

# What is GNSS CORS?

**FIG References Frame in Practice Seminar**

**Operational Aspects of GNSS CORS Technical Workshop**

Holiday Inn, Suva - Fiji

**PGSC Partnership Desk, GEM Division, Pacific Community (SPC)**

**National Geodesy & GNSS Networks Team, Geoscience Australia**

*18 September 2018*

# What does GNSS CORS stands for..

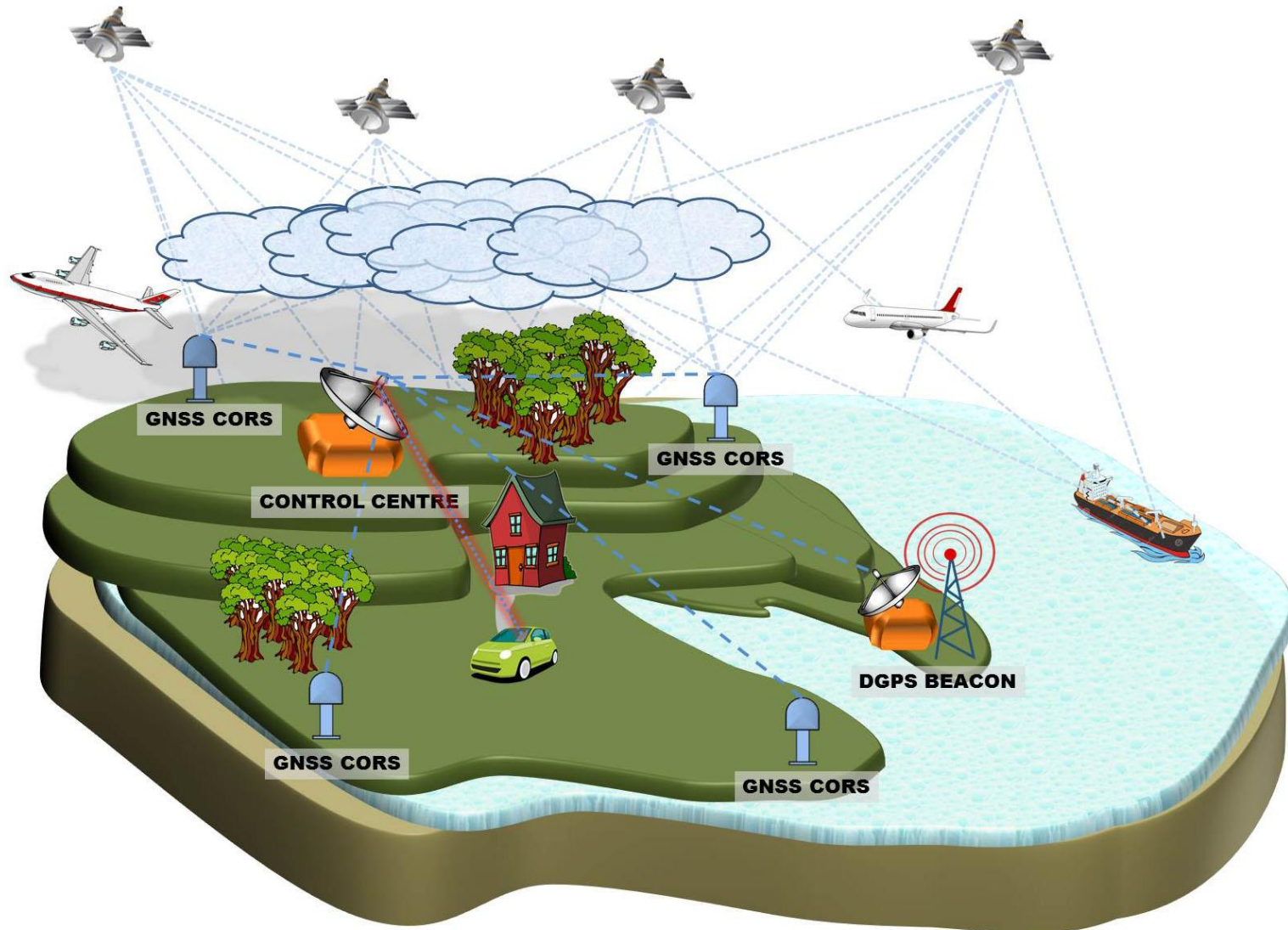
**Global Navigation Satellite Systems  
(GNSS)**

**Continuously Operating Reference Station  
(CORS)**

# What is GNSS CORS?

**It** is a network of permanent geodetic quality GNSS Stations (Geospatial Infrastructure) established on a stable ground that operates continuously to ensure accurate positioning and navigation at a specified time over an internet connection in real time.

# GNSS CORS Network



# What is GNSS?

A satellite navigation system with global coverage is termed as **Global Navigation Satellite System (GNSS)** that comprises of the United States Global Positioning System (GPS), Russia's GLONASS, China's BeiDou Navigation Satellite System (BDS) and the European Union's Galileo that provides positioning and navigation solutions at a specified time.





# GNSS COR Station



Monument



Antenna



Power



Receiver (Hut)



Communication

# GNSS CORS - Requirements

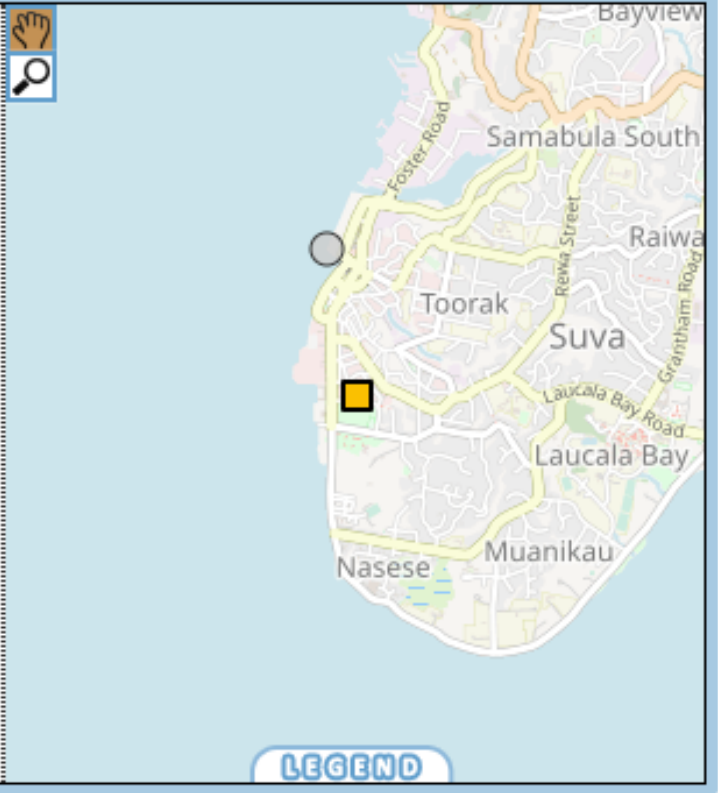
- Foundation
- Monumentation
- Interference
- Power
- Communications
- GNSS Receiver
- GNSS Antenna
- Weather Station
- Coordination
- Site Monitoring
- Data Format
- Reliability
- Metadata

# Background - GPS CORS

## Station summary

### SUVA

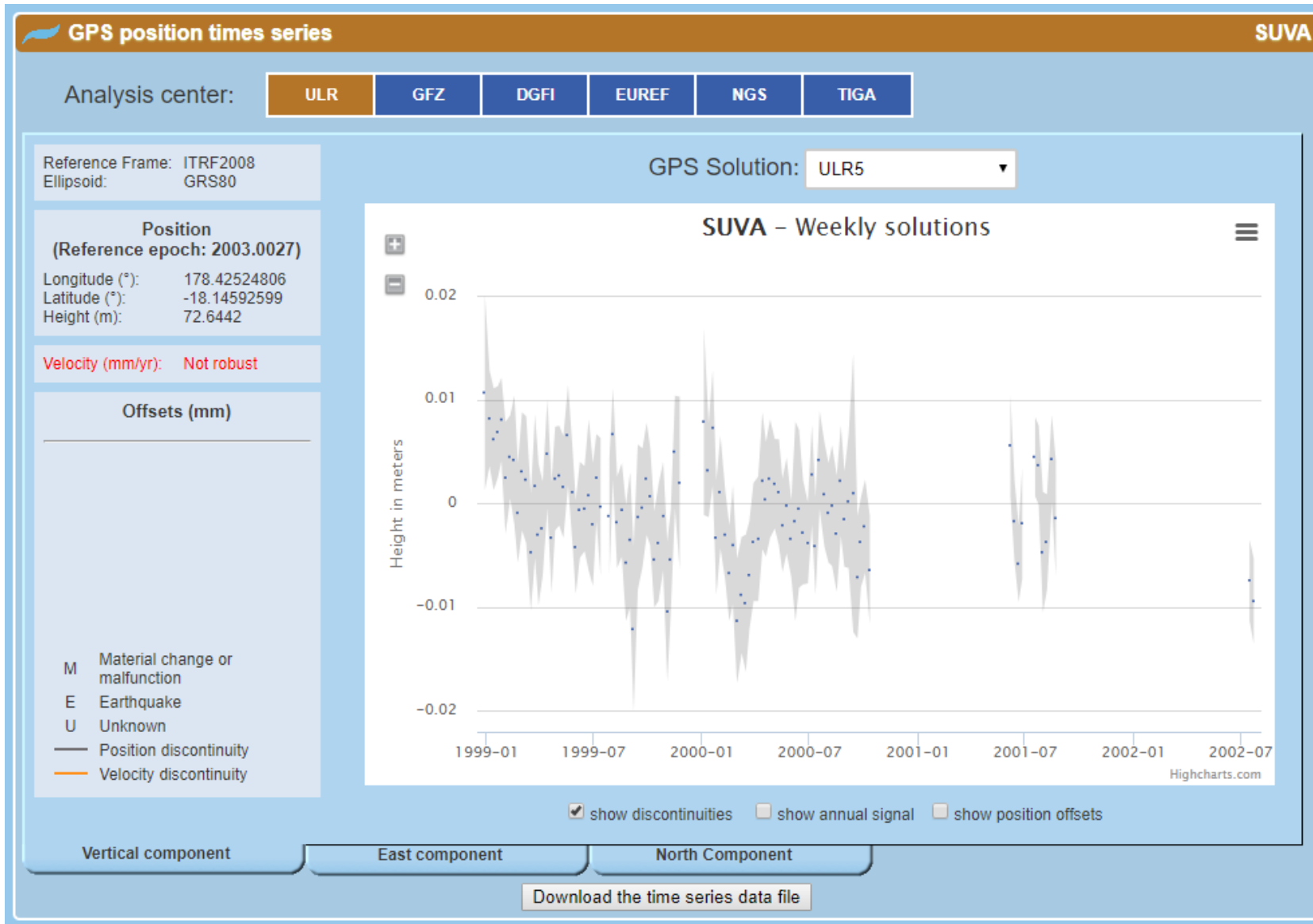
IGS-type acronym :	SUVA
Latitude :	-18.14590000
Longitude :	178.42520000
Installed date :	1999-01-01
Decommissioned date :	
Country :	FIJI
City :	SUVA
Station status :	No data for 30 days (orange)
Distance to Tide Gauge (m) :	1168
Domes Nr.:	50801S001
Station operator:	Unknown <a href="#">Manage this station</a>
IGS-like station form :	<input type="text" value="suva_20010501.log (current)"/> <a href="#">View</a>



LEGEND



# GPS CORS - SUVA



# GPS CORS, SUVA

## Data available at SONEL

SUVA



First data : 1999-01-01 (1999-001) -- Latest data : 2002-07-26 (2002-207)

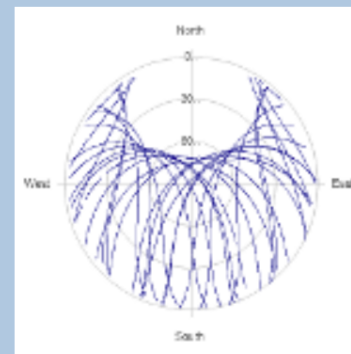
Click on the timeline to display detailed calendar

## Quality plots on RINEX files

SUVA



Observations & tracking performance



Satellite tracking



Plots generated using  
software developed with the  
EPN team at ROB

## Co-located instruments

SUVA

Tide gauge : **SUVA-A** (*SUVTG*)

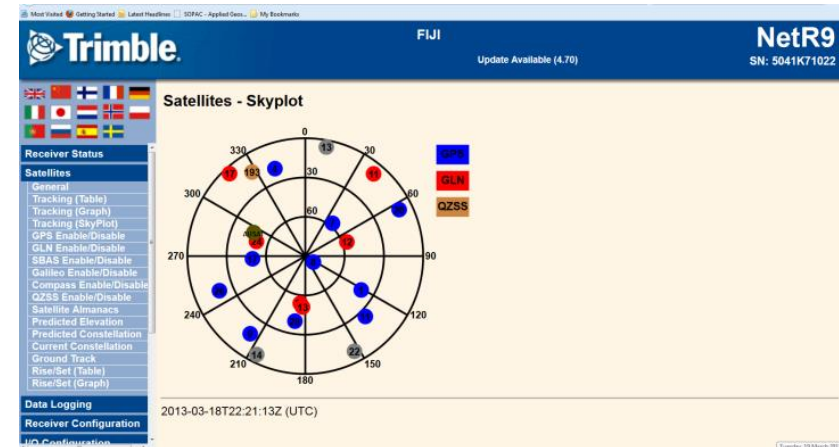
# GNSS CORS - LAUT

Established in November 2002; Supported by Survey Department



## 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>

# Types of GNSS CORS





# Types of GNSS CORS





# Types of GNSS CORS



# Types of GNSS CORS

## **Tier 1 GNSS CORS;**

High stability monuments for geoscientific research and global reference frame definition.

## **Tier 2 GNSS CORS;**

High stability monuments for the national geodetic agencies to define and maintain national geodetic reference frames. These sites form the primary national GNSS network. Tier 1 CORS sites are generally a subset of these Tier 2 stations, providing a link between the national geodetic datum and the ITRF

## **Tier 3 GNSS CORS;**

Stable monuments established by national, state, territory governments and/or commercial agencies for the densification of the national CORS network but often supporting real-time positioning applications. These stations generally operate in, and provide access to, the datum rather than define it.

# Why GNSS CORS??

- GNSS CORS network is aligned to International Terrestrial Reference Frame (ITRF) that includes WGS84, which is the Global Geodetic Reference Frame (GGRF)
- The GGRF underpins the global coordinate system which allows us to know where we and things on the Earth are
- The GGRF requires a well distributed global infrastructure of observatories
- Countries access the GGRF through regional and national GNSS CORS networks

# 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



United Nations  
General Assembly  
Sixty-ninth session  
Agenda item 9  
Report of the Economic and Social Council

Dist. Limited  
19 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, and recognizing also its resolution 44/68 of 6 December 1999, in which the Assembly endorsed the resolution entitled "The Space Millennium Vienna Declaration on Space and Human Development", 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<sup>1</sup> 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,

<sup>1</sup> Adopted by the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNCONF-III), held in Vienna from 19 to 30 July 1999 (see A/CONF.193/L.1, resolution 1).

<sup>2</sup> Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-8 September 2002 (United Nations publication, Sales No. E.03.S.I.1 and corrigendum, chap. I, resolution 2, annex).

15492953 JES 150215

Photo recycle

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.

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.

Many 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, systems remain for nearly 80 percent of all reported disasters.

**Flood preparedness**

The Surveyor explains that until recently, despite the immense social and economic costs, Pacific island countries have been reactive rather than proactive in dealing with flood preparedness and response. However, this is changing - a project addressing flooding of Fiji river basins, is aiming to strengthen flood forecasting and warning systems, flood risk assessment and address institutional strengthening for integrated flood management, Lal says.

The flood integrated flood management is a pilot project aiming to develop integrated flood management for the Pacific using tidal as a case study.

**Topography model**

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

Another deliverable is use of a 2D flood inundation model and flood hazard and risk mapping to assess flood mitigation measures and dissemination of the methodology to the Pacific region.

The model 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 host country's datasets, 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 lead project include the National Disaster Management Office, Town and Country Planning, Water Authority of Fiji, Fiji Meteorological Service and Land and Water Resources Management.

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

UN-GGIM - Global Geodetic Reference Frame Working Group

February 2016  
06

**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 GGIM 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.

ggim.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 the geodesy, geodesic researchers, experts and surveys 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 geospatial data sharing**

"Open geospatial 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," said Alessandro Giacobbe, Director, IAGLR, Monaco.

**Geospatial capacity building**

"The UN resolution has influenced the 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," said Rishabh Mishra, Director, National Geomatics Engineering Research Institute, New Delhi, India.

**Joint efforts on networks**

"The UN resolution can give benefits to the research in the use of new approaches and methods of surveying in geodesy, as well as joint efforts to establish regional networks of GNSS CORS by the established national, public or private networks," said Alexander Kopylov, Deputy Director of Institute for Registration of Rights to Immovable Property, Kirgizstan.

**Defining sea baselines**

"The high latitudes of planet Earth, where combinations of data sources are essential," said Bjørn Rognvald Pedersen, Norwegian University of Science, Technology and Life Sciences, Norway.

**Observing global change**

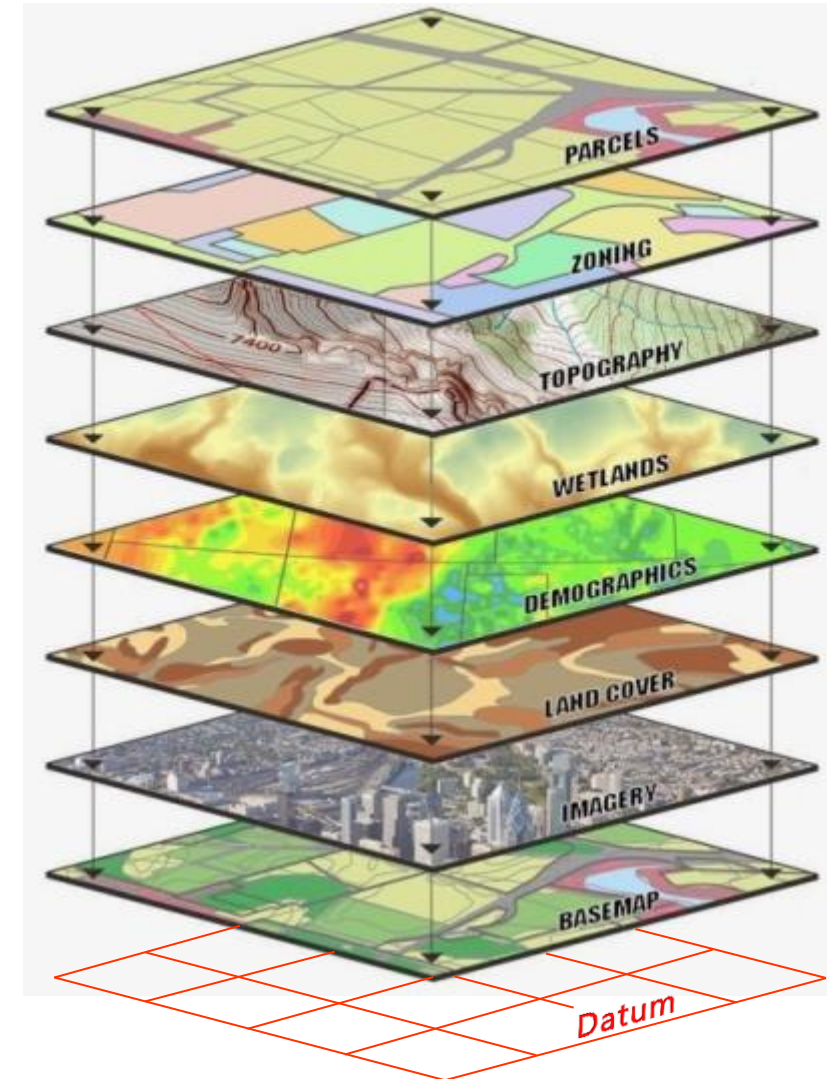
"The Global Geodetic Reference Frame is fundamental to integrating geodetic observations related to global change, whether obtained from the surface of the planet or from satellites in space. Our own research includes

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



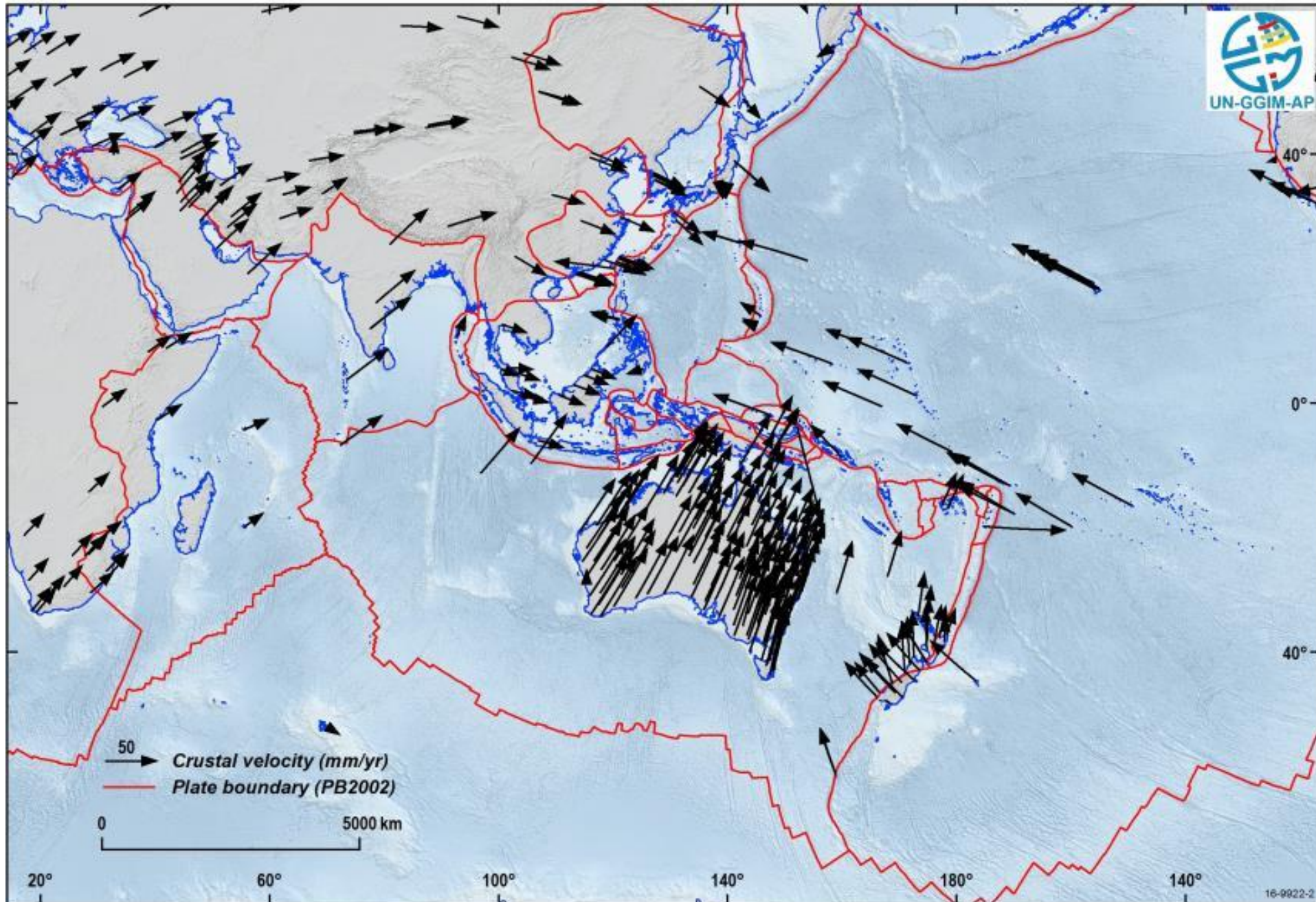
# GNSS CORS Context & Purpose

- Therefore in geodetic context - GNSS CORS forms an integral component of the nation's geospatial infrastructure.
- The primary purpose of GNSS CORS is to collect data to measure and monitor the land movement so that the reference frame and datum can be defined, improved, and maintained for geoscience and spatial datasets.
- GNSS CORS also supports applications such as infrastructure projects, asset management, resource and emergency management, machine guidance, intelligent transport systems, precision agriculture and environmental research.





# Crustal velocities of Asia and the Pacific

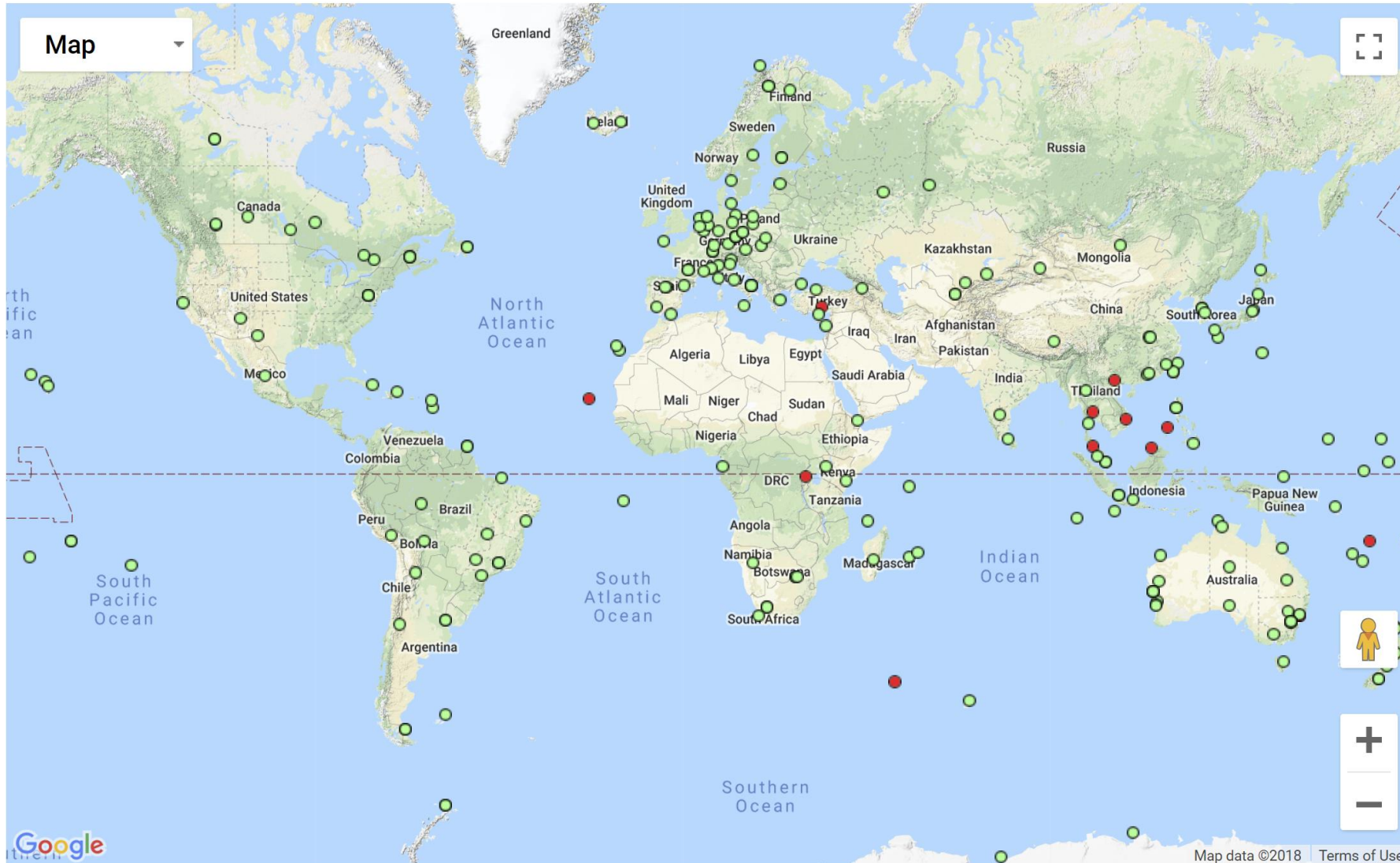




# Network

<http://www.igs.org/network?network=multi-GNSS>

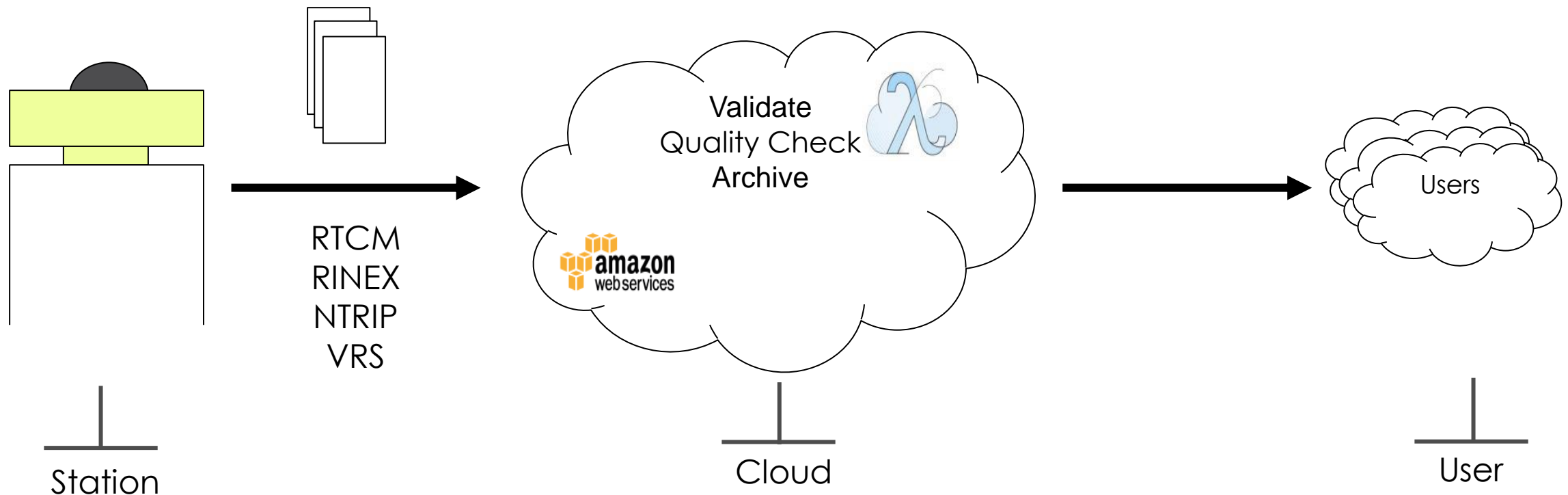
Information



# Accessibility – Data Centre in the Cloud



Provide access to a true and complete GNSS data archive to users at local, national, regional and international level.



# Users & Projects of GNSS CORS



Australian Government  
Geoscience Australia



...?

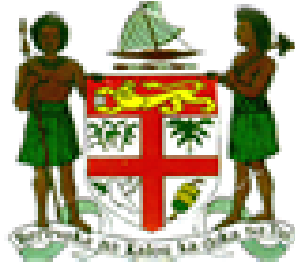




# GNSS CORS Commission – 20<sup>th</sup> September 2018



Pacific  
Community  
Communauté  
du Pacifique



## MEMORANDUM OF UNDERSTANDING

BETWEEN

THE PACIFIC COMMUNITY (SPC)

&

THE MINERAL RESOURCES DEPARTMENT OF THE MINISTRY OF LANDS AND MINERAL RESOURCES

ON BEHALF OF THE GOVERNMENT OF THE REPUBLIC OF FIJI

### PREAMBLE

The Pacific Community hereinafter referred to as 'SPC' and the Mineral Resources Department hereinafter referred to as 'MRD' of the Ministry of Lands and Mineral Resources for and on behalf of the Government of the Republic of Fiji, share a commitment to establish a Continuous Operating Reference Station (CORS) located at the old Wind Turbine in the Drilling Compound of the MRD located on the corner of Maddocks Road and Mead Road in Nabua.



# Questions?

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**Vinaka**