NIWA
Taihoro Nukurangi

Sustainable measurements post donor funding

Andrew Harper, Alan Porteous, Graham Elley

andrew.harper@niwa.co.nz

TECO 2018, Amsterdam, 8-11 October 2018

Climate, Freshwater & Ocean Science

For many regions of the world, donor funded (aid) projects are essential for the continued development of essential meteorological, climatological and hydrological monitoring networks, and organisational capability.

TECO 2016 - IOM Report No. 125

ICAWS 2017 - IOM Report No. 127

- Consistency – in the design and operational methods of systems nationally and regionally
- Long-term sustainability – adequate financial resourcing and capacity building of staff and NMHS
- Preventive maintenance of networks' needs to be a priority
- The development of measurable competencies – observations, instruments, calibration and network management
- Training – needs to be available at all stages, targeted and regularly reinforced
- Technical agencies and regional partners need to coordinate and sustain their collaborative engagement, to continue to improve the sustainability and resilience of the wider monitoring communities

- 185 Member States and 6 Member Territories public.wmo.int/en/about-us/members

- 47 countries categorised as Least Developed Countries (LDC) www.un.org

- 52 Small Island Developing States (SIDS) unohrlls.org

Least Developed Countries (LDCs)

(47 countries)

Africa 33, Asia 9, Caribbean 1, Pacific 4

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT
UNCTAD

UNITED NATIONS
UNCTAD

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT
UNCTAD

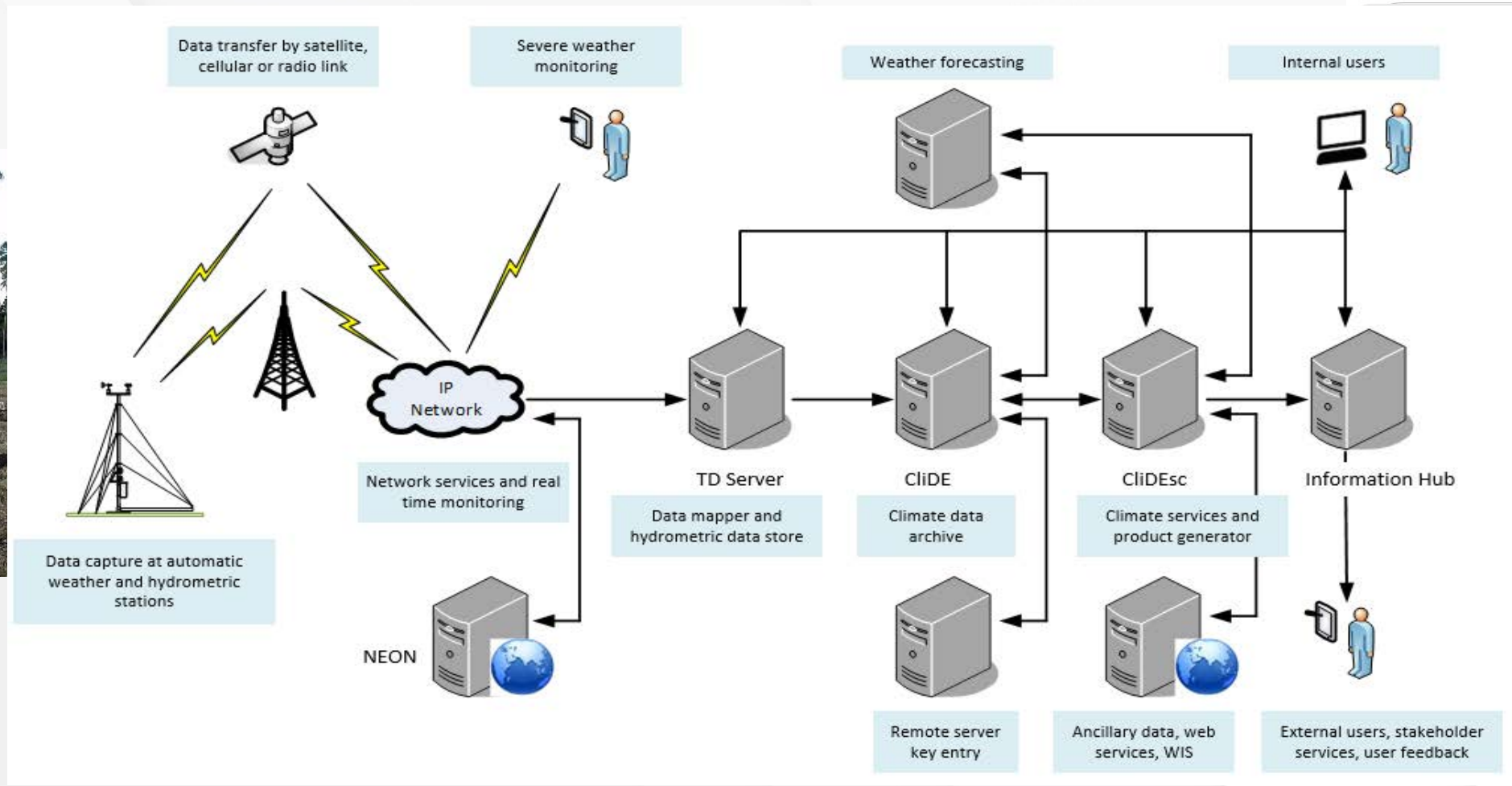
Small Island Developing States (SIDS)

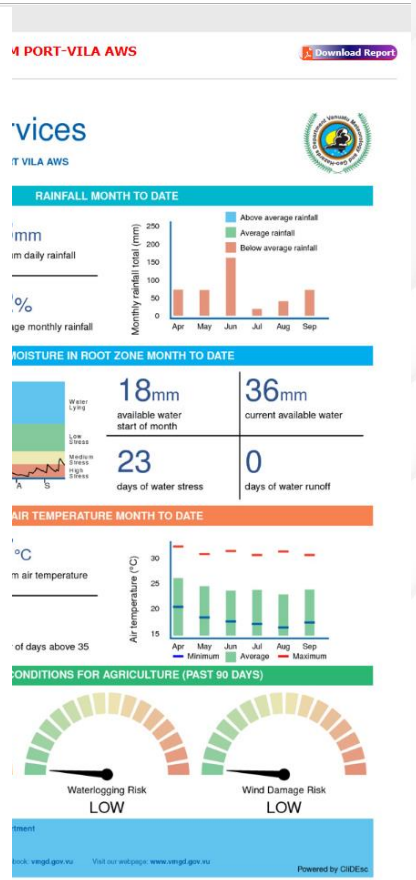
(28 States)

Challenges to sustaining monitoring networks

- Significant constraints on Government resourcing and funding
- Reliance on on-going access to international aid and investment projects
- Many projects have been focussed on Disaster Risk Reduction (DRR) and Climate Change Mitigation (CMM)
  - AWS considered a priority but only a small component of the overall project
  - Provision for maintenance and ongoing operation less important

An end to end CLEWS





NIWA
Taihoro Nukurangi

Pacific Key Outcomes (PIMS 2017-2026)

- ✓ Improved aviation weather services
- ✓ Improved marine weather services and establishment of ocean services
- ✓ Improved public weather services
- ✓ Strengthened NMHSs capacity to implement Multi-Hazard Early Warning Systems (MHEWS) for tropical cyclones, coastal inundation and tsunamis
- ✓ NHMSs contribution to climate change activities
- ✓ Improved climate information and prediction services through the implementation of the Pacific Roadmap for Strengthened Climate Services
- ✓ Strengthen collaboration between meteorological and hydrological services to better manage water resources and reduce the impact of water related hazards
- ✓ Integrated observing and communication systems
- ✓ NMHSs institutional strengthening and capacity development
- ✓ Support to NHMSs is coordinated
- ✓ The Pacific Meteorological Council is an efficient and effective body

Support Initiatives

Operational competencies training

- Development of a Training Workbook
- Supplements the activities of several donor programmes and consultation with several NMHS

Training scholarships

- Short term training scholarships (NZ)

RESPAC (Disaster Resilience in the Pacific Small Island States) regional support programme

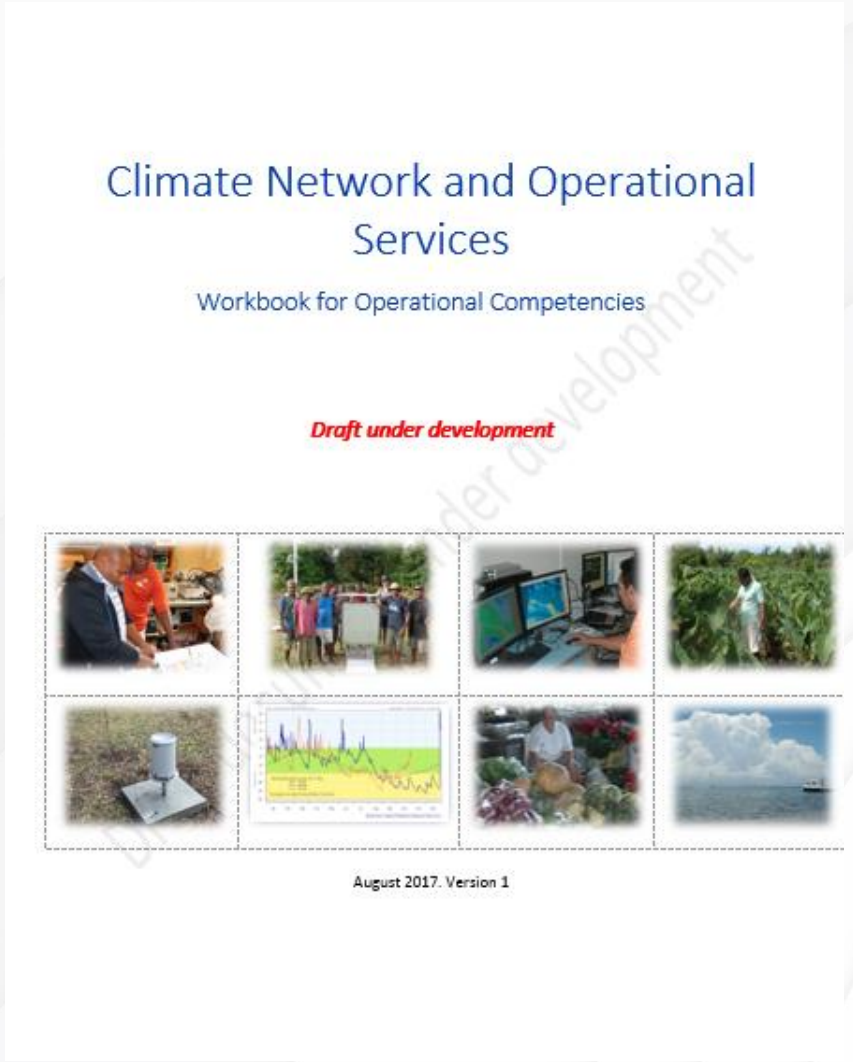
- Partnership with the Russian Federation, UNDP Pacific Office and Pacific Island Governments

Other regional programmes/agencies

- COSPPac (Aust), FINPAC (Finland), JICA (Japan), SPREP etc.

Training Workbook

1. Climate services – strategic and technical overview
2. **Instruments and measurements**
3. Data transfer, telemetry and integration
4. Data storage and quality management
5. Climate monitoring, reporting and client services
6. Sector engagement, decision support and risk management



NIWA
Taihoro Nukurangi

- All staff involved in climate data information, services and early warning systems have a general understanding of all aspects of the system and its **national and international** relevance.
- Improved staff knowledge, skills and competencies related to key operations of climate services, including instruments, telemetry systems, data integration, product development, and sector engagement.
- Improved institutional capacity to sustain, maintain and operate national climate services and build climate resilience within vulnerable communities and economic sectors.

Competency based

- Basic awareness: Has been shown the task and has basic understanding and some knowledge of implementation.
- Competent: Understands the purpose of the task and can implement while under supervision.
- Proficient: Task(s) can be carried out successfully and repeatedly with full understanding, and without supervision.
- Advanced knowledge: The individual has developed knowledge and understanding of the task, and is able to develop improvements, and also train others.
- Expert: The individual is a recognised expert, can trouble shoot and repair, can advise on strategic use of tasks and processes, and can work across multiple applications.

Levels of competency are not distinguished under the tasks and activities covered in the Workbook. They are set out above as a guide for technical staff to self-monitor their own performance levels.

Sourcing guidance material

- Hyperlinked where possible
- >30 WMO docs
- Includes WMO information portal

	Automatic weather stations operations manual NIWA technical guide to AWS operations		**Electronic weat stations inspect calibration mar** NIWA guide to mai systems to optimal standards
	Data to CliDE User Guide V1.8 September 2013		**CliDE User Guid** A guide for adminis users of the Climat Environment (CliDE management syste
	CliDEsc User Guide A guide to using the CliDEsc product generator system, including building and installing new products and services		**Unidata NRT U** Should be read in with associated Sta Manual

	Guide to Meteorological Instruments and Methods of Observation WMO-No 8 2014		**Technical Regulations** Vol 1 – General Meteorological Standards and Recommended Practices WMO-No 49 2012
	Technical Regulations Vol 2 – Meteorological Services for International Air Aviation WMO-No 49 2004		**Technical Regulations** Vol 3 - Hydrology WMO-No 49 2006
	Implementation Plan of the Global Framework for Climate Services 2014		**Pacific Islands Meteorological Strategy** 2012-202

NIWA
Taihoro Nukurangi

Module 1 Climate services – strategic and technical overview

- Objectives
- Who should be involved
- Topics
- Background information

Objectives of this module

- Understand and implement the strategic objectives for developing climate and hydrological information and early warning services.
- Understand the technical scope and operations of climate information systems – from observations to decision-making.
- Introduce and outline the technical training programme for operational competencies.

Recommended participants

All technical and operations staff who are operating any part of the climate information and services system.

Topics addressed

PART 1: BACKGROUND

1. National objectives and framework for climate services.
2. Technical infrastructure and operations for climate services.
3. How to use this Workbook: Building operational skills and support: Introduction to the workbook for operational competencies; certification for operational competencies.

PART 2: GETTING STARTED

4. Implementing the system – planning and design, community engagement, user needs.
5. Maintenance and sustainability: staffing; budgets, operational costs; revenue.
6. Health and safety.
7. International collaboration and alignment; Pacific Meteorological Strategy; Global Framework for Climate Services.

Air Temperature			
Make /Model /Serial No			Vaisala HMP155A, M4340486
Physical condition good	√		
Cabling in good condition & secure	√		
Mount secure	√		
Pre-exchange: sensor | reference			Ref 2
Reading #1 ....26.6 .|....26.3...	√		26.5
Reading #2: ... 26.9 .|....26.8...	√		27.2
Reading #3: ... 27.1 .|....27.0			
Reading #4:			

Objectives of this module

- Understand key principles of climate network design and purpose in Solomon Islands.
- Improve skills and knowledge to select, install and calibrate instruments, including suitability for the observing environment and measuring the required variables.
- Plan and implement a programme for sustainability – trouble shooting, instrument rotation and maintenance, documentation and metadata.

Recommended participants

Climate services technical officers, instrument technicians

Topics addressed

1. Climate and hydrometric networks of Solomon Islands
2. Site location and exposure criteria
3. Selecting instruments
4. Installing a station
5. Station commissioning and documentation
6. Storing and preserving station records
7. Station inspections and routine maintenance
8. Trouble shooting and fault diagnosis

Module 2 Instruments and measurements

NIWA
Taihoro Nukurangi

2010

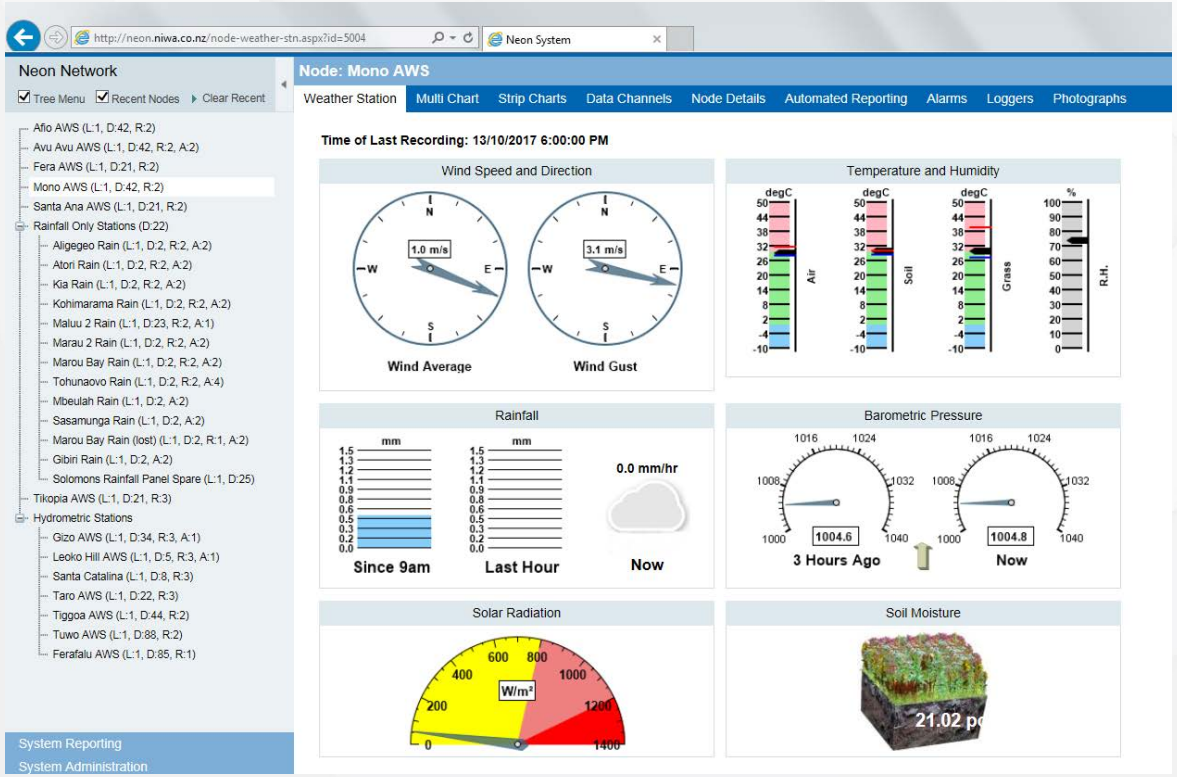
2017

OBJECTIVE: The principles of network design and climate monitoring are understood, and considered prior to new stations being established or network changes being made.

Selection of station location		Completed
Station location complements and strengthens network design and purpose	Network design considers and incorporates measurements that take into account: urban areas; different climate zones; different land-use; range of altitudes; spatially representativeness.	
	As far as possible, any network changes and additions assist the continuity and homogeneity of the climate record.	
	A period of overlap (preferably two years) between new and old observing systems and instruments has been undertaken to assist continuity and homogeneity of records.	
Select suitable locations for stations	Priority has been given to data-sparse regions and poorly observed parameters, for example places exposed to change and/or extreme conditions, or where improved time resolution is needed.	
	The collected data will adequately representative the local environment and climate, including both air and ground (e.g. soil temperature, soil moisture) conditions.	
	Local effects are fully considered ('exposure').	
	Ground surface is suitable for construction.	
	Siting classification tool has been applied (is site 'fit for purpose'?)	
Consider issues related to long-term site suitability and access	Exposure will not change (e.g. due to growth of trees, new buildings) or there will be minimum change.	
	Site access will be available for servicing – may need to establish protocols to give advance notice of access.	
REFERENCES	WMO-No 8 Guide to Meteorological Instruments and Methods of Observation WMO 100 Guide to Climatological Practices WMO 1185 Guidelines on Climate Observation Networks and Systems	

Example table from Module 2, Topic 2 Site location and exposure and criteria

NIWA
Taihoro Nukurangi



- Some overlapping with Module 2
- Larger ICT component

Objectives of this module

- Understand, operate and maintain data logging, transfer by telemetry, and processes for data ingest into the climate data archive.
- Ensure data transfer and integration to all operational services and as required.

Recommended participants

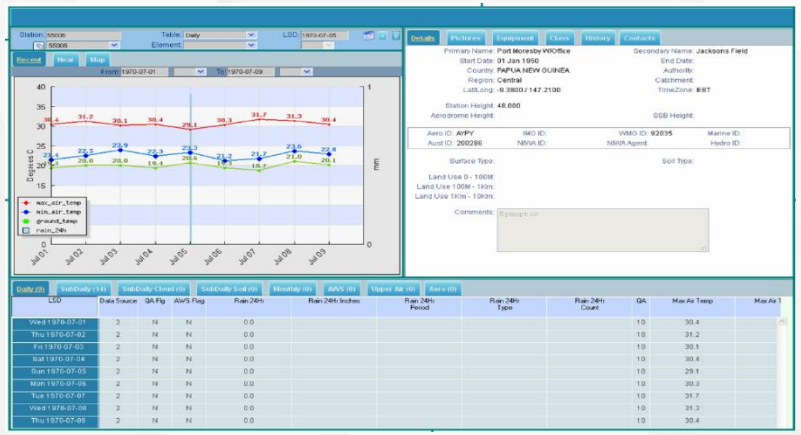
IT staff, instrument technicians, weather and hydrological monitoring and forecasting operational staff.

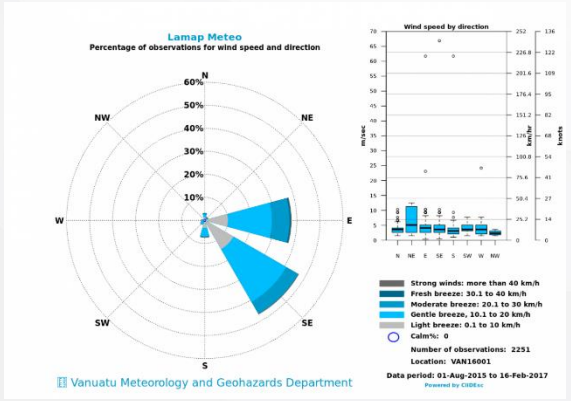
Topics addressed

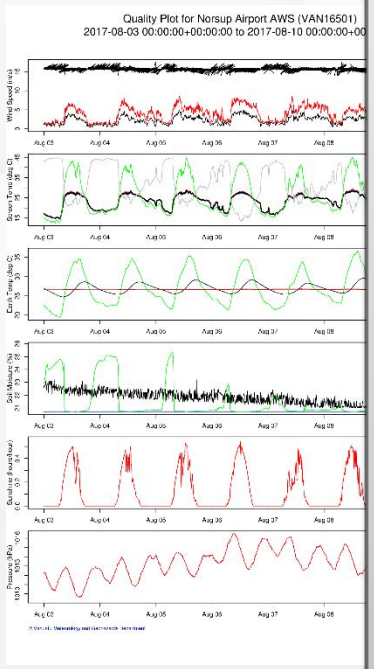
1. Options for telemetry systems – cellular and satellite
2. At the AWS site – the sensor-logger interface
3. NEON configuration: Data logging and transmission
4. NEON operations: Data viewing and applications
5. Data integration with national climate and weather services
6. Data integration with Global systems – GTS/WIS

Module 3 Data transfer, telemetry and integration

NIWA
Taihoro Nukurangi







Objectives of this module

- Improve proficiency in monitoring and maintaining all data entry and ingest services.
- Ensure all operational data are up to date and quality assured.
- Maximise the capability and services of the CliDE data management system.

Recommended participants

Staff involved in key entry, automatic data ingest, data quality assurance and climate reporting; database administrators.

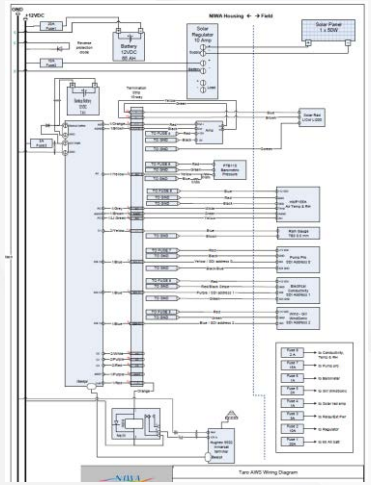
Topics addressed

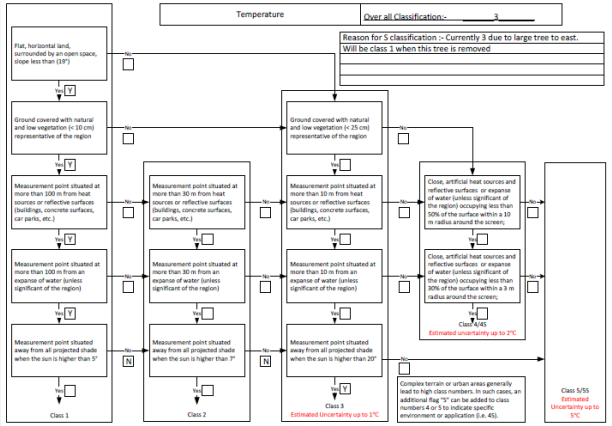
1. CliDE administration
2. Station set up and registration, including metadata
3. Data tables and types
4. Data entry processes; automatic data ingest; monitoring data services.
5. Data quality assurance and data modification
6. Data reports and quality plots; identifying data quality issues.

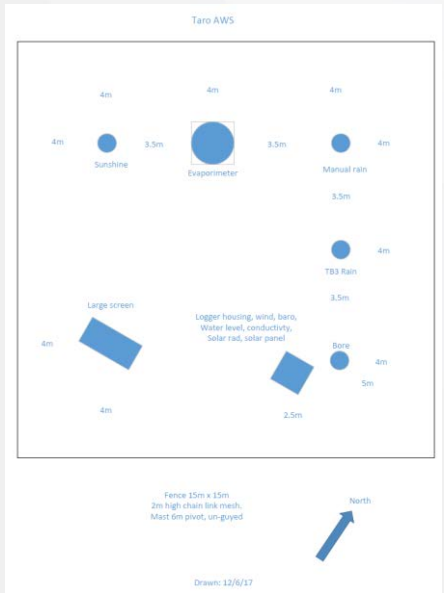
Module 4 Data storage and quality management

- Some overlap with 2 and 3
- Roles clearly defined?

NIWA
Taihoro Nukurangi







General Exposure of Station: Lincoln is some 16km southwest of Christchurch City in a direct line and 10km north of the northern end of Lake Ellesmere. The area is very flat fertile farm land with many shelter belts and hedge rows as wind breaks. The Port Hills begin to rise 8.5km away to the east and reach a height of 573m AMSL at Coopers Knob 12km away. The foothills of the Southern Alps are 60km to the west and northwest.

The enclosure is a 20m x 20m grass plot surrounded by an open mesh 1m high fence. The site is very exposed but is typical of large areas of the Canterbury Plains. There are now obstructions near this site.

There is a shallow dip to the SW.

Exposure is very good.

The Canterbury Nor'wester strikes this area. The rotor generated by this airflow sometimes reaches the ground as a very gusty east to southeasterly.

Local Effects / other information: The Canterbury Nor'Wester strikes this area. This airflow sometimes curls to strike the ground as a very gusty east to south-easterly wind

AUTOMATIC WEATHER STATION RECORD SHEET

Station Name: ANEITYUM AWS — **VMGD No**: VAN03005

WMO No: 91569 — **WIGOS No**: 0-20000-0-91569
ICAO: NVVA

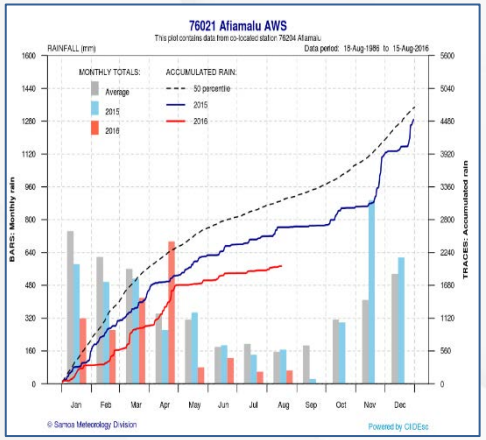
Date Station Established: 24 May 2017
Latitude: 20.23447 deg S — **Longitude**: 169.78219 deg E
Height above MSL: 7 m — **Point used**: Rain gauge
Observer: Vanuatu Meteorological and Geo-Hazards Department
Phone No: +678 24686

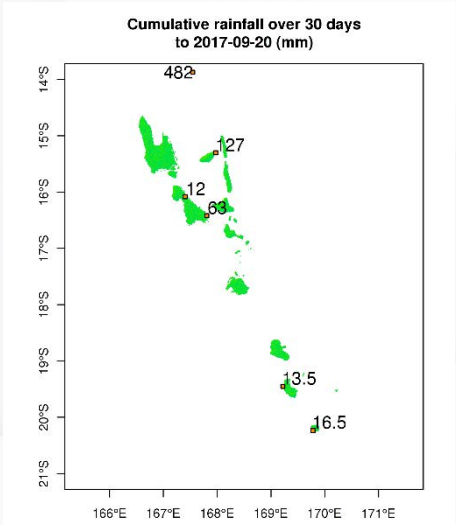
OBJECTIVE: Data entry staff are familiar with station setup, prior to entry of data.

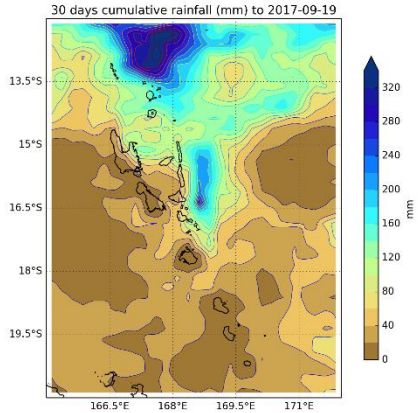
Set up stations in CliDE		Completed
Set up station metadata	Check station information correct and up to date	
	Set up new station for data entry	
	Complete station metadata check list (refer to CliDE station setup)	
	Complete instrument metadata check list and consistent with administration standards	
	Upload station information files and photographs	
Manage manual entry of data records	Key entry daily data	
	Key entry sub daily data	
	Conduct post-entry data checks	
Upload spreadsheet data to CliDE	Set up csv files in native CliDE ingest format	
	Submit and upload spreadsheet data	
	Check upload complete and correct	
Manage automatic data ingest (see also Section 4.5)	Set up DataToCliDE for an automatic station	
	Edit data channel thresholds as needed	
	Switch data channels on/off as needed	
Data rescue: Identify and collate station paper records, and upload data from historic records	Identify stations missing from the electronic data archive	
	Locate and organise/collate paper records	
	Check quality and reliability of paper records metadata	
	Key enter data from historic paper records	
REFERENCES	CliDE User Guide DataToCliDE WMO 100 Guide to Climatological Practices WMO 1185 Guidelines on Climate Observation Networks and Systems WMO 1186 Guidelines on Climate Metadata and Homogenisation	

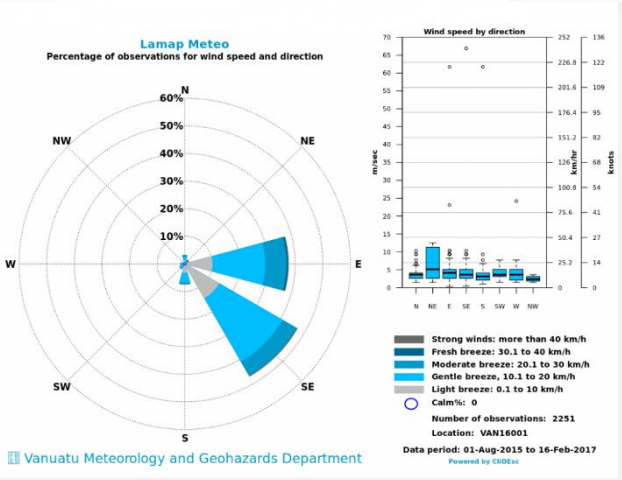
Example table from Module 4, Topic 2 Station set up and registration, including metadata

NIWA
Taihoro Nukurangi









Objectives of this module

- Monitor the climate in real time and recognise climate variations and extreme events.
- Develop and generate routine climate reports for public distribution.
- Respond to key clients to develop and routinely generate customise services.

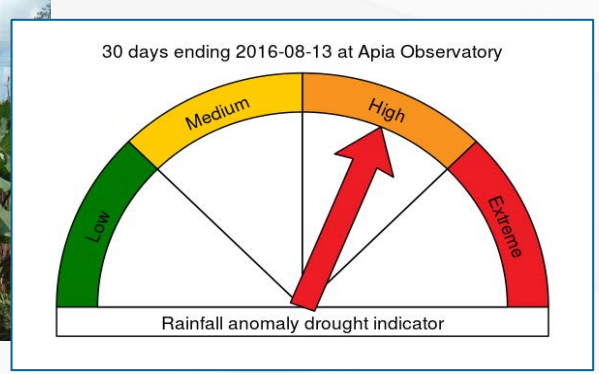
Recommended participants

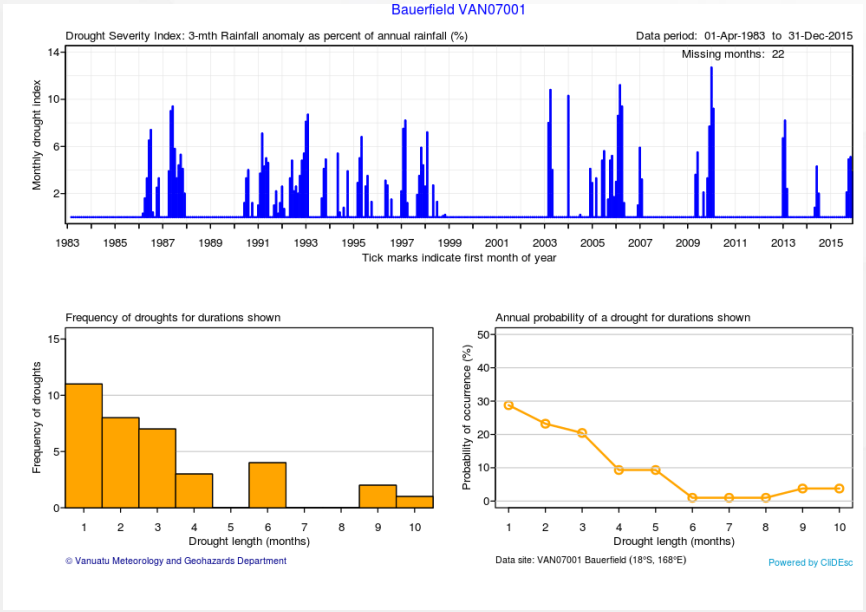
Climate services staff.

Topics addressed

1. CliDE data downloads and reports
2. Design and generate products and services with CliDEsc
3. Regular climate reports and advisories – monthly, seasonal, ENSO
4. Public data services and requests – data tables, data visualisation (time series and maps).
5. Advanced data analysis and products.

Module 5 Climate monitoring, reporting and client services





Objectives of this module

- Work with sectors of government, business, civil societies and communities to determine climate vulnerabilities and needs for information.
- Develop the scope and range of national climate services.
- Develop and apply advanced interpretation and application of climate data.

Recommended participants

Climate science and services staff.

Topics addressed

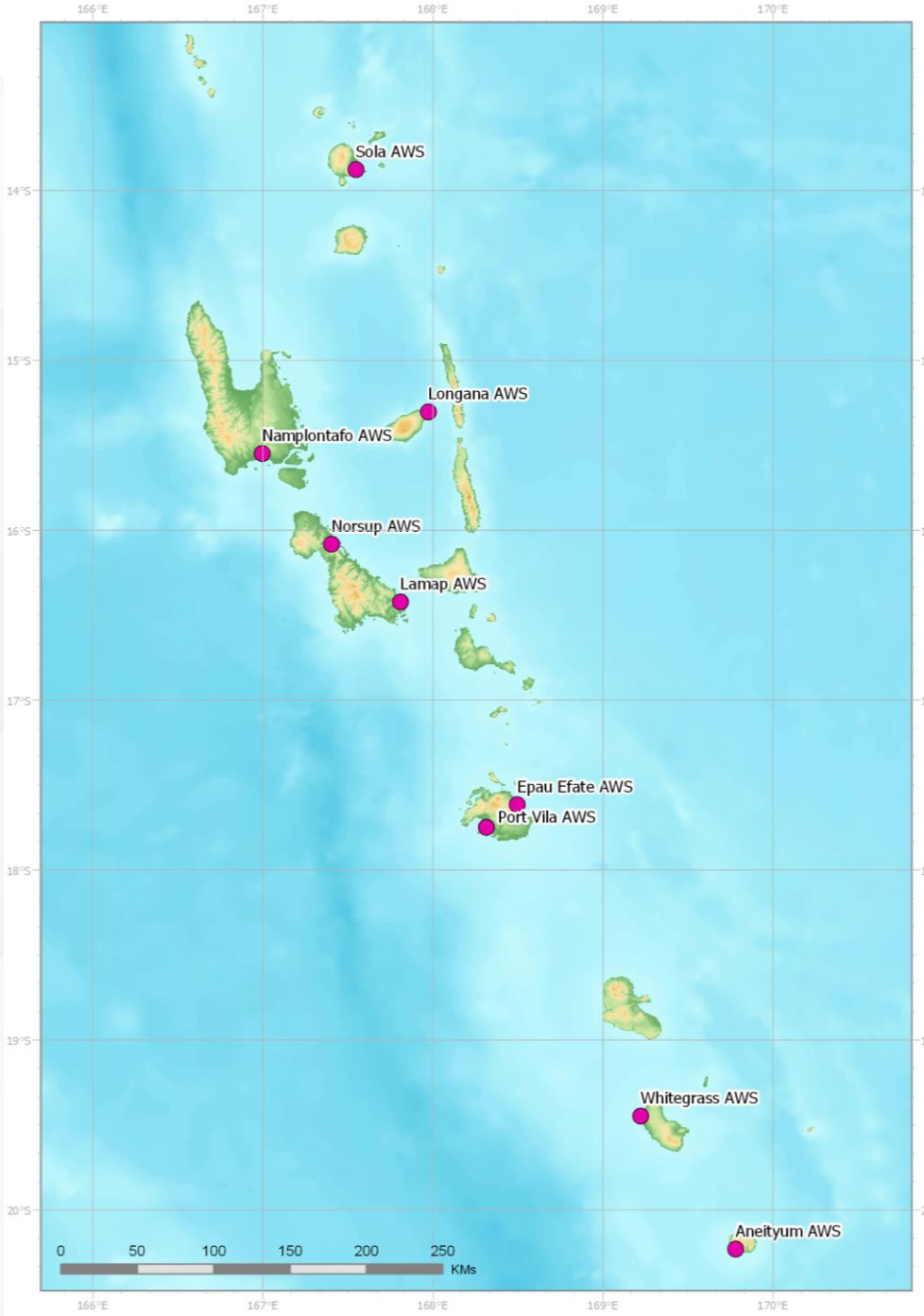
1. Engaging with end uses and identifying climate vulnerabilities and information needs
2. Data interpretation and reporting for decision making and risk management
3. Designing and implementing improved public bulletins, climate products and services
4. Improved data analysis and interpretation.
5. Developing sector partnerships and joint responsibilities

Module 6 Sector engagement, decision support and risk management

NIWA
Taihoro Nukurangi

Vanuatu

- 82 small islands
- Steep and unstable, limited fresh water
- Active volcanoes
- Earthquakes
- Tsunami
- Cat 5 Tropical Cyclones



Installations funded by multiple donors:

- UNDP supported GEF-DCF funded Vanuatu Coastal Adaptation Programme (V-CAP), JICA, GIZ

Remote and isolated, yet near to observing outposts

Operations and maintenance

- VMGD - ICT and Engineering Division
- Well organized maintenance programme
- Operational budget – routine/non-routine
- Training for outpost observing staff

Papua New Guinea

- Culturally diverse
- Mostly rural population
- 462,840 square kilometres
- Rugged
- Tropical rainforest
- Active volcanoes
- Earthquakes common (Tsunami)
- Monsoon

NIWA
Taihoro Nukurangi

UNDP implemented, GEF funded. “Enhancing Adaptive Capacity of Communities to Climate Change-related Floods in the North Coast and Islands Region of PNG”

AWSs and hydrological stations for Initial training in NZ

STTS four staff/disciplines

- Network Management
- Instruments
- ICT
- Climate Services/Products

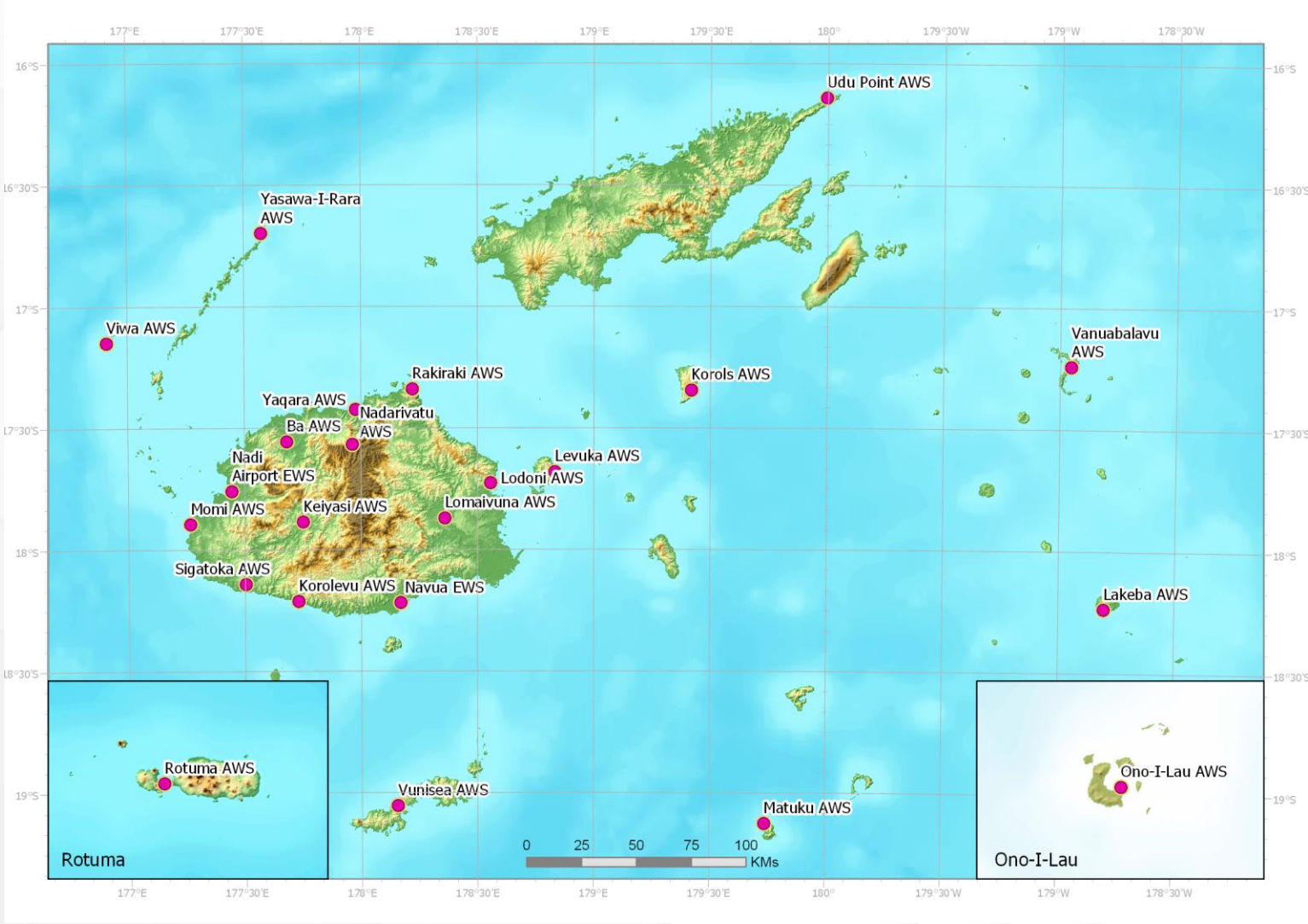
NIWA
Taihoro Nukurangi

Network management - 6 Assignments

1. Document the current operational status of PNG NWS network
2. Prepare an annual operational budget for their 6 AWS
3. Complete a desktop scoping exercise for the definition of locations for 6 further AWS
4. Collate metadata of 6 AWS for input into OSCAR metadata management tool
5. Create a draft AWS site maintenance recording form
6. Compile a list of operational spares and consumables required for management of the AWS

Fiji

- >300 islands
- Mostly rural population
- 19,400 square kilometres
- Drought
- Flooding
- Tropical Cyclones



NIWA
Taihoro Nukurangi

Large number of AWS and Hydrometric stations

Growth in staff and organisational capability

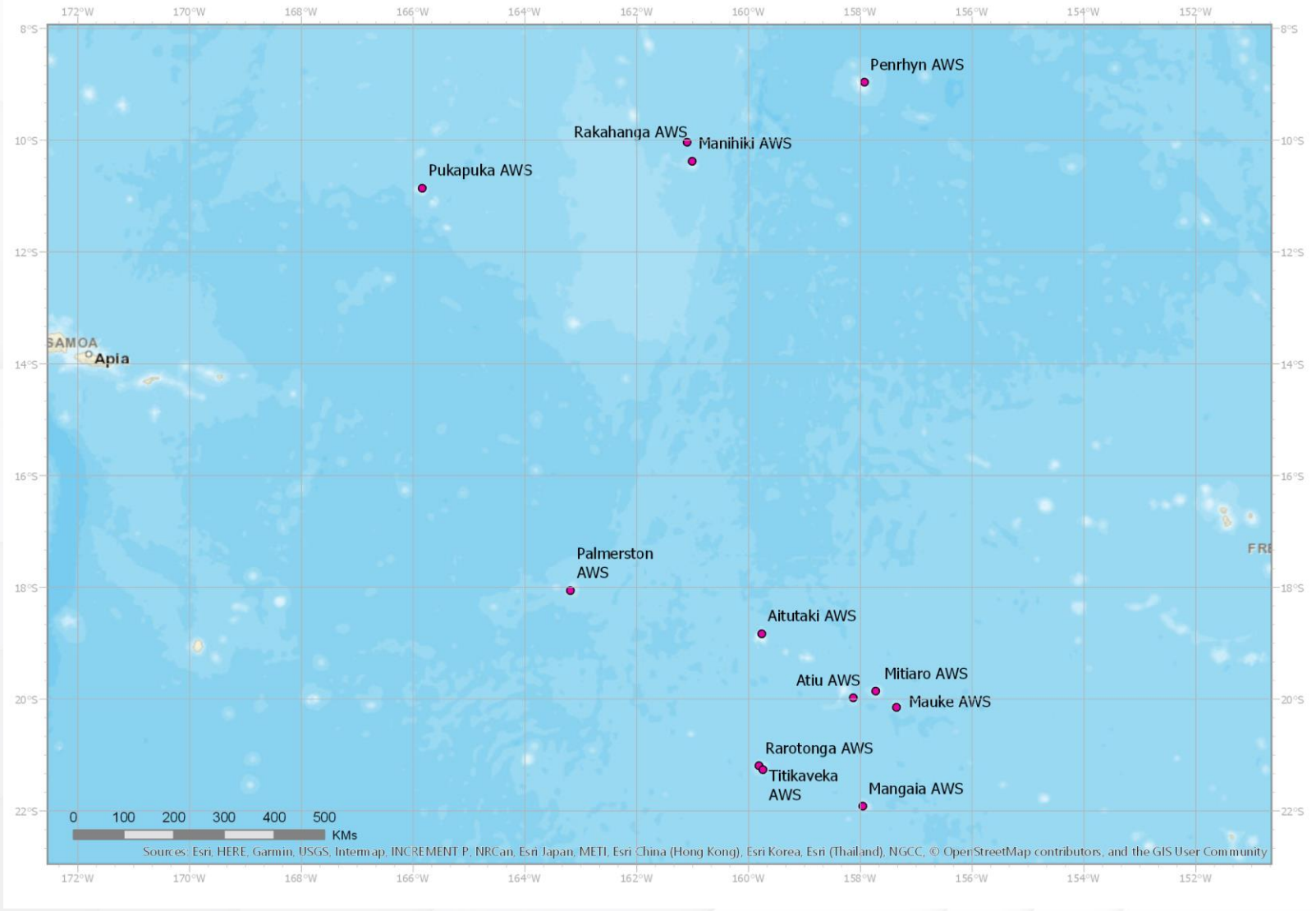
- Calibration facilities (JICA and JMA)

RESPAC training projects

- Technical staff
- Restore network
- Instruments and Trouble-shooting

Cook Islands

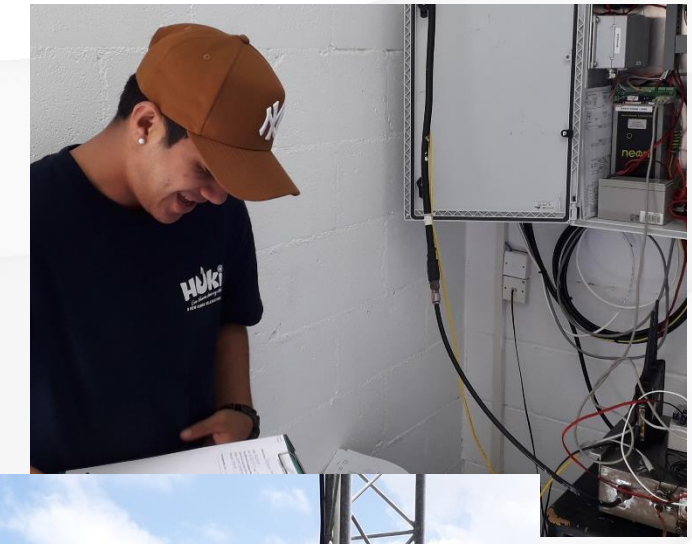
- 15 islands
- 237 square kilometres
- Drought prone
- Tropical Cyclones
- Storm-surge
- Tsunamis



NIWA
Taihoro Nukurangi

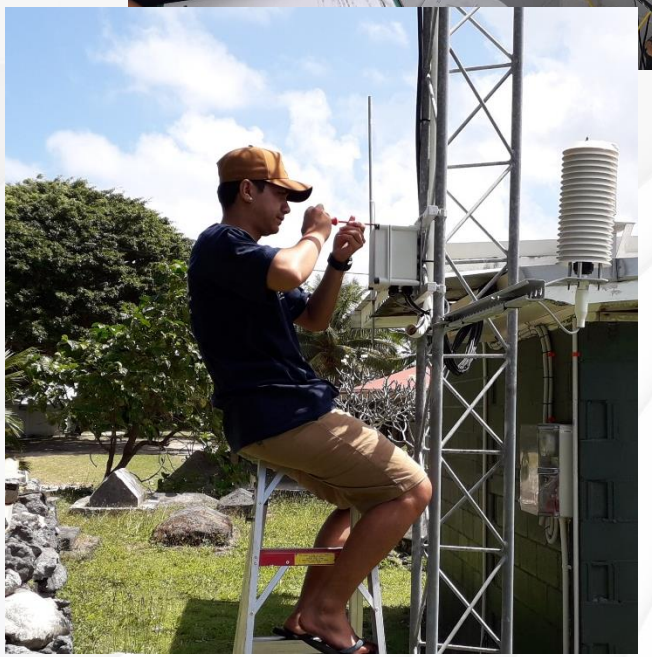
Benefits of common approach

- Increased cooperation
- Installations, observations and products



Excellent examples of increasing technical cooperation across the region

- NIWA - training, AWS, climate services development
- MetService - AWS, Upper Air, reporting
- Bureau of Meteorology - training, database development
- UNDP/RESPAC - AWS installations have included service and calibration training opportunities for technical staff from other PICTs, which has been supported and funded by the partnership.



Performance Report of the GUAN

Region V was slightly worse in 2017 compared to 2016, with 8 stations not meeting the minimum requirement. Four (4) stations were completely in-active during the period, Honiara, Solomon Islands; Vanuatu, Bauerfield; Rarotonga, Cook Islands and Port Moresby, PNG, all due to having no radiosonde consumables. (*GCOS Networks Report 2017*)

Progress?

- Consistency
- Long-term sustainability – financial, resourcing and capacity building
- Maintenance of networks and systems
- Development of competencies – observations, instruments, calibration and network management
- Training
- Coordination of technical agencies and regional partners

- *Lots of work to do*
- *Still knowledge gaps*
- ***Share experiences and learn off each other***
- *Start small and grow*
- ***Don't be frightened to ask for help/advice***