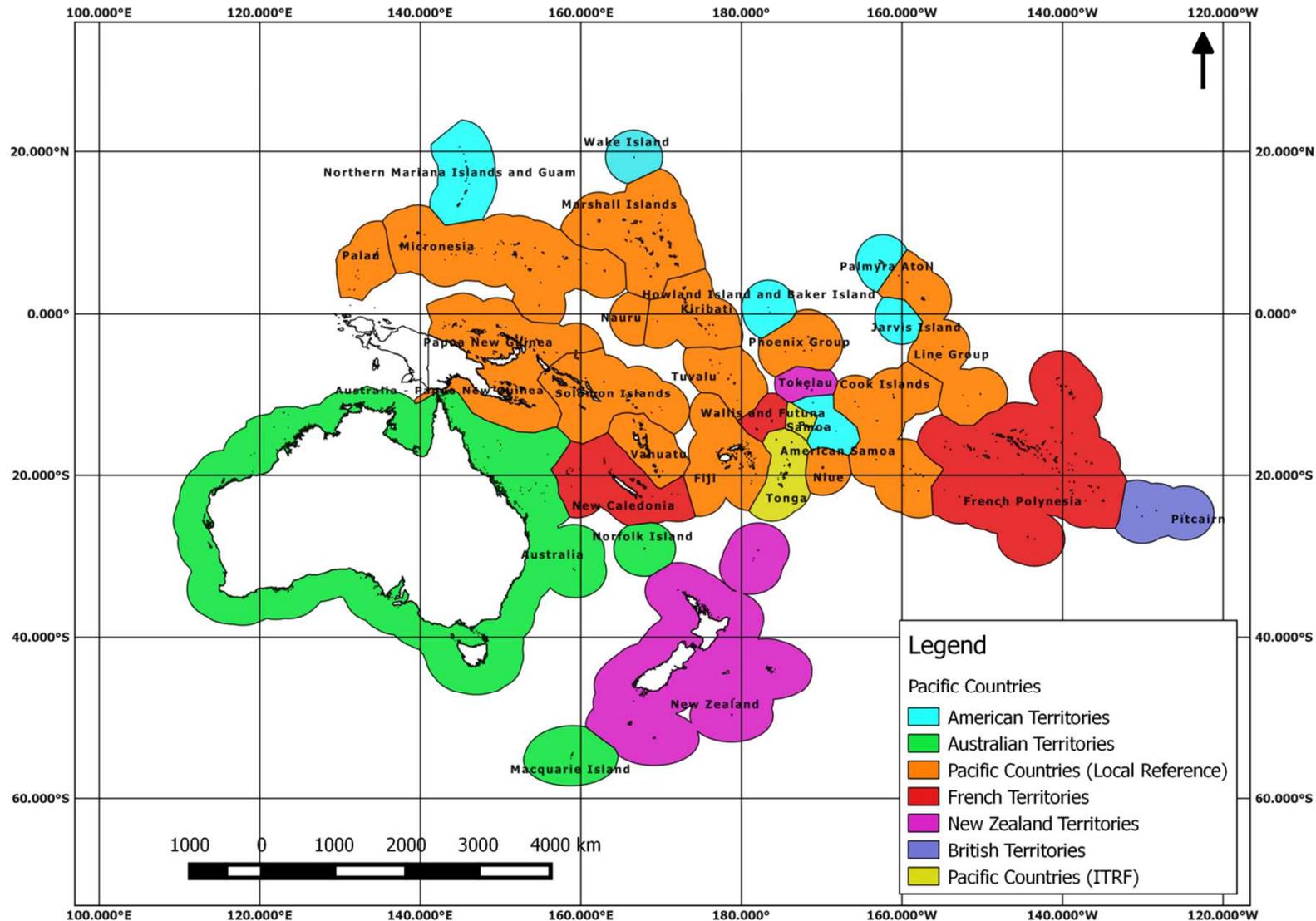


Date	User Stations	Reference Stations	Orbit Type
2016/10/01 00:00:00	TUVA	ASPA AUCK HNLC KIRI KOKB KOUK LAUT MAUI MKEA NAUR NIUM PTVL SAMO TONG TOW2	IGS final

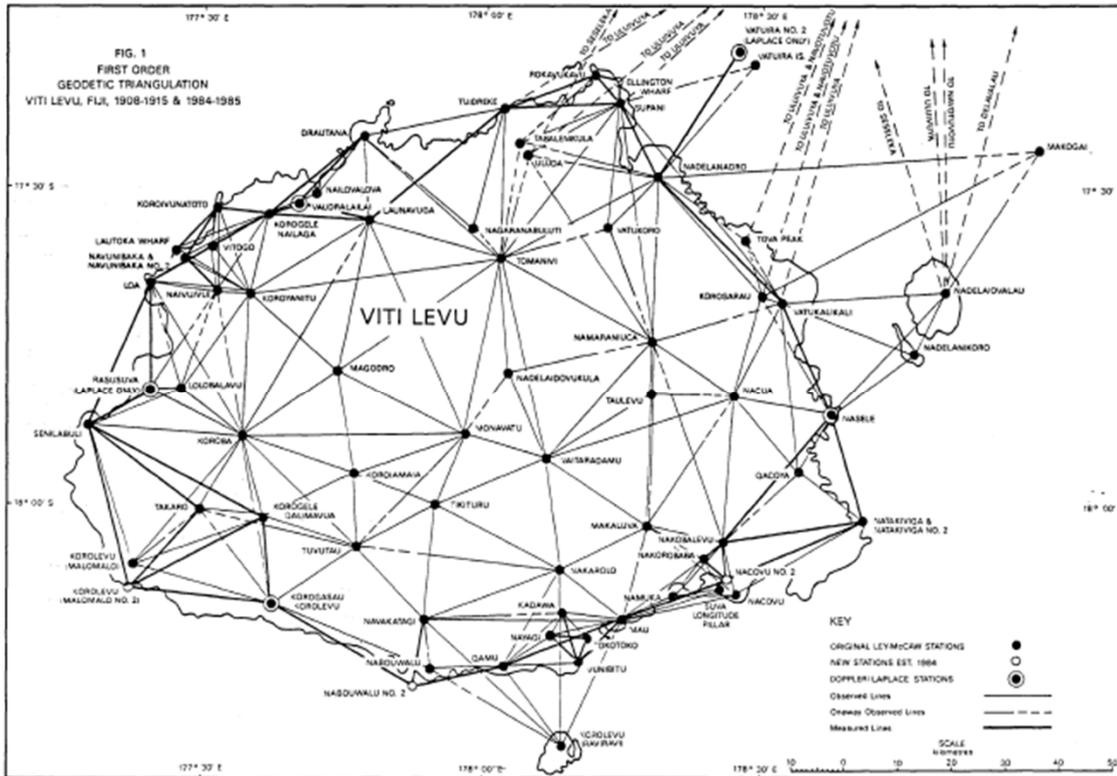
Geodetic Reference Frame - Pacific



Pacific Community
Communauté du Pacifique



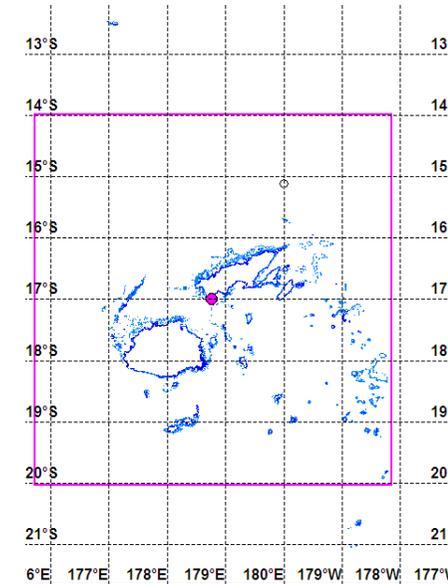
Fiji Islands Geodetic Reference Frame



THE DEFINITION AND ADJUSTMENT OF THE FIJI
GEODETIC DATUM -1986

J. Hannah and J. Maseyk

Department of Survey and Land Information, Wellington, New Zealand



Fiji Map Grid (FMG1986 is based on the Gauss-Krüger Transverse Mercator projection where:

Latitude of Origin = 17° 00' South

Central Meridian = 178° 45' East

Scale Factor at Origin = 0.999854

False Northing = 4 000 000m

False Easting = 2 000 000m

Ellipsoid of reference = WGS 72

where $a = 6378135m$

$1/f = 298.26$

GNSS Surveys



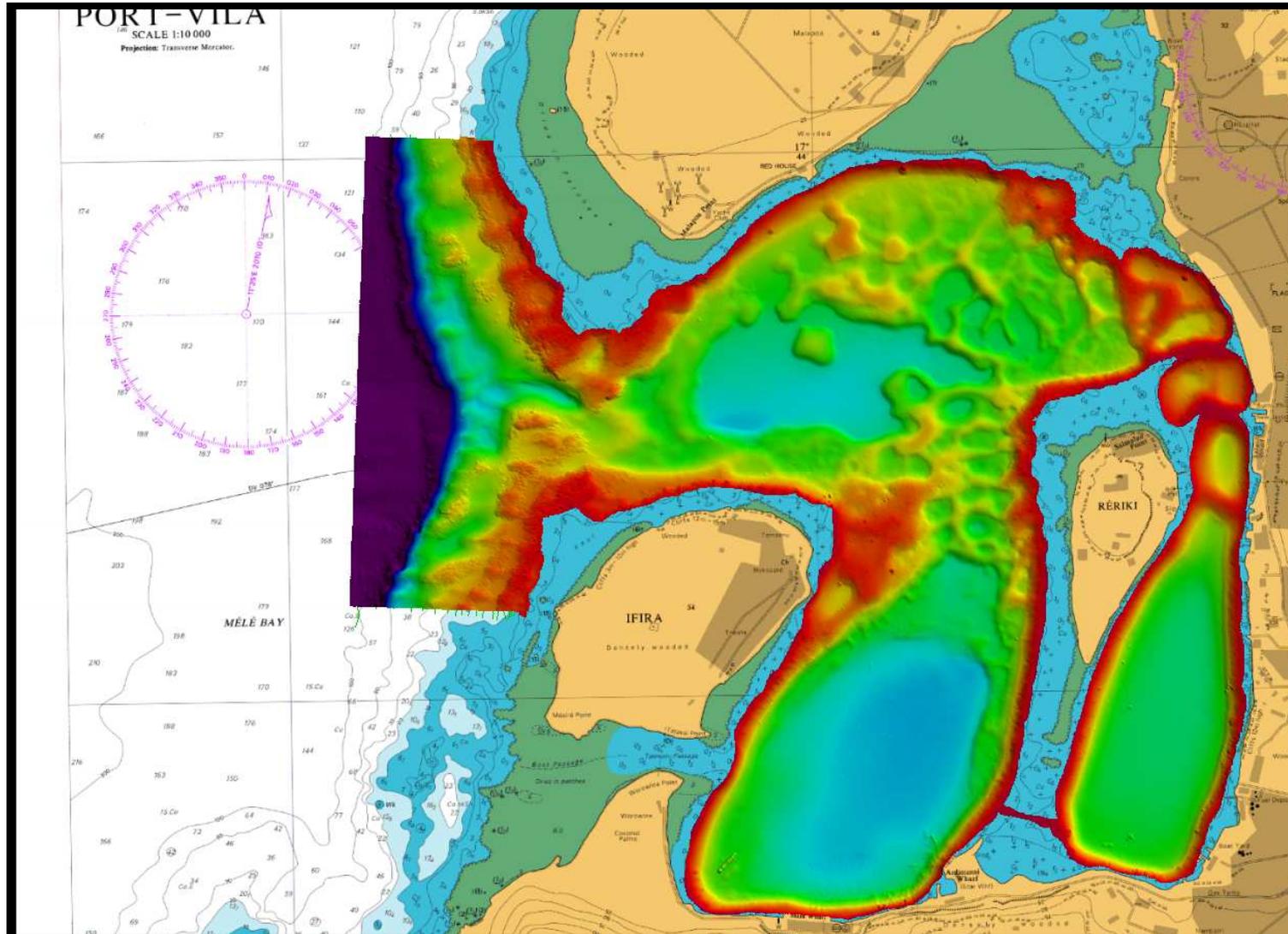
Tide Gauge Installation & Tide Watch



Hydrographic Surveys

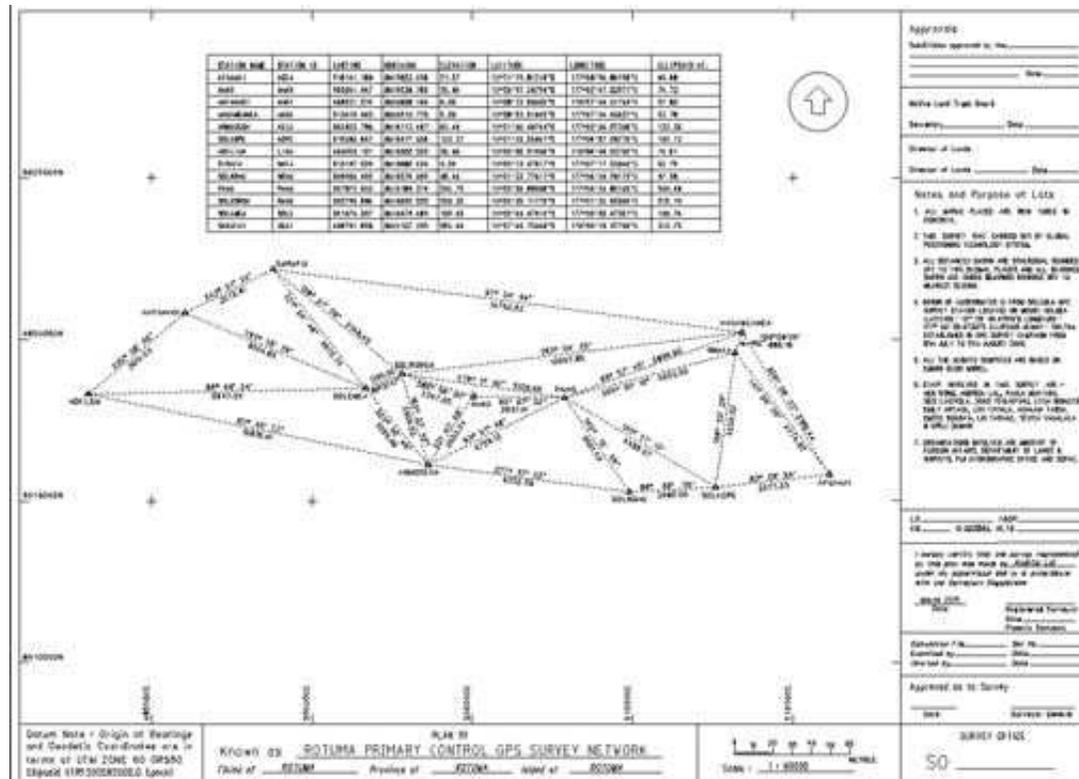


Pacific
Community
Communauté
du Pacifique



Local Vertical Reference Frame

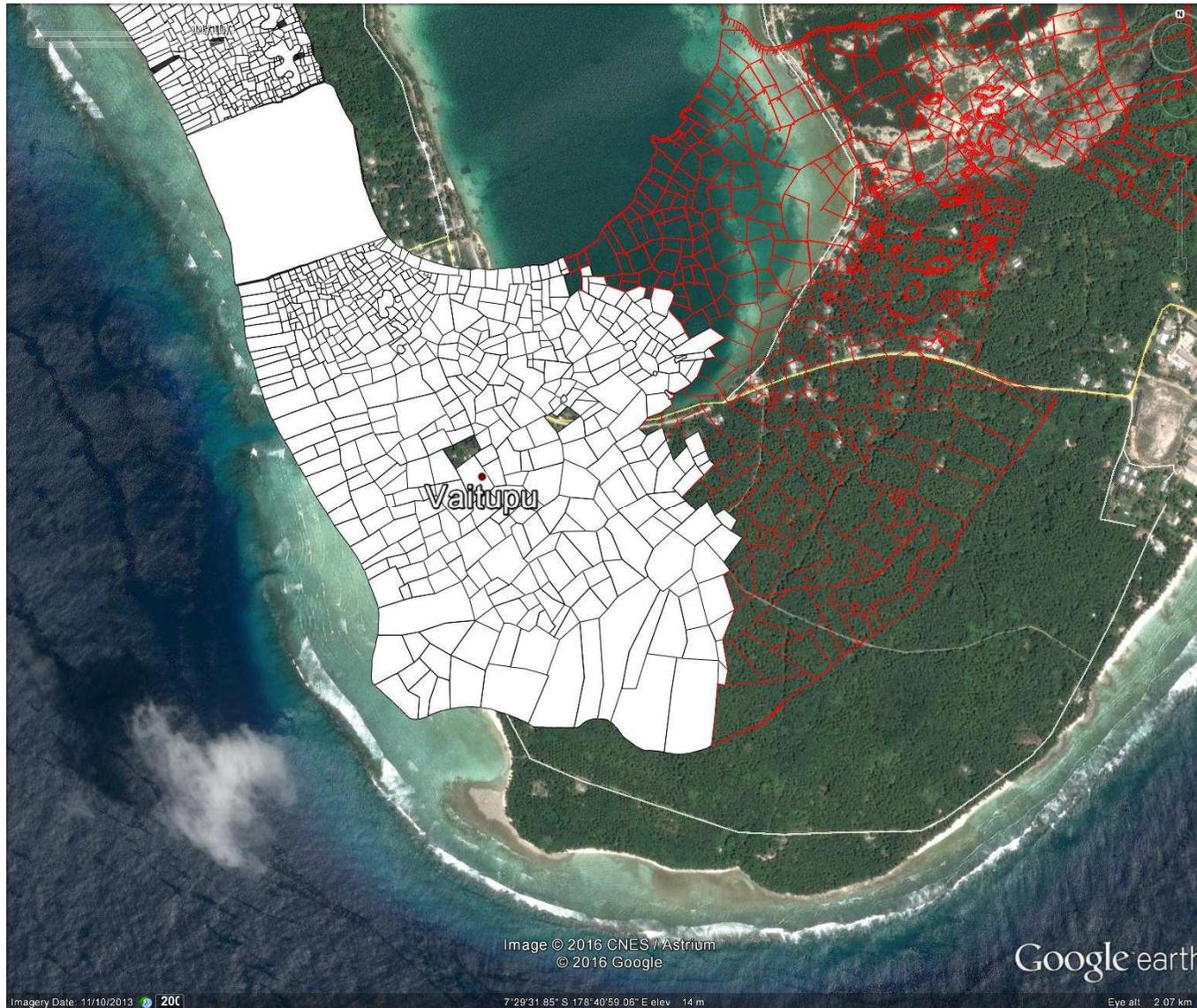
- A local Constant GNSS site can provide the opportunity to preform accurate baseline measurements when the user only has 1 geodetic quality GNSS receiver available.
- Having observations from a CORS available will allow local Lands & Survey departments to update their current network of survey control from a Local coordinate system onto the International Terrestrial Reference Frame [currently ITRF2008].



Cadastre and Satellite Imagery



Pacific
Community
Communauté
du Pacifique



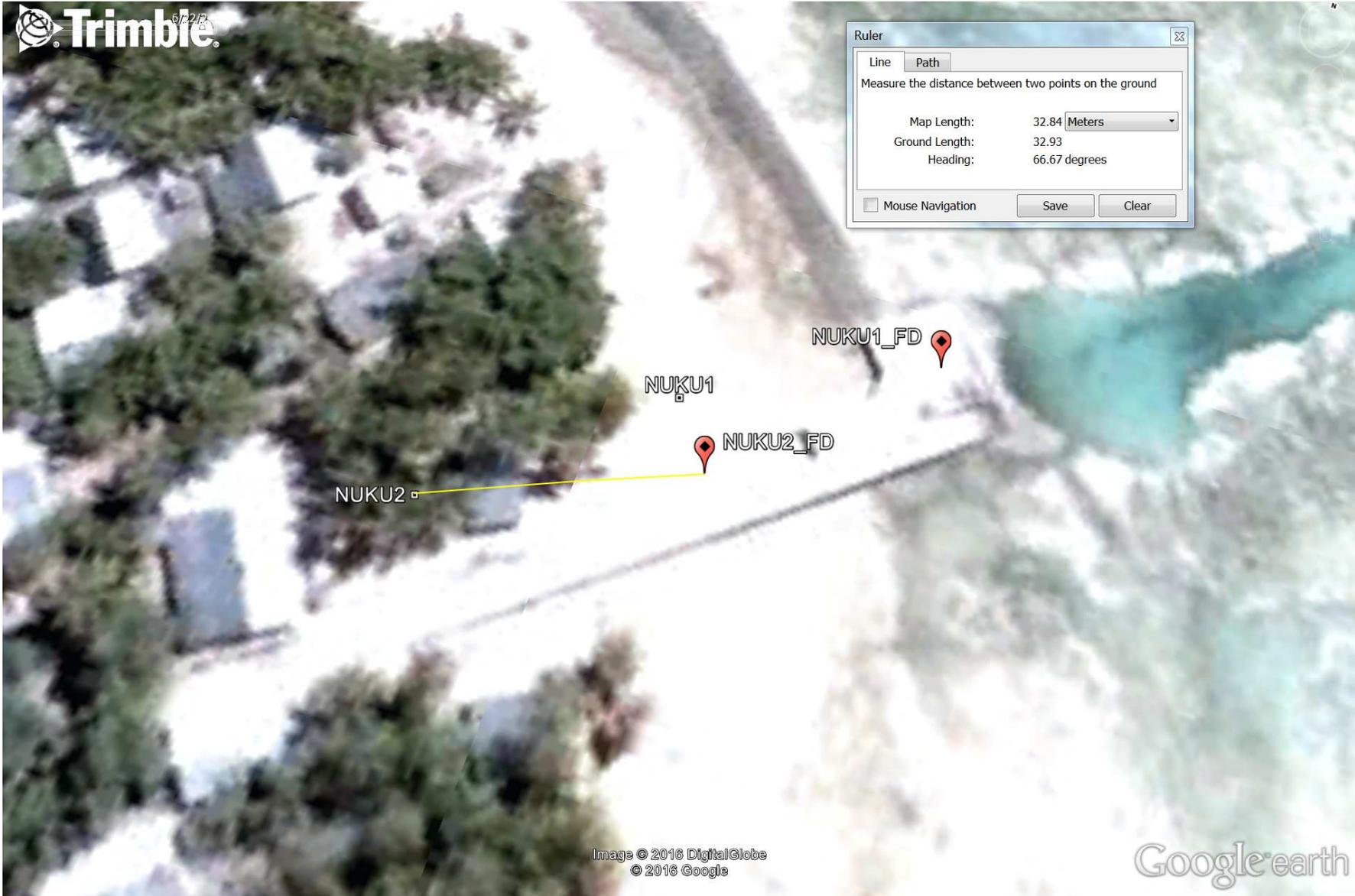
GNSS Surveys – Reference Image Points



Pacific
Community
Communauté
du Pacifique



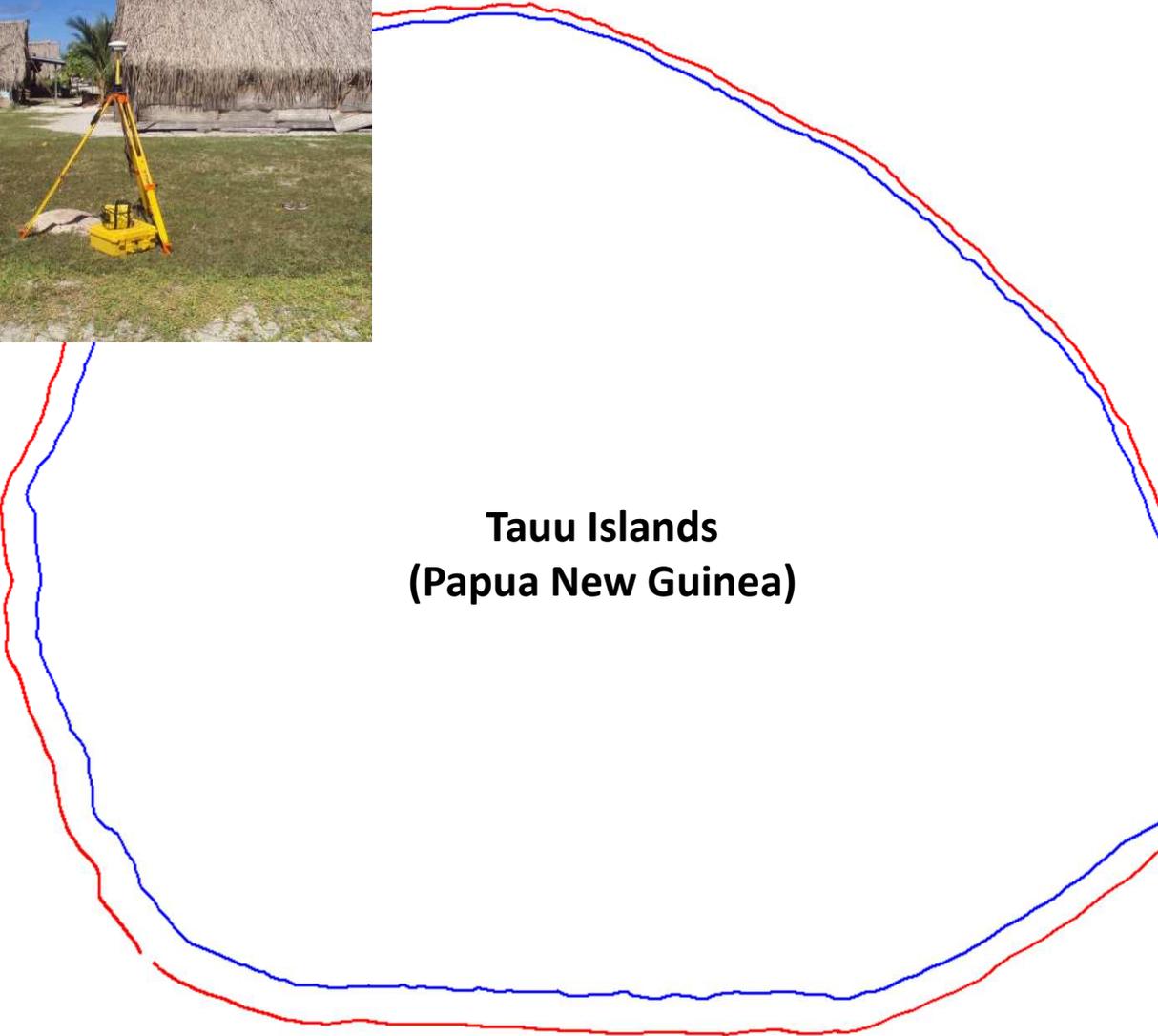
GNSS Surveys & Satellite Imagery



Reef Delineation Surveys - GNSS



**Tauu Islands
(Papua New Guinea)**



Why it is Important?

- **Natural Disasters**
- **Climate Change**
- **Sea Level Changes**
- **Urban Development**
- **and etc.**



Building Capacity & Resilience

- **Survey Technology**
- **Field Survey Operations**
 - **Planning**
 - **Geodetic/Hydrographic/Topographical Surveys**
 - **Survey Data Processing & Analysis**
 - **Reporting**
- **Survey Standards & Specifications**
- **Survey Guidelines**

Future Directions

- **Geodetic Infrastructure**
- **Global Geodetic Reference Frame**
- **Geodetic Registry (Spatial Database)**
- **Capacity Development for Pacific**

Pacific Geospatial & Surveying Council



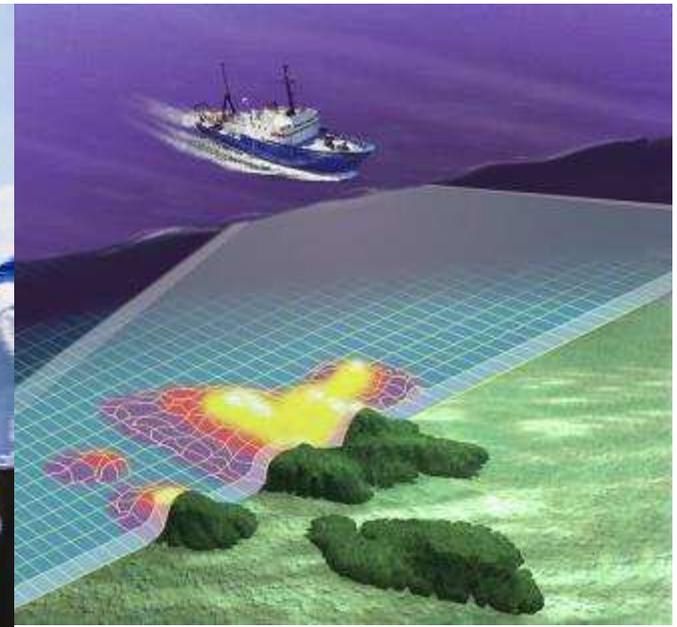
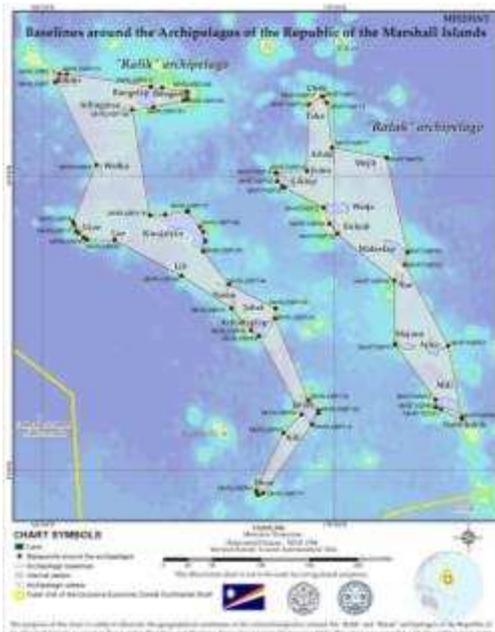
- Independent regional body advancing geospatial and surveying standards and capacity
- Established in the margins of the GIS/RS User Conference in November 2014
- Governed by the PGSC Charter endorsed by 11 Pacific Island governments
- Supported by PGSC Partnership Desk (SPC)

For more info, visit:
<http://gsd.spc.int/pgsc/>



PGSC Vision

Sustainable development in the Pacific enabled by world class geospatial information and surveying services



PGSC Strategy

PACIFIC ISLANDS
GEOSPATIAL AND SURVEYING STRATEGY
2017-2027

POSITIONING PACIFIC ISLAND COUNTRIES AND TERRITORIES FOR THE FUTURE



- 10-year regional plan for developing geospatial and surveying capacity
- Collaborative process
- Member ownership



Purpose



1. To demonstrate the critical nature of geospatial and surveying information and services and the development and maintenance of these services in the Pacific region;



2. To articulate the collaborative aspirations of the region's geospatial and surveying professionals in advancing capacity;



3. To guide the development of sustainable geospatial and surveying information and services in Pacific Island Countries & Territories, and;



4. To serve as an entry point for engagement with internal and external partners.

PGSC Strategy Goals



1. Leadership and Visibility

- The PGSC enables regional leadership, guidance and support for members to engage stakeholders and the community on geospatial and surveying activities.



2. Standards and Technology

- Countries across the region adopt a modern Geodetic Reference Frame (GRF) and improved technology underpinning geospatial systems and applications.



3. Sustainability

- Geospatial and surveying activities at the national and regional level are supported by a diverse and sustainable resource base.



4. Capacity Building

- The geospatial and surveying community is self-reliant with a culture supportive of learning innovation and gender equity.

Thank You

