

APEC Climate Symposium

Dynamical, Statistical and
traditional climate forecasting in
the Pacific Island countries: What
we do now and challenges for
future



Outline

- SPREP background
- Statistical models
- Dynamical models
- Traditional Knowledge
- Challenges and way forward

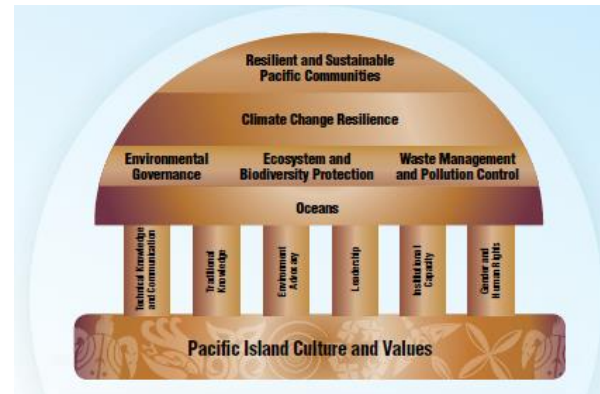


What is SPREP

- Secretariat of the Pacific Regional Environmental programme (SPREP)

The Strategic Plan 2017–2026 prioritises four regional goals with supporting objectives. Together these define the core priorities and focus of SPREP for the next ten years:

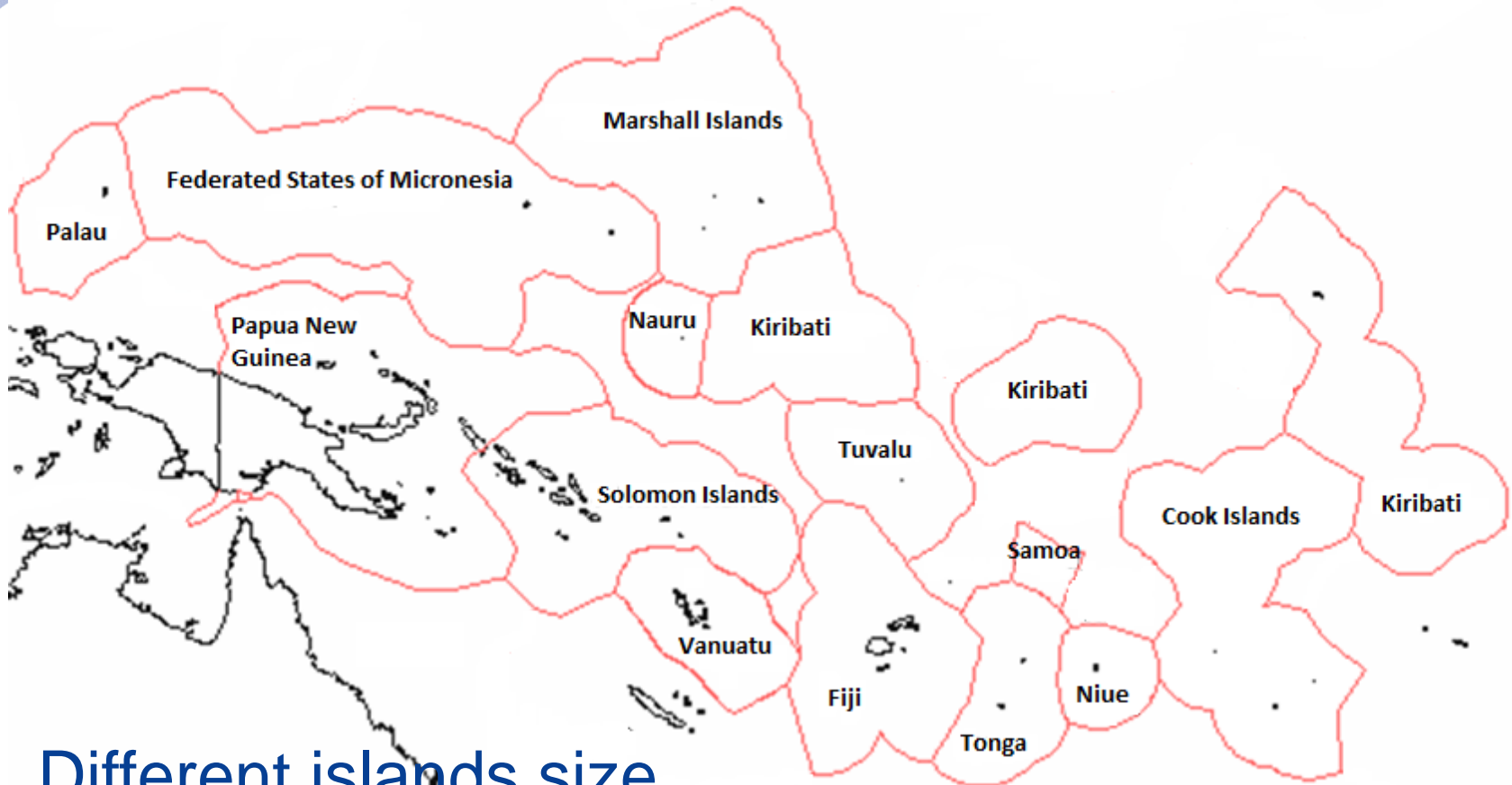
- Climate Change Resilience
- Ecosystem and Biodiversity Protection
- Waste Management and Pollution Control
- Environmental Governance



OUR VISION: 'A resilient Pacific environment sustaining our livelihoods and natural heritage in harmony with our cultures.'

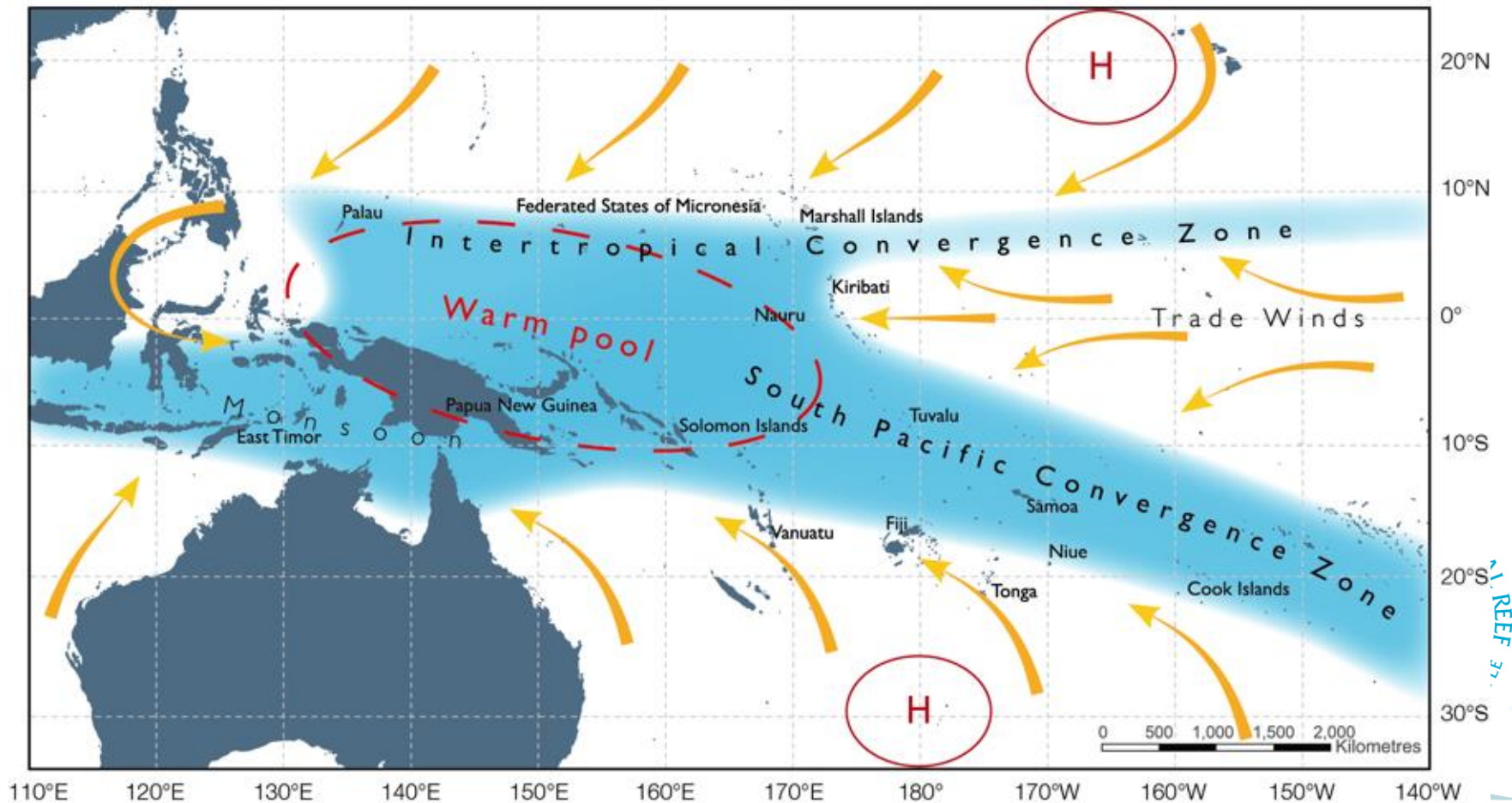


Pacific region background



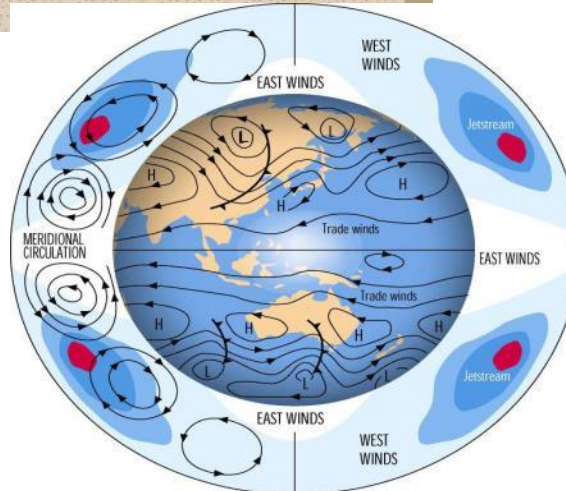
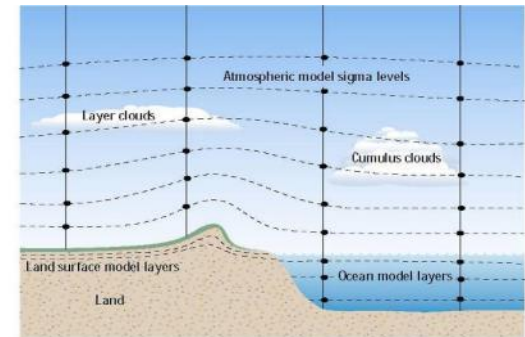
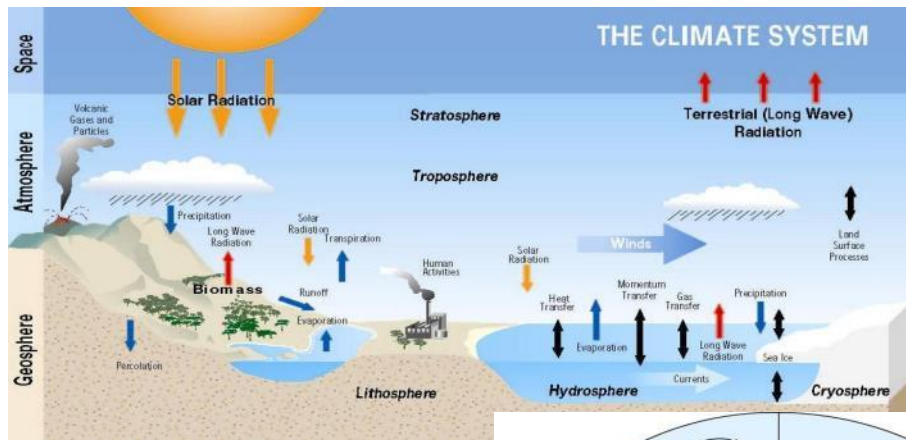
- Different islands size
- Different population size

Climate variability: Climate features in the Pacific



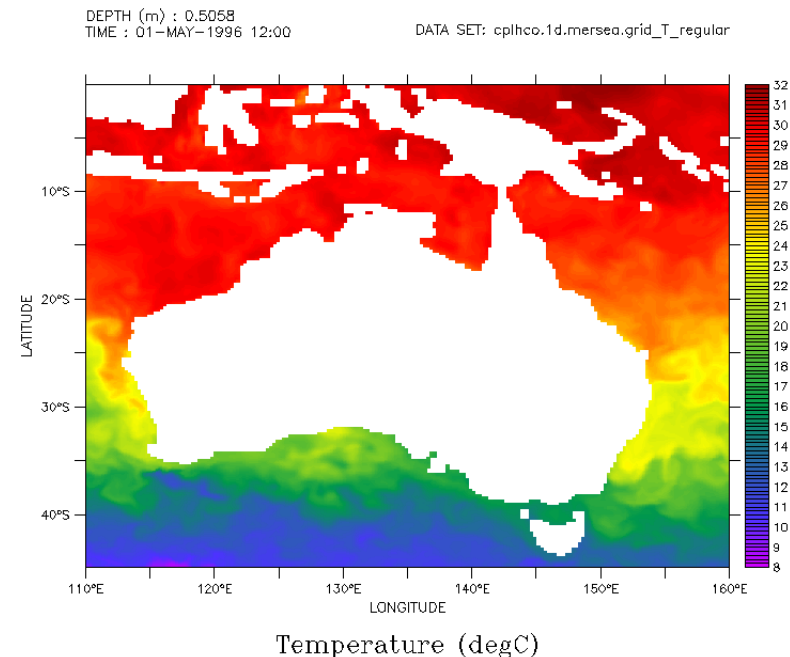
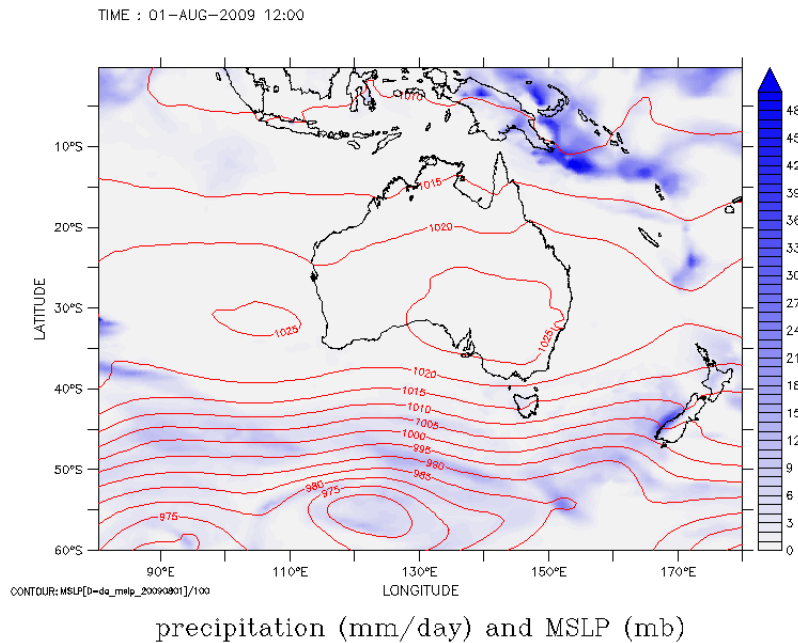
Climate Forecasting in the Pacific Islands

- Mainly Statistical forecasting- history to forecast future
- Dynamical forecast is new – use current conditions



The fundamental difference; statistical vs dynamical

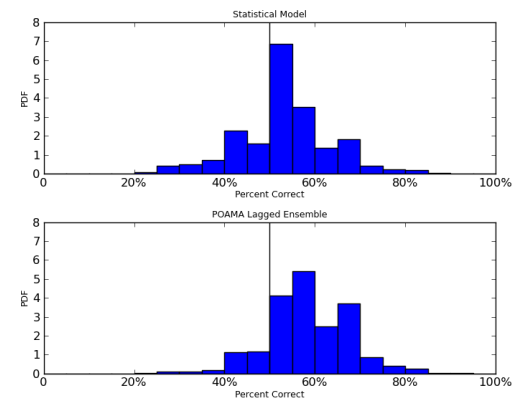
- Climate models generate 'weather' several months ahead
- Run many (POAMA:165) times with different starting values
- Proportion of "wet average weather" is the seasonal outlook



Dynamical better than Statistical - Australia

Table 2 Brier skill score (BSS) with reliability (REL) and resolution (RES) components and percent consistent (PC). Scores are calculated over all grid points and seasons over Australia. POAMA-single is for a twenty day lead seasonal forecasts initialised on the eleventh of the month.

<i>System</i>	<i>Period</i>	<i>BSS</i>	<i>REL</i>	<i>RES</i>	<i>PC</i>
Statistical	1981-2010	0.3%	0.0028	0.0028	51.7% (45.4,58.1)
POAMA-lagged (20 day)	1981-2010	4.4%	0.0017	0.013	55.9% (48.0,64.8)
POAMA-lagged (10 day)	1981-2010	5.2%	0.0015	0.014	54.0% (53.0,69.2)
Statistical	2000-2011	2.7%	0.0022	0.0078	58.3% (47.8,68.7)
POAMA-lagged (20 day)	2000-2011	3.6%	0.0063	0.015	60.1% (44.4,75.9)
POAMA-lagged (10 day)	2000-2011	5.0%	0.0049	0.017	64.0% (47.5,78.7)
Statistical	1950-1979	1.3%	0.00035	0.00338	51.2% (45.5-56.2)
Statistical	1950-1999	0.55%	0.00095	0.00228	50.3% (45.9-54.8)
Statistical	1980-1999	-0.77%	0.00385	0.00173	49.1% (41.9-56.7)
POAMA-single 20 day	1981-2010	2.6%	0.00505	0.0115	60.1% (52.8-67.5%)



The POAMA 20 day lead lagged ensemble, weighted mean percent consistent over Australia is 55.9% with a 95% range of 48.0%—64.8%. The statistical SCO weighted mean percent consistent is 51.7% with a 95% range of 45.4%—58.1%. The better spatial distribution of skill from the dynamical model can be seen clearly by the construction of a histogram of the



Seasonal Forecasting for Australia using a Dynamical Model: Improvements in Forecast Skill over the Operational Statistical Model

AN Charles, RE Duell, X Wang, AB Watkins

AUSTRALIAN METEOROLOGICAL AND OCEANOGRAPHIC JOURNAL 65 (3-4), 356-375

Statistical climate models



- Seasonal Climate Outlook for Pacific Islands countries
 - is a statistical seasonal forecasting application for desktop computers, funded by Australia (DFAT)
 - Since early 2000s
 - Use historical rainfall and climate conditions (SST and SOI)
 - Predict rainfall for the next three months
 - 11 countries
 - First ever statistical model develop and use by PICs



SCOPIC software

SCOPIC V4.4.15 (64bit): Vanuatu (C:\Users\philipm\Documents\SCOPIC4\projects\Vanuatu.scp)

File Edit Help

Predictands (70) Start record → End record

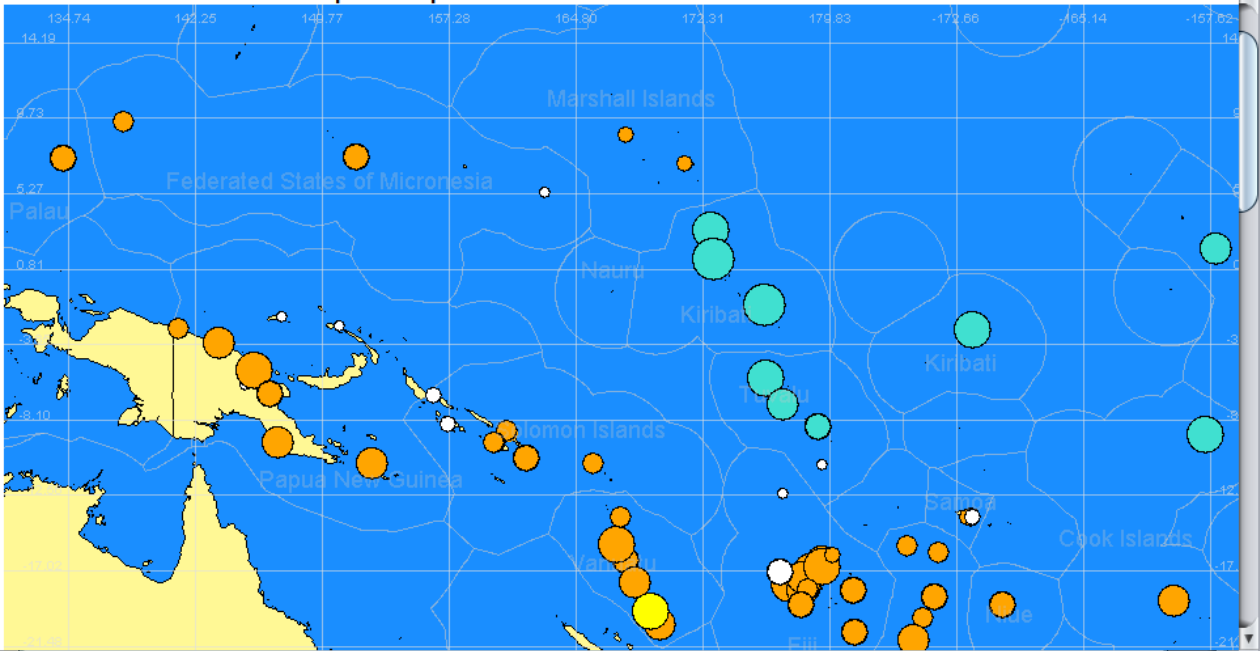
- ▼ **Australia** Select a preferred predictor
 - Cairns Aero Sep 1942 - Aug 2017 75.0yrs @ 100.0%
- ▼ **Cook Islands** NINO3.4 SST Anomalies
 - Aitutaki Jan 1914 - Aug 2014 100.7yrs @ 88.7%
 - Penrhyn Apr 1937 - Jul 2018 81.3yrs @ 97.6%
 - Rarotonga Jan 1899 - Jul 2018 119.6yrs @ 100.0%
- ▼ **Federated States of Micronesia** NINO3.4 SST Anomalies
 - Chuuk Feb 1946 - Jul 2018 72.5yrs @ 97.0%
 - Kosrae May 1954 - Jul 2018 64.2yrs @ 70.4%
 - Pohnpei_QC Dec 1949 - Jul 2018 68.7yrs @ 99.6%
 - Yap Sep 1948 - Jul 2018 69.9yrs @ 99.8%
- ▼ **Fiji** NINO3.4 SST Anomalies
 - Labasa Airfield Jan 1956 - Jul 2018 62.6yrs @ 99.5%
 - Lakeba Aug 1949 - Jul 2018 69.0yrs @ 99.4%
 - Lautoka Apr 1900 - Jul 2018 118.3yrs @ 100.0%
 - Nabouwalu Jan 1918 - Apr 2017 99.3yrs @ 97.0%
 - Nadi Airport Jan 1942 - Jul 2018 76.6yrs @ 99.1%
 - Nausori Airport Nov 1956 - Jul 2018 61.8yrs @ 99.5%
 - Navua Jan 1945 - Jul 2018 73.6yrs @ 99.5%
 - Ono-I-Lau Jan 1943 - May 2018 75.4yrs @ 93.0%
 - Penang Jan 1910 - Jul 2018 108.6yrs @ 99.3%
 - Rotuma Jan 1912 - Jul 2018 106.6yrs @ 97.7%
 - Savusavu Jan 1957 - Jul 2018 61.6yrs @ 94.6%
 - Suva Jan 1942 - Jul 2018 76.6yrs @ 100.0%

Organise Data
Explore Data
Analyse Relationships
Test Skill
Generate Reports
Drought

Outlooks
Current Condition
Spatial Summary

Map
?

Seasonal Climate Outlook for the period September to November 2018



Predictor Jun - Jul 2mths

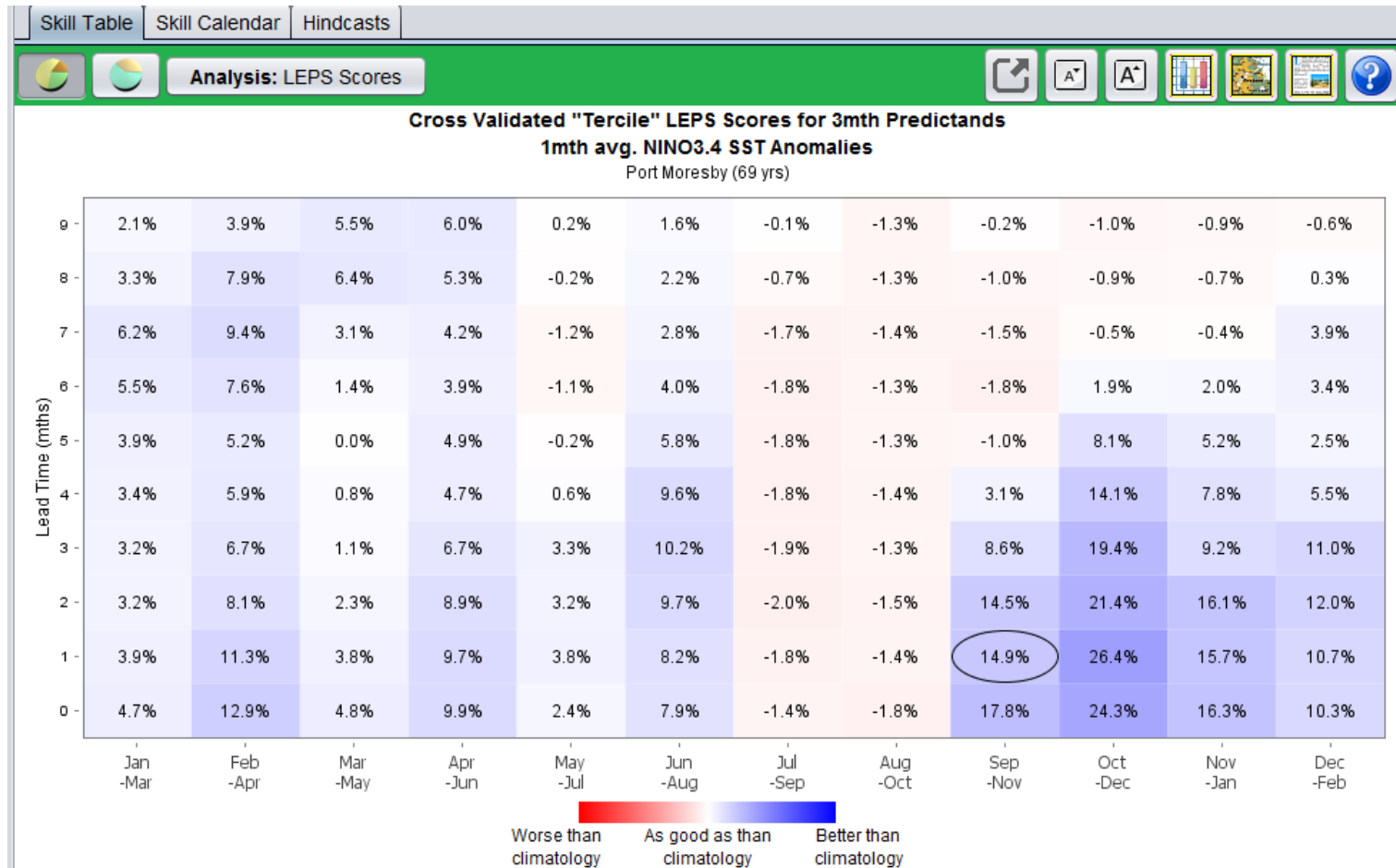
Predictand Sep - Nov 3mths

S O N D J F M A M J J A S O N D J F M A M J J A

2018 2019

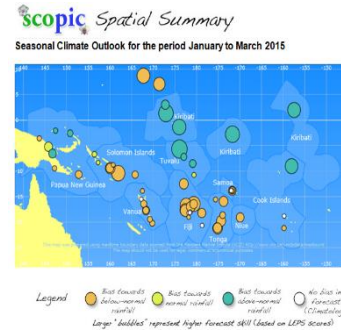
SCOPIC skills

- Skill is high during wet season and low during dry season



SCOPIC activities

- SCOPIC successfully transitioned to SPREP
 - SCOPIC version 4.4.15 distributed to all countries
 - Regional training including Palau, FSM, Nauru and Tokelau – September 2017
 - SCOPIC Drought monitoring training for Solomon Islands, PNG, Fiji and Vanuatu to link to drought plan



SCOPIIC activities

- Online Climate Outlook Forum (OCOF) - transitioned to SPREP
 - Data agreement by all countries except three
 - Monthly teleconference hosted by SPREP
 - Monthly review of OCOF tables
 - Regional and In-country training
 - PICO3 - Climate and Health
 - Teleconference facilities for SPREP



Station (include data period)			November 2017				
	September 2017 Total	October 2017 Total	Total	33%tile Rainfall (mm)	67%tile Rainfall (mm)	Median Rainfall (mm)	Ranking
Auki (1962 - 2017)	360	226	214	175	263	223	27/54
Henderson (1975 - 2017)	118	57	168	102	192	141	24/43
Honiara (1964 - 2017)	181	67	205	175	263	223	27/54
Kirakira 1965 - 2017)	227	224	286	172	267	200	46/50
Lata (1976 - 2017)	559	728	464	268	418	365	32/43
Munda (1962 - 2017)	239	176	272	181	280	235	37/56
Taro (1975 - 2017)	276	390	185	203	293	237	12/40



Dynamical climate models




- There were 3 main models use in the Pacific

1. Poama (Predictive Ocean-Atmosphere Model for Australia)– Developed by Australia

Gridded Outlooks
Station Outlooks
Climate Index Outlooks

Station : Port Moresby ,Papua New Guinea
 WMO Station Number: 92035
 Coordinates (Decimal Degrees): 189°S, 32°W

Note: Outlooks presented below are for the region surrounding the station location of interest. Model grid cells are approximately 250 km by 250 km and may not account for local topography.



Moresby, Papua New Gu

Rainfall Terciles

Rainfall Tercile Outlook:
 Portmoresby - SON
 Forecast issued: 20180901

[Download Data](#)

Tercile	Frequency (%)
Dry	~45
Normal	~15
Wet	~35

Normal accumulated rainfall for SON
 Portmoresby: 53 - 125 mm

Station Outlooks

Previous outlooks:
 latest

Station:
 Port Moresby ,Papua New Guinea

Variable:
 Rainfall
 Temperature

Outlook Period:
 SON

Terciles
 ENSO Climatology

[Update](#)

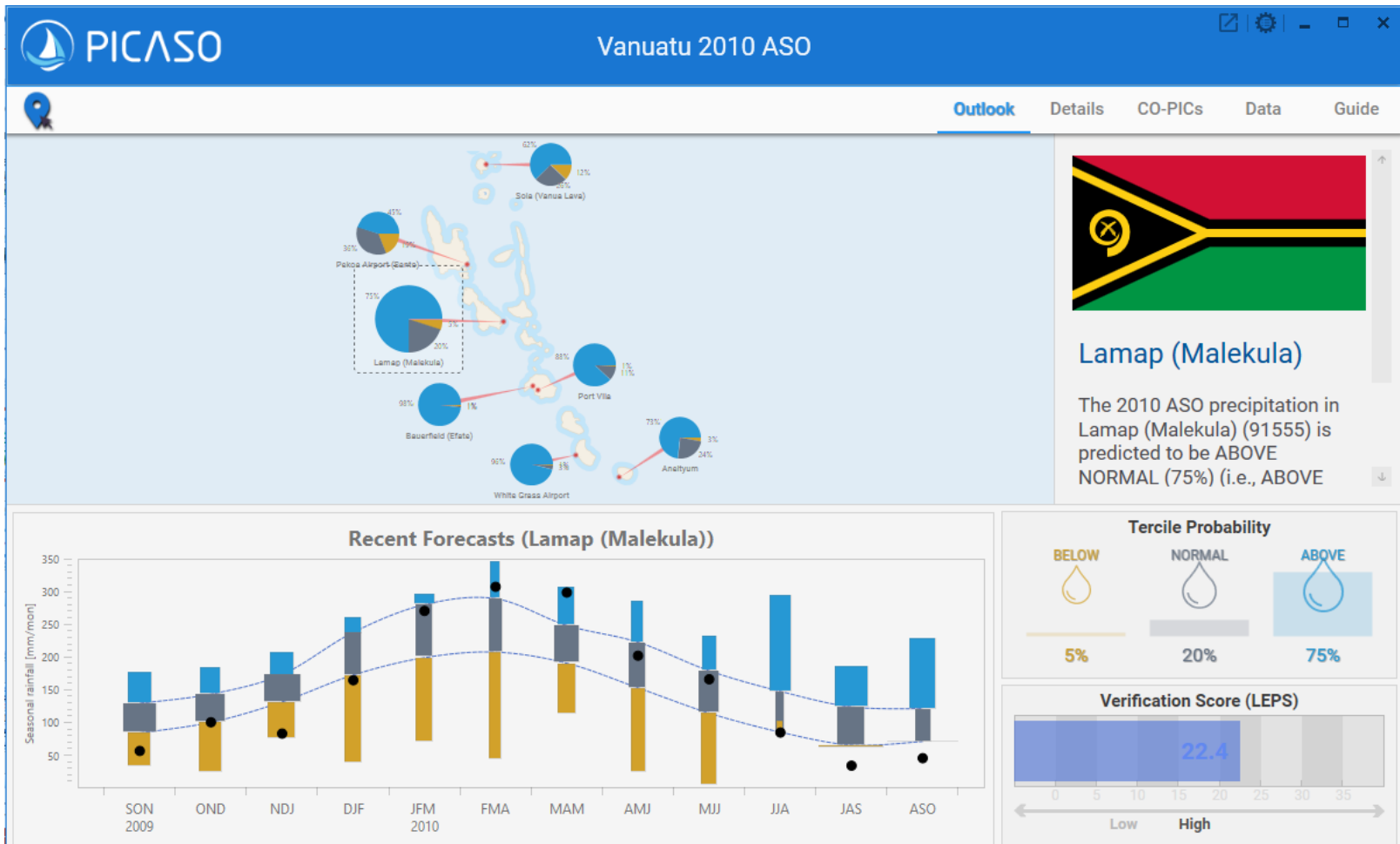


1. Clik-P -Climate Information ToolKit for the Pacific developed by Republic of Korea

The screenshot displays the CLiKo web interface. The top navigation bar includes Home, Prediction, My Page, and PICASO. A sidebar on the left shows system metrics: CPU Usage, Queue Status, and User Job Result (Success: 1, Failed: 0, Processing: 0, Queued: 0). The main content area is titled 'Prediction' and contains several configuration panels: 'Lead Month' (3Month), 'When' (Year: 2018, Season: ASO), 'Variables' (PREC selected, T850 unselected), 'Methods' (Deterministic selected, Probabilistic unselected), and 'Model' (ALL, APCC, CMCC, CWB, MISC, NASA, NCEP, PNU, POAMA selected). A 'Predict & Verify' button is located at the bottom right of the prediction settings. Below this is the 'Result' section, which includes a 'Toggle: Prediction/Verification' and 'Move Countries' and 'Download' buttons. The main display is a map of the Pacific region, showing temperature anomalies with a color scale from green (cooler) to yellow/orange (warmer). Labeled countries include Micronesia, Palau, Marshall Islands, Kiribati, Nauru, Papua New Guinea, Solomon Islands, Tuvalu, Vanuatu, Samoa, Tonga, and Cook Islands.



3. PICASO – Pacific Island Advance Seasonal Outlook developed by Republic of Korea



What is CLIK-P?

CLIK-P

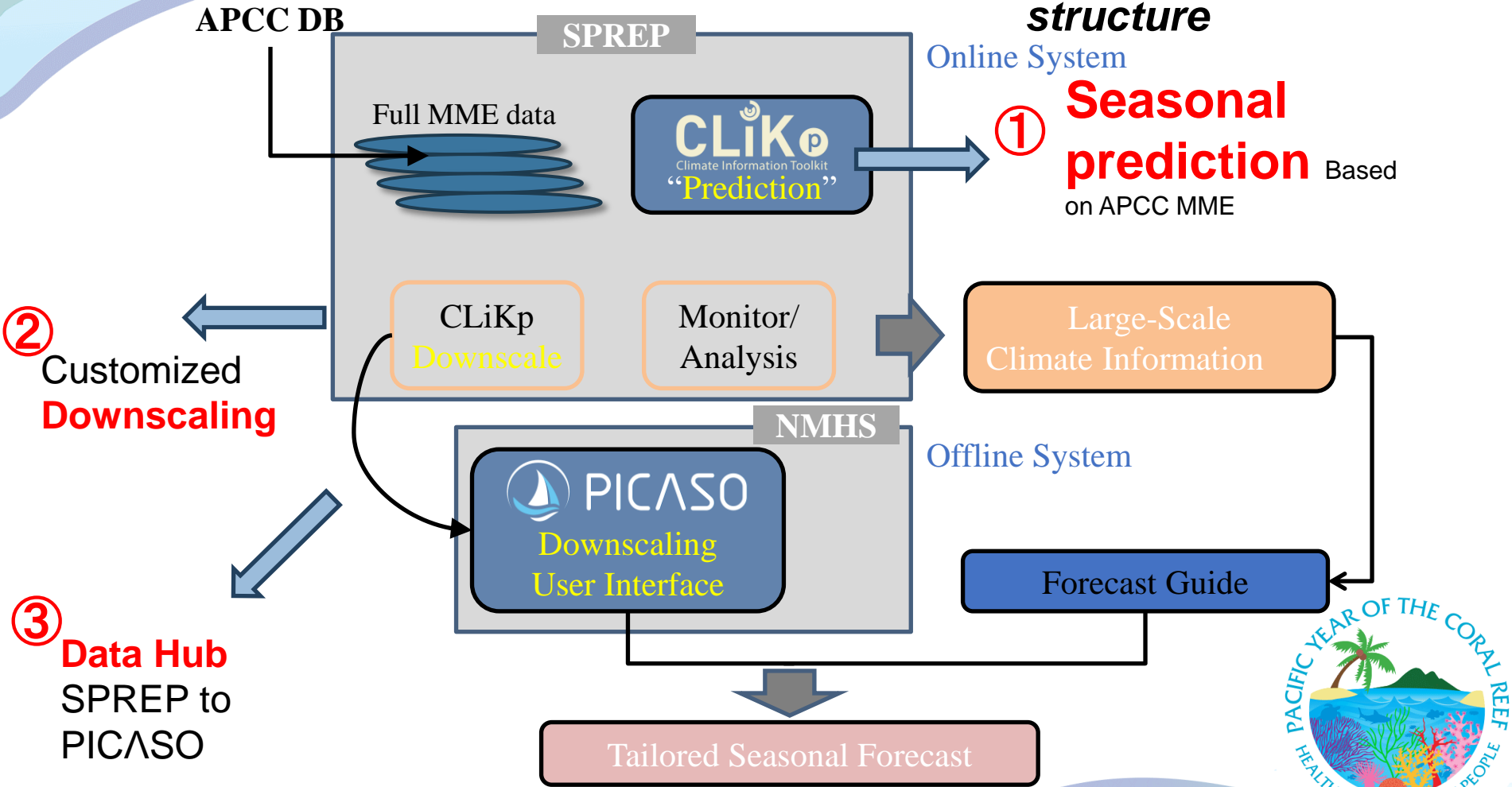
- **CL**imate **I**nformation **T**ool**K**it for the **P**acific

<http://clikp.sprep.org>



Mission of CLIK-P!

ROK-PI CLIPS structure



CLIK-P was developed to provide customized seasonal prediction based on APCC MME!

CLIK-P Mission!!!

- Seasonal prediction based on APCC MME.
(It focused on Pacific Islands regions.)

Users can get the focused seasonal prediction easily.

- Customized downscaling toolkit.
(But, it doesn't display on the CLIK-P.)

CLIK-P just calculate and save the tailoring results.

- Data hub to connect PICASO and SPREP.
(PICASO display the tailoring results.)

Although PICASO designed off-line tailoring toolkit, PICASO needs some network connection to receive the downscaled results.



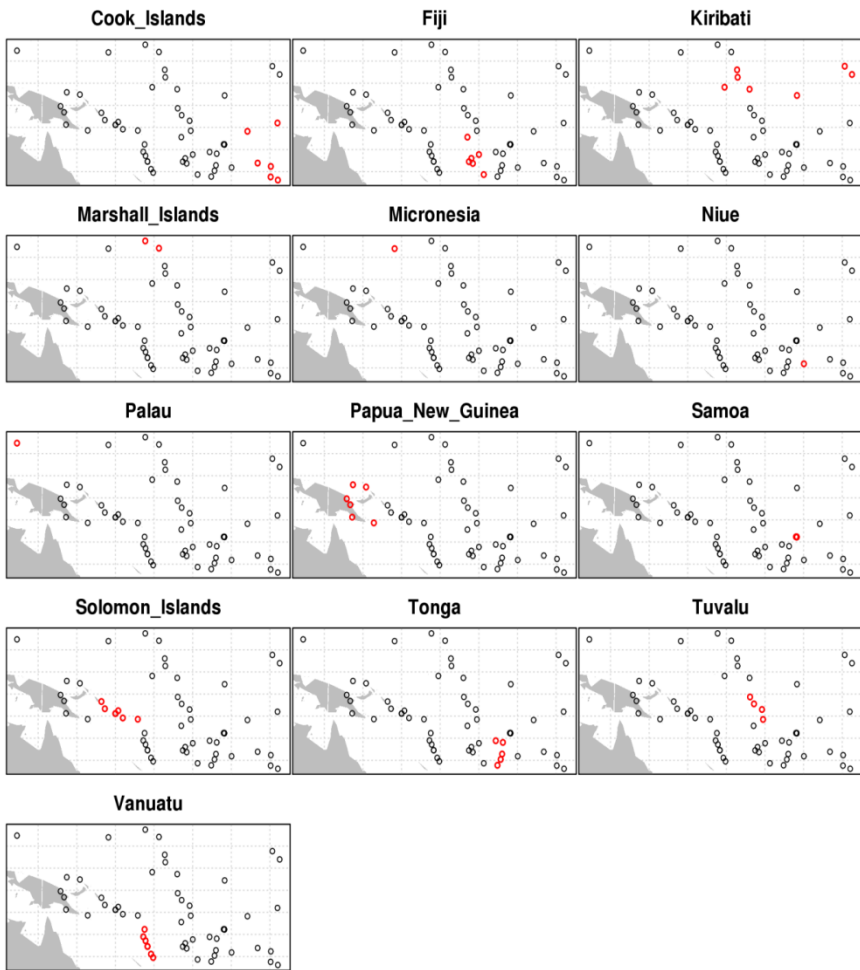
PICASO

- PICASO – **P**acific **I**sland **C**ountries
Advanced **S**easonal **O**utlook
- Developed by the Republic of Korea
through APCC
- Use since 2017



49 Pacific Observing Stations (PICASO)

- Which stations are downscaled in PICASO system?



Country	Station	Country	Station
Cook Islands	Penrhyn	Solomon Islands	Auki
	Rarotonga		Honiara
Fiji	Nabouwalu		Honiara Henderson
	Nadi Airport		Kira Kira
	Rotuma		Munda
	Udu Point		Santa Cruz
	Ono I Lau		Taro Island
	Suva	Haapai	
	Kiribati	Butaritari	KeppelMata ' aho Airport
Kanton		Lupepau ' u	
Kiritimati		Niuafuoo	
Tawara		Nuku ' alofa	
Marshall Islands	Kwajalein Bucholz Aaf	Tuvalu	Funafuti
F.S. Micronesia	Majuro		Nanumea
Niue	Pohnpei		Niulakita
Palau	Hanan Airport	Vanuatu	Nui
Papua New Guinea	Koror		Aneityum
	Kavieng		Bauer field (Efate)
	Madang		Lamap (Malekula)
	Misima		Pekoa Airport (Santo)
	Momote		Port Vila
	Nadzab		Sola (Vanua Lava)
	Port Moresby	White Grass Airport	
Samoa	Afiamalu		
	Faleolo		
	Apia		

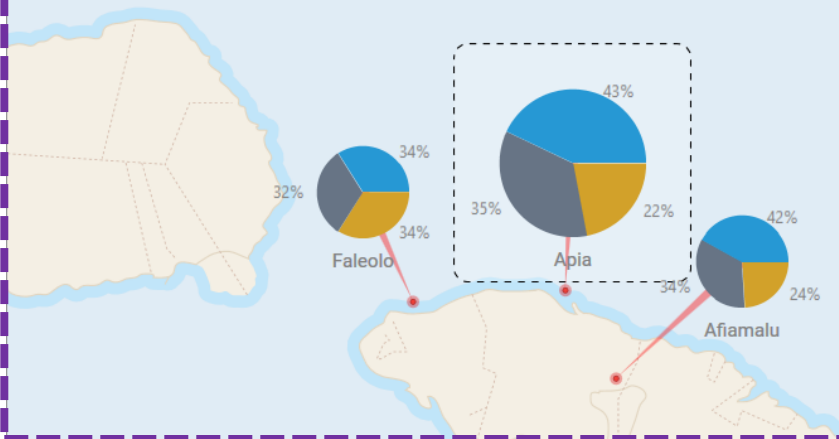


PICASO Outlook

PICASO Samoa 2017 SON

Outlook Details CO-PICs Data Guide

A: Map with pies



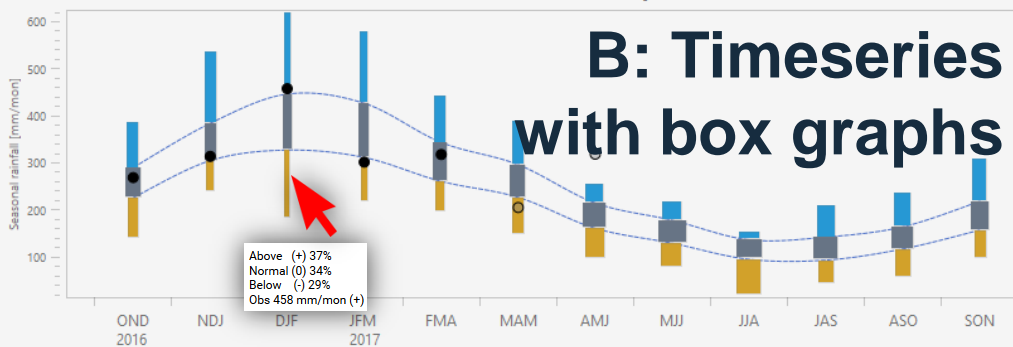
Apia

The 2017 SON precipitation in Apia (91762) is predicted to be ABOVE NORMAL (43%; ABOVE 43%, NORMAL 35%, BELOW 22%) around 207.1 mm/mon.

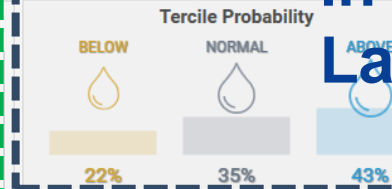
The prediction skill at Apia (91762) is Low.

C: Forecast in human language

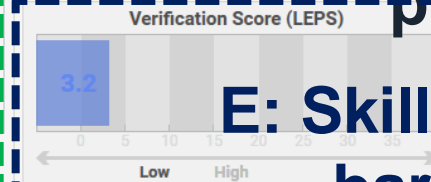
Recent Forecasts (Apia)



B: Timeseries with box graphs



D: Tercile probability bar chart

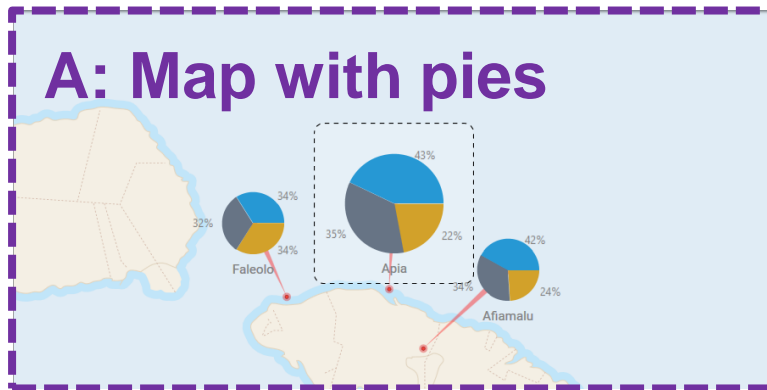


E: Skill bar

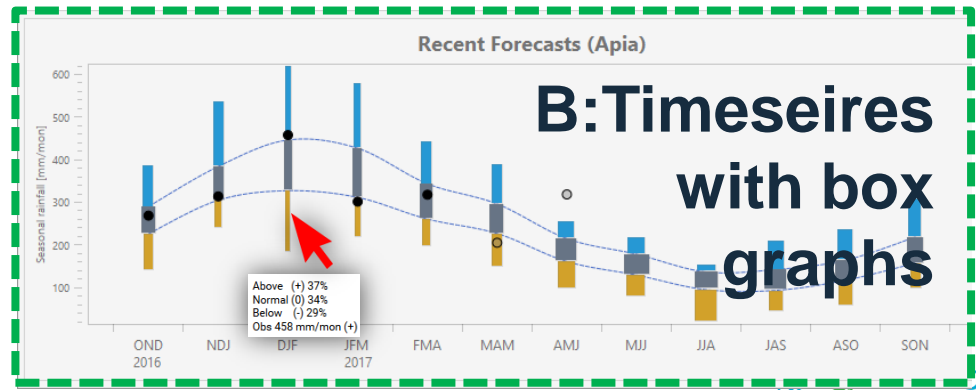


PICASO Outlook provides...

**Spatial distribution of
 forecast
 (over a country in a
 target season)**



**Temporal variation of
 forecast
 (in recent 12 seasons at a
 target station)**



- Box top/bottom: upper and lower 5% value of forecast distribution
- Box extent: probability of AN/NN/BN
- Circles: observed rainfall
- Lines : Lower/upper terciles



Dynamical better than Statistical

Conclusions

- Statistical modelling, where the skill is increasingly difficult to gauge due to a changing climate, offers little opportunity to see significant improvements in seasonal forecast accuracy.
- Statistical models which assume a stationary climate should be viewed cautiously.
- Future increases in accuracy are likely with dynamical modelling as new science, better modelling techniques, more observations and greater computer power are introduced.



Seasonal Forecasting for Australia using a Dynamical Model: Improvements in Forecast Skill over the Operational Statistical Model

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Traditional Knowledge (TK) in weather and climate



Why traditional knowledge?

- Way of living for PICs community
- Communication to reach last mile
- Level of knowledge to understand the scientific information from National Met Services (NMS)



Traditional Knowledge – Project

- Funded by DFAT
- 5 countries (Vanuatu, Solomon Islands, Niue, Samoa, Tonga)
- Interest from other countries



Aim of TK project

- Collections of stories on use of TK on weather and climate in the Pacific
- Validate the TK indicators
- Monitor the indicators
- Combine TK and modern science



Progress and Transition of the Traditional Knowledge Project

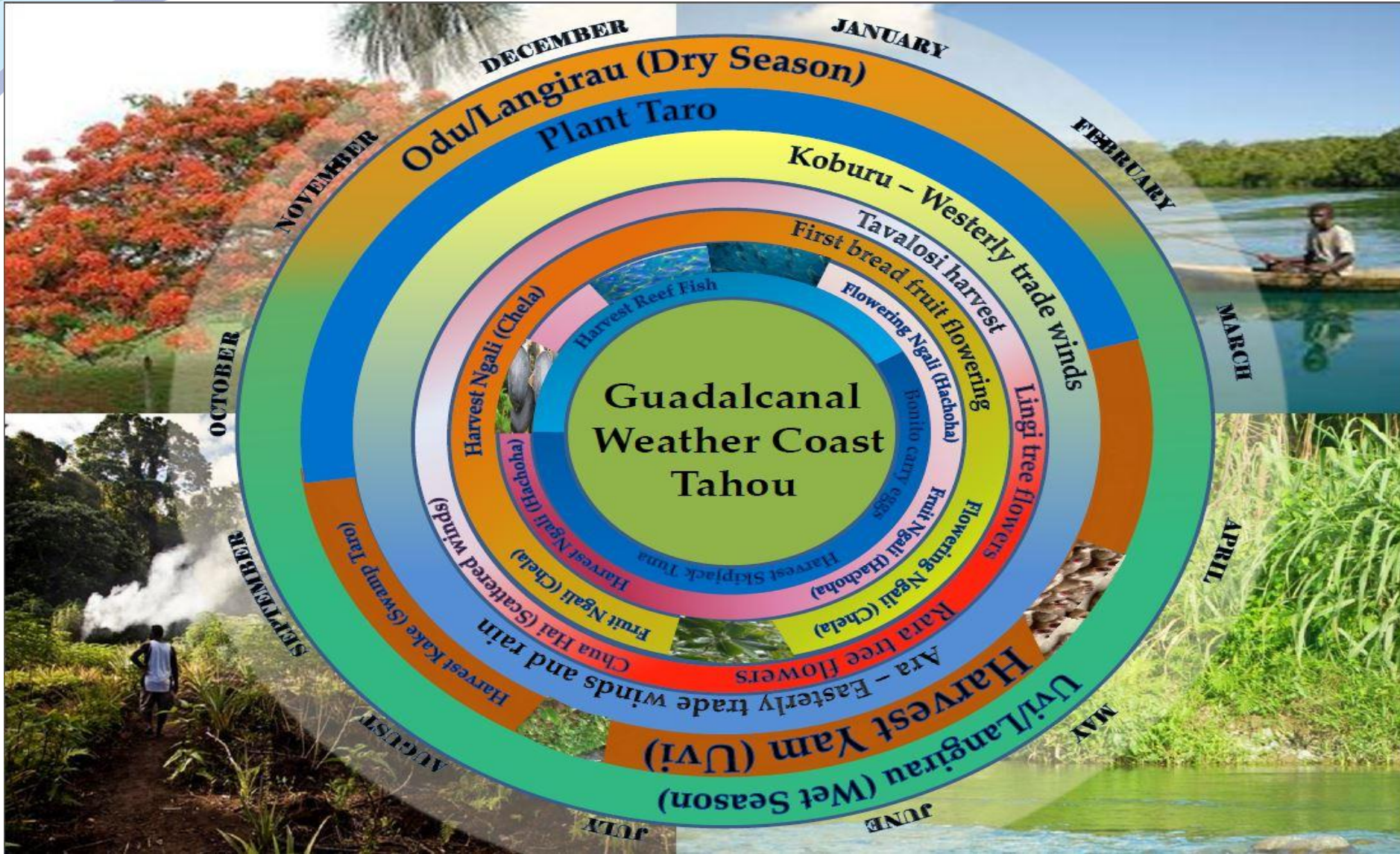




“The Tera, a coastal tree rarely flowers. However, when it flowers in April or the end of May, a long dry season is certainly coming” – Interview with Elders on Tanna Island, Vanuatu

“When fruit trees, such as mango, have many fruits the rainy season will surely come in 6 months” – Interview with elder from Penama Province , Vanuatu

Solomon Islands



Project stages

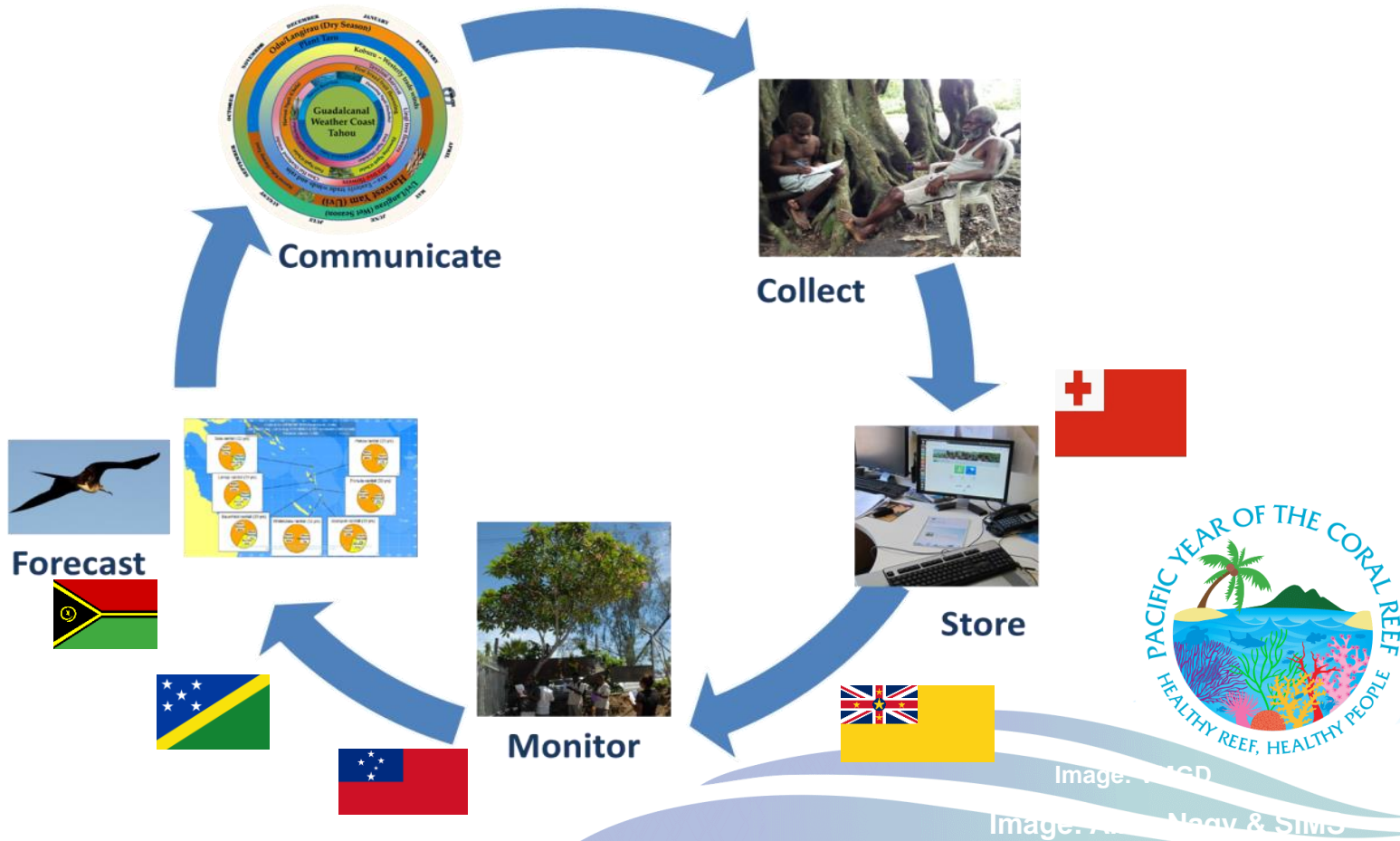
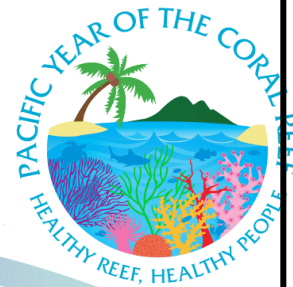


Image: UNCD

Image: Navy & SIMS

Season and location	TK summary report and indicators	NMS forecast	Integrated Report	Performance of integrated forecast
<p>March-May 2010</p> <p>Same, Tanzania</p>	<p>Frogs making a lot of noise, ants moving and spreading across roads signify rainy season about to start. TK indicators show rains during this season will decrease especially in May</p>	<p>Seasonal rainfall will be normal. Main indicators include sea surface temperatures of the Indian and Pacific Oceans and wind strength</p>	<p>TK and NMS forecasts indicate normal rains, expected to decrease as the season progresses</p>	<p>Reported as “very good” – almost all predicted events came to pass</p>



Communication and Project Awareness Raising



Mr. Espen Ronnerberg at the 9th Research Dialogue during the International Climate Change Meeting in Bonn, Germany. Photo: SPREP

COSPPAC traditional knowledge poster presented at Climate Change meeting in Bonn

SPREP was invited to participate in the 9th research dialogue during the international Climate Change Meeting in Bonn, Germany. Work undertaken on mapping and understanding traditional knowledge for climate and weather prediction had been developed into a poster by SPREP staff Siosinamele Lui and was presented by Espen Ronneberg.

[READ MORE ...](#)



Photo: Siosinamele Lui/SPREP

Stakeholders join the Met Office to collect traditional knowledge

The Tongan Meteorology Department today joined with various stakeholders from the Community, Private Sector, other Government Agencies and Non-government agencies for a 2 day workshop on collecting and documenting weather and climate related traditional knowledge. The workshop is funded by the Government of Australia under the Climate and Ocean Support Program for the Pacific (COSPPAC) initiative and implemented by the Australian Bureau of Meteorology, SPREP and the Tonga Meteorological Service.

[READ MORE ...](#)

Increasing community resilience by combining traditional knowledge on weather and climate with modern climate forecasting techniques

By Liu S, Winayo P, Tilsona M, Tahoni L, Farama P, Malote P, Pato R, Chantong L
Co-funded by the Department of Environment, Planning and Infrastructure (DEPI), Climate Change Centre, University of Technology Sydney, Pacific Meteorological Service, Tonga Meteorological Service, Tonga Meteorological Service, Tonga Meteorological Service, Tonga Meteorological Service

Remote communities in the Pacific are facing increased exposure to extreme climate and weather events.

Pacific communities have traditional knowledge (TK), forecasting skills and coping strategies for extreme weather and climate events. The knowledge is under threat from social and environmental change.

In most Pacific countries, weather and seasonal climate forecasts are made available and regularly updated through national meteorological services (NMS). While many communities can access information provided:

- the jargon used to communicate these information are often too technical;
- information is presented in graphs and diagrams that are not easily understood;
- communities have incomplete understanding of information; and
- communities mistrust the accuracy of the information.

We work with NMOS from Fiji, Samoa, Solomon Islands, Tonga and Vanuatu to collect, store, monitor and combine TK with modern forecasting information to:

- bridge the communication gap between NMOS and communities;
- translate the technical language to relevant local concepts and examples;
- increase the update of up to date climate and weather information; and
- increase the accuracy and spatial extent of forecasts.

Designing appropriate resources and communicating climate and weather information can be difficult. Working together ensures that TK on weather and climate are collected, stored, combined with modern forecasting and used in communication tools and products that can be easily understood by communities and policy makers.





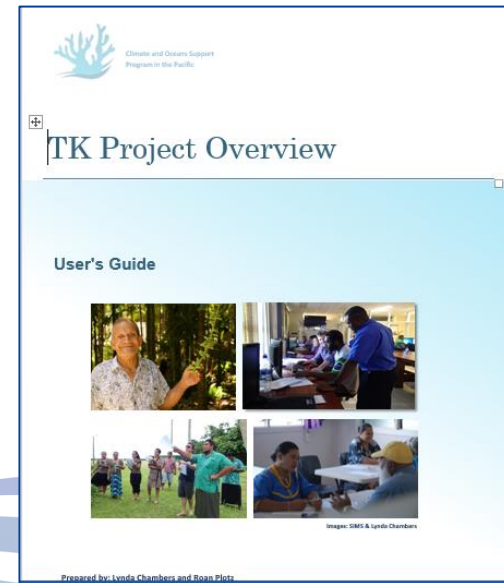
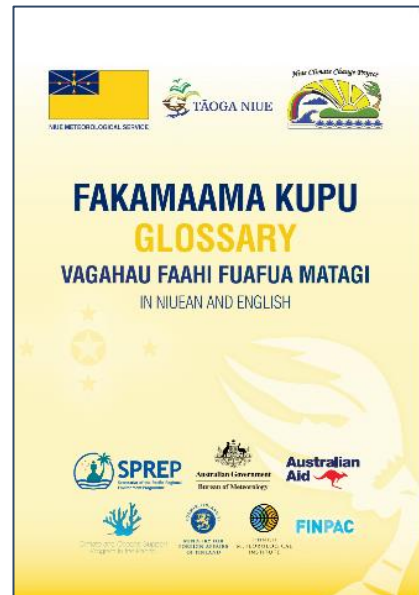
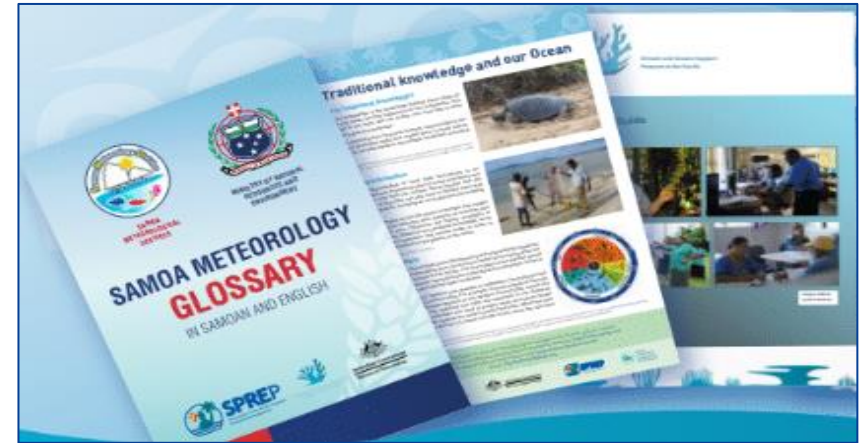
Australian Government
Department of Climate Change and Energy Efficiency
Division of Meteorology

SPREP
Secretariat of the Pacific Regional Environment Programme

CLASSIFICATION OF WIND SPEEDS MO E FAKATAITAI VAGAHAU NIUE



WIND SPEED NUMBER	WIND SPEED (KNOTS OR MPH)	SYNOPTICAL DESCRIPTION	TO NIUEAN (NIUE)	TO ENGLISH (ENGL)	EFFECT BY WIND ON THE SEA	EFFECT BY WIND ON THE LAND	SUGGESTED NIUEAN NIUE
0	<1	Calm	Light wind	Small waves. Mānōmānōhapōpōpō.	Small waves vertically. Tāu tēmūmū atā kua āhau tākā kē faga.		Nōnōkōr Calmness
1	1-3 kt or 1-5 km/hr	Light air	Light wind	Small waves. Mānōmānōhapōpōpō.	Direction of wind shown by smoke drift. Hōhōhōa he tū tēmūmū atā.		Nōnōkōr Calmness
2	4-6 kt or 6-11 km/hr	Light breeze	Light wind	Small waves. Mānōmānōhapōpōpō.	Wind is felt on face. Leaves rise. Hāvī e mātagi kē he tōhōa he tagata. Hāvī e tū tū atā.		Hāvī
3	7-10 kt or 12-14 km/hr	Gentle breeze	Gentle-moderate	Large waves to small waves. Fōfō.	Leaves and small twigs in constant motion. Wind extends light flag. Hair disturbed. Clothing flaps. Hāvī e tū tūpū atā.		Afū Mātagi mātagi
4	11-16 kt or 20-28 km/hr	Moderate breeze	Gentle-moderate	Large waves to small waves. Fā mōhō.	Raise dust and loose paper. Small branches are moved. Hair disarranged. Hāvī tōhō e tū tū atā.		Afū Mātagi mātagi
5	17-21 kt or 25-30 km/hr	Fresh breeze	Fresh wind	Moderate waves, with many white caps. Crested waves form on inland waters. Lūlūlū.	Small twigs in leaf begin to sway. Force of wind felt on body. Hāvī tōhō e tū atā atā.		Hāvī atā
6	22-27 kt or 30-39 km/hr	Strong gale	Strong wind	Large waves with many white caps. Kamāta tūhōmā - mōmōa nō e lūlūlū tū.	Large branches in motion. Blowing toward or away from water. Unstable use with difficulties. Some inconvenience in walking. Kamāta vevē e tū tū.		Hāvī atā atā atā
7	28-33 kt or 50-61 km/hr	Fresh breeze	Strong wind	Large waves with many white caps. Tūhōa lūhōmā e tū tū. Pāpā e tū tū he tū tū.	Whole trees in motion. Inconvenience when walking. Hāvī tōhō e tū nū tū.		Hāvī atā atā atā
8	34-40 kt or 62-74 km/hr	Fresh gale	Gale	High waves with foam streaks. Lūlū mō nō e gā e tū.	Breaks twigs of trees generally opposite progress against wind. Mōhō e tū tūhōmā, māhōhō tū tū tū, māhōhō tū tū tū.		Mātagi mātagi
9	41-47 kt or 75-88 km/hr	Fresh gale	Gale	High waves with foam streaks. Lūlū e tū. Pāpā e tū tū.	Slight structural damage occurs. Vevē e tū tū nō e tū tū tū.		Mātagi mātagi
10	48-55 kt or 89-102 km/hr	Whole gale	Whole gale	Very high waves and rolling seas. Tū tū tū e tū tū tū. Lūlū e tū tū tū. Lūlū e tū tū tū.	Trees uprooted. Considerable structural damage occurs. Mōhō e tū tū tū e tū tū tū, vī tū.		Mātagi mātagi
11	56-63 kt or 103-117 km/hr	Storm	Whole gale	Very high waves, rolling seas. Tū tū tū e tū tū tū. Lūlū e tū tū tū. Lūlū e tū tū tū.	Widespread damage. Pāpā e tū tū tū he tū tū tū. Lūlū e tū tū tū he tū tū tū. Lūlū e tū tū tū he tū tū tū.		Kamāta e Mātagi e tū tū tū
12	>64 kt or >118 km/hr	Hurricane or cyclone	Hurricane	Sea, white with spray and foam. Tū tū tū tū tū tū. Lūlū e tū tū tū.	Widespread damage. Mōhō e tū tū tū tū tū. Mōhō e tū tū tū tū tū. Mōhō e tū tū tū tū tū.		Mātagi atā tūhōmā





Digital Cameras,
Voice recorders
Video Cameras
Water proof Canvas



Tonga

- Attachment
 - Tonga Met TK Lead
 - Tonga Met IT
- National TK Survey Workshop
- TK Database Installation
- TK Database Training
- Data Collection



Samoa

- Samoa Glossary
- Verification Workshop with Elders
- Forecast Verification
- Combination Verification Training
- Write shop
- Data Collection and Monitoring



Vanuatu

- TK Forecast Verification and Integration verification training
- TK Database Refresher training
- TK Monitoring Refresher training
- Data Collection



Solomon Islands

- Forecast Verification and
Combination Training
- Refresher Database Training
- User Guides and Resources



Niue

- Launch of Resource Materials
- National TK Verification Workshop
- TK Database Refresher training
- TK Calendar Development training with stakeholders
- TK Survey and Data collection
 - High school students



Scientific Papers and Communication

- TK Database paper (Published)
 - Community engagement
 - Combined Forecast methodology (publish)
 - Seasonal Calendar
 - Forecast use paper

- 1 **Protocols and partnerships for engaging Pacific Island communities**
- 2 **in the preservation of traditional climate knowledge**
- 3
- 4 Philip Malsale^{1,*}, Noel Sanau², Tile I. Tofaono³, Zarn Kavisi⁴, Albert Willy¹, Ross
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A database for traditional knowledge of weather and climate in the Pacific

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ABSTRACT: Growing interest in traditional knowledge (TK), particularly in relation to the prediction of weather or climate extremes, raises issues concerning the appropriate storage and management of the information collected. The Traditional Knowledge Database (TK Database) for the storage and use of TK associated with weather and climate prediction in the Pacific was designed with the following principles in mind: (1) preservation of the knowledge, maintaining cultural context wherever possible; (2) respect for intellectual property and cultural sensitivities around data sharing and use; (3) appropriate system design, accounting for ongoing costs of system maintenance and often intermittent internet access; and (4) moving beyond data preservation to ensure continued use and growth of the TK. The TK Database was successfully deployed in four countries in the south Pacific and is regularly used by their national meteorological services, and partner organizations, both to preserve TK related to weather and climate and as a tool to assist in monitoring the TK indicators. As the first database of its kind, the TK Database fills a critical gap in the appropriate storage and application of TK and provides an important foundation for future developments.

KEY WORDS Oceania; indigenous knowledge; Vanuatu; Samoa; Niue; Solomon Islands; digital rights management; environmental monitoring; database management

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Partnership and Opportunities with SPREP

- Pacific Meteorological Council (PMC) – provide guidance and direction on weather and climate activities
- Pacific Met Desk and Partnership carry out activities with NMS
- Regional Climate Centre – virtual centre for climate forecasting (Models)- different nodes with different institutions
- Pacific Climate Change Centre – Training and research
- Research – Weather and climate in the Pacific
- Weather and climate activities/Projects
- Traditional Knowledge activities/Project



Challenges and what for the Future?

- Use high resolution models
 - ACCESS-S (DFAT)
- Data sharing
- More observing sites (Land and sea)
- Combination of traditional knowledge and modern science for weather and climate forecasting



Thank you

