Pacific Community
Communauté du Pacifique

GNSS and the Pacific Community (SPC)

Andrick Lal, Andreas Antoniou, Herve Damlamian, Robert Smith, Salesh Kumar, Zulfikar Begg
Email: andrickl@spc.int
Webpage: http://gem.spc.int/

UNOOSA Workshop on the Applications of Global Navigation Satellite Systems
28 June 2019

UNITED NATIONS
Office for Outer Space Affairs

USP
THE UNIVERSITY OF THE SOUTH PACIFIC

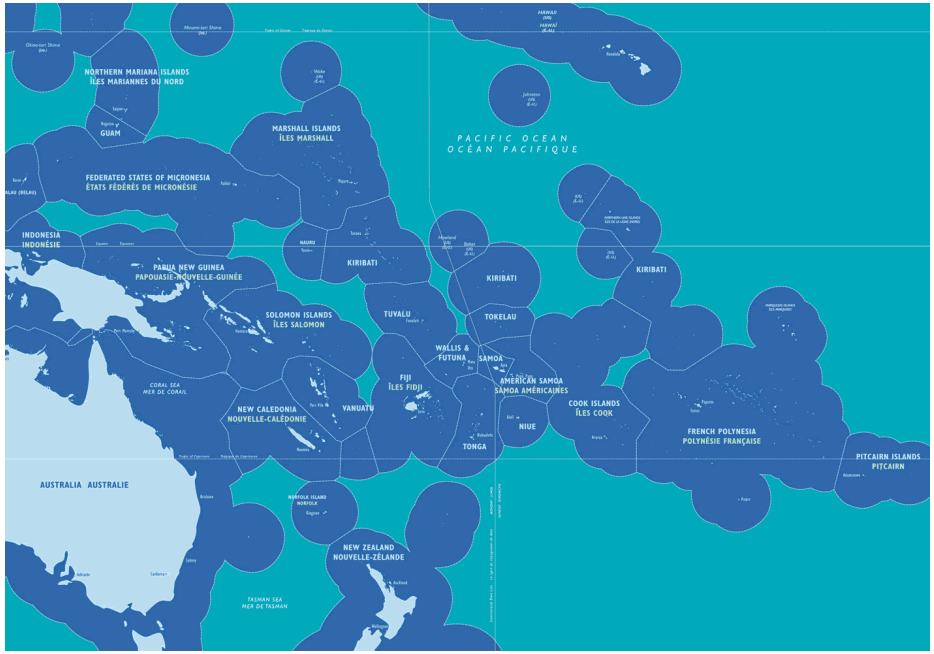
International Committee on Global Navigation Satellite Systems
ICG

Climate and Oceans Support Program in the Pacific

PGSC
Pacific Geospatial and Surveying Council

Pacific Community (SPC) *is the principal scientific and technical organisation in the Pacific region, proudly supporting development since 1947. We are an international development organisation owned and governed by our 26 country and territory members.*

Pacific Community
Communauté du Pacifique



About

Our unique organisation covers more than 20 sectors. We are renowned for knowledge and innovation in such areas as fisheries science, public health surveillance, geoscience and conservation of plant genetic resources for food security.

Mission

We work for the well-being of Pacific people through the effective and innovative application of science and knowledge, guided by a deep understanding of Pacific Island contexts and cultures.

Background:

Geoscience Energy Maritime Division

“Supports Pacific Countries and Territories by developing critical data, applied science, and technical solutions to overcome challenges faced by our members. We work in partnership with countries to better understand the challenges whilst supporting and developing innovative solutions to overcome some of the greatest risks faced by this region.”

Global Geodetic Reference Frame

Pacific Community
Communauté du Pacifique

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 A/69/L.53

General Assembly

Distr.: Limited
18 February 2015

Original: English

Sixty-ninth session
Agenda item 9
Report of the Economic and Social Council

Argentina, Australia, Belgium, Brazil, Bulgaria, Canada, China, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Ethiopia, Fiji, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Jamaica, Japan, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Papua New Guinea, Philippines, Poland, Portugal, Republic of Korea, Samoa, Slovenia, Solomon Islands, Spain, Sweden, Tunisia, Tuvalu, United Kingdom and Great Britain and Northern Ireland, United States of America and Vanuatu: draft resolution

A global geodetic reference frame for sustainable development

The General Assembly,

Reaffirming the purposes and principles of the Charter of the United Nations,

Reaffirming also its resolution 54/68 of 6 December 1999, in which the Assembly endorsed the resolution entitled “The Space Millennium: Vienna Declaration on Space and Human Development”,[1] which included, inter alia, key actions 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,

Reaffirming further its resolution 57/253 of 20 December 2002, in which it endorsed the Plan of Implementation of the World Summit on Sustainable Development,[2] 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 (UNISPACE III), held in Vienna from 19 to 30 July 1999 (see A/CONF.184/6, chap. I, resolution 1).
[2] *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August–4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum, chap. I, resolution 2, annex).

A/69/L.53 150218

Please recycle


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

FIJI

Will reduce flood losses

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

– Fiji is highly susceptible to flooding, with severe floods and cyclones the key natural disasters facing the country, says Andrick Lal, Senior Surveyor, Secretariat of the Pacific Community.

Mountainous Pacific countries are particularly susceptible to flood impacts. Aside from the obvious humanitarian impact of flooding, flooding also has an economic dimension. In the Pacific, cyclones account for nearly 60 percent of all reported disasters.

PRECISE OBSERVATIONS! Mesing a global geodetic reference frame is key

Flood preparedness

The Surveyor explains that until recently, despite the immense social and economic costs, Pacific island countries have been reactive rather that proactive in dealing with flood preparedness and response. However, this is changing.

– A project addressing flooding of Fiji's river Nadi, is aiming to strengthen flood forecasting and warning systems, flood risk assessment and address institutional strengthening for integrated flood management, Lal says.

The Nadi Integrated Flood Management is a pilot project aiming to develop integrated flood management for the Pacific using Nadi as a case study.

Topography model

Among the deliverers are operating procedures for flood warning services and a high-resolution topography model for the low-lying areas of Nadi using Light and Detection Ranging (LiDAR) survey. LiDAR is a remote sensing method used to examine the surface of the Earth.

Another delivery is use of a 2D Flood inundation model and flood hazard and risk maps to recommend flood mitigation measures and dissemination of the methodology to the Pacific region.

The models will also be important for decision making and can provide guidance on land-use practices and whether to avoid development in particular areas.

Seamlessly with a Reference Frame

– Having a Global Geodetic Reference Frame is key for precise observations. The reference frame will allow the future work to be seamlessly combined with the Nadi project's dataset, says Lal.

The Global Geodetic Reference Frame is accessed by the nearby existing Global Navigation Satellite System (GNSS) and Continuous Operating Reference Stations (CORS) and enables more precise observations of height.

Key stakeholders in the Nadi project include the National Disaster Management Office, Town and Country Planning, Water Authority of Fiji, Fiji Meteorological Services and Land & Water Resources Management.

FIJI: In the Pacific, cyclones account for nearly 60 percent of all reported disasters.

UN-GGIM | United Nations Initiative on Global Geospatial Information Management ggim.un.org


Newsletter February 2016 06 | UN-GGIM – Global Geodetic Reference Frame Working Group

UN RESOLUTION

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.

The GGRF Working Group is working on the development of a roadmap that will describe how governments can contribute to the sustainability and enhancement of the Global Geodetic Reference Frame.

ggrf.org

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 this newsletter, geodetic researchers, experts and surveyors explain how the UN resolution on global geodesy and what it contributes to will benefit their work and the study of our changing planet.

Implement open geodetic databasing

“Open geodetic data access from neighboring countries helps in modeling much better gravity field, as well as it facilitates the development of joint regional projects towards capacity building, for a better integration and dissemination of the understanding of the Global Geodetic Reference Frame.”

Guido Alejandro Gonzalez Franco, INEGI, Mexico

Defining sea baselines

“I have worked on a project defining the territorial sea baseline. Transformation from local grid system to global reference system and local cooperation in the field survey together with the availability of GPS processing service made this possible.”

Andrick Lal, Secretariat of the Pacific Community, Fiji

Observing global change

“The Global Geodetic Reference Frame is fundamental to interpreting geodetic observations related to global change, whether obtained from the surface of the planet or from satellites in space. Our own research includes the high latitudes of planet Earth where combinations of data sources are essential.”

Dr. Bjorn Ragnvald Pettersen, Norwegian University of Environmental and Life Sciences, Norway

Joint efforts on networks

“The UN resolution can give benefits to my research in the use of new approaches and methods of surveying in geodesy, as well as joint efforts to establish regional networks of GNSS/GPS by the established national, public or private networks.”

Asanat Kanjanz, Department of Cadastre and Registration of Rights to Immovable Property, Kyrgyzstan

Pacific Island Countries to establish the Pacific Geospatial and Surveying Council for the development of geospatial capacity in the Pacific region. Accurate geospatial information provides a critical foundation for sustainable economic development.”

Fesaitei Maliloga, Tuvalu Lands & Survey Department, Tuvalu

Geospatial capacity building

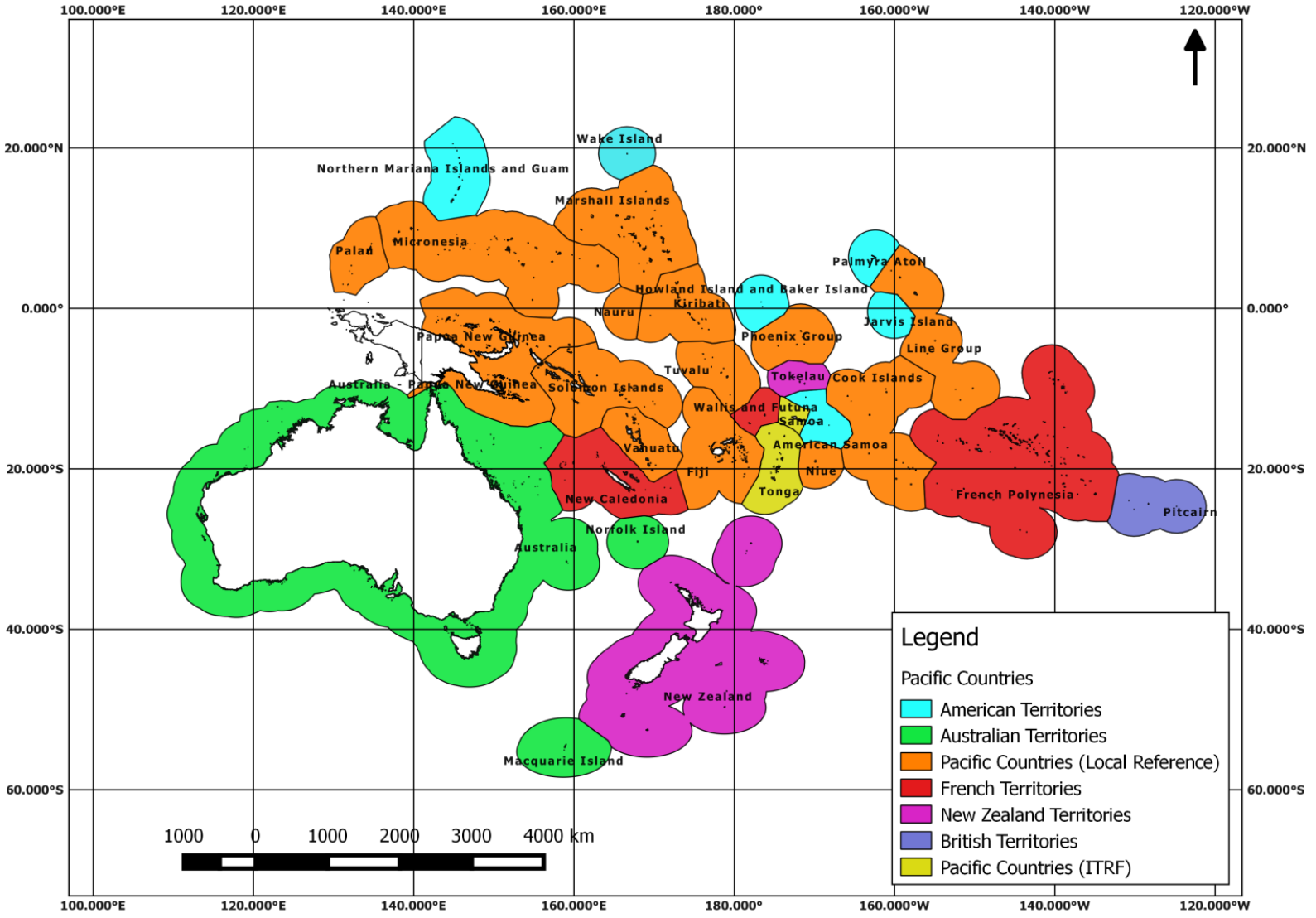
“The UN resolution has influenced the

UN-GGIM | United Nations Committee of Experts on Global Geospatial Information Management ggim.un.org

PGSC
Pacific Geospatial and Surveying Council

Geodetic Reference Frame - Pacific

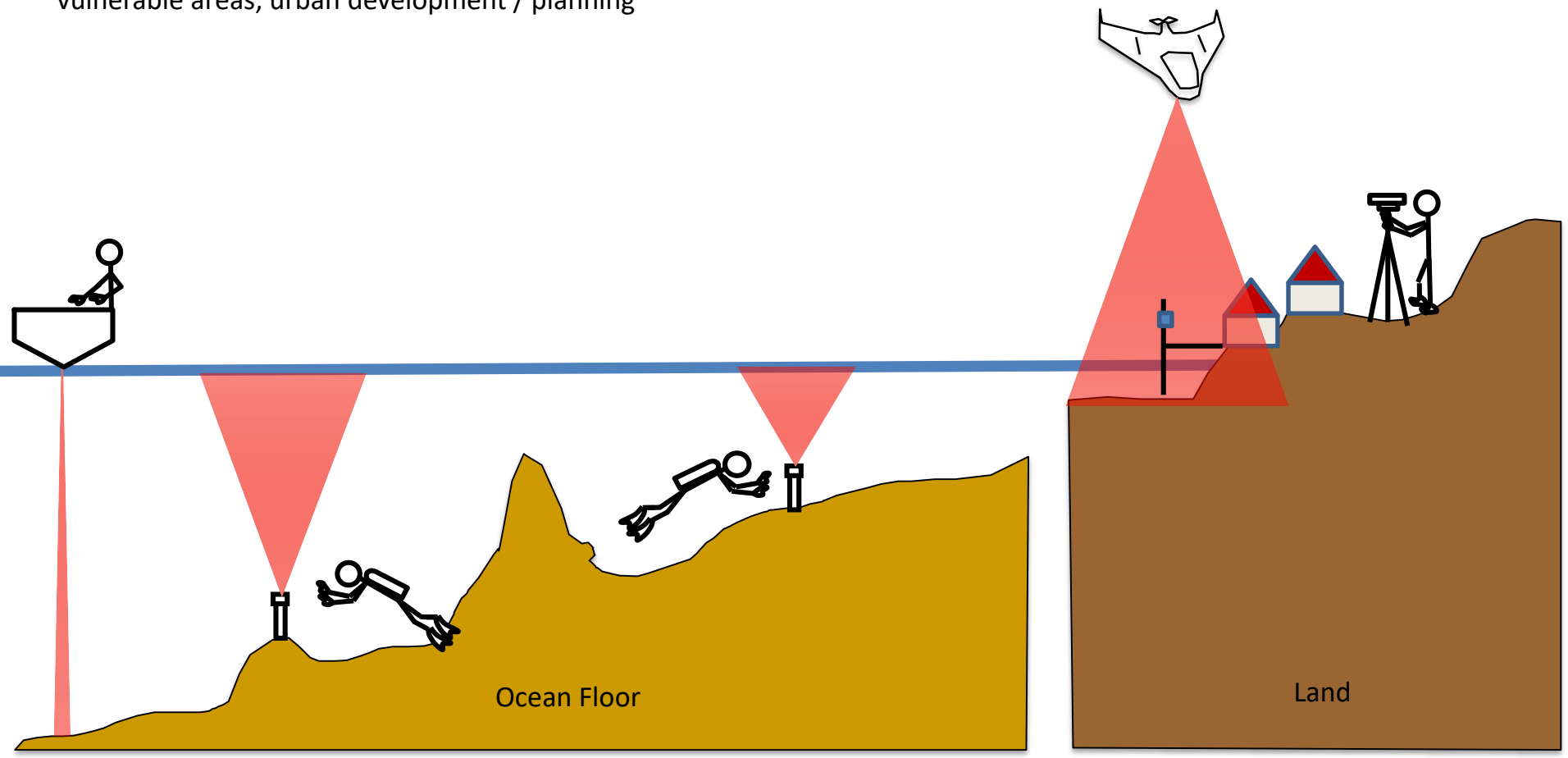
Pacific Community
Communauté du Pacifique



Why we need one Reference Frame?

Pacific Community
Communauté du Pacifique

Baseline Data: A Critical information for identification of vulnerable areas, urban development / planning



Some Important facts for the Pacific:-

Pacific Community
Communauté du Pacifique

There are more than **1500 Islands** in our Pacific island countries.

1

The average island is **90 km^2 in size** and you could walk around it in one day.

2

50% of the population in the Pacific live within 5 km of the coast.

3

50% of all islands are highly or very highly sensitive to future climate-ocean processes and sea-level rise.

4

Coastal change has the potential to severely impact island populations and economies.

5

GNSS and SPC

- Project implementation:-
  - Pacific Sea Level & Geodetic Monitoring Project – 2001 to Current (13 PICs)
  - Regional Maritime Boundaries Project – 2002 to Current (14 PICs)
- GNSS Related Survey Activities:-
  - Geodetic Surveys
  - Hydrographic Surveys
  - Geophysical Surveys
  - Topographical Surveys
  - Hydrological Surveys
  - Post Disaster Surveys
- **Capacity Development, Assessment & Technical Advice**

Supporting Activities

Global Navigation Satellite System (GNSS)
Continuously Operating Reference Station (CORS)

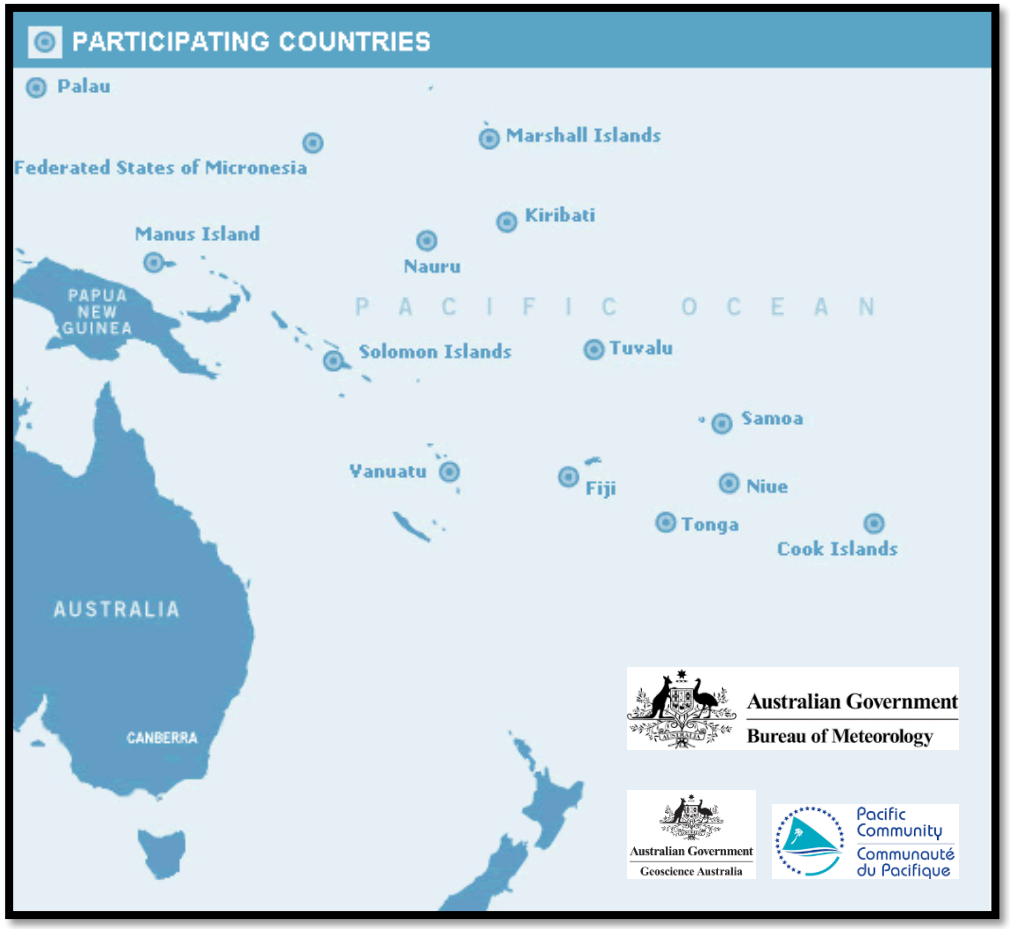
- **Geospatial and Surveying Infrastructure**
  - **Nationally**
    - Geodetic Datum & Geodetic Surveys
    - Native Land Demarcation
    - Topographic Surveys
  - **Internationally**
    - IGS Stations
    - Crustal velocities
  - Real time positions and measurements
  - International Standards and Specifications

SPC GNSS CORS SUVA

Pacific Sea Level & Geodetic Monitoring Project

Australian Government
Geoscience Australia

Pacific Community
Communauté du Pacifique



GNSS COR Station

Tide Gauge Station

Climate and Oceans Support Program in the Pacific

Data Access - GNSS

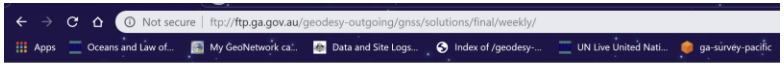
Australian Government
Geoscience Australia

Pacific Community
Communauté du Pacifique

Index of /geodesy-outgoing/gnss/data/

[parent directory]

Name	Size	Date Modified
campaign/		5/16/13, 12:00:00 PM
Creative_Commons_Copyright_Authorisation.txt	748 B	11/15/12, 1:00:00 PM
daily/		1/2/19, 1:02:00 PM
GA_NTRIPCaster_Info.txt	3.6 kB	1/18/13, 1:00:00 PM
GNSS_data_Readme.txt	4.7 kB	11/4/12, 1:00:00 PM
highrate/		6/7/19, 6:51:00 AM
hourly/		6/6/19, 7:52:00 PM
sprgn/		1/2/19, 1:02:00 PM

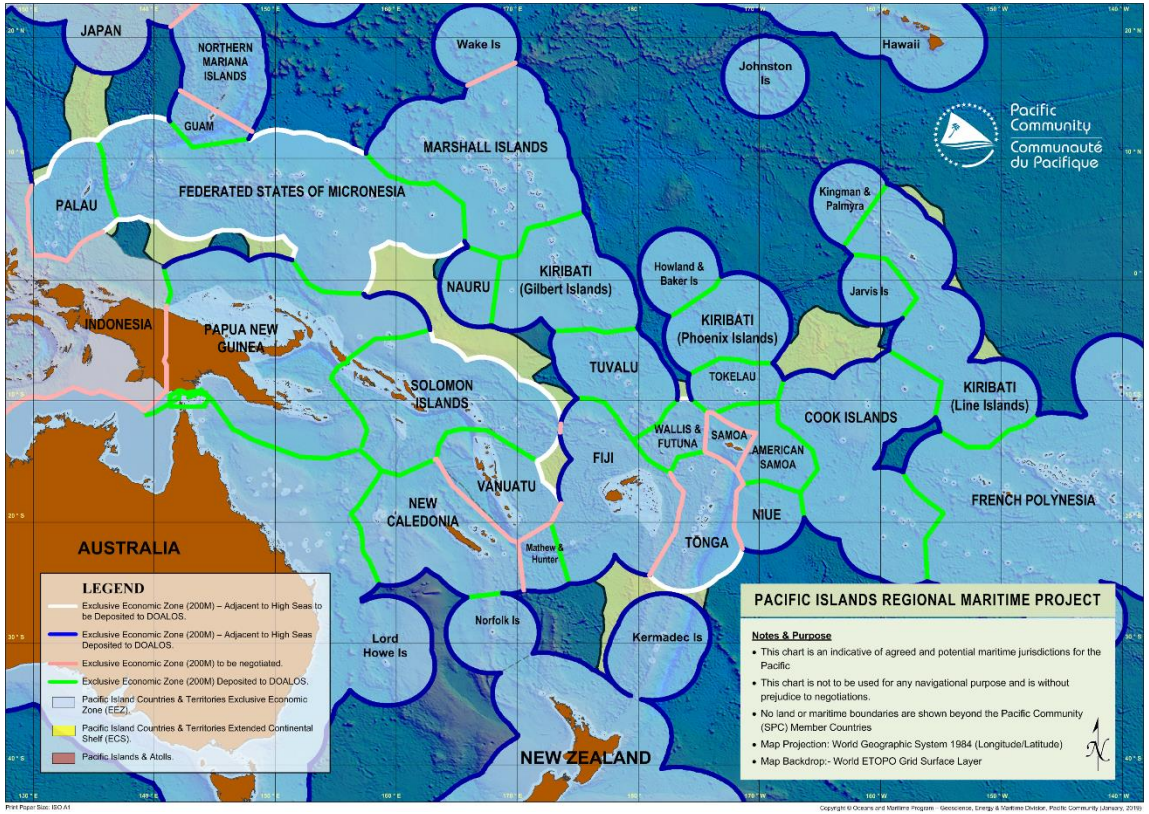


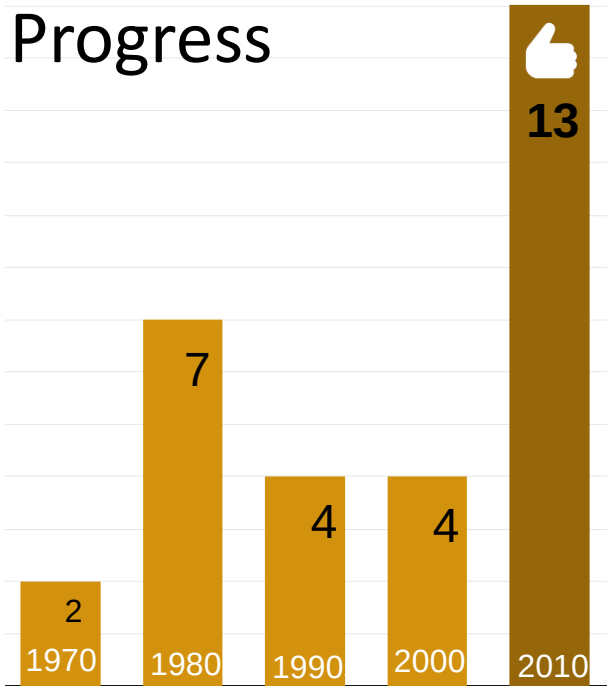
Index of /geodesy-outgoing/gnss/solutions/final/weekly/

[parent directory]

Name	Size	Date Modified
AUS10957.pdf	24.9 kB	4/28/16, 12:00:00 PM
AUS10957.SNX	3.1 MB	1/8/19, 6:00:00 PM
AUS10957.SUM	47.8 kB	1/9/19, 4:11:00 PM
AUS10967.pdf	24.7 kB	4/28/16, 12:00:00 PM
AUS10967.SNX	3.1 MB	1/8/19, 6:00:00 PM
AUS10967.SUM	46.7 kB	1/9/19, 4:11:00 PM
AUS10977.pdf	25.2 kB	4/28/16, 12:00:00 PM
AUS10977.SNX	3.1 MB	1/8/19, 6:00:00 PM
AUS10977.SUM	50.4 kB	1/9/19, 4:11:00 PM
AUS10987.pdf	24.9 kB	4/28/16, 12:00:00 PM
AUS10987.SNX	3.3 MB	1/8/19, 6:00:00 PM
AUS10987.SUM	47.4 kB	1/9/19, 4:11:00 PM
AUS10997.pdf	24.5 kB	4/28/16, 12:00:00 PM
AUS10997.SNX	3.1 MB	1/8/19, 6:00:00 PM
AUS10997.SUM	46.7 kB	1/9/19, 4:11:00 PM
AUS11007.pdf	24.8 kB	4/28/16, 12:00:00 PM
AUS11007.SNX	3.0 MB	1/8/19, 6:00:00 PM
AUS11007.SUM	47.4 kB	1/9/19, 4:11:00 PM
AUS11017.pdf	24.6 kB	4/28/16, 12:00:00 PM
AUS11017.SNX	2.6 MB	1/8/19, 6:00:00 PM
AUS11017.SUM	49.4 kB	1/9/19, 4:11:00 PM
AUS11027.pdf	24.7 kB	4/28/16, 12:00:00 PM

Regional Maritime Boundaries Project





The number of treaties signed has increased in response to strengthened regional cooperation

4 facts about the Regional Maritime Boundaries Project

Pacific Community
Communauté du Pacifique

20%

Ocean Space

The 22 Pacific Island Countries and Territories manage 20% of the world's ocean in their Exclusive Economic Zones

476

Capacity

476 participants have attended 17 regional technical and legal training sessions in 2005. The most recent meeting in 2019 had 33% women participants.

33 out of 47

Treaties

There are 47 shared boundaries in the Pacific. 33 treaties have been signed between countries since 1974

Ownership

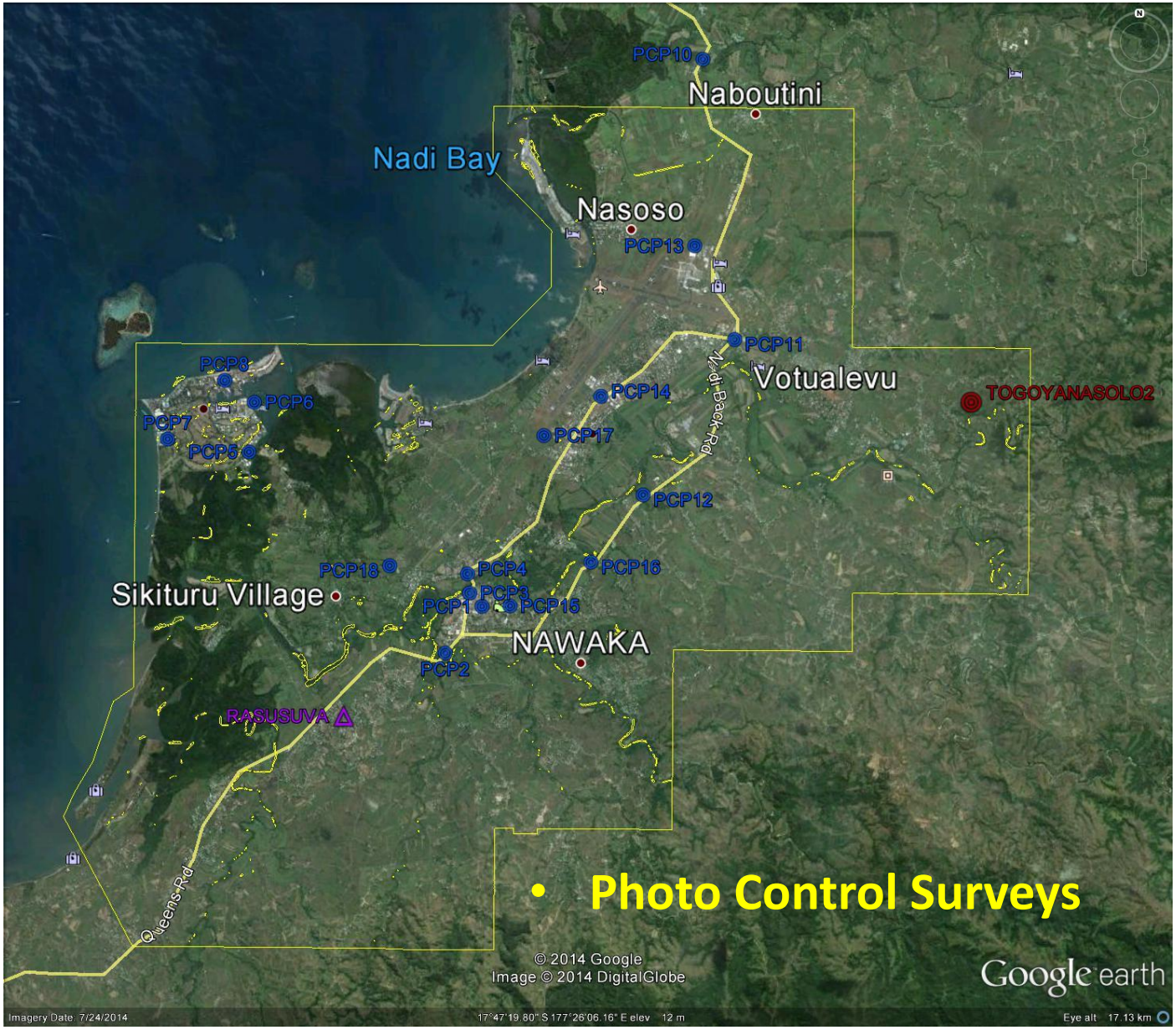
Pacific islands may disappear due to rising seas and erosion. The settlement of maritime boundaries provides 'certainty' to the ownership of ocean space and is an urgent action in the face of climate change

GNSS Surveys in Projects

Pacific Community
Communauté du Pacifique

Geodetic Surveys - GNSS

Pacific Community
Communauté du Pacifique



- **Photo Control Surveys**

Geodetic Control Survey – Trig Stations

Pacific Community
Communauté du Pacifique

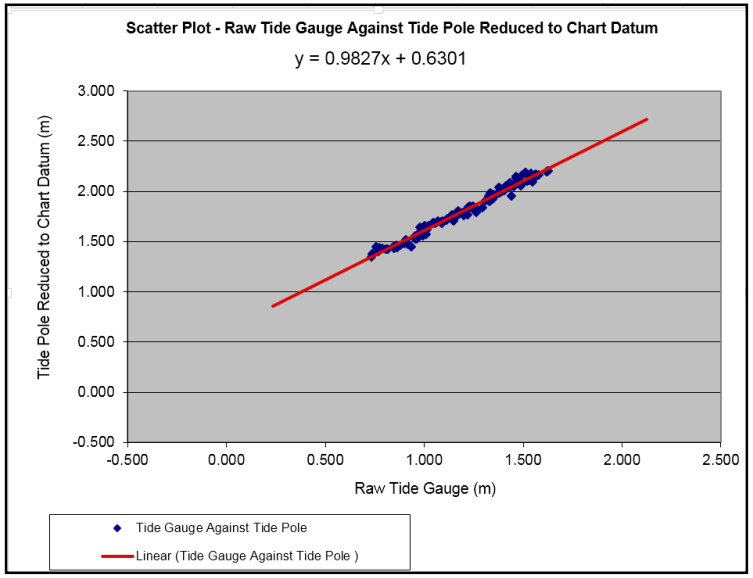
Geodetic Control Survey – Trig Stations

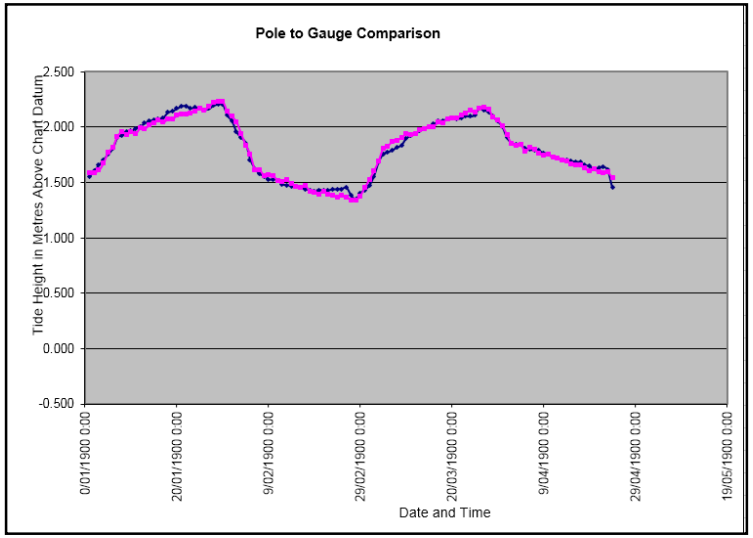
Tide Gauge Installation & Tide Watch

Pacific Community
Communauté du Pacifique

Vertical Reference System

- GNSS Pole to Gauge Calibrations

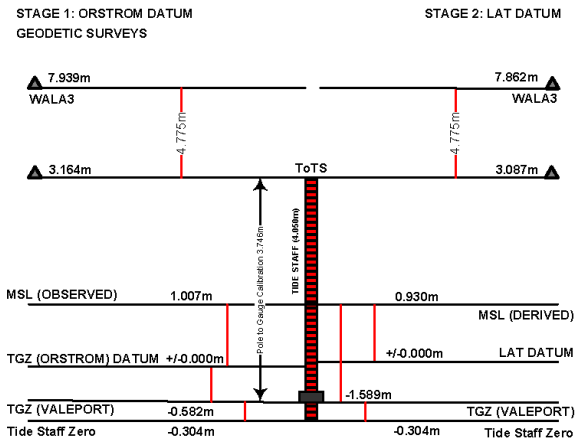




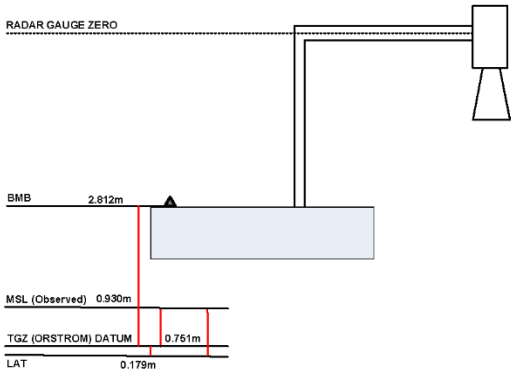
Vertical Datum – Pacific Countries

Country	Vertical Datum		
Cook Is	MSL	TSZ (UoH)	LAT (93-94)
Fiji	MSL (93)	TSZ (NTFA)	LAT
FSM	Arbitrary		
Kiribati	TGZ (SEAFRAME) 1992		TGZ (UoH) 1988
Manus (PNG)	MSL	TSZ (NTFA)	LAT
Marshall Is	MSL (68-69)		LAT (93-94)
Nauru	MSL (93-94)	NID (Local)	LAT (93-94)
Niue	MSL (55)		LAT (93-94)
Samoa	MSL (51-69)		
Solomons	MSL	TSZ	
Tonga	MSL (90)	CD	
Tuvalu	MSL (93-94)	CD / TSZ (UoH)	LAT (93-94)
Vanuatu	MSL (73)	TGZ (Orstom)	

Wala Island Wiring Diagram

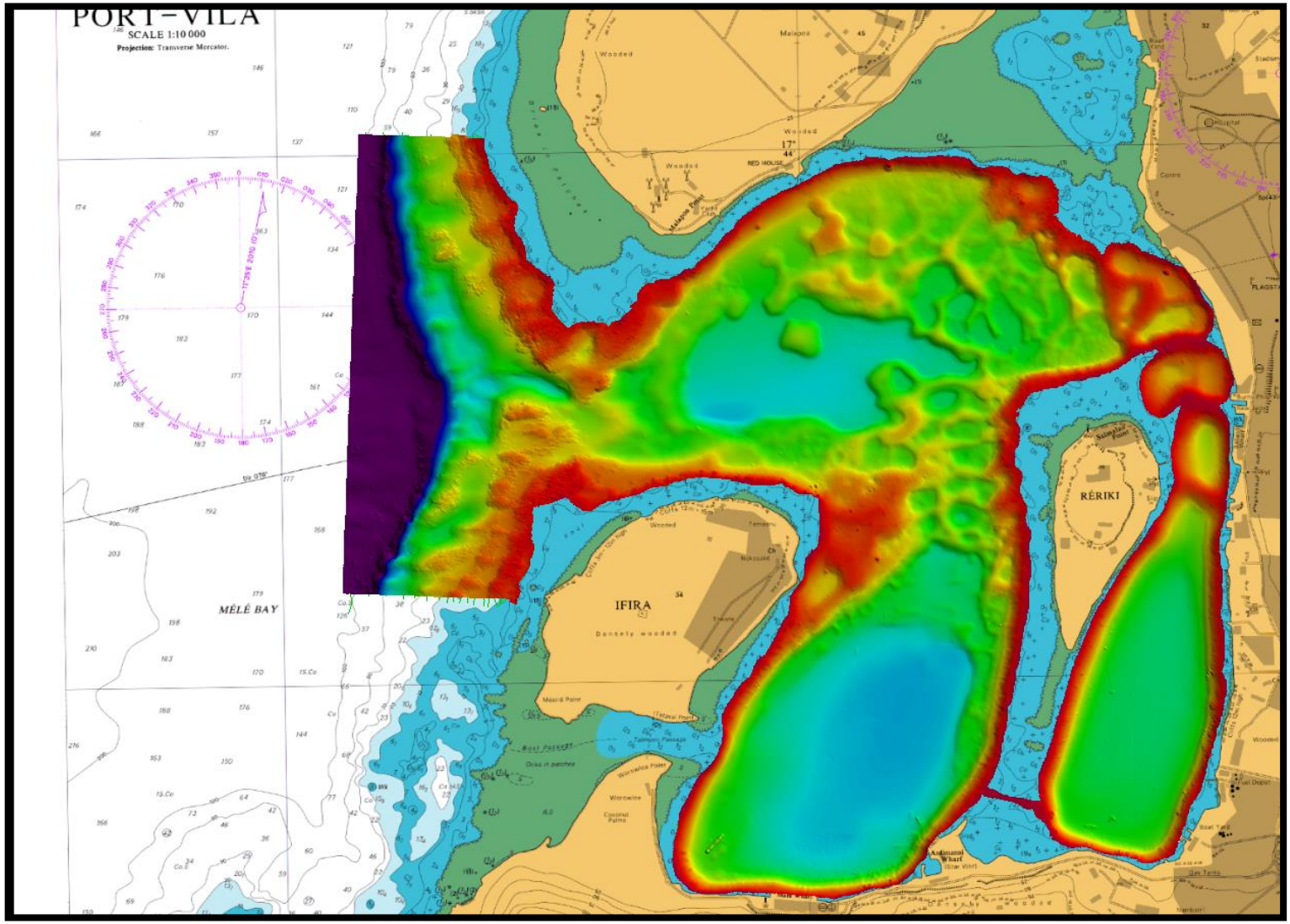


Santo Radar Gauge Wiring Diagram



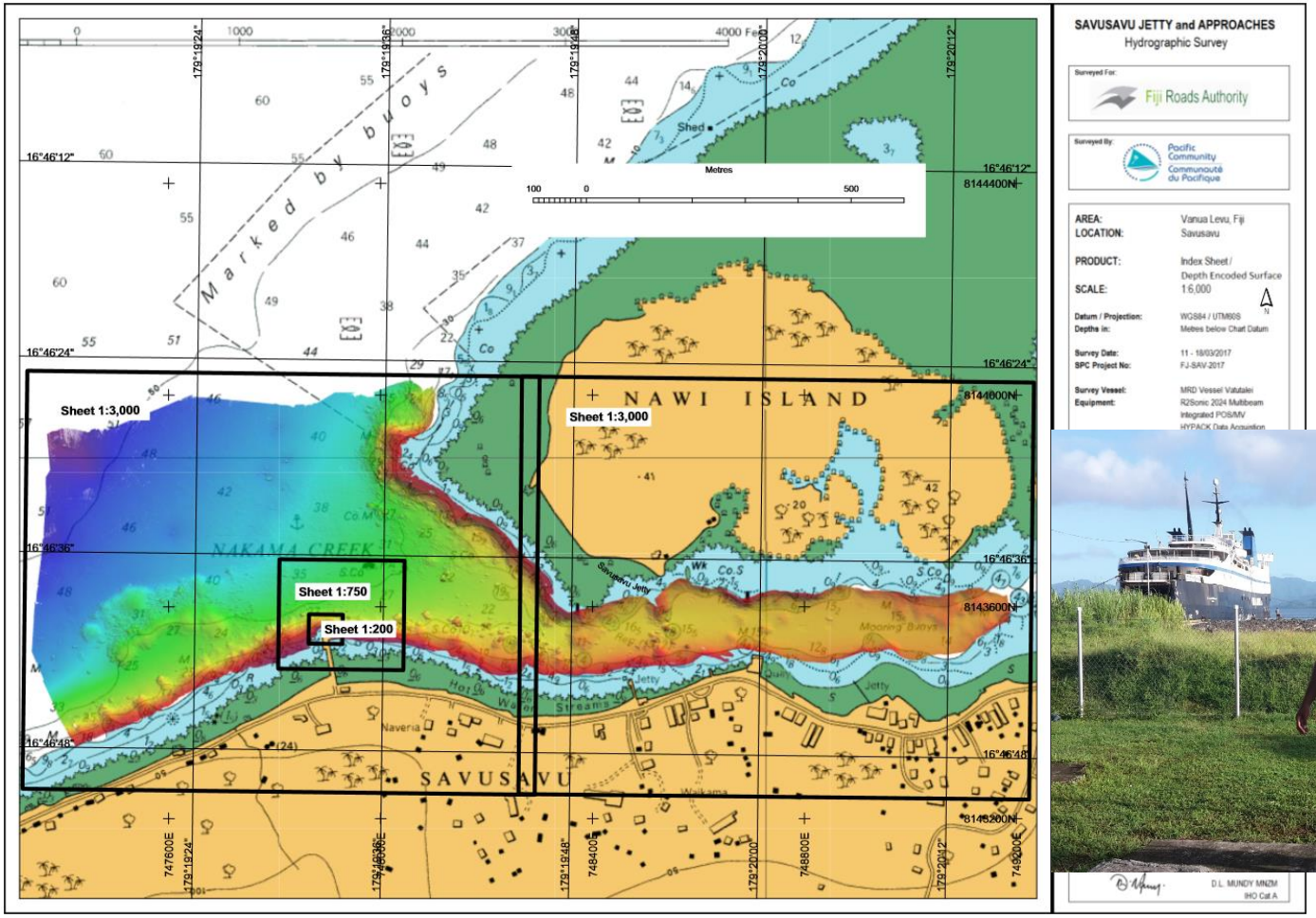
Hydrographic Surveys

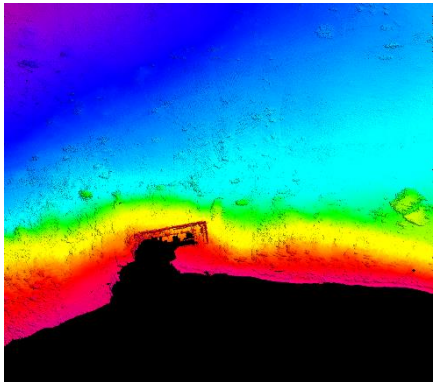
Pacific Community
Communauté du Pacifique



Hydrographic Survey of Savusavu Jetty and Approaches (March 2017)

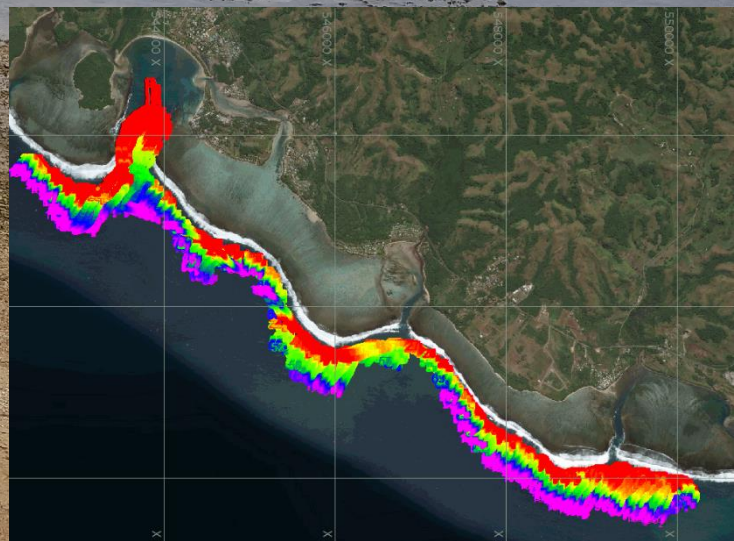
Pacific Community
Communauté du Pacifique





Hydrographic Support to SPC Projects

- Coastal Inundation Forecasting Demonstration Project (CIFDP) in Fiji,
- SBES survey
- Tide Gauge installation
- RTK Survey
- Oceanographic instrument deployment



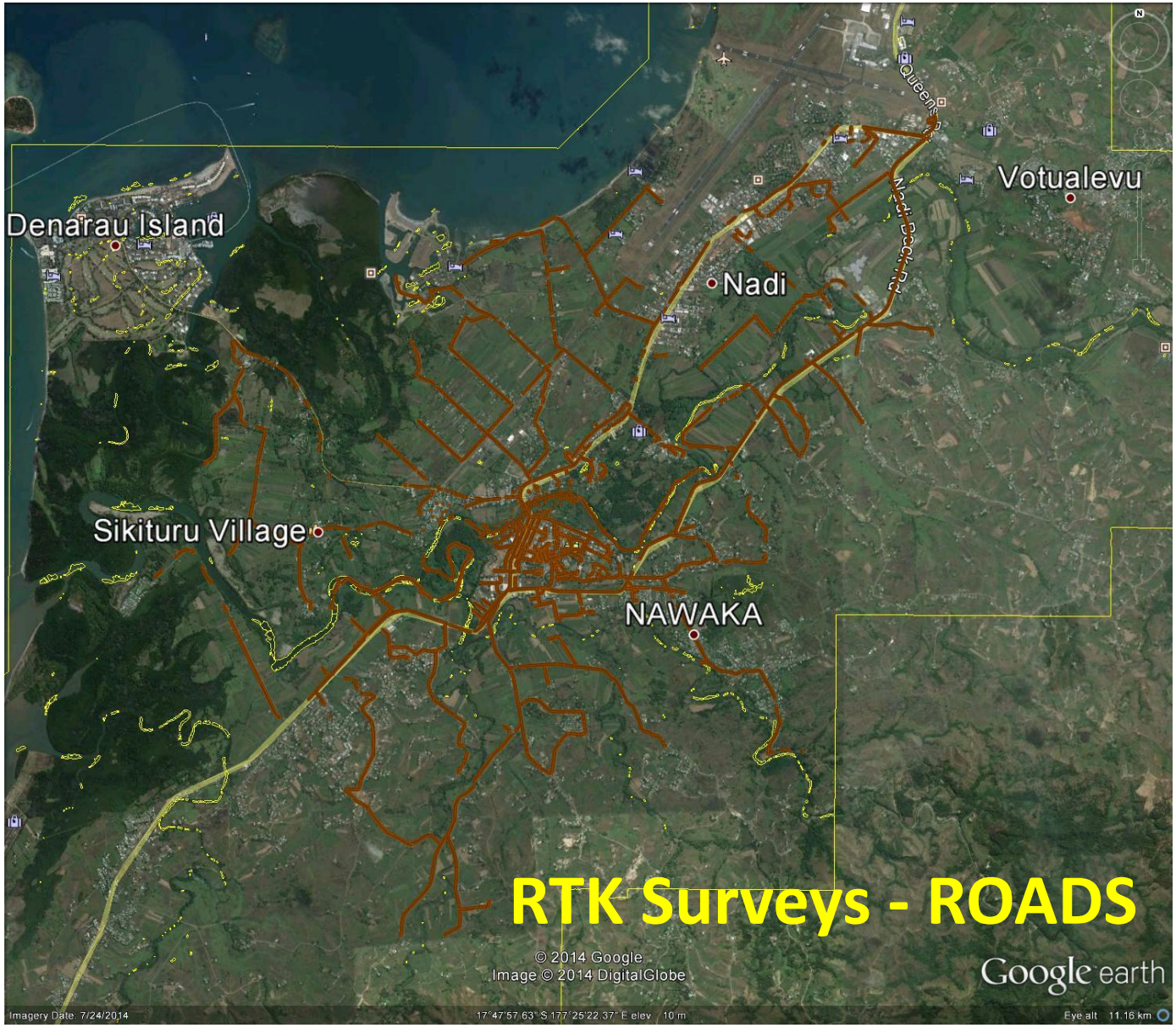
RTK GNSS Surveys

- RTK Surveys – Base Station

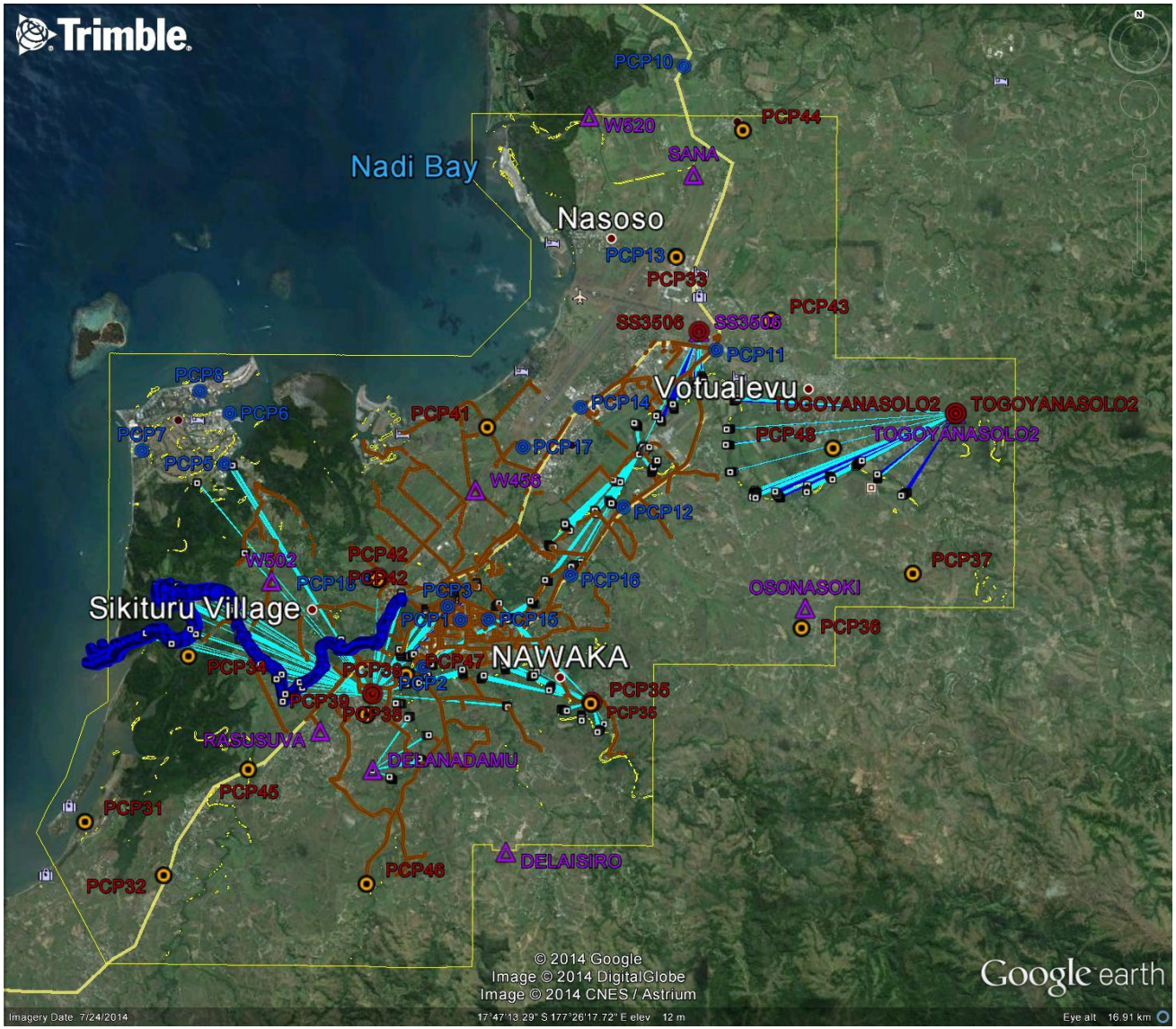
- RTK Surveys – Rover on the Vehicle

Topographical Surveys - GNSS

Pacific Community
Communauté du Pacifique

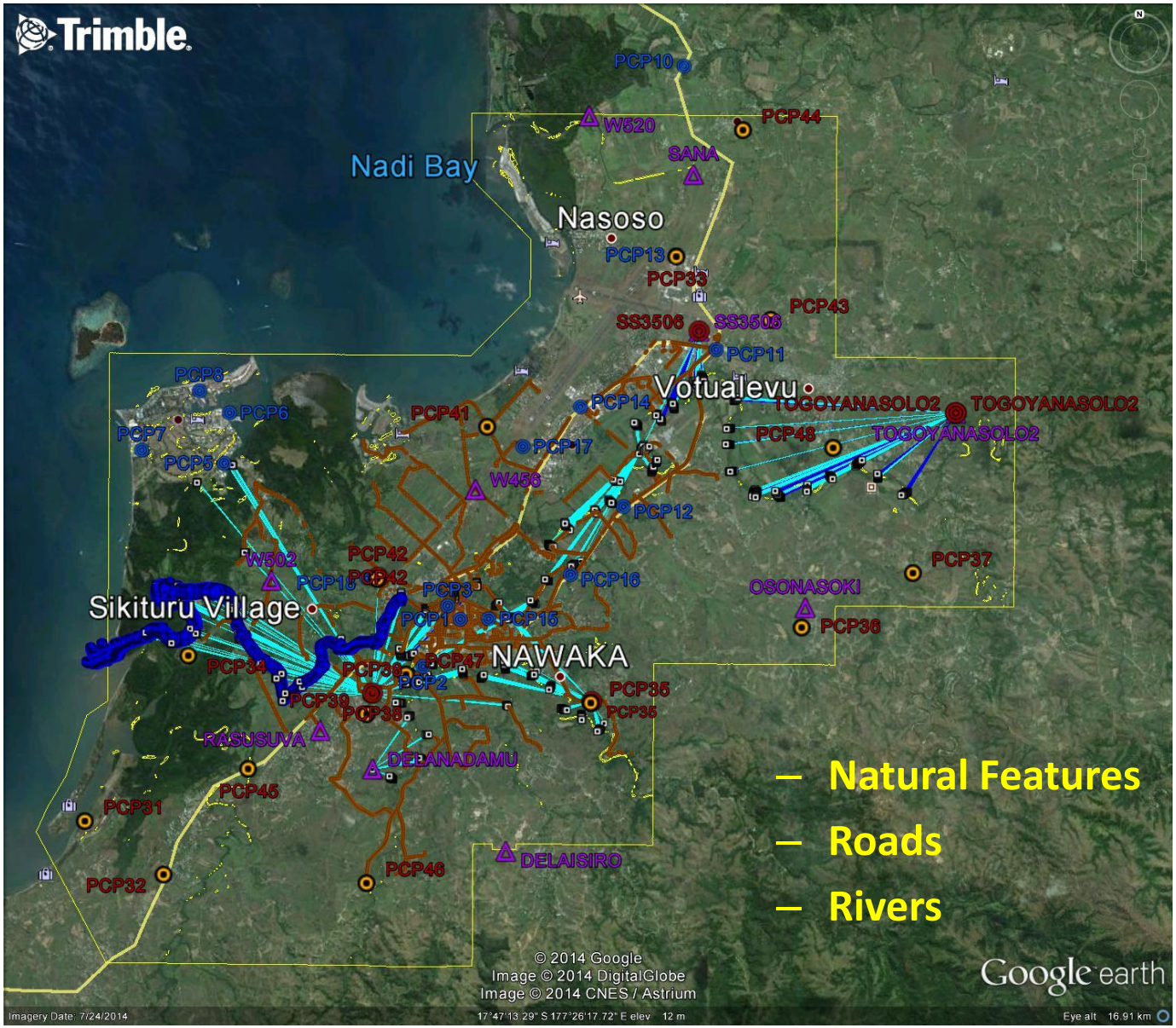


Topographical Surveys – RTK GNSS



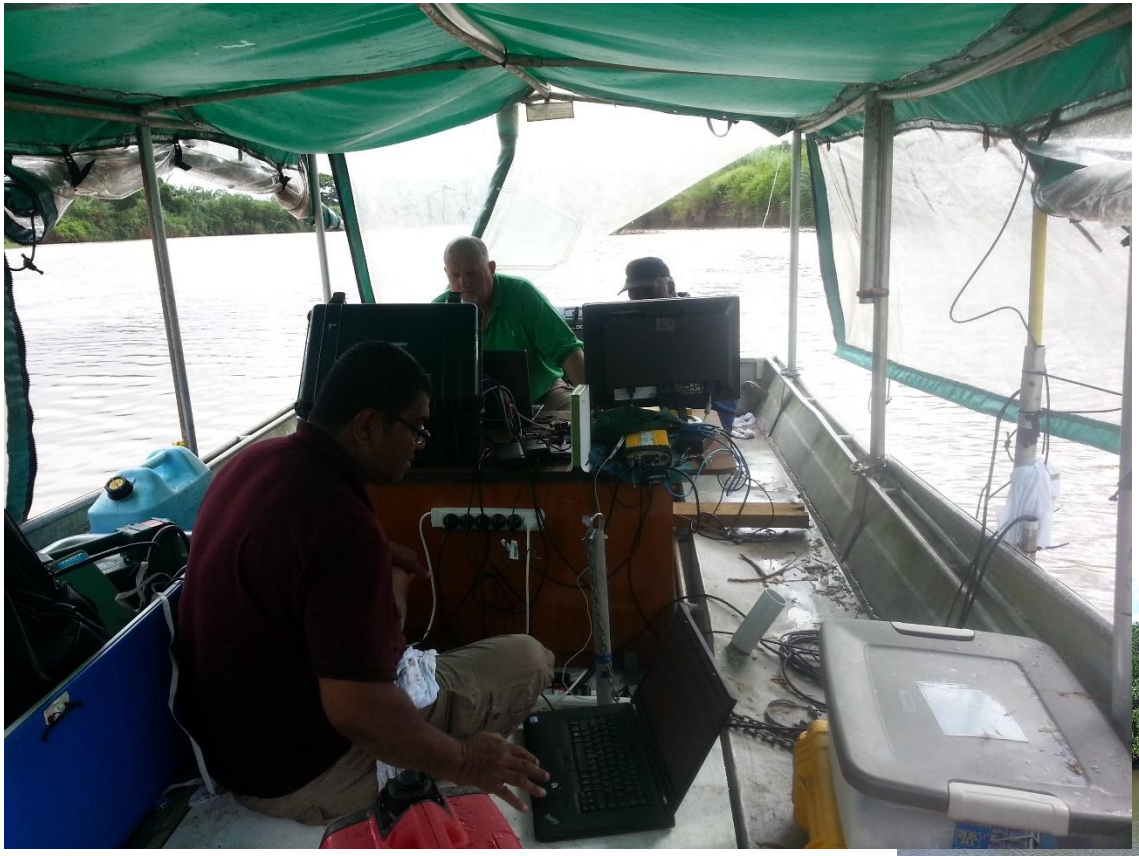
GNSS Surveys - Projects

Pacific Community
Communauté du Pacifique



Nadi Survey Phase 3 – Disaster Risks Programme

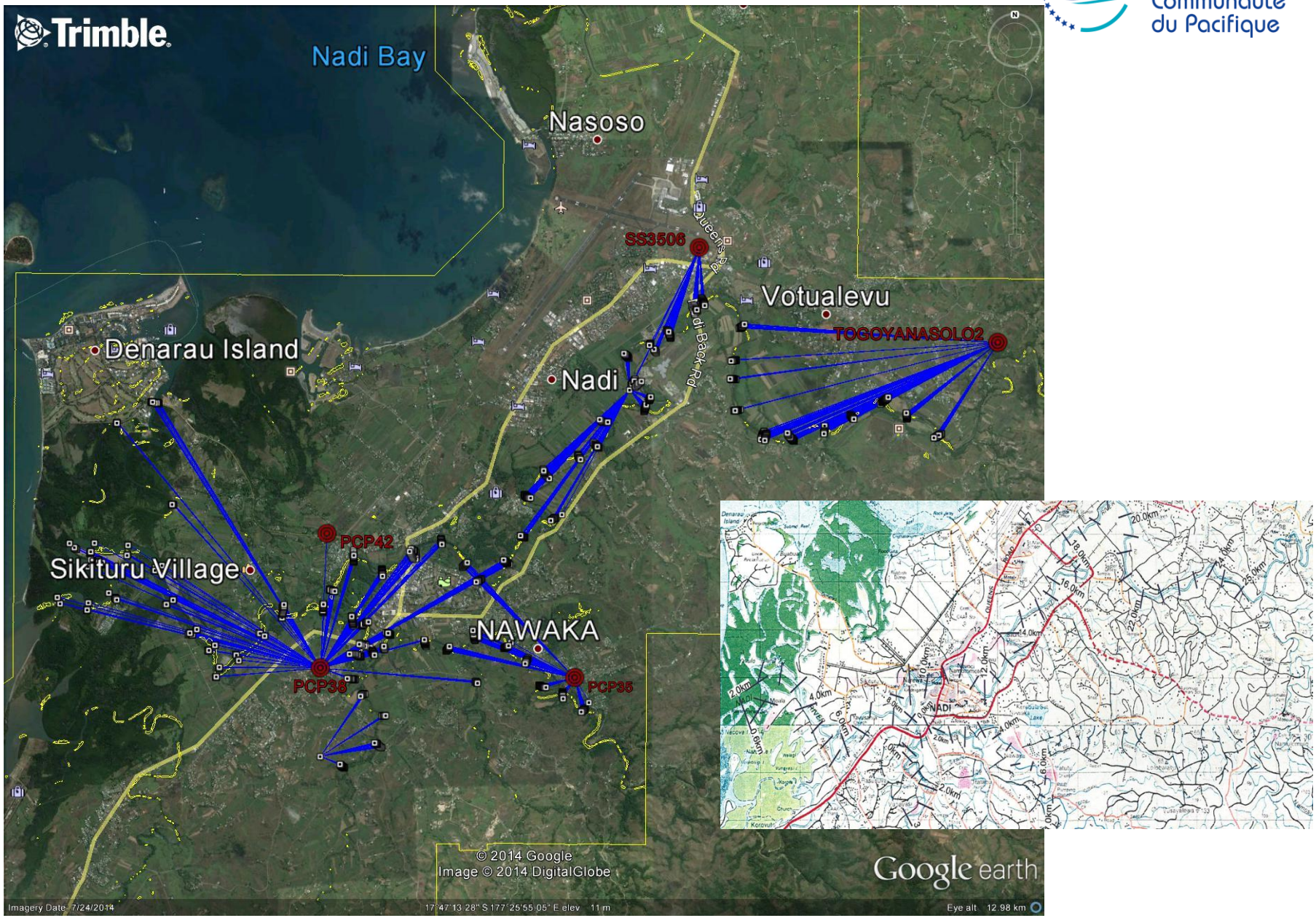
Pacific Community
Communauté du Pacifique



- **Bathymetry Surveys**

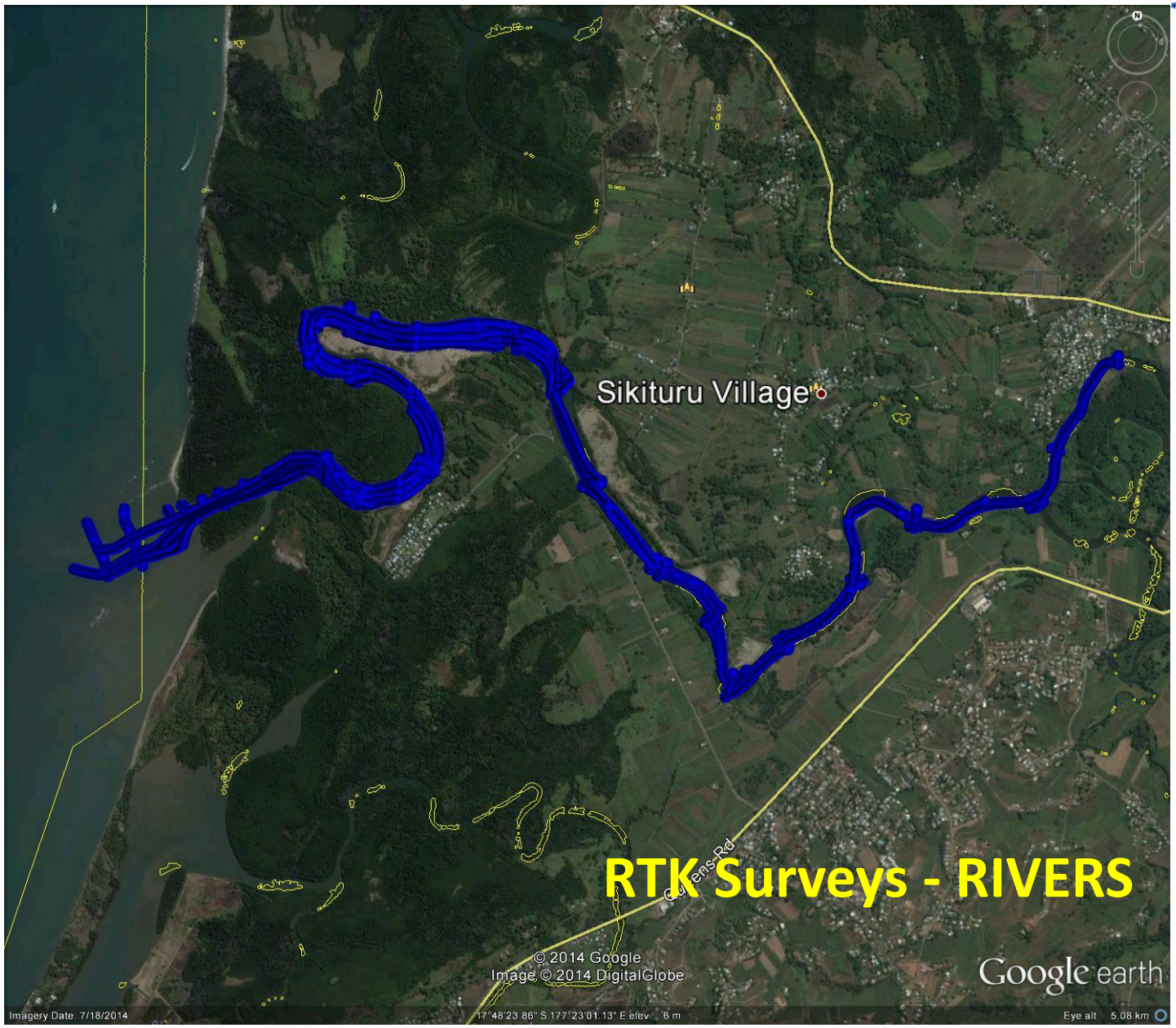
RTK GNSS Surveys - RIVERS

Pacific Community
Communauté du Pacifique



Nadi Survey Phase 3 – Disaster Risks Programme

Pacific Community
Communauté du Pacifique

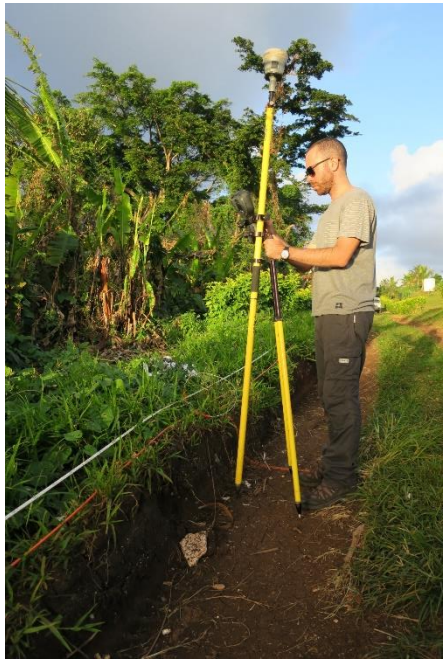


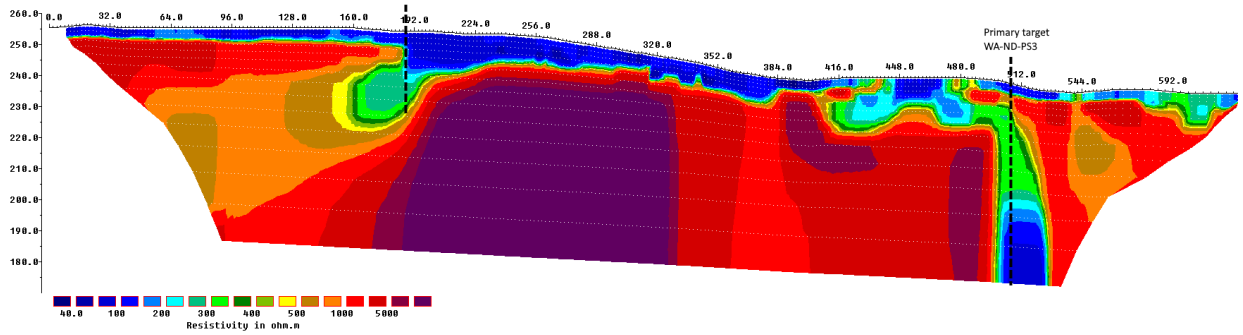
Coastal Inundation- RTK GNSS

Pacific Community
Communauté du Pacifique

Groundwater resources assessment in Tanna, Vanuatu

- Purpose: Identification of fresh groundwater resources for potable water supply
- Tool: Electrical resistivity geophysics (ERT) for the identification of low-resistivity zones in volcanic deposits suggesting the presence of fractures and weathered zones with high freshwater potential
- PPK survey to adjust the modelled profiles for topography

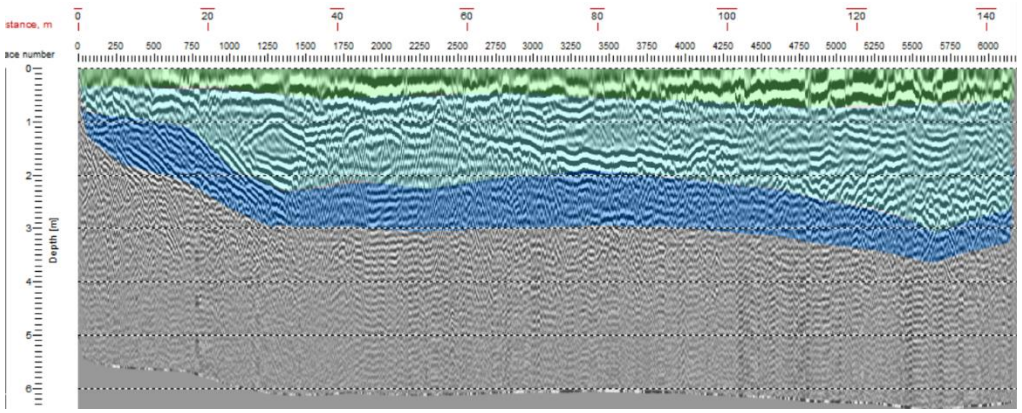




Assessing the potential for on-site greywater disposal in South Tarawa, Kiribati

Pacific Community
Communauté du Pacifique

- Purpose: Collecting data for the development of a groundwater model to simulate the migration of contaminants upon greywater disposal on the existing freshwater lenses
- Tool: Ground Penetrating Radar (GPR) for the identification of groundwater table and fresh/saltwater interface to delineate the thickness of freshwater lenses
- RTK survey to adjust the modelled profiles for topography



Extreme events in the region

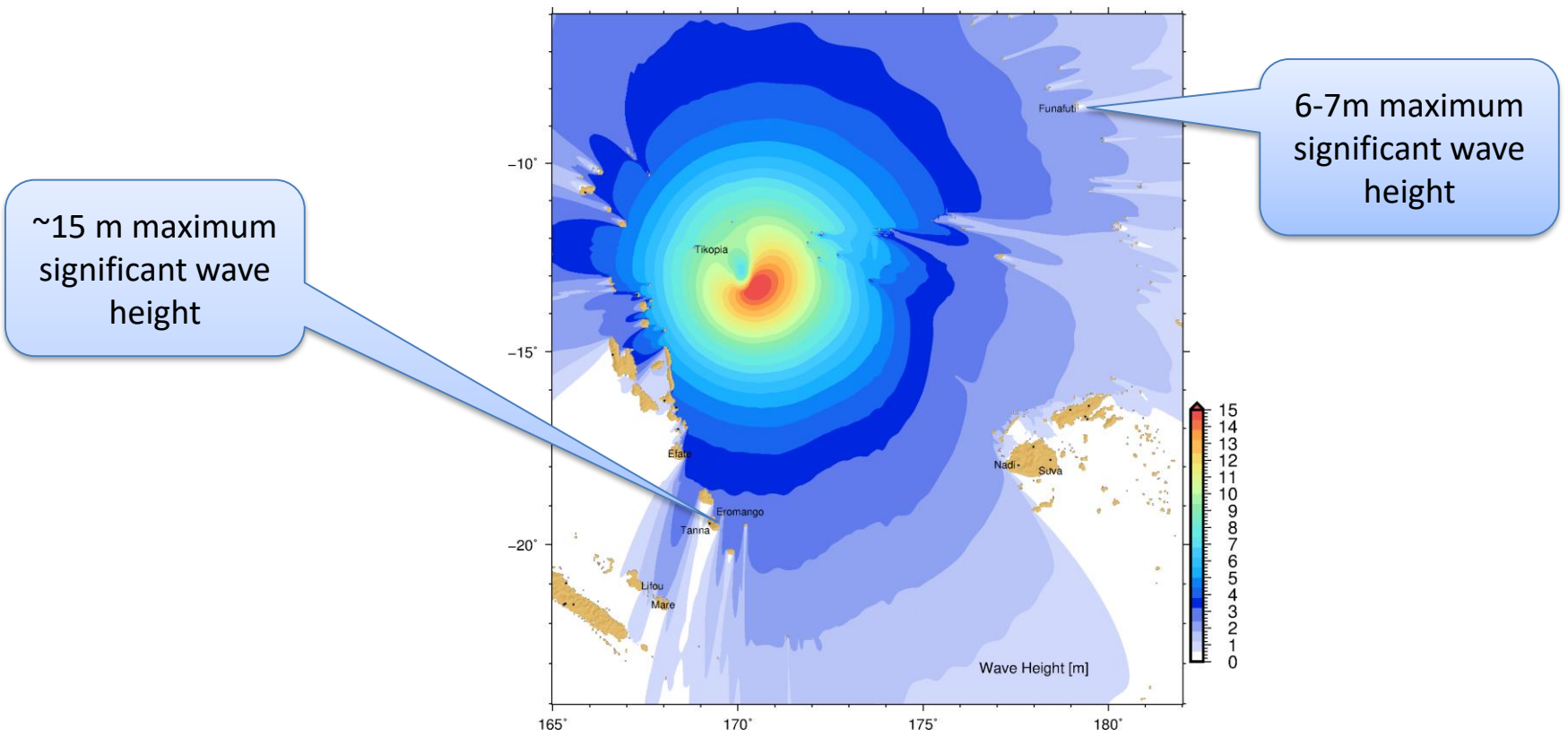
TC Ian-2014

TC PAM-2015

TC WINSTON-2016

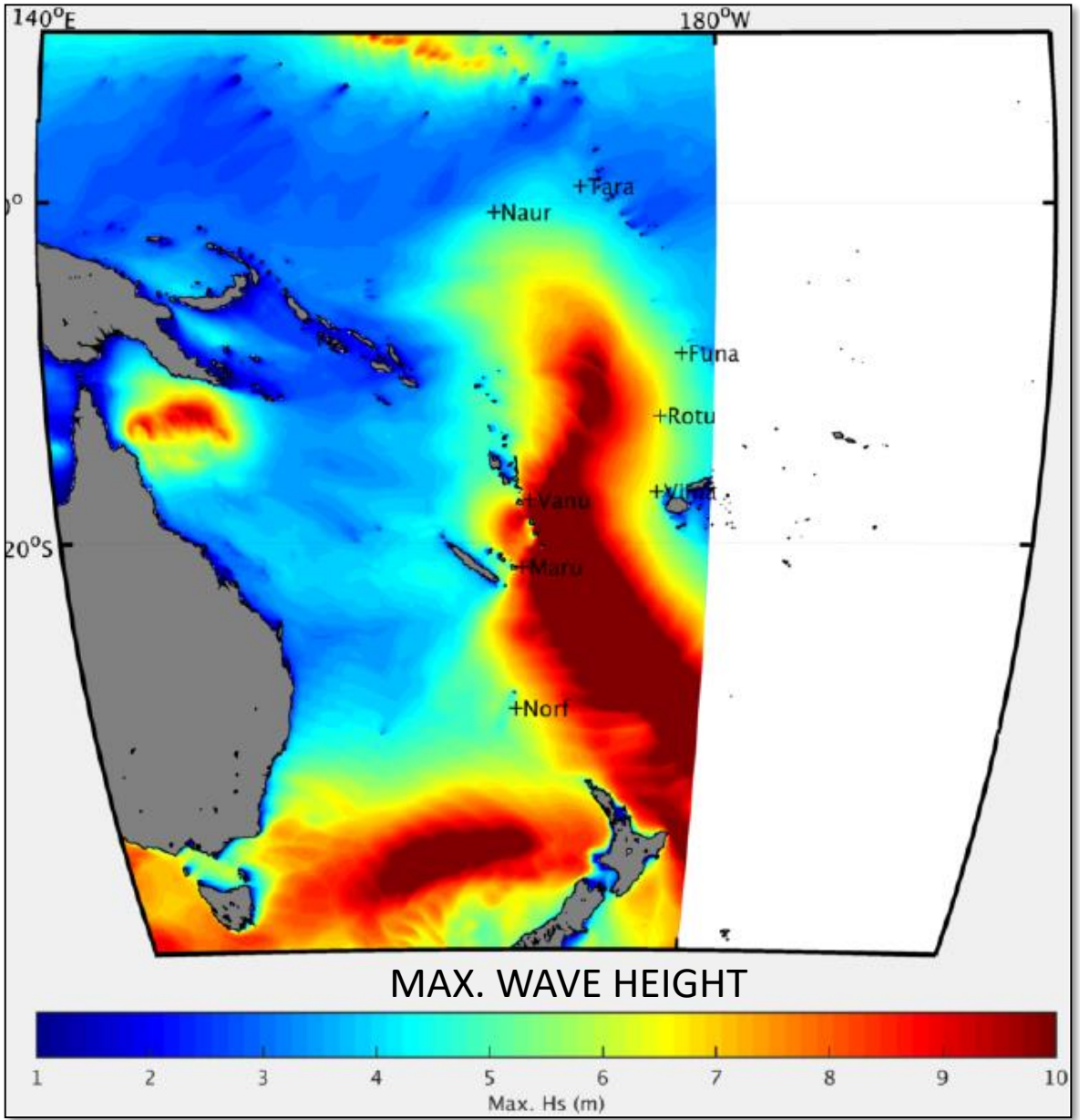
TC GITA-2018

TC PAM 2015



March 2015 simulated wave heights

Tropical Cyclone PAM



Tuvalu:

- AU$ ~14M
- 25% of TV 2013 GDP
- 41% population affected
- 90% damage on crops in 3 Islands, 30% damage on crops in 4 Islands

Vanuatu:

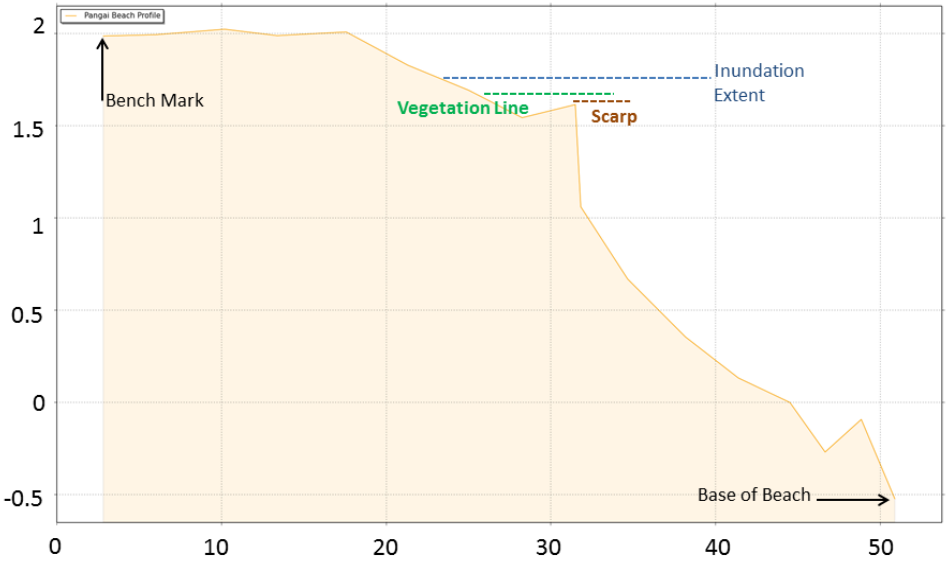
- **16** death
- **65,000** people displaced
- **>50%** population affected (166,000)
- **17,000** buildings affected
- **AU$ ~619M** – Damage and Loss
- **64.1%** of GDP
- Livelihood of more than 80% of rural population affected.

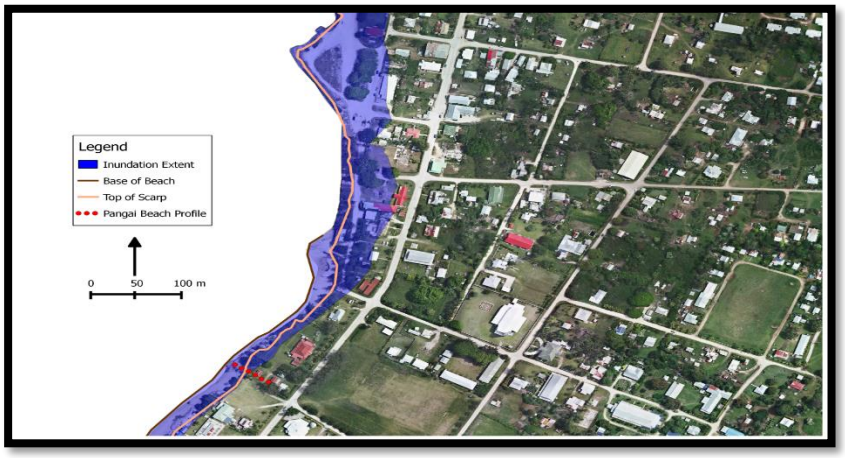
Other country affected: New Caledonia, Solomon Island, Kiribati, New-Zealand.

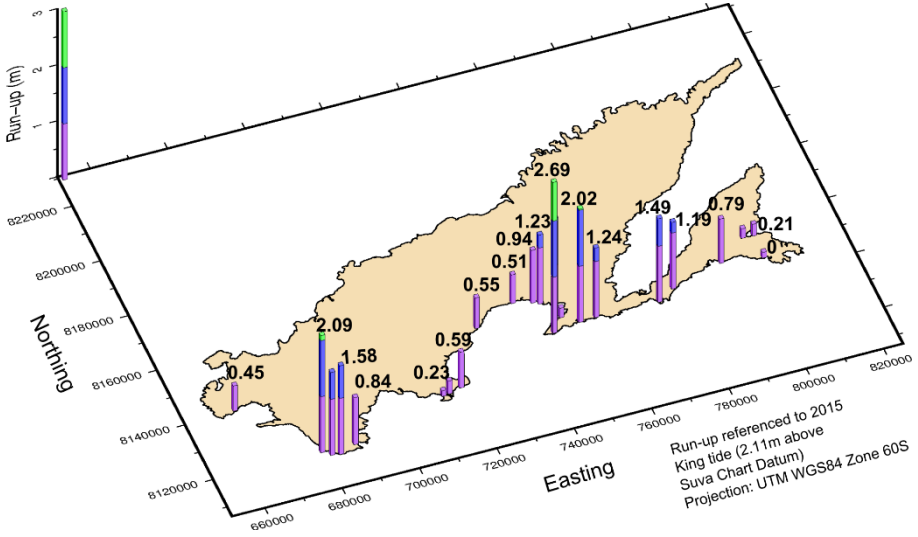
Source: Ron Hoeke, CSIRO, 2015

Post Disaster Rapid Assessments

Pacific Community
Communauté du Pacifique







Pacific Community
Communauté du Pacifique

TC PAM : Before / After

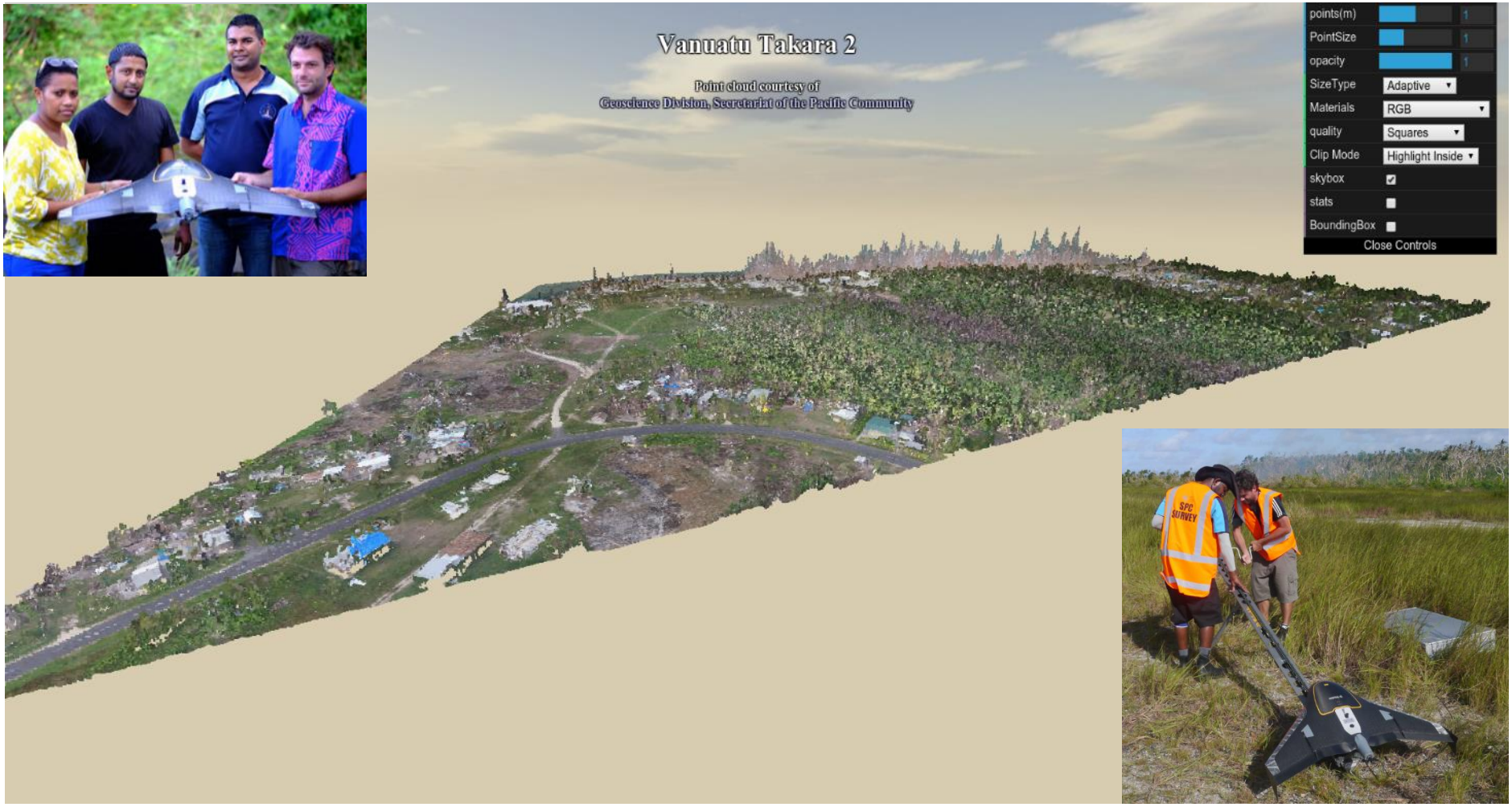
using Aerial photograph taken during LiDAR campaign (2012)

Post Disaster Rapid Assessments

Pacific Community
Communauté du Pacifique

UAV Surveys – Pacific Community

Pacific Community
Communauté du Pacifique



Online Data Processing - GNSS

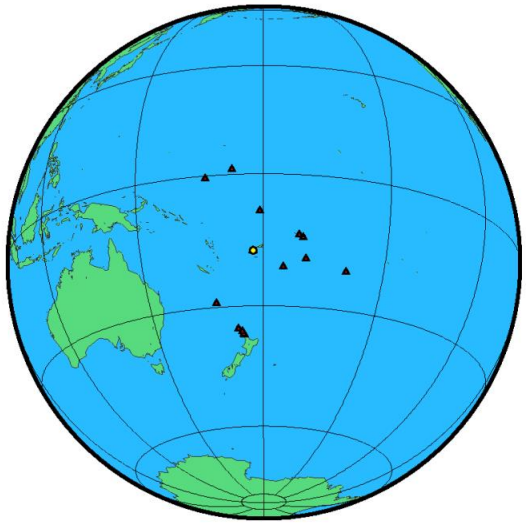
AUSPOS

1 User Data

All antenna heights refer to the vertical distance from the Ground Mark to the Antenna Reference Point (ARP).

Station (s)	Submitted File	Antenna Type	Antenna Height (m)	Start Time	End Time
0947	09471090.18o	TRMR10 NONE	1.700	2018/04/19 22:24:30	2018/04/20 01:39:00

2 Processing Summary



Date	User Stations	Reference Stations	Orbit Type
2018/04/19 22:24:30	0947	ASPA AUCK CKIS KIRI KTIA LAUT NAUR NIUM NIUT NORF SAMO TONG TUVA WARK WHNG	IGS final

3.2 Geodetic, GRS80 Ellipsoid, ITRF2014

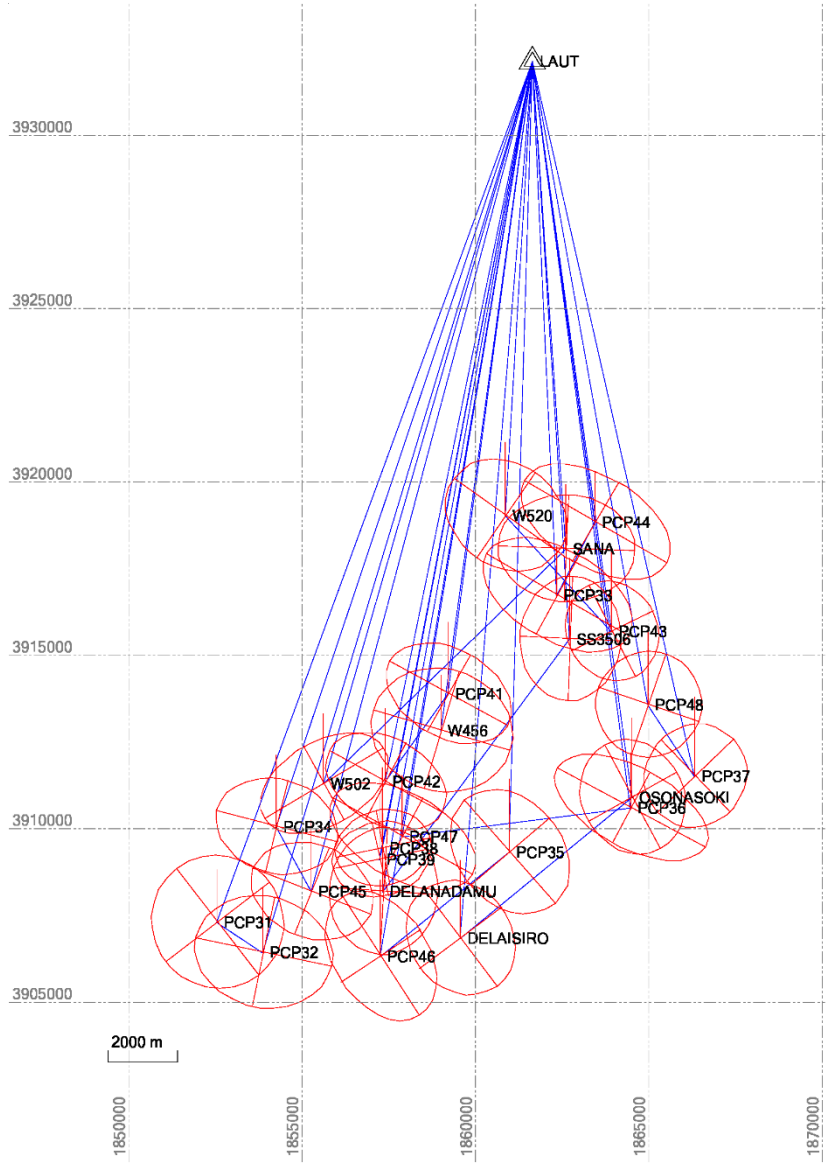
Geoid-ellipsoidal separations, in this section, are computed using a spherical harmonic synthesis of the global EGM2008 geoid. More information on the EGM2008 geoid can be found at http://earth-info.nga.mil/GandG/wgs84/gravitymod/egm2008/.

Station	Latitude (DMS)	Longitude (DMS)	Ellipsoidal Height(m)	Derived Above Geoid Height(m)
BM01	-17 32 14.59750	177 41 53.33896	92.305	34.895
ASPA	-14 19 33.92725	-170 43 20.78718	53.471	20.847
AUCK	-36 36 10.21650	174 50 03.79109	132.686	97.753
CKIS	-21 12 03.68258	-159 48 02.22564	18.397	5.776
KIRI	1 21 16.50799	172 55 22.39685	36.156	4.845
KOUC	-20 33 31.27495	164 17 14.42099	84.136	23.689
KTIA	-35 04 08.13341	173 16 23.19973	127.433	89.089
LAUT	-17 36 31.71548	177 26 47.69582	89.654	31.694
NAUR	-0 33 06.21820	166 55 31.95384	46.232	6.057
NIUM	-19 04 35.48544	-169 55 37.46285	89.693	59.074
NIUT	-19 03 10.79188	-169 55 14.35329	37.651	7.060
NORF	-29 02 36.03120	167 56 19.80154	159.004	112.159
NRMD	-22 13 41.95700	166 29 05.59331	160.321	100.010
PTVL	-17 44 57.95614	168 18 54.07726	86.466	22.648
SAMO	-13 50 57.14127	-171 44 18.34073	76.761	39.520
TONG	-21 08 40.96954	-175 10 45.15552	56.275	3.705

3.3 Positional Uncertainty (95% C.L.) - Geodetic, ITRF2014

Station	Longitude(East) (m)	Latitude(North) (m)	Ellipsoidal Height(Up) (m)
BM01	0.014	0.010	0.041

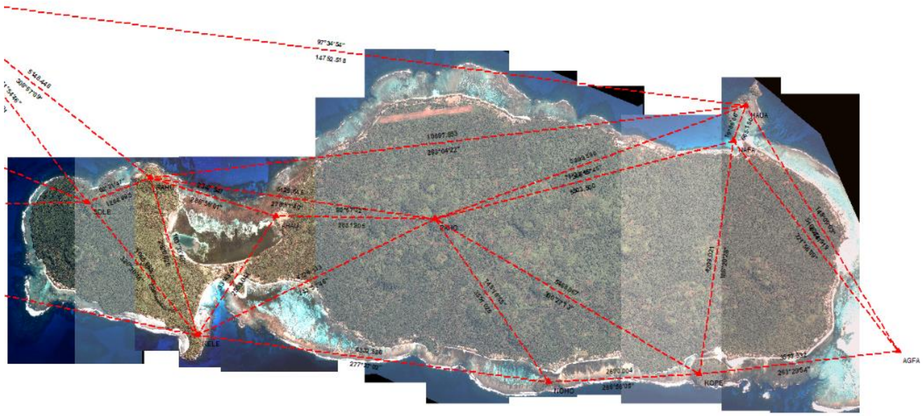
GNSS Survey Data Processing & Analysis

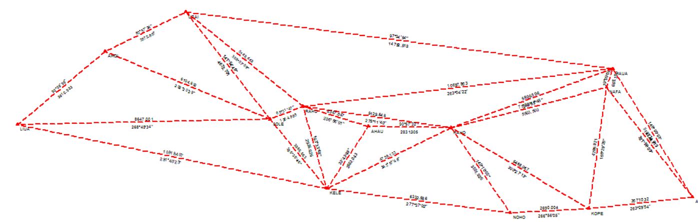


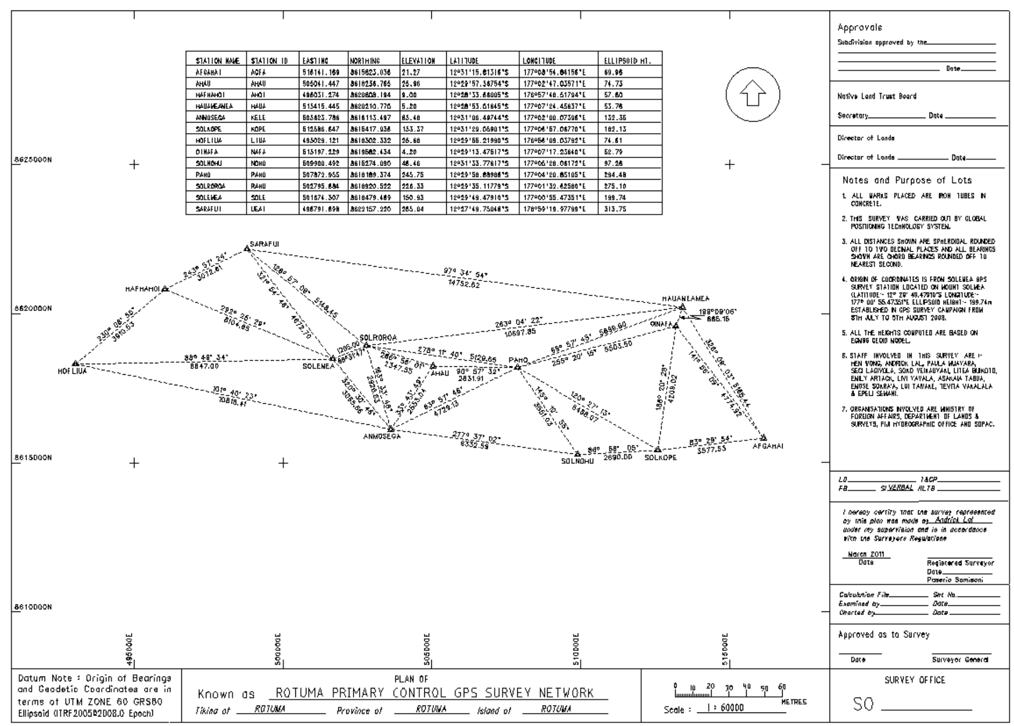
- **Horizontal Datum**
  - **ITRF2008**
  - **FMG 1986**
- **Vertical Datum**
  - **Mean Sea Level**

	GPS - ITRF2005@2008		FMG1986			Difference	
Point ID	Easting	Northing	Easting	Northing	Source	Easting	Northing
DELAISIRO	1859568.018	3906832.807	1859567.52	3906832.53	SO4242 Lands	0.50	0.28
DELANADAMU	1857337.157	3908177.427					
LAUT	1861654.67	3932152.668			GA/SOPAC		
OSONASOKI	1864531.073	3910904.769	1864530.72	3910904.9	Lands	0.35	-0.13
SANA	1862618.49	3918080.606	1862617.82	3918080.41	SO4242 Lands	0.67	0.20
SS3506	1862729.196	3915474.878	1862728.58	3915474.66	SO4242 Lands	0.62	0.22
TOGOYANASOLO2	1867008.881	3914145.559	1867008.3	3914145.46	SO4242 Lands	0.58	0.10

GNSS Survey Data Processing & Product







STATION NAME	STATION ID	EASTING	NORTHING	ELEVATION	LATITUDE	LONGITUDE	ELLIPSOID HT.
AFGAHAI	AGFA	516141.169	8615623.036	21.27	12°31'15.61316"S	177°08'54.84156"E	69.96
AHAU	AHAU	505041.447	8618236.765	26.96	12°29'57.56754"S	177°02'47.03571"E	74.73
HAFHAHOI	AHOI	498031.274	8620808.194	9.00	12°28'33.86005"S	176°57'46.51794"E	57.60
HAUAMEANEA	HAUA	513415.445	8620210.776	5.20	12°28'53.61645"S	177°07'24.45637"E	53.78
ANNOSEGA	KELE	503623.786	8616113.497	85.48	12°31'06.49744"S	177°02'00.07396"E	132.35
SOLKOPE	KOPE	512586.647	8615417.938	153.37	12°31'29.05901"S	177°06'57.06770"E	182.13
HOFLIUA	LIUA	493029.121	8618302.332	26.66	12°29'55.21990"S	176°56'09.03792"E	74.61
OINAFA	NAFA	515197.229	8619582.434	4.20	12°29'13.47617"S	177°07'17.23640"E	52.79
SOLNOHU	NOHO	509900.492	8615274.090	48.46	12°31'33.77617"S	177°06'28.06172"E	97.28
PAHO	PAHO	507872.955	8618189.374	245.75	12°29'58.83986"S	177°04'20.85105"E	294.48
SOLROROA	RAHU	502795.684	8618920.522	226.33	12°29'35.11779"S	177°01'32.62580"E	275.10
SOLENEA	SOLE	501674.307	8618479.489	150.93	12°29'49.47910"S	177°00'55.47351"E	199.74
SARAFUI	UEAI	498791.698	8622157.220	265.04	12°27'49.75048"S	176°59'19.97799"E	313.75

Approvals
Subdivision approved by the ________
Date ________

Native Land Trust Board
Secretary ________ Date ________

Director of Lands
Director of Lands ________ Date ________

Notes and Purpose of Lots

1. ALL MARKS PLACED ARE IRON TUBES IN CONCRETE.
2. THIS SURVEY WAS CARRIED OUT BY GLOBAL POSITIONING TECHNOLOGY SYSTEM.
3. ALL DISTANCES SHOWN ARE SPHEROIDAL ROUNDED OFF TO TWO DECIMAL PLACES AND ALL BEARINGS SHOWN ARE CHORD BEARINGS ROUNDED OFF TO NEAREST SECOND.
4. ORIGIN OF COORDINATES IS FROM SOLENEA GPS SURVEY STATION LOCATED ON MOUNT SOLNEA (LATITUDE:- 12° 29' 49.47910"S LONGITUDE:- 177° 00' 55.47351"E ELLIPSOID HEIGHT:- 199.74m ESTABLISHED IN GPS SURVEY CAMPAIGN FROM 8TH JULY TO 5TH AUGUST 2008.
5. ALL THE HEIGHTS COMPUTED ARE BASED ON EGM96 GEOID MODEL.
6. STAFF INVOLVED IN THIS SURVEY ARE :- HEN WONG, ANDRICK LAL, PAULA MUAYARA, SECI LAGIVOLA, SOKO VEIKAUYAKI, LITEA BUKOTO, EMILY ARTACK, LIVI YAVALA, ASAKAIA TABUA, EMOSE SOKRA'A, LUI TAWAKE, TEVITA VAKALALA & EPELI SEMANI.
7. ORGANISATIONS INVOLVED ARE MINISTRY OF FOREIGN AFFAIRS, DEPARTMENT OF LANDS & SURVEYS, FIJI HYDROGRAPHIC OFFICE AND SOPAC.

LO ________ T&CP ________
FB ________ SI VERBAL NLTB ________

I hereby certify that the survey represented by this plan was made by Andrick Lal under my supervision and is in accordance with the Surveyors Regulations

March 2011
Date

Registered Surveyor
Date ________
Paserio Samisoni

Calculation File ________ Sht No. ________
Examined by ________ Date ________
Charted by ________ Date ________

Approved as to Survey
Date Surveyor General

Datum Note : Origin of Bearings and Geodetic Coordinates are in terms of UTM ZONE 60 GRS80 Ellipsoid (ITRF2005@2008.0 Epoch)

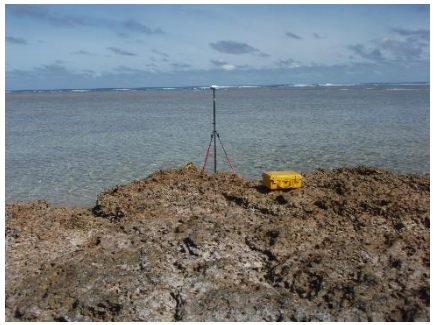
PLAN OF
Known as ROTUMA PRIMARY CONTROL GPS SURVEY NETWORK
Tikina of ROTUMA Province of ROTUMA Island of ROTUMA

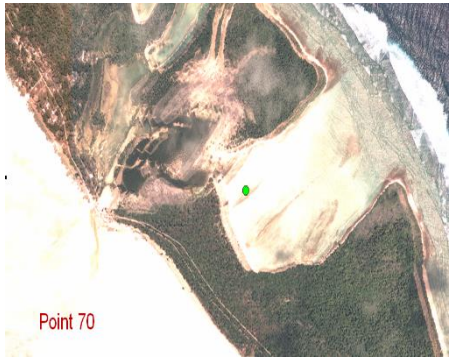
Scale : 1 : 60000 METRES

SURVEY OFFICE
SO ________

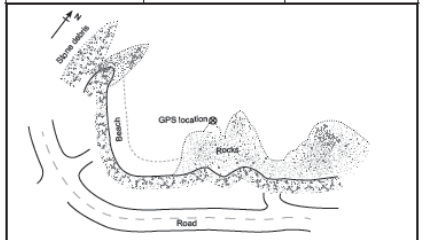
GNSS Survey Points - Documentation

Pacific Community
Communauté du Pacifique

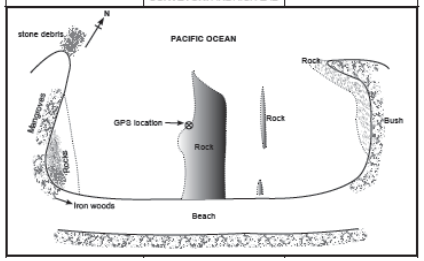




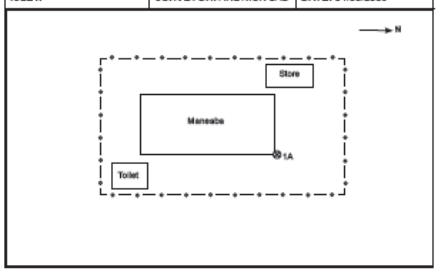
COUNTRY: KIRIBATI	PROJECT: KIMBP (Tarawa)	L. D. P.: 4
ATOLL: TARAWA	ORGANISATION: SOPAC	POINT No.: 73
ISLET: -	SURVEYOR: ANDRICK LAL	DATE: 06/03/2009



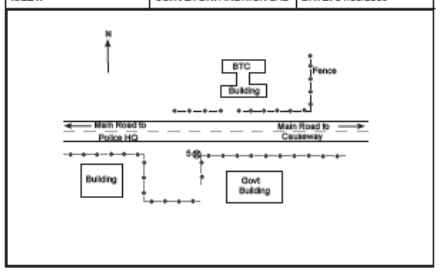
COUNTRY: KIRIBATI	PROJECT: KIMBP (Tarawa)	S. D. P.: 1
ATOLL: TARAWA	ORGANISATION: SOPAC	POINT No.: 70
ISLET: -	SURVEYOR: ANDRICK LAL	DATE: 06/03/2009



COUNTRY: KIRIBATI	PROJECT: KIMBP (Tarawa)	L. D. P.: 18
ATOLL: TARAWA	ORGANISATION: SOPAC	POINT No.: 1
ISLET: -	SURVEYOR: ANDRICK LAL	DATE: 04/03/2009

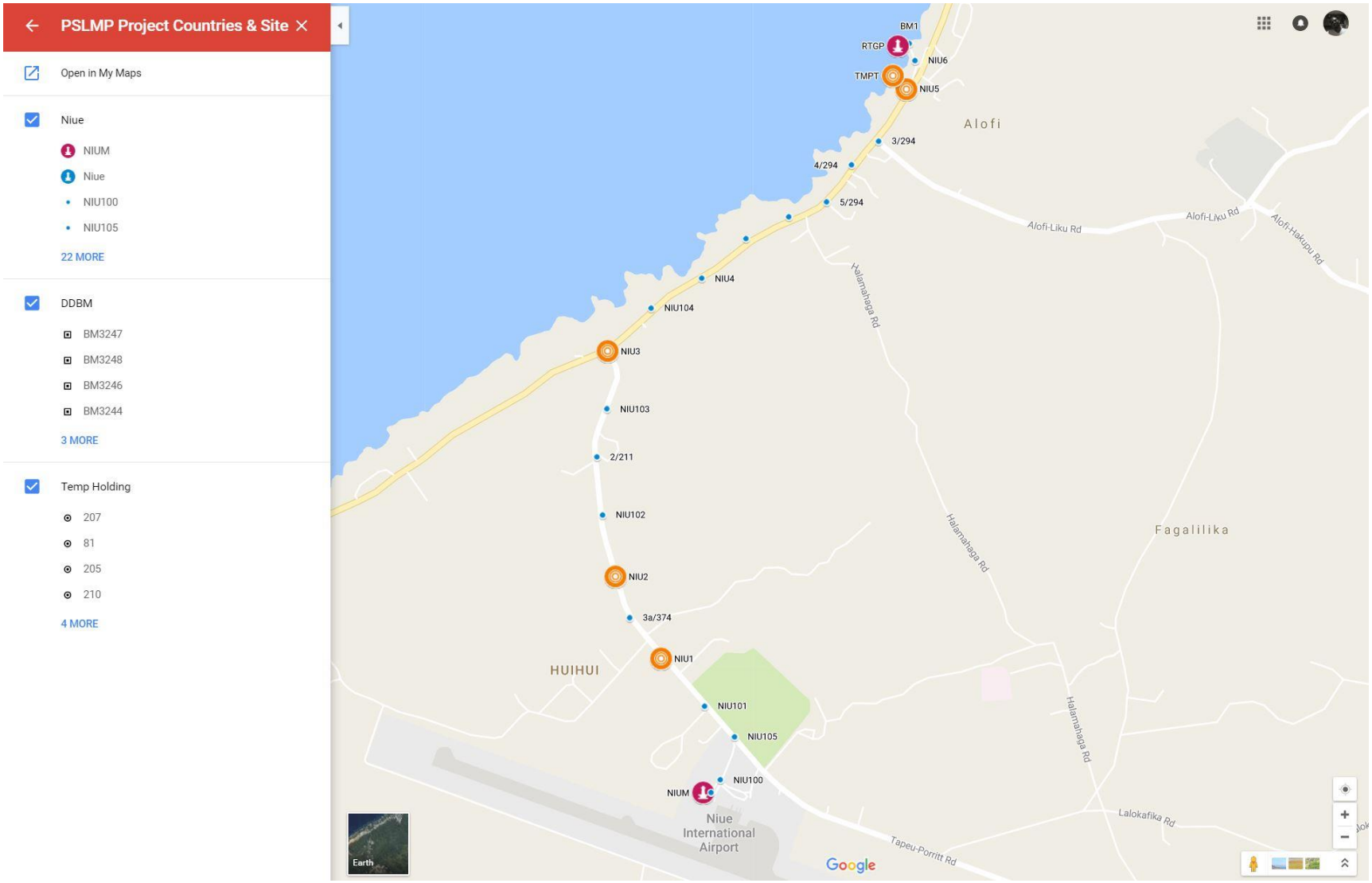


COUNTRY: KIRIBATI	PROJECT: KIMBP (Tarawa)	L. D. P.: 22
ATOLL: TARAWA	ORGANISATION: SOPAC	POINT No.: 5
ISLET: -	SURVEYOR: ANDRICK LAL	DATE: 04/03/2009



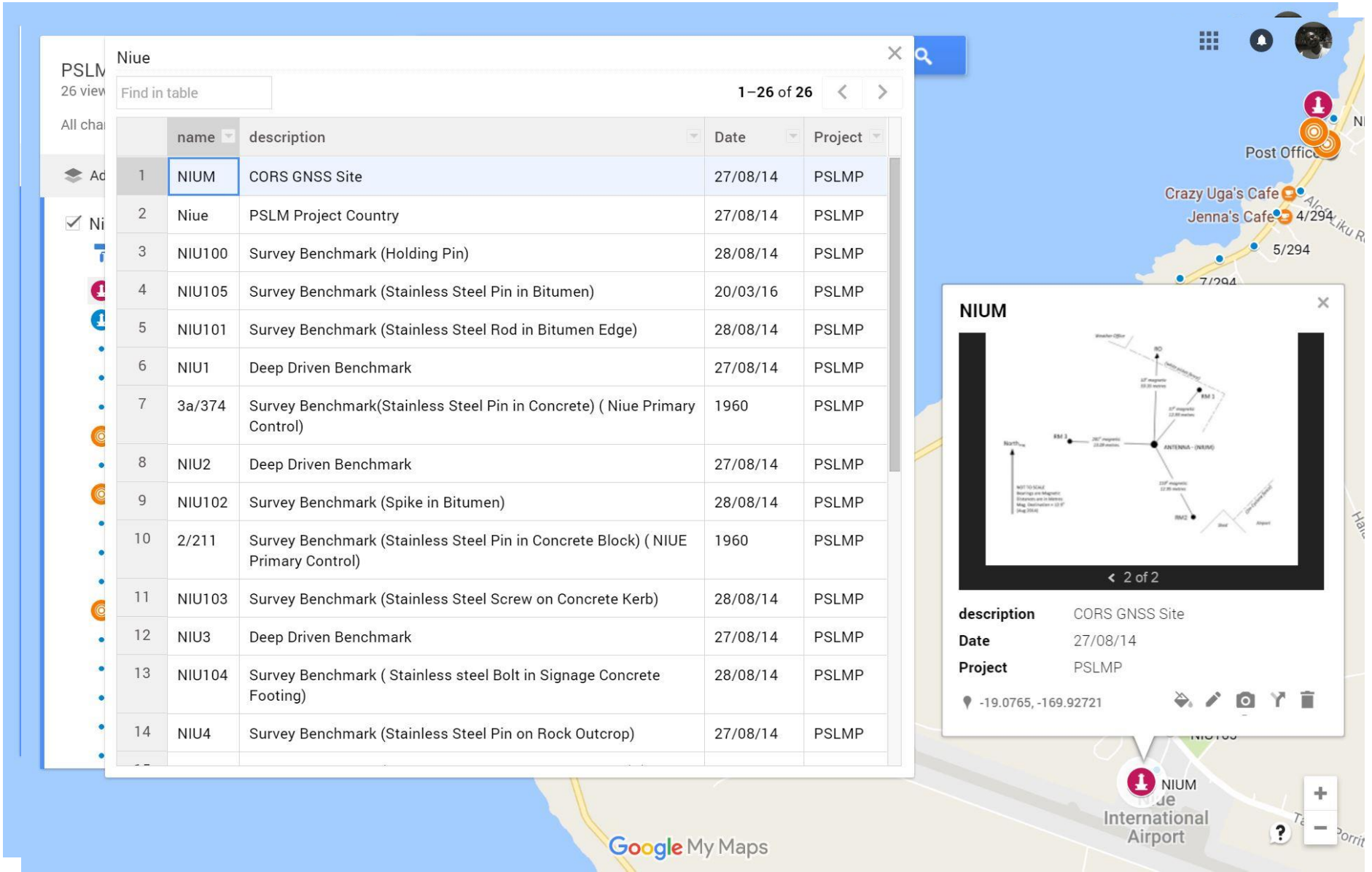
PSLGMP Survey Benchmarks

Pacific Community
Communauté du Pacifique



PSLGMP Survey Benchmarks

Pacific Community
Communauté du Pacifique



Building Capacity & Resilience

Pacific Community
Communauté du Pacifique

- Survey Visits
- Freight & Logistics
- Field Survey Operations
  - Planning
  - Geodetic Surveys
  - Survey Data Processing & Analysis
  - Reporting
- Survey Guidelines (Standards & Specifications)
- Review and Maintenance of Geodetic Infrastructure
- Improve Geodetic Capacity

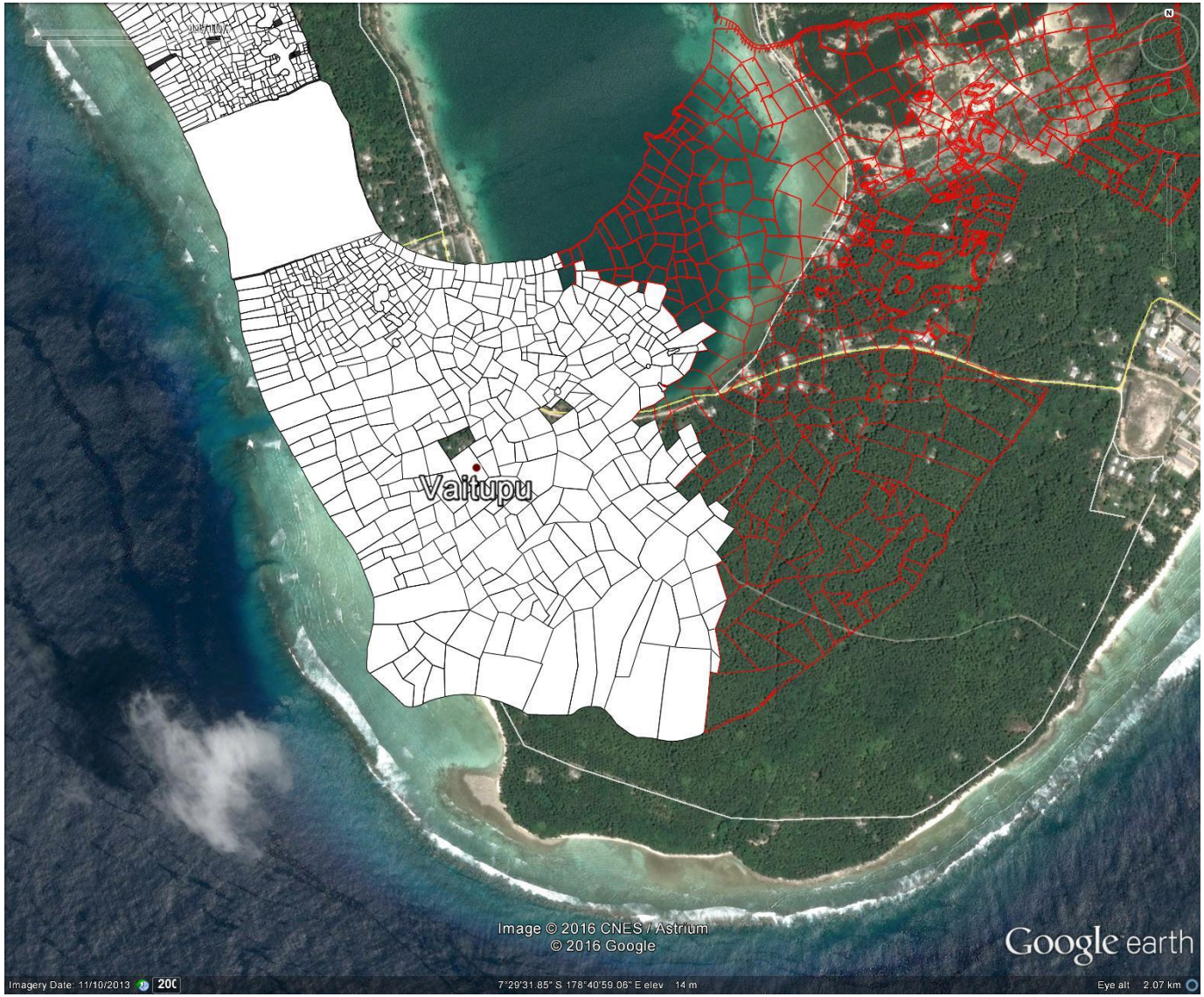
Capacity Building – Pacific Islands

Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu

- Sustainable capacity - GNSS Surveys

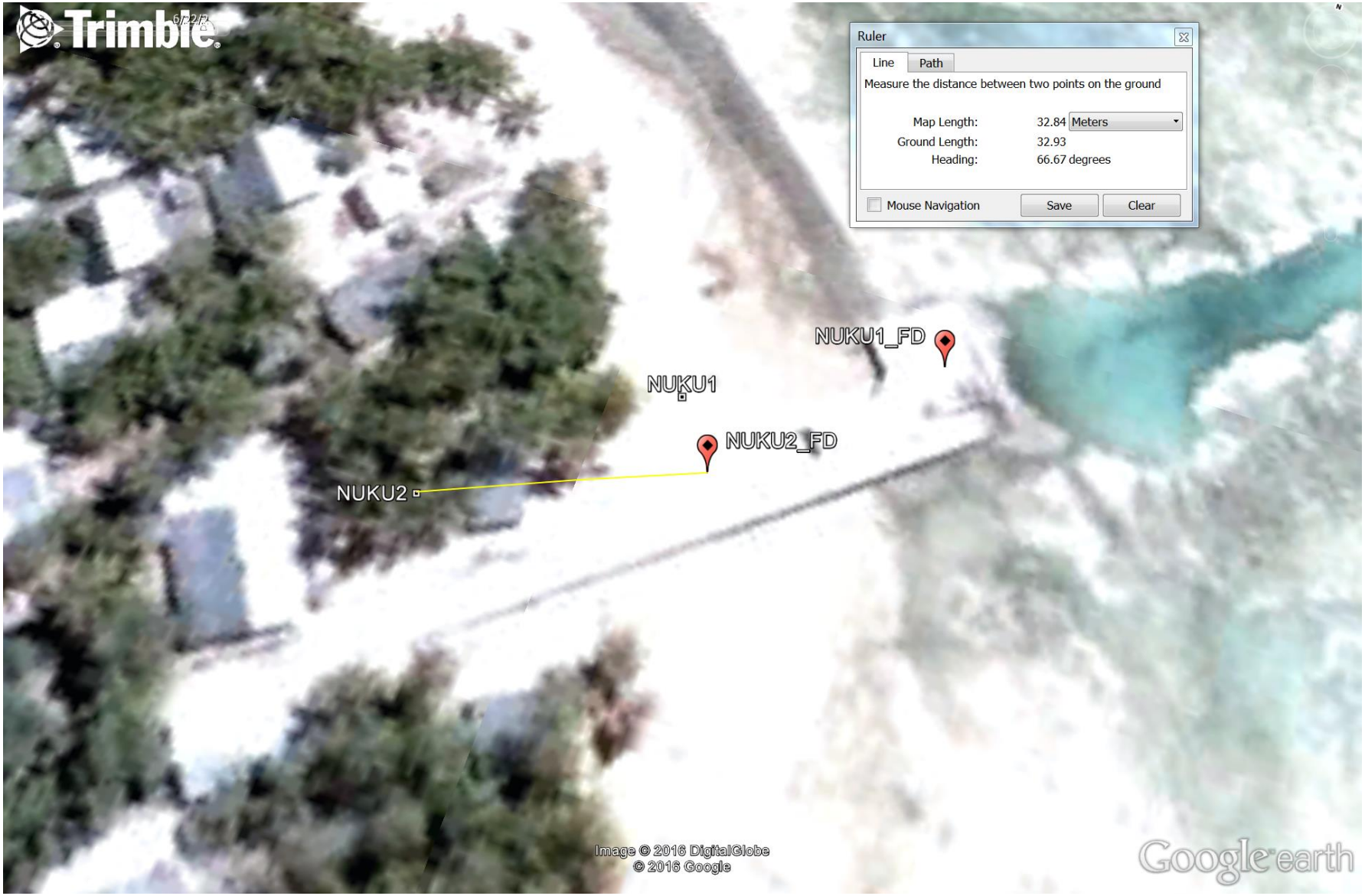
Cadastre and Satellite Imagery

Pacific Community
Communauté du Pacifique



GNSS Surveys & Satellite Imagery

Pacific Community
Communauté du Pacifique



Challenges

- Lack of technical capacity for surveying in the region
- Financial support of the Procurement and the Maintenance of the survey equipment and surveying software in SPC and for PICs.
- Freight logistics
- Sustainable development of surveying capacity in the region.
- Implementation of the PGSC Strategy; 10 year regional plan
  - Leadership and Visibility
  - Standards and Technology
  - Sustainability
  - Capacity Building
- Articulate the emphasis of the development PGSC Strategy and its impact for the Socio & Economic growth regionally and internationally.
- Attract women surveyors
- Surveying Equipment including transportation
- Survey Legislation and Geospatial Policy

Vinaka Vakalevu

Pacific Community
Communauté du Pacifique