International Climate Change Adaptation Initiative

International Climate Change Adaptation Initiative

Yuriy Kuleshov
Australian Bureau of Meteorology

Australian Government
Bureau of Meteorology

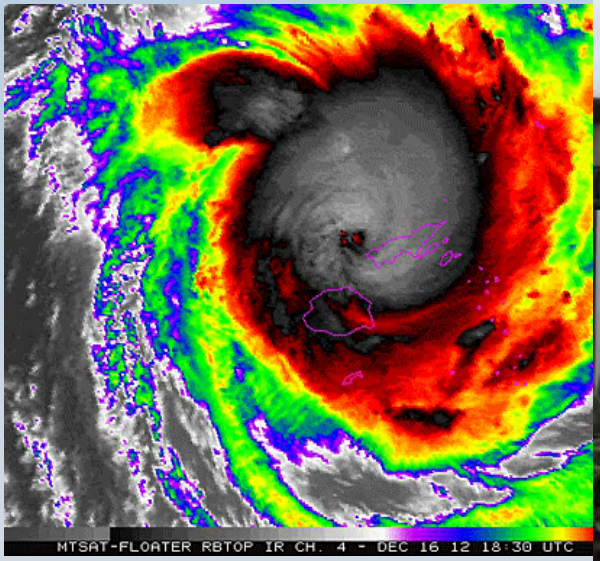
- Thirty five years of experience in satellite remote sensing for climate applications, disaster risk reduction and climatology of severe weather phenomena (tropical cyclones, thunderstorms, lighting etc.)
- Department of Satellite Remote Sensing of the Environment, the USSR Academy of Sciences (1980-1994).
- National Climate Centre, Bureau of Meteorology, Melbourne, Australia (1995 -).
- Leader of climate science and adaptation projects of the International Climate Change Adaptation Initiative (Pacific Climate Change Science Program, Pacific Adaptation Strategy Assistance Program, Pacific Australia Climate Change Science and Adaptation Planning Program).

WMO Expert:

Use of Remote Sensing Data for Climate Monitoring; Tropical Cyclone Panel; Weather and Climate Extremes Evaluation.

Academic activity: Adjunct Professor at the Royal Melbourne Institute of Technology (RMIT) University and Swinburne University of Technology.

For lifetime achievements in satellite remote sensing of the environment, in 2011 was elected as an Academician of the Academy of Engineering Sciences, Russian Federation.



Outline

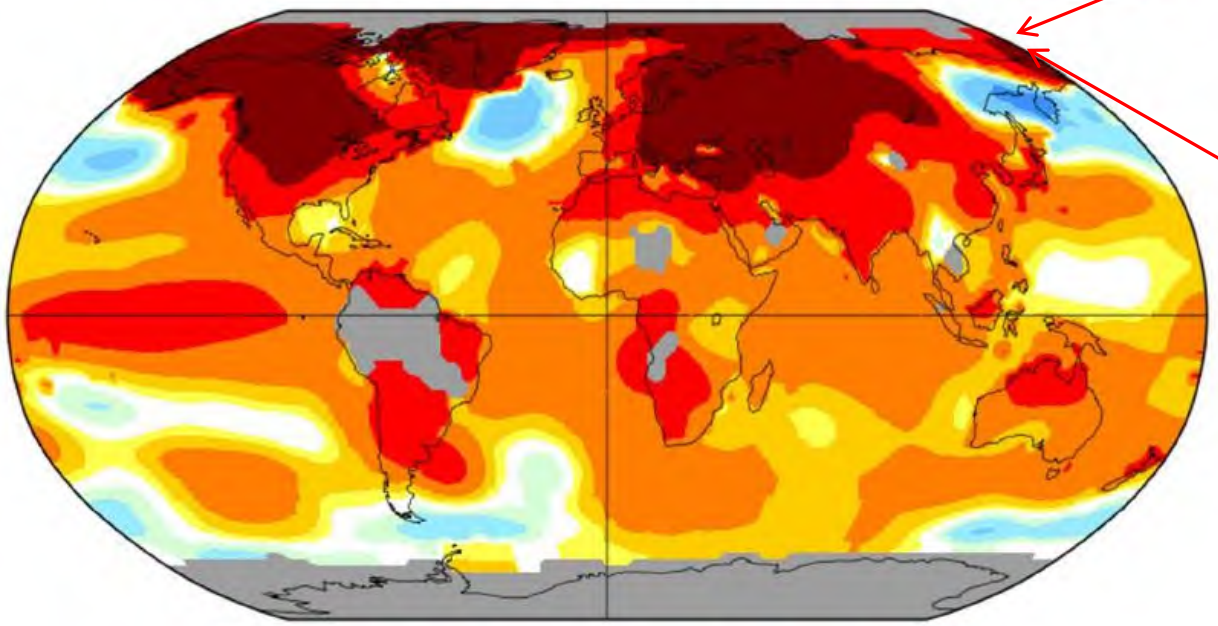
- Introduction
- Global Framework for Climate Services (GFCS)
- Climate Services Information System (CSIS)
- Climate Services Toolkit (CST)
- International Climate Change Adaptation Initiative (ICCAI)
- PCCSP: Web-based information tools to support the use and dissemination of data and analyses
- PASAP / PACCSAP: Web-based information tools to support decision making and assist with risk reduction

Global Climate Change

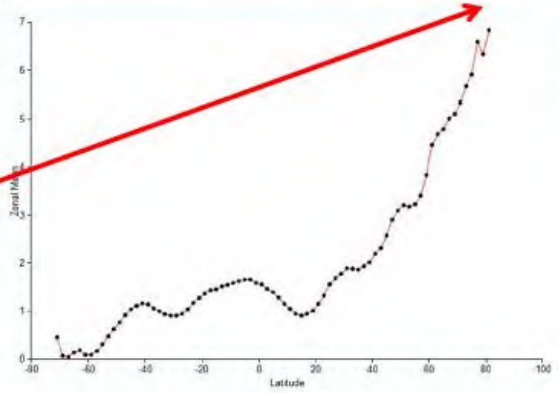
- Climate affects us all, but we also affect - and change – the climate
- Human greenhouse-gas emissions continue to rise resulting in further increase of the temperature of the atmosphere and the ocean.

•The Earth global atmospheric temperature is already warmer by 1° C compared to the beginning of the XX century.

•Urgent actions are required to mitigate and adapt to climate change.

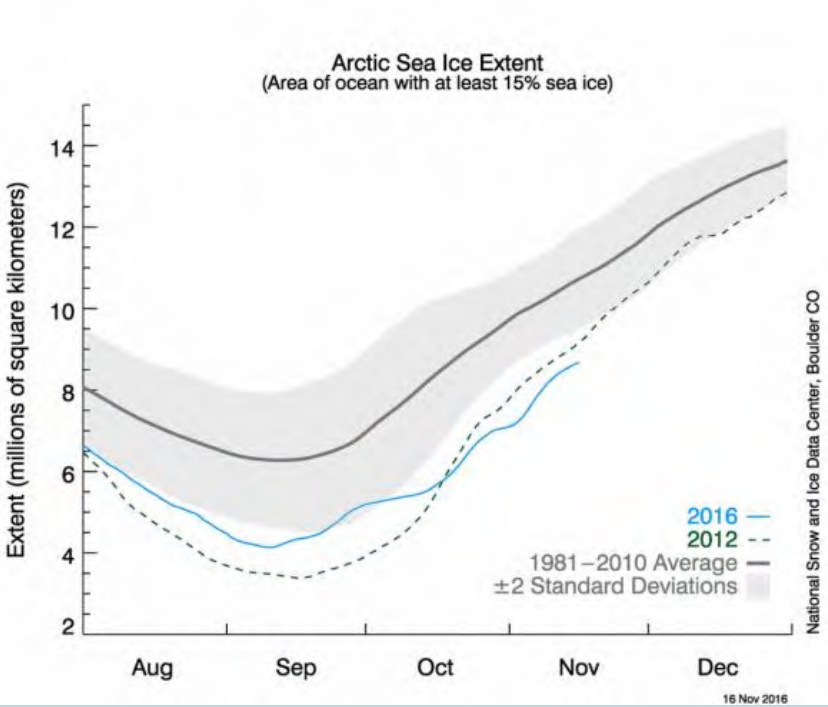


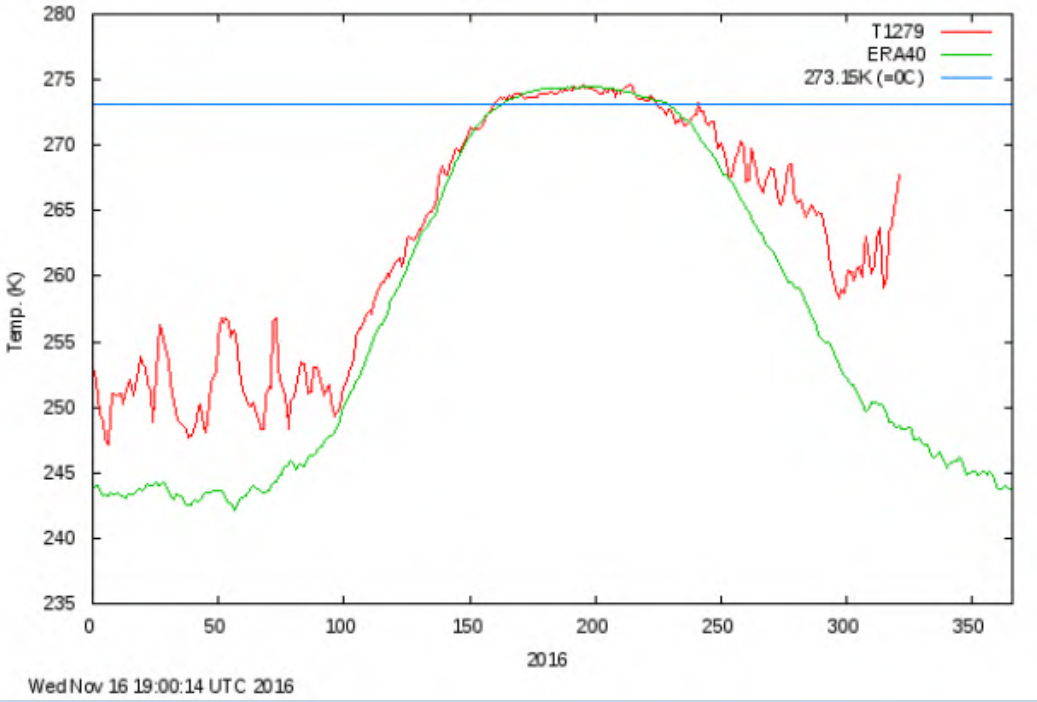
At the latitude of 81° N, the temperature anomaly of February 2016 relative to the average of 1881-1990 has been of 6.83 °C, more than 5 °C higher than the global anomaly



- Credit: Professor Petteri Taalas, Secretary-General
- World Meteorological Day 2016 "Hotter, Drier, Wetter. Face the Future"

Warming of the Arctic





Credit:

- Arctic Sea Ice Extent. National Snow and Ice Data Center
- Daily mean temperatures for the Arctic area north of the 80th northern parallel. Danish Meteorological Institute

- World Meteorological Organization (WMO) and the National Meteorological and Hydrological Services (NMHSs) are playing an essential role in building climate-resilient societies.
- Because of past and present emissions, we must prepare for a future with more hot days, warm nights and heatwaves.

Professor Petteri Taalas, WMO SG, Message on the Occasion of World Meteorological Day 2016.

UNFCCC

The WMO community, which consists of NMHSs, meteorological associations, private companies and other organizations, is at the forefront of global efforts to monitor, understand and respond to climate change.

This community contributes to action under the UN Framework Convention on Climate Change (UNFCCC) by:

- Observing the planet.
- Coordinating research.
- Developing Services.

Professor Petteri Taalas, WMO SG: WMO pledges support to Paris Agreement, 4 November 2016.

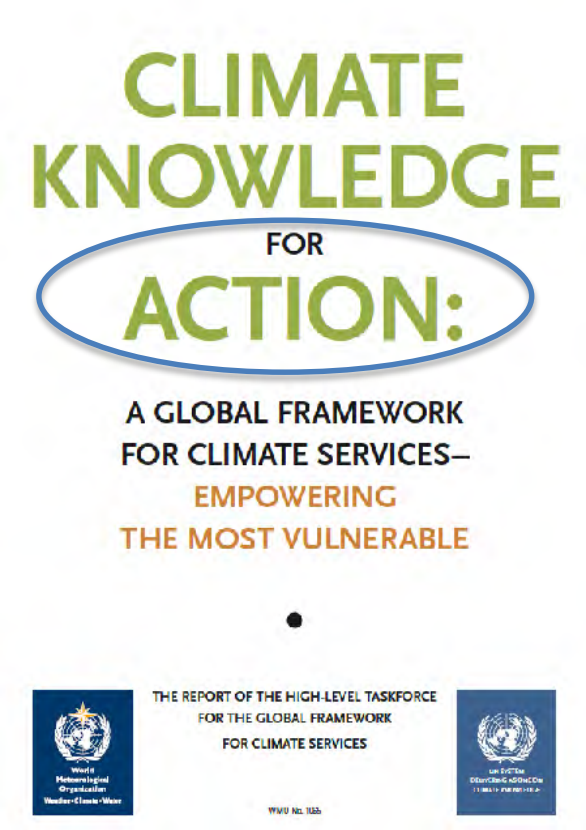
Climate Services

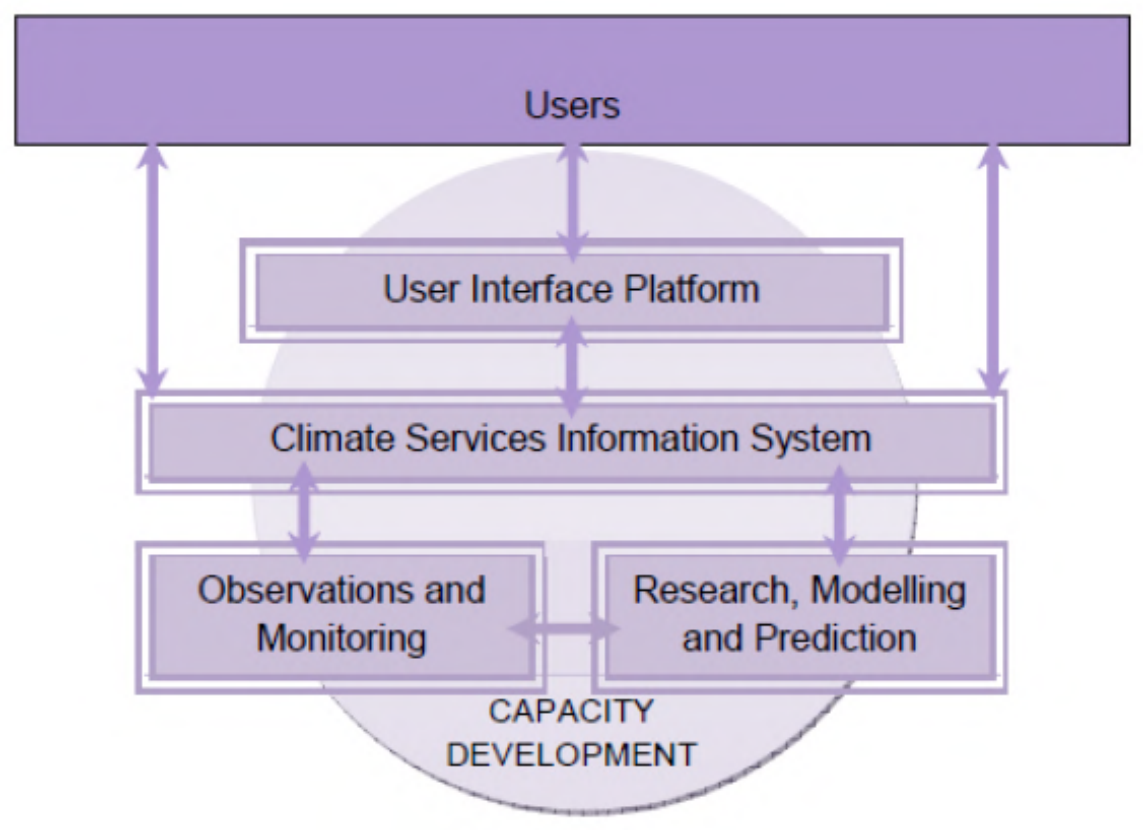
Like weather services, **climate services** use observations and research findings to provide predictions and information for decision-making, but on the scale of seasons to decades.

Sophisticated climate services combine climate forecasts with information from other sectors to inform decisions on public health, agriculture, water management, disaster risk and other sectors and priorities.

Professor Petteri Taalas, WMO SG: WMO pledges support to Paris Agreement, 4 November 2016.

Global Framework for Climate Services (GFCS)





The Global Framework for Climate Services (GFCS) is an UN-led initiative headed by the World Meteorological Organization (WMO) to guide the development and application of science-based climate information and services in support of decision-making.

Global Framework for Climate Services (GFCS)

Presently, the GFCS has five priority areas:

- Agriculture & Food Security
- Disaster Risk Reduction
- Health
- Water
- Energy

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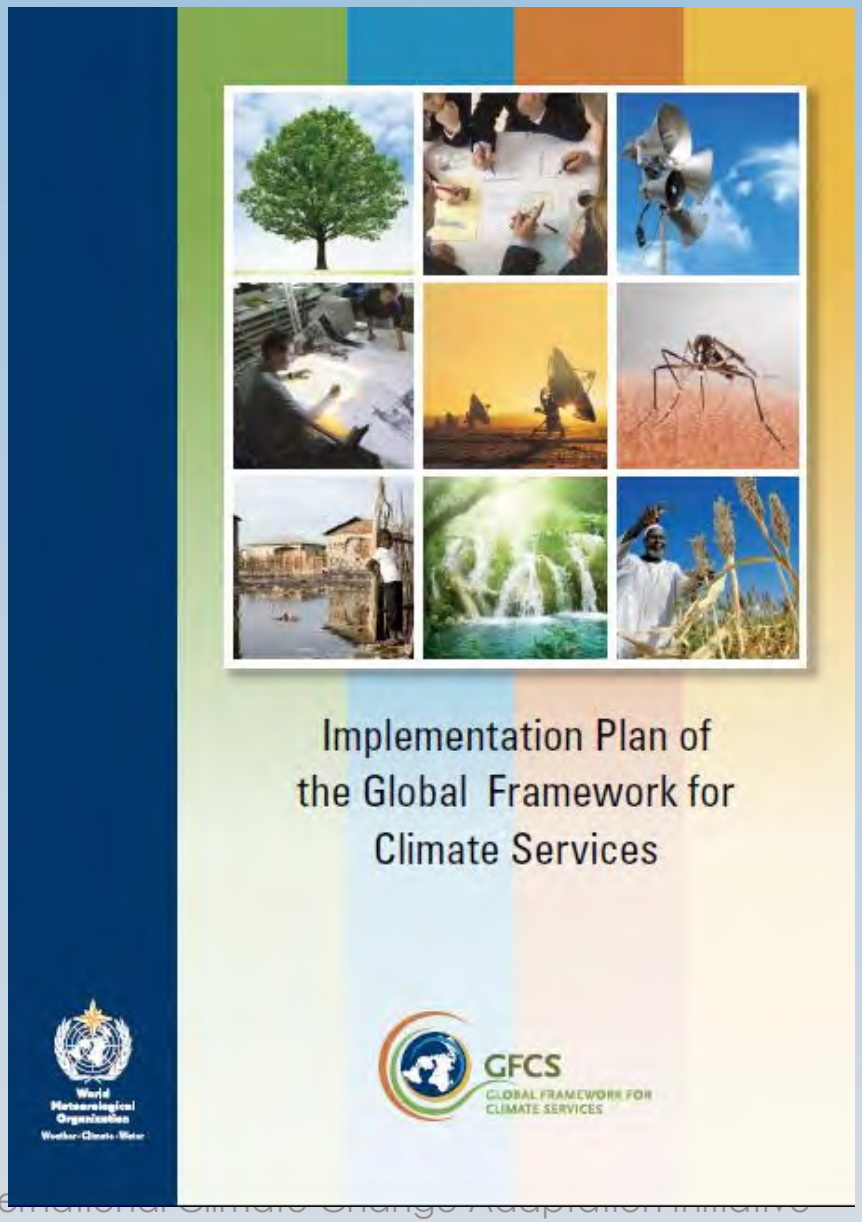
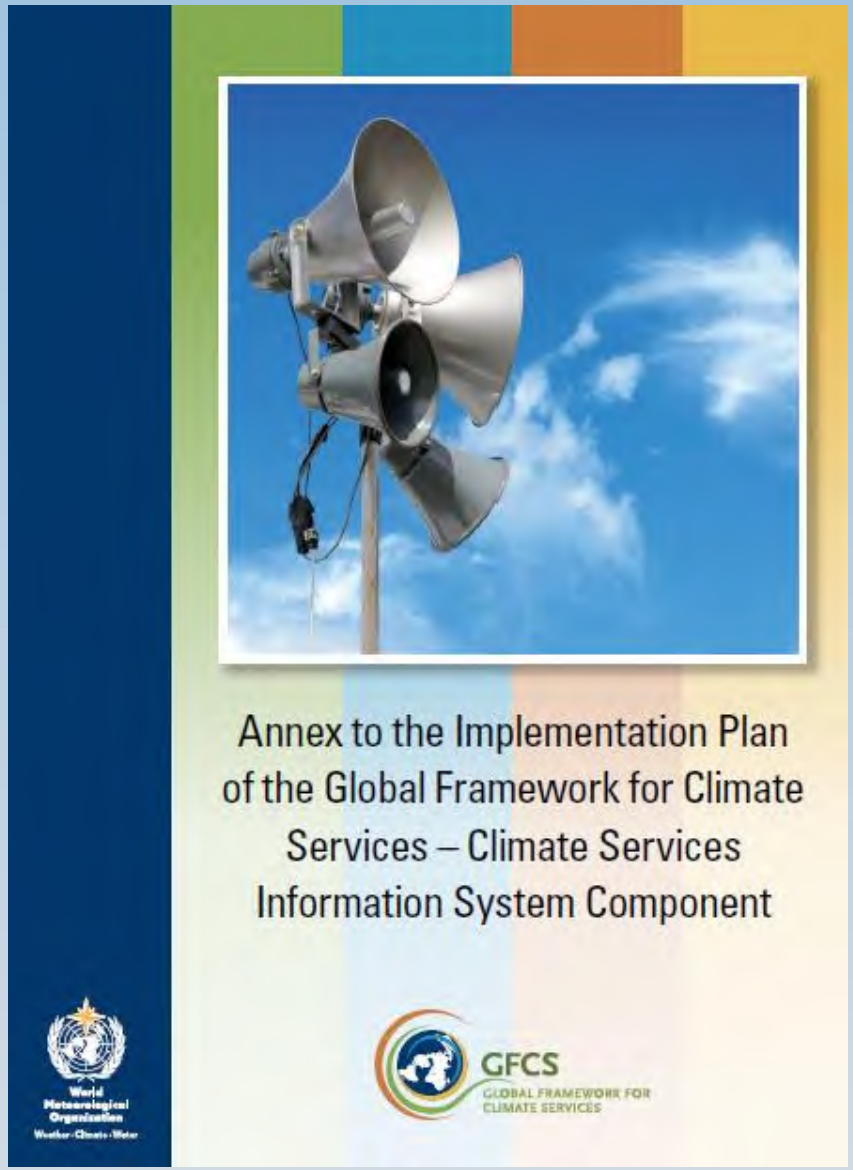
Global Framework for Climate Services (GFCS)



The vision of the GFCS is

"To enable better management of the risks of climate variability and change, through the development and incorporation of **science-based climate information and prediction** into planning, policy and practice on the global, regional and national scale".

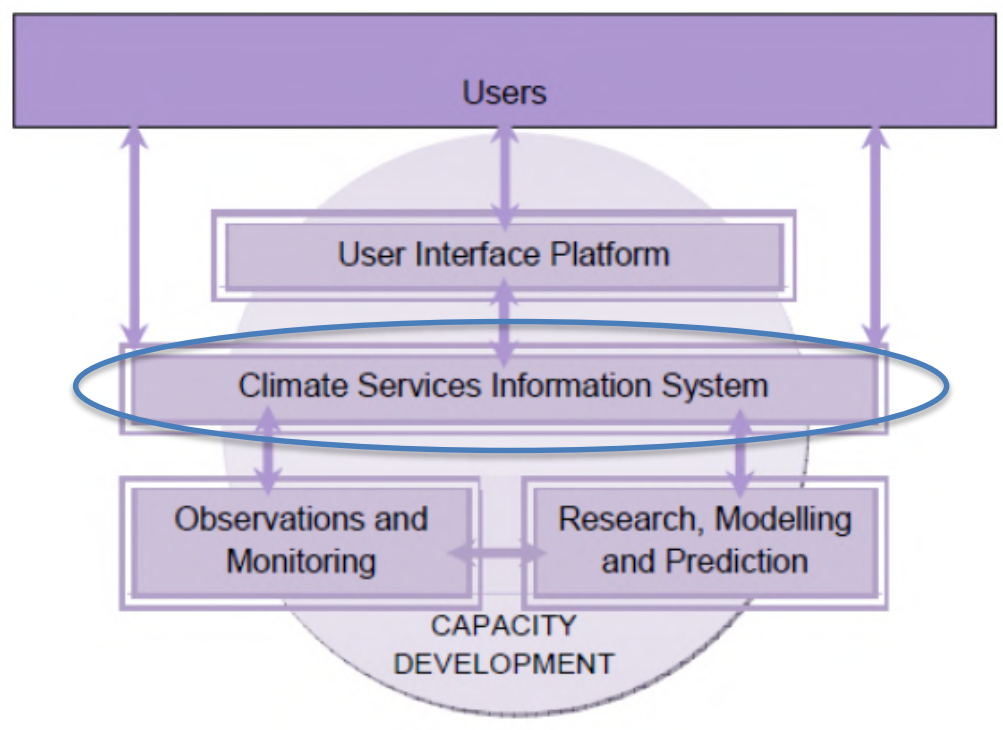
Climate Services Information System (CSIS)



Climate Services Information System (CSIS)

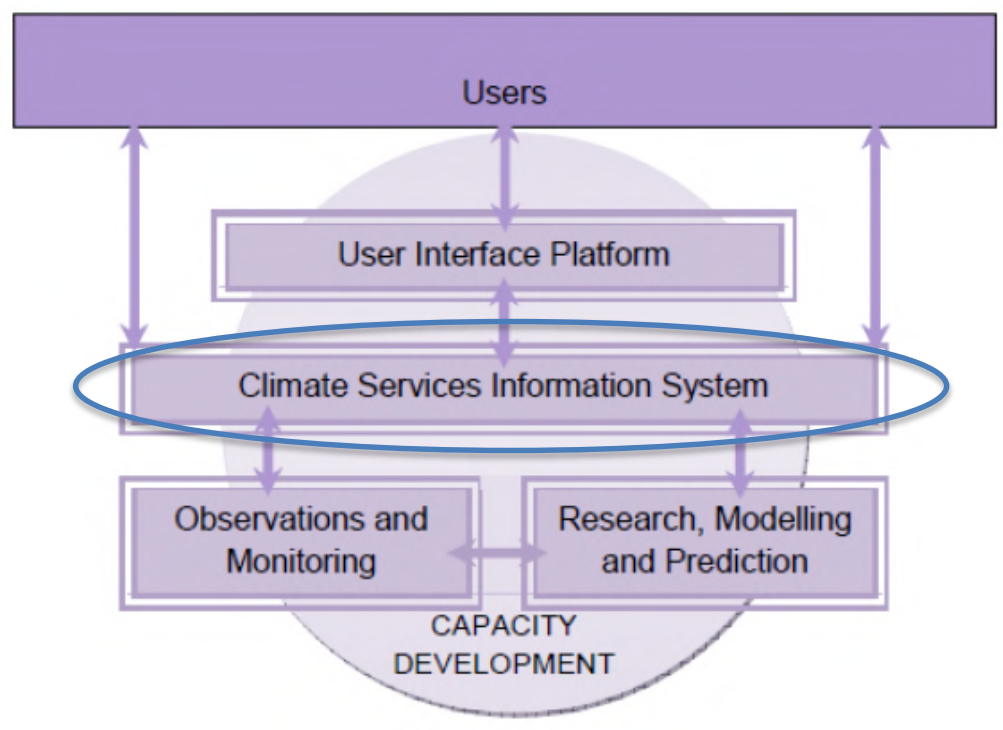
- The CSIS is the component of the GFCS most concerned with the generation and dissemination of climate information.

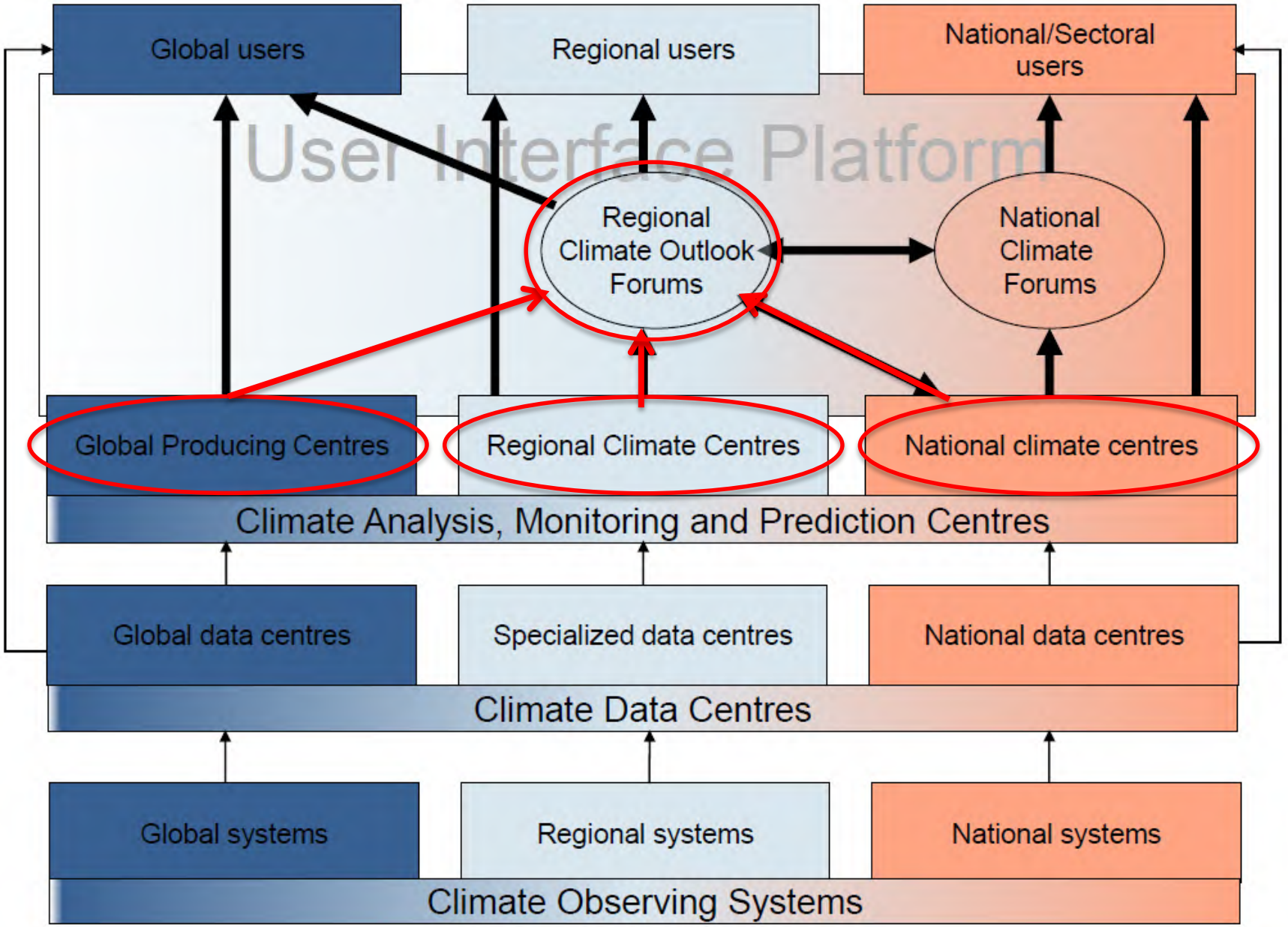
- It is the 'operational centre' of the GFCS which includes climate data, monitoring, prediction (monthly, seasonal, decadal) and projection (centennial) activities.



Climate Services Information System (CSIS)

- The CSIS comprises global, regional and national centres and entities that generate / process climate information (observations and predictions), and the exchange of data and products to agreed standards and protocols.




Global users
Regional users
National/Sectoral users
User Interface Platform
Regional Climate Outlook Forums
National Climate Forums
Global Producing Centres
Regional Climate Centres
National climate centres
Climate Analysis, Monitoring and Prediction Centres
Global data centres
Specialized data centres
National data centres
Climate Data Centres
Global systems
Regional systems
National systems
Climate Observing Systems

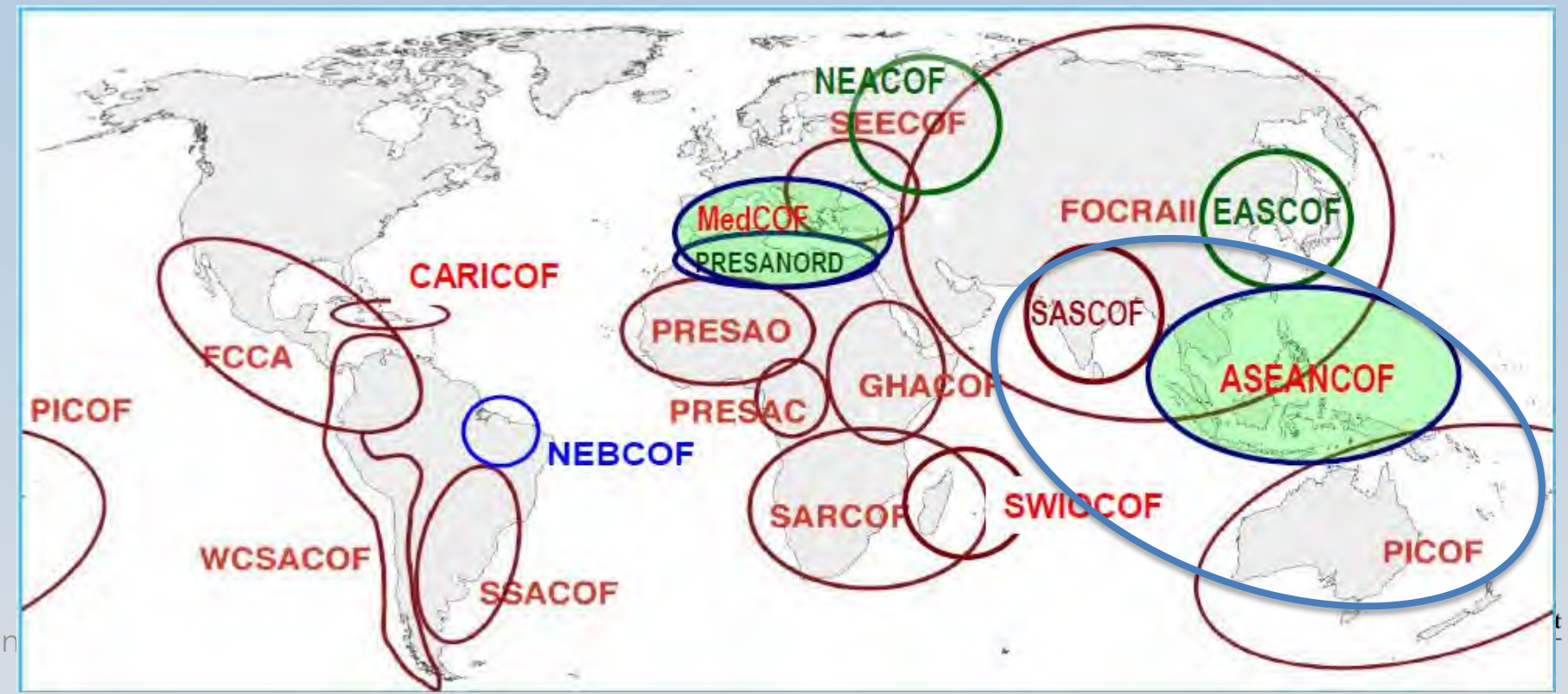
Global Producing Centres for LRFs

- WMO has officially designated 12 GPCLRFs
- WMO Lead Center for Long-Range Forecast Multi-Model Ensemble (LC-LRFMME) jointly coordinated by KMA and CPC/NOAA.
- WMO Lead Center for Standard Verification System of Long-Range Forecasts (LC-SVSLRF) jointly coordinated by BoM and MSC

Regional Climate Outlook Forums

WMO RCOFs provide platforms for climate experts and climate information users to:

- Discuss current climate status
- Exchange views on scientific developments in climate prediction
- Develop consensus-based regional climate outlooks that can feed into national climate outlooks produced by NMHSs
- Engage in user-provider dialog



Regional Statement on the Impacts of the 2015/16 El Niño and 2016/17 Climate and Tropical Cyclone Outlook for the Pacific Islands

Key Messages:

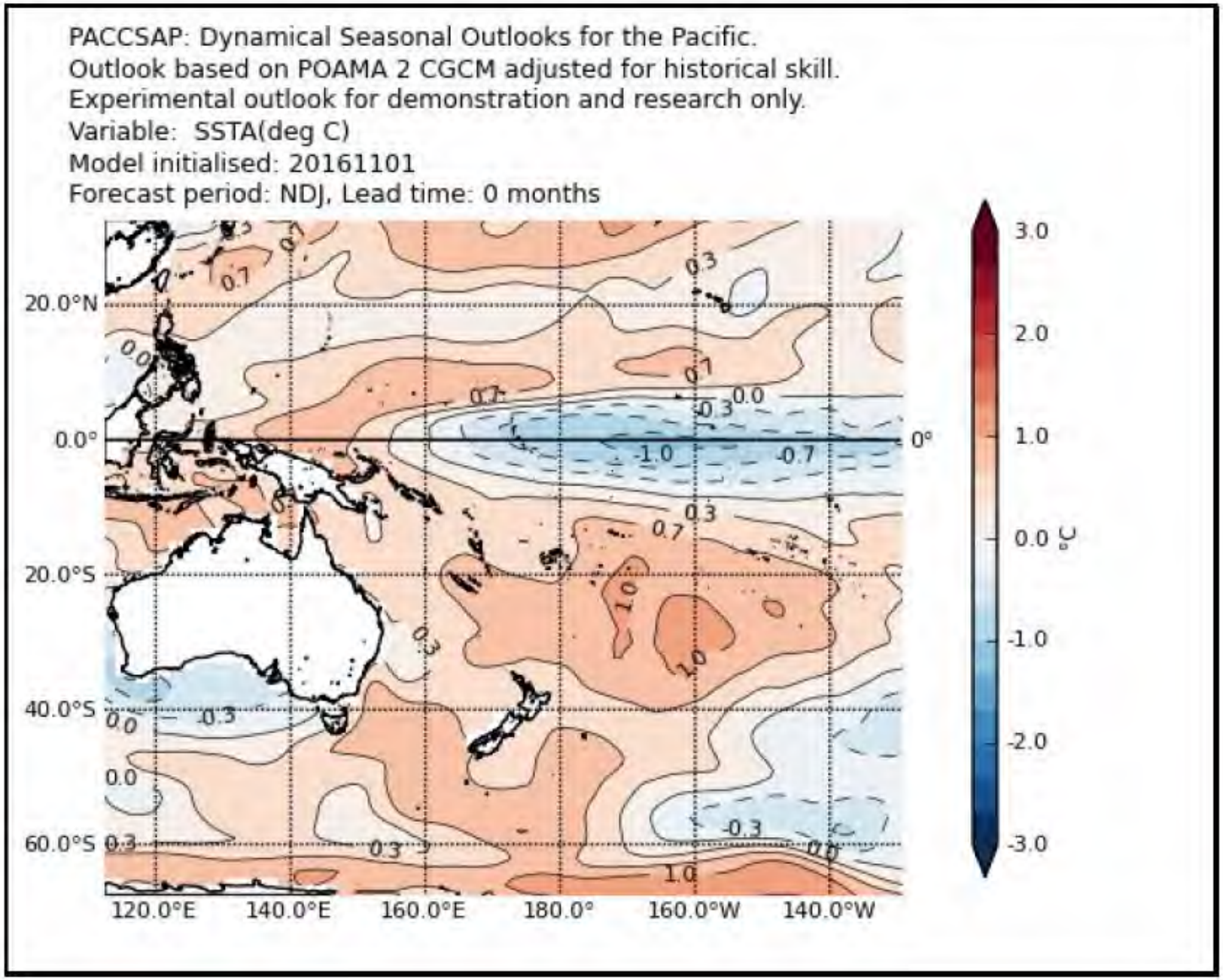
2015/16 El Niño

- The strong El Niño in 2015/16 was similar to previous events in 1997/98 and 1982/83.
- Significant impacts associated with the 2015/16 El Niño were anticipated and experienced across the Pacific Islands region, mainly associated with below normal rainfall and reduced sea level in the southwest Pacific. The central Pacific experienced increased rainfall and elevated sea level.
- These impacts came on the back of "El Niño like" conditions experienced throughout most of the region in 2014.

2016/17 Outlook

- For November 2016 to January 2017, weak La Niña to neutral conditions are expected.
- Below normal rainfall is forecast for the central Pacific (moderate-high confidence), and normal or above normal rainfall is possible for the islands in the northwest tropical Pacific and the region from Papua New Guinea southeast to the southern Cook Islands (moderate confidence).
- 8 to 10 named tropical cyclones are expected for the southwest Pacific region for the period November 2016 to April 2017 (this is near the long-term average).
- Typhoon activity for the western north Pacific is expected to be below normal to normal, from October to December 2016.

Sea surface temperature outlook (from Bureau of Meteorology, POAMA model)



Climate Services Toolkit (CST)

- **CST** is a set of fit-for-purpose **software products** (data portals, analysis and prediction packages) and specifically designed **accompanying training modules.**

- **Share** new tools, information and methods, and thereby enable all CSIS providers to utilise **research advances**.

- And in this way to **ensure** that the information and products developed for and provided to end-users are **reliable**, **consistent** (through time and across regions) and of **high quality**.

Climate Services Toolkit – What could be included?

- Data Management tools, including
  - ✓ Data portal for access to and analysis of observations and GCM outputs
  - ✓ Database management tool for quality control and simple manipulation of data
- Climate analysis tool for diagnostic analyses
- Climate monitoring tools for calculation of anomalies, percentiles, return periods etc.
- Forecasting, downscaling and verification tools, including flexibility to interface to impacts models.

- CST – how it was implemented under the ICCAI.

International Climate Change Adaptation Initiative – Pacific Programs

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- Climate change
- Adapting to climate change
  - National Climate Resilience and Adaptation Strategy
  - Australia's coasts and climate change
  - PACCSAP
  - Publications and resources

Pacific-Australia Climate Change Science and Adaptation Planning programme

The Pacific-Australia Climate Change Science and Adaptation Planning (PACCSAP) programme supported 14 Pacific Island countries to build resilience to current and future climate risks through improved science and data, increased awareness of climate change and its impacts, and better adaptation planning.

PACCSAP was delivered in partnership with the CSIRO and the Bureau of Meteorology and ran from 2011 to 2015.

The programme responded to the serious and immediate challenges Pacific Islands face from the impacts of climate change, and the need for climate data and information in the Pacific region. It built on the success of earlier programmes: the East Timor Climate Change Science Program; the Pacific Adaptation Strategy Assistance Program; and the Pacific Climate Change Science Program.

A small island in Gizo in the Solomon Islands, with trees and a few houses

Key achievements from the PACCSAP programme

Climate science

PACCSAP built the climate science knowledge base in the Pacific by:

- updating the national climate projections to inform decision-making for climate adaptation and disaster risk reduction in the region (See: Climate Variability, Extremes and Change in the Western Tropical Pacific: New Science and Updated Country Reports 2014
- developing core climate change science and seasonal forecasting capability in Pacific countries' national meteorological services (Communication and capacity building), and
- developing a range of climate education and support materials to help schools, local communities, and Pacific meteorological services better understand and communicate climate change science.

Water security

PACCSAP informed water planning and investment at national and regional scales by:

Early warning and preparedness to hydro-meteorological hazards

•Strengthening climate services in the most vulnerable and least developed countries, including small island developing States and least developed countries in the Asia-Pacific region is a high priority task for GFCS with focus on improving early warning and preparedness of communities to hydro-meteorological hazards.

•Tropical cyclones, floods and droughts are among the most damaging and destructive weather and climate hazards which affect population of countries in the Asia-Pacific region.

•To assist with improving analysis, monitoring and seasonal prediction of hydro-meteorological hazards in the region, a range of activities have been undertaken through climate science and adaptation programs of the International Climate Change Adaptation Initiative (ICCAI).

International Climate Change Adaptation Initiative (ICCAI)

•Australia supports high priority climate change adaptation needs in vulnerable countries in our region.

•The primary geographic emphasis of the AusAID–DCCEE jointly–managed International Climate Change Adaptation Initiative (ICCAI, $350 M , 2008-2014) is on Australia's neighbouring island countries.

•The Pacific Climate Change Science Program (PCCSP) and the Pacific Adaptation Strategy Assistance Program (PASAP), 2008–2011, helped 14 Pacific island Countries and East Timor better understand how climate change will impact on them.

• The Pacific Australia Climate Change Science and Adaptation Planning (PACCSAP) Program, 2011-2014, was a continuation of the PASAP and PCCSP, with a focus on **climate extremes**.

Asia-Pacific Disaster Report 2012

•Asia-Pacific is one of the most disaster-prone areas of the world.

•According to the "Asia-Pacific Disaster Report 2012" prepared by the UN Economic and Social Commission for Asia and the Pacific and the UN Office for Disaster Risk Reduction, "Almost 2 million people were killed in disasters between 1970 and 2011, representing 75 per cent of all disaster fatalities globally.

•The most frequent hazards in the region are **hydro-meteorological**, which also affect the most people.

•Since 2000, more than 1,2 billion people have been exposed to hydro-meteorological hazards alone, through 1,215 disaster events".



Climate extremes in the Pacific

Little knowledge about current climate of the Pacific Island Countries and climate projections prior to PCCSP research.

Climate extremes have a major impact on Pacific Island countries, and their changes over the coming decades are expected to drive many of the most significant effects of climate change.

Of particular concern are tropical cyclones, hydro-meteorological extremes (droughts and floods), sea level extremes and unusually warm ocean temperatures, and their impacts through severe weather, coastal inundation and coral bleaching.

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Pacific Islands Partner Countries

Cook Islands

East Timor

Federated States of Micronesia

Fiji

Kiribati

Niue

Palau

Papua New Guinea

Republic of Marshall Islands

Republic of Nauru

Samoa

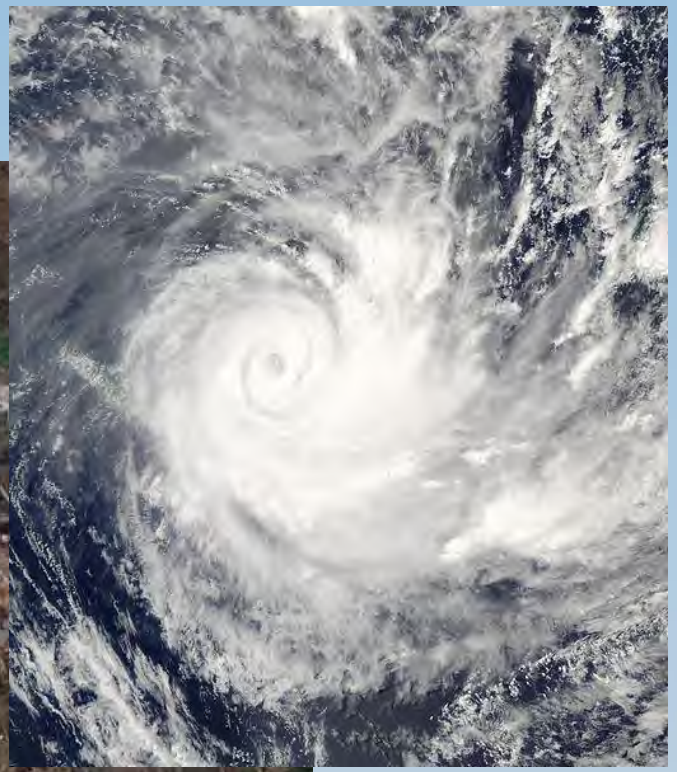
Solomon Islands

Tonga

Tuvalu

Vanuatu

Floods in the Pacific



Severe flash flooding associated with TC *Evan* in Samoa in Dec 2012.

- Severe floods frequently affect major infrastructure, transportation, business and property in Pacific Island Countries.
- Often significant flooding is attributed to a tropical cyclone or a tropical depression.
- Typhoon-flood modelling is a high priority (e.g. applying new wind field model).

Droughts in the Pacific

- On the other side of hydro-meteorological extremes are droughts which also frequently affect islands of the Pacific impacting on the countries' population and the environment (e.g. forest fires => air quality) to a various degrees of severity depending on the drought's length.
- There is general perception amongst Pacific Islanders that the frequency and magnitude of drought has increased, particularly in the last couple of decades.
- This would be of significant concern as agriculture and water storages on most Pacific Islands are particularly sensitive to drought.

Meteorological drought affected Fiji in 2010

800 hectares of forests were destroyed by fire in Samoa in 2011

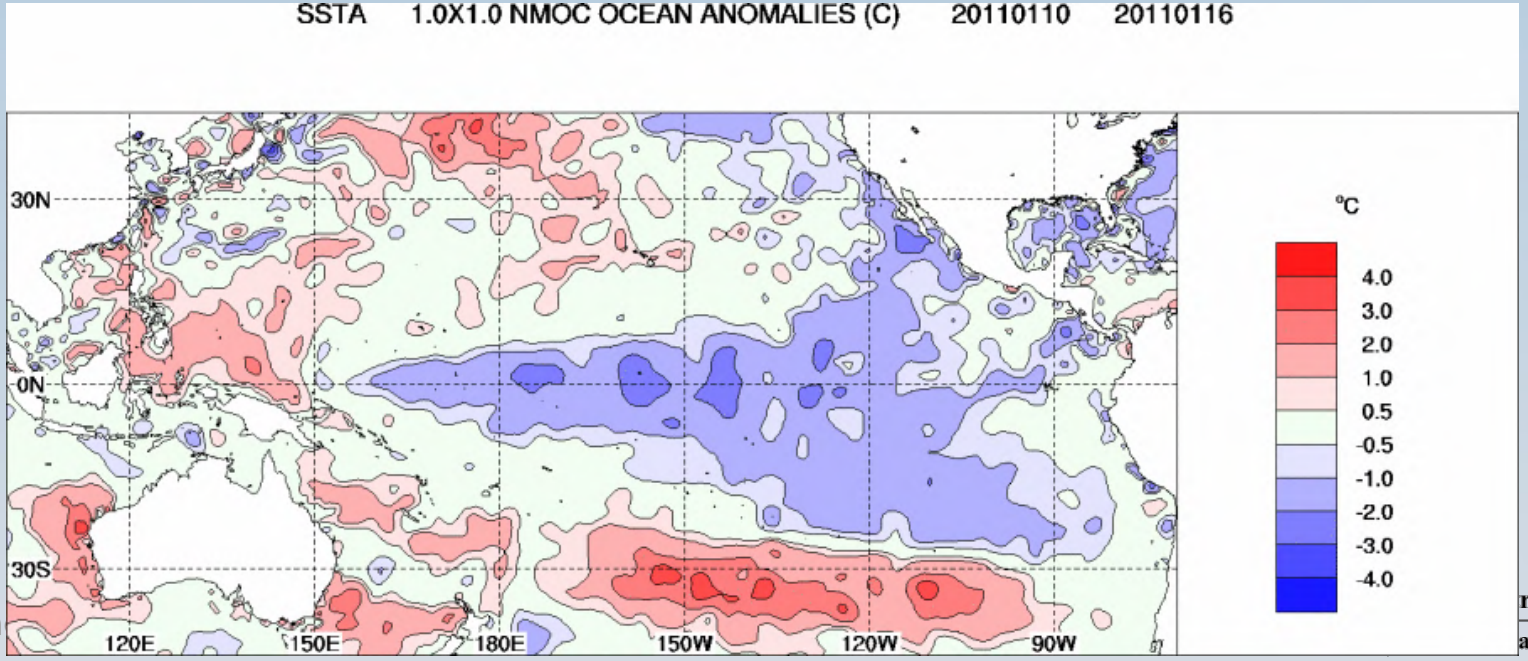
Droughts in the Pacific

- Rainfall records for 21 countries and territories in the Pacific since 1951 have been examined to identify trends in drought occurrence, duration and magnitude.
- The strength of the relationship between the main climate drivers in the Pacific – El Niño-Southern Oscillation (ENSO), Inter-decadal Pacific Oscillation (IPO) and Pacific Decadal Oscillation (PDO) - and precipitation has been also examined.
- Station scale drought trends are largely positive; however, spatially, trend patterns are largely heterogeneous.
- Drought was found to be longer and more severe south of the SPCZ and north of the ITCZ during the positive phase of the IPO and PDO.

McGree, Schreider and Kuleshov, 2016: *Trends and variability in droughts in the Pacific Islands and northeast Australia*, Journal of Climate http://dx.doi.org/10.1175/JCLI-D-16-0332.1

Droughts in the Pacific

- In extreme cases, droughts affect countries to such an extent that they cause devastating water crisis (e.g. the 2011 drought in Tuvalu).
- This prolonged drought episode was related to a strong La Niña event which affected the region in 2010-11.



The 2011 droughts in Tuvalu

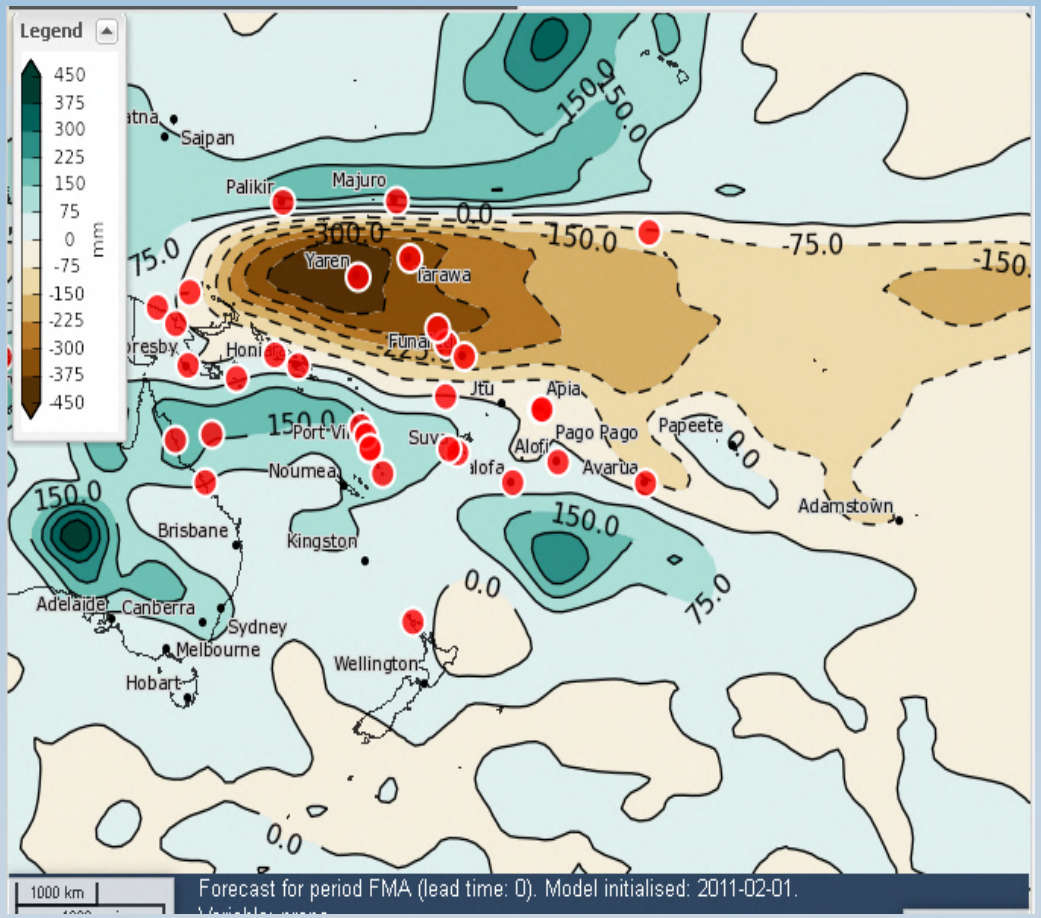
- In 2011, a number of countries and territories in the region, including Samoa, Tokelau and Tonga were affected by La Niña-induced rainfall deficit; however, Tuvalu was particularly seriously impacted.

- On the 28 September 2011, the government of Tuvalu declared a state of emergency due to critically low water supplies.

- Households were rationed to about 40 litres of fresh-water a day as some parts of Tuvalu had just a two day supply of water left.

- The situation was critical and the governments of Australia, Japan, New Zealand and South Korea immediately began delivering fresh water supplies and portable desalination plants.

The Pacific Seasonal Climate Prediction Portal



POAMA-based prediction of seasonal rainfall anomalies in the South Pacific region. The seasonal forecasts issued in February 2011 for three-month period FMA.

The POAMA-based seasonal forecast issued in February 2011 for the three-month period February-March-April (FMA) predicted that the rainfall deficit in the area of Tuvalu would continue, with the ensemble mean forecast quantity of seasonal rainfall about 225 mm below average.

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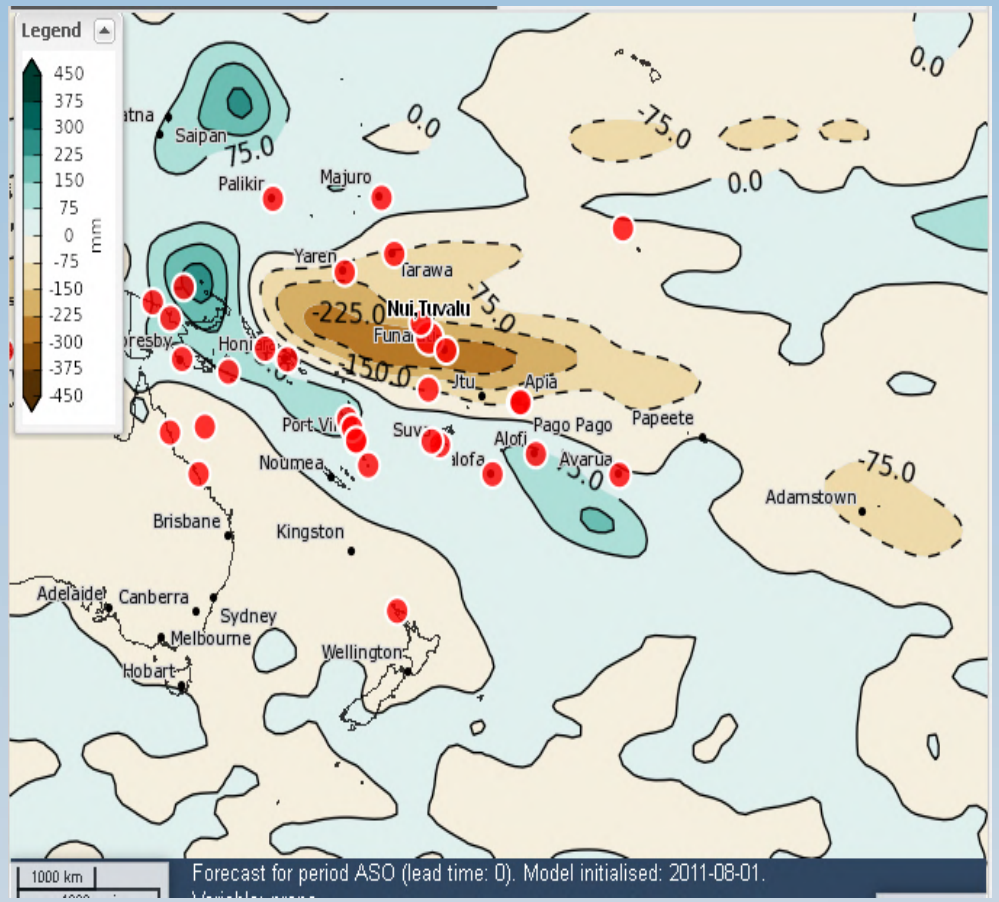
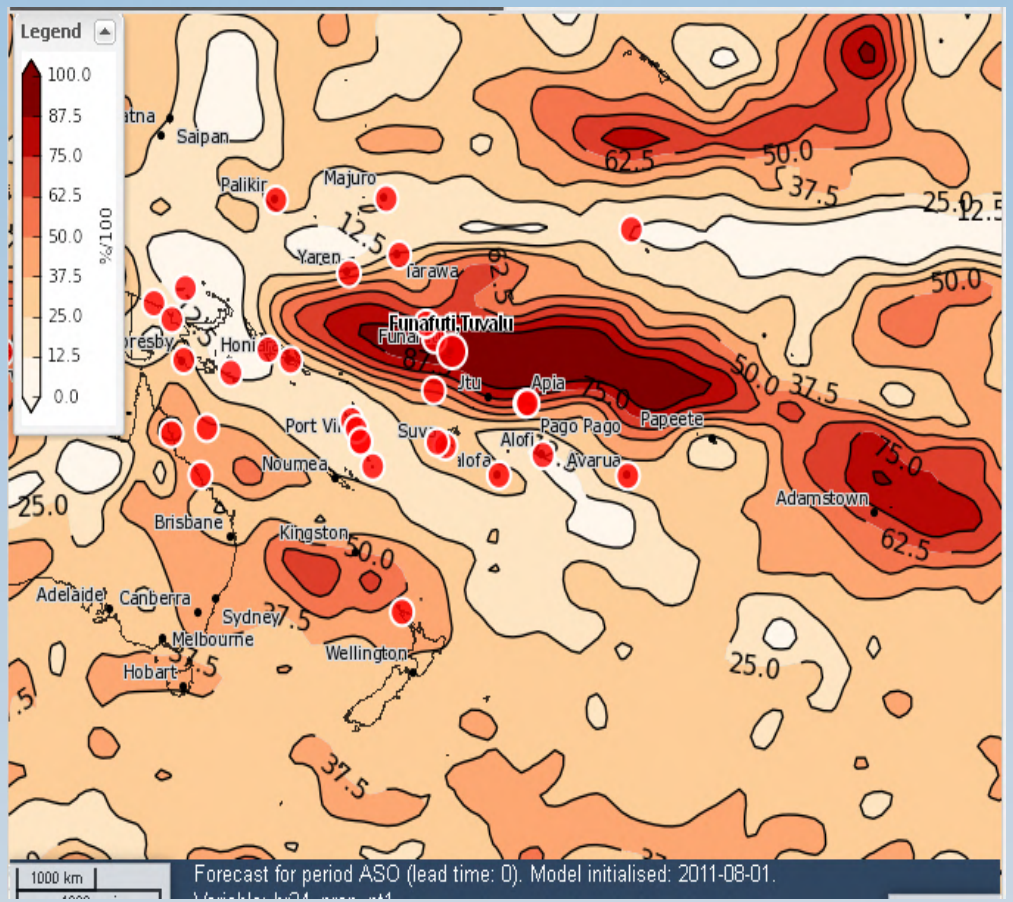
The Pacific Seasonal Climate Prediction Portal



POAMA-based prediction of seasonal rainfall anomalies in the South Pacific region. The seasonal forecasts issued in February 2011 for three-month period ASO.

Subsequent forecasts from POAMA, produced monthly, consistently indicated that rainfall deficits would further continue, e.g. the forecast for August-September-October (ASO), issued in August 2011, predicted a rainfall deficit greater than 225 mm.

The Pacific Seasonal Climate Prediction Portal



Probability of accumulated rainfall in the lower climatological tercile (more than 87.5% in the region containing Tuvalu) predicted by POAMA for ASO 2011.

- Information available from POAMA from the beginning of 2011 consistently indicated high probability of continuous drought in the region.
- If used in a timely manner by disaster managers, such information could be used as a trigger for early preventive actions to reduce the impact of water shortages on the local population.

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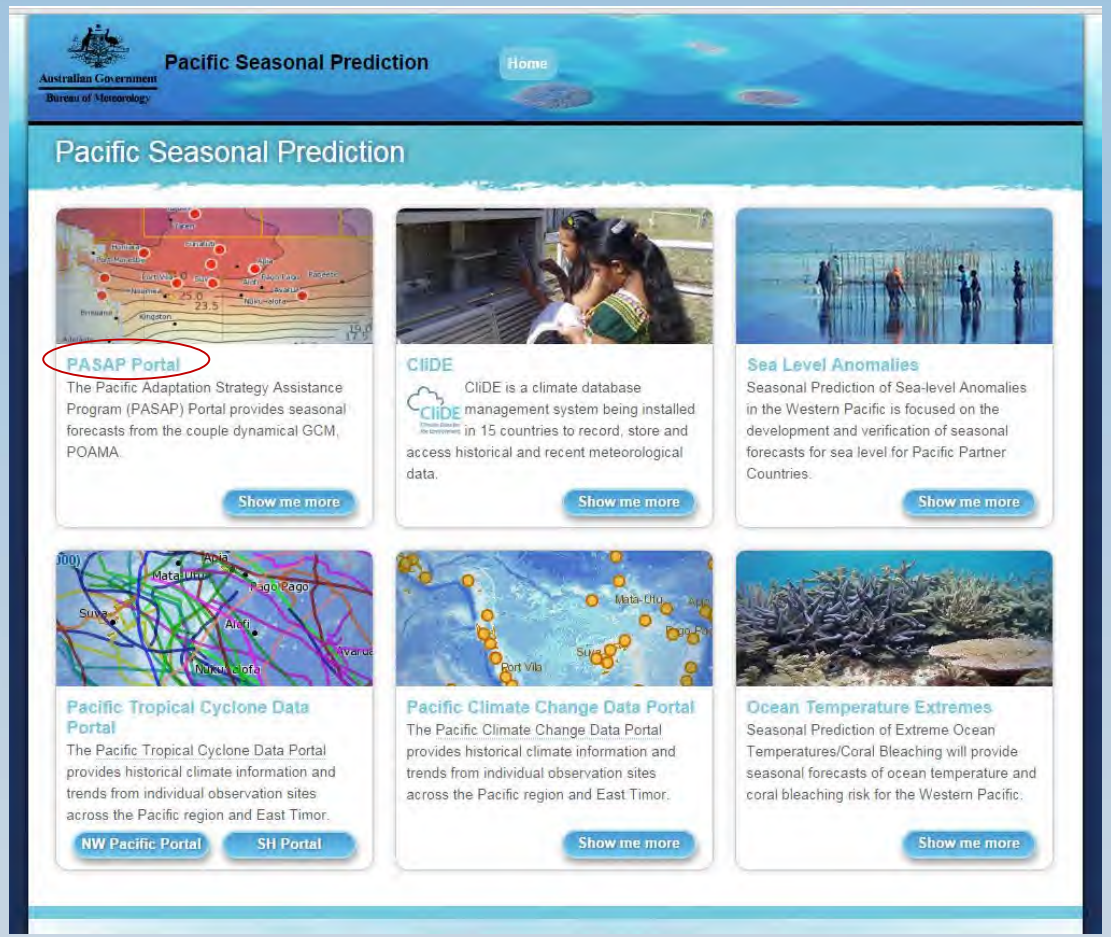
The Pacific Portal



http://www.bom.gov.au/climate/pacific/projects.shtml

A range of web-based information tools have been developed to assist National Meteorological and Hydrological Services of 15 island countries in the Western Pacific with climate change adaptation:

- Climate Data for the Environment (CliDE)
- Pacific climate change data portal
- Seasonal climate prediction portal (currently WMO GPCLRF portal)
- Pacific tropical cyclone data portal
- Sea level anomalies
- Ocean temperature extremes

Climate Services Toolkit / The Pacific Portal

- Data Management tools, including
  - ✓ Data portal for access to and analysis of observations and GCM outputs
  - ✓ Database management tool for quality control and simple manipulation of data
- Climate analysis tool for diagnostic analyses
- Climate monitoring tools for calculation of anomalies, percentiles, return periods etc.
- Forecasting, downscaling and verification tools for statistical and MOS models, and with flexibility to interface to impacts models.

- Climate Data for the Environment (CliDE)
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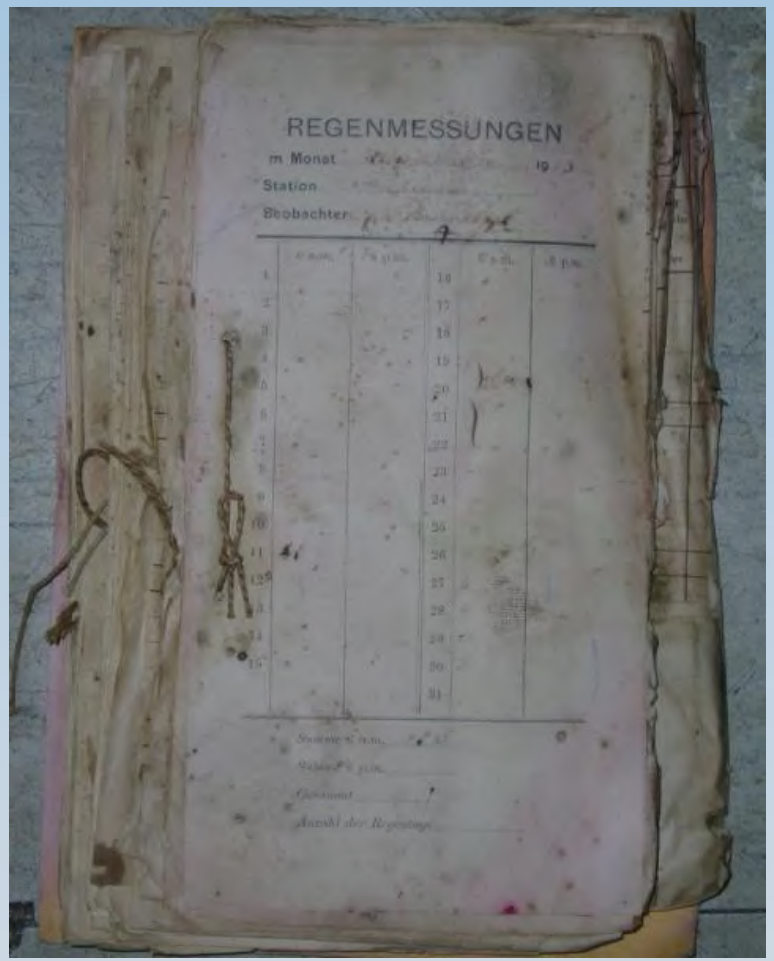
Data rescue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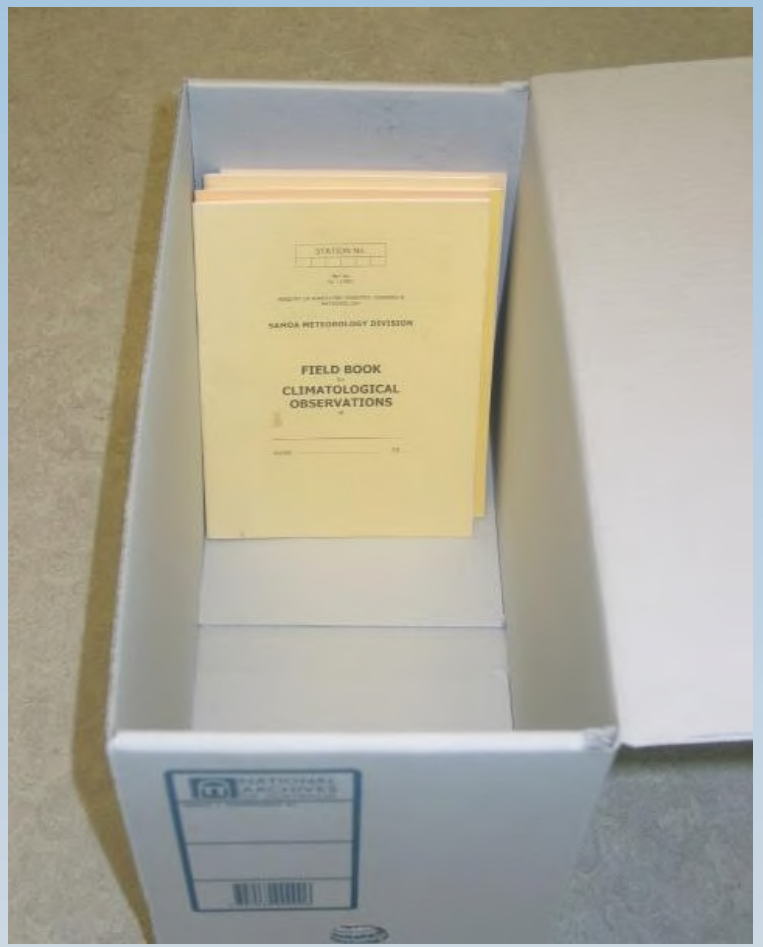
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FIELD BOOK
CLIMATOLOGICAL
OBSERVATIONS

Data rescue

500 Year Archive Boxes

Shipment by Sea

Data entry

Data organisation

Print

Monthly data for Port Moresby W/Office for 1970 to 1974

Site Name: **Port Moresby W/Office** Site Number: **55006**
Latitude: **-9.3800** Longitude: **147.2100** Elevation: **48.000**
Commenced: **Jan 1950** Status: **Open**

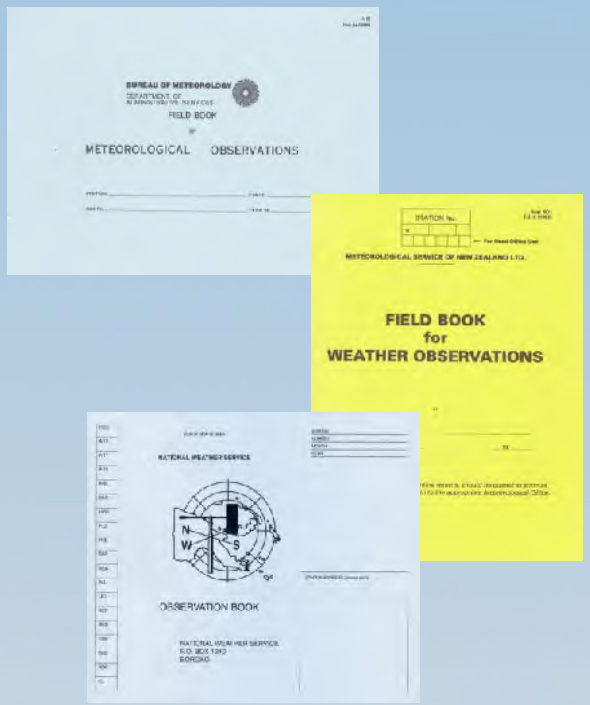
Rainfall (mm) Max Temp (°C) Min Temp (°C)

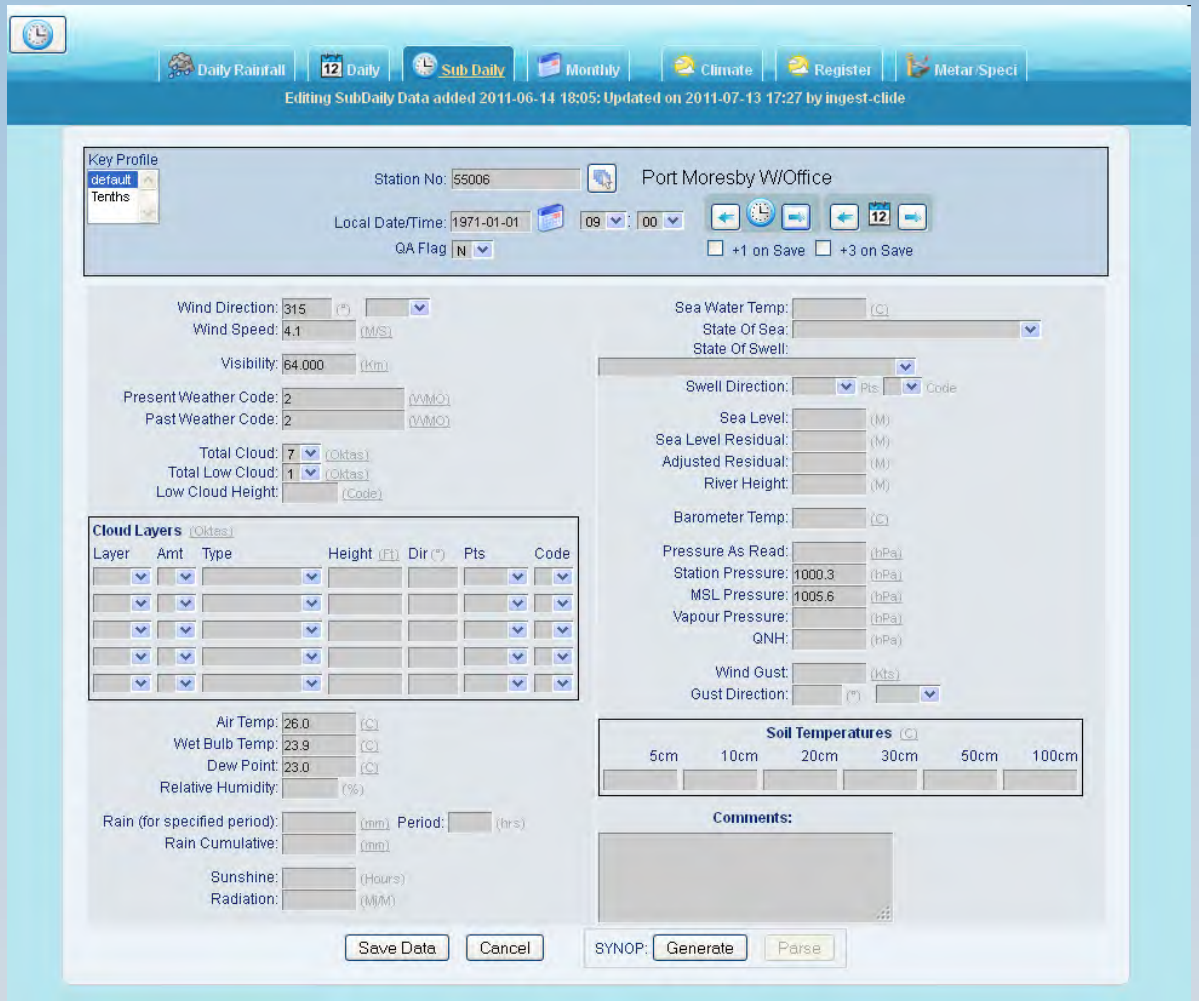
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1970	139.6	371.5	359.3	53.2	49.2	9.8	32.6	44.6	93.6	112.7	108.8	119.2	1494.1
	31.5	30.8	31.0	31.1	30.4	30.8	29.6	30.2	30.3	30.6	31.4	31.0	30.7
	23.2	22.8	23.3	23.2	23.3	22.3	21.9	22.9	23.0	23.2	23.1	22.9	22.9
1971	172.3	165.4	248.8	121.4	70.2	96.6	28.8	10.6	27.6	25.0	63.0	126.5	1156.2
	30.7	31.2	31.0	30.6	29.9	29.2	29.0	30.3	31.1	32.1	33.0	31.5	30.8
	22.9	23.0	22.8	22.6	22.9	22.8	22.2	22.1	23.0	23.0	22.8	22.7	22.7
1972	182.6	274.4	315.4	66.4	145.2	3.2	6.2	0.0	1.8	5.2	15.2	4.2	1019.8
	30.7	30.6	30.6	30.2	28.8	29.2	29.0	29.4	29.8	31.0	32.3	32.7	30.4
	22.6	22.7	22.3	22.3	21.7	21.0	21.2	19.0	20.5	21.7	23.8	23.7	21.9
1973	245.9	108.7	232.9	40.8	162.1	56.9	20.8	15.6	5.4	8.7	282.6	240.0	1420.4
	33.1	32.5	31.0	31.7	30.9	30.9	30.3	31.4	32.0	32.3	32.2	31.4	31.6
	23.7	23.6	23.8	23.6	22.8	22.9	21.0	22.4	23.5	23.2	23.4	23.0	23.1
1974	320.8	335.0	49.4	107.8	73.5	21.8	25.4	2.8	55.6	8.6	5.8	52.8	1059.3
	31.2	31.0	31.3	31.1	30.8	29.8	30.3	30.8	31.8	32.2	33.2	32.7	31.4
	22.8	22.8	22.3	22.4	22.2	21.2	21.5	21.3	23.0	23.6	23.5	22.9	22.5

Stat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	212.2	251.0	241.2	77.9	100.0	37.7	22.8	14.7	36.8	32.0	95.1	108.5	1,229.9
	31.4	31.2	31.0	30.9	30.2	30.0	29.6	30.4	31.0	31.6	32.4	31.9	31.0
	23.0	23.0	22.9	22.8	22.6	22.0	21.6	21.5	22.6	22.9	23.3	23.0	22.6
Lowest	139.6	108.7	49.4	40.8	49.2	3.2	6.2	0.0	1.8	5.2	5.8	4.2	414.1
	30.7	30.6	30.6	30.2	28.8	29.2	29.0	29.4	29.8	30.6	31.4	31.0	30.1
	22.6	22.7	22.3	22.3	21.7	21.0	21.0	19.0	20.5	21.7	22.8	22.7	21.7
Highest	320.8	371.5	359.3	121.4	162.1	96.6	32.6	44.6	93.6	112.7	282.6	240.0	2,237.8
	33.1	32.5	31.3	31.7	30.9	30.9	30.3	31.4	32.0	32.3	33.2	32.7	31.9
	23.7	23.6	23.8	23.6	23.3	22.9	22.2	22.9	23.5	23.6	23.8	23.7	23.4

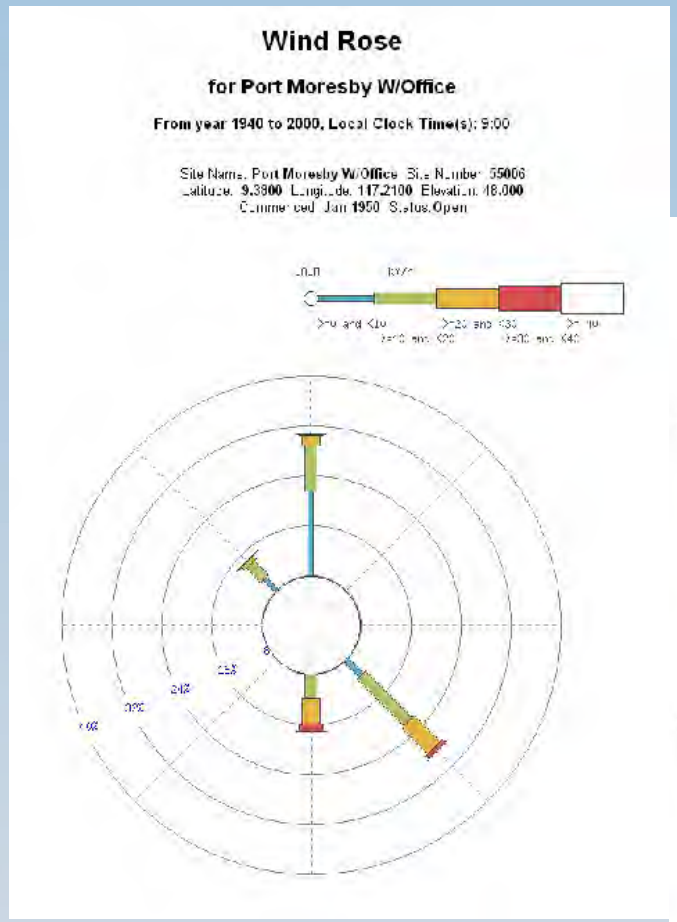
CliDE: Climate Data for the Environment

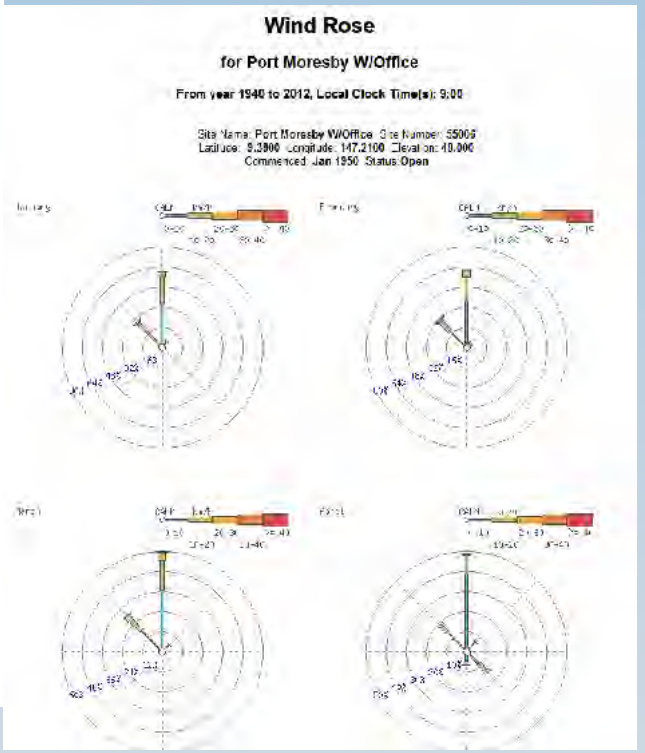
Keyboard data entry





Products





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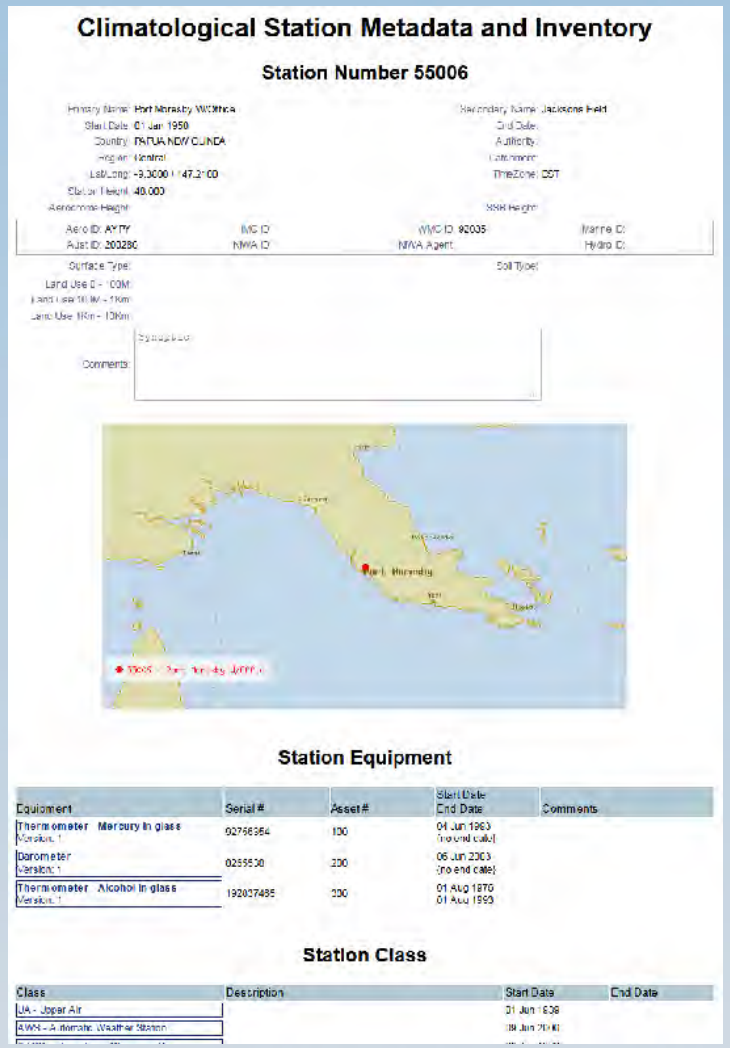
Products continued…



Climatological Station Metadata and Inventory

Station Number 55006

Primary Name: Port Moresby WO/Hca
Secondary Name: Jackson Field
Start Date: 01 Jan 1950
End Date:
Country: PAPUA NEW GUINEA
Authority:
Region: Central
Lat/Long: -9.3000 / 147.2100
Datum:
Station Height: 40.000
TimeZone: EST
Aerodrome Height:
WMO Height:

Aero ID: AYPY	IMO ID:	WMO ID: 92035	Marine ID:
Aust ID: 200280	NWA ID:	NWA Agent:	Hydro ID:

Surface Type:
Soil Type:
Land Use 0 - 100M:
Land Use 100 M - 1Km:
Land Use 1Km - 10Km:
Synopsis:
Comments:

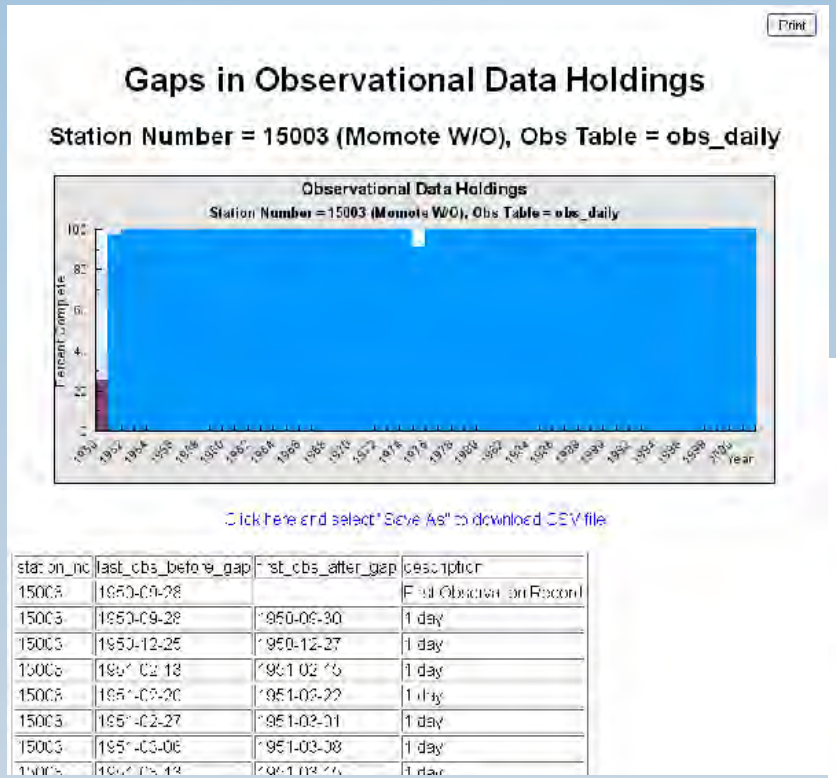
Station Equipment

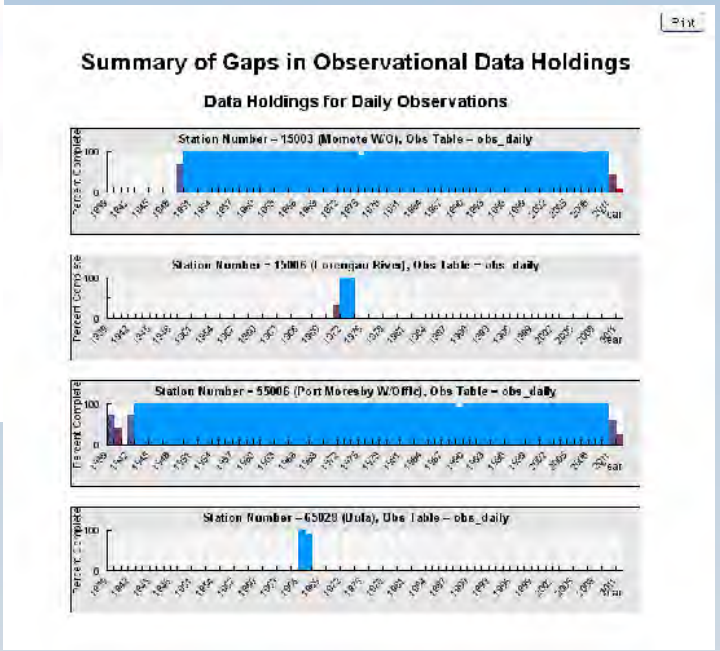
Equipment	Serial #	Asset #	Start Date End Date	Comments
Thermometer - Mercury in glass Version: 1	92756954	100	04 Jun 1963 (no end date)	
Barometer Version: 1	0255536	100	06 Jun 2003 (no end date)	
Thermometer - Alcohol in glass Version: 1	192037485	100	01 Aug 1870 01 Aug 1993	

Station Class

Class	Description	Start Date	End Date
UA - Upper Air		01 Jun 1938	
AWH - Automatic Weather Station		08 Jun 2010	

Products continued…





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Products continued…

Print

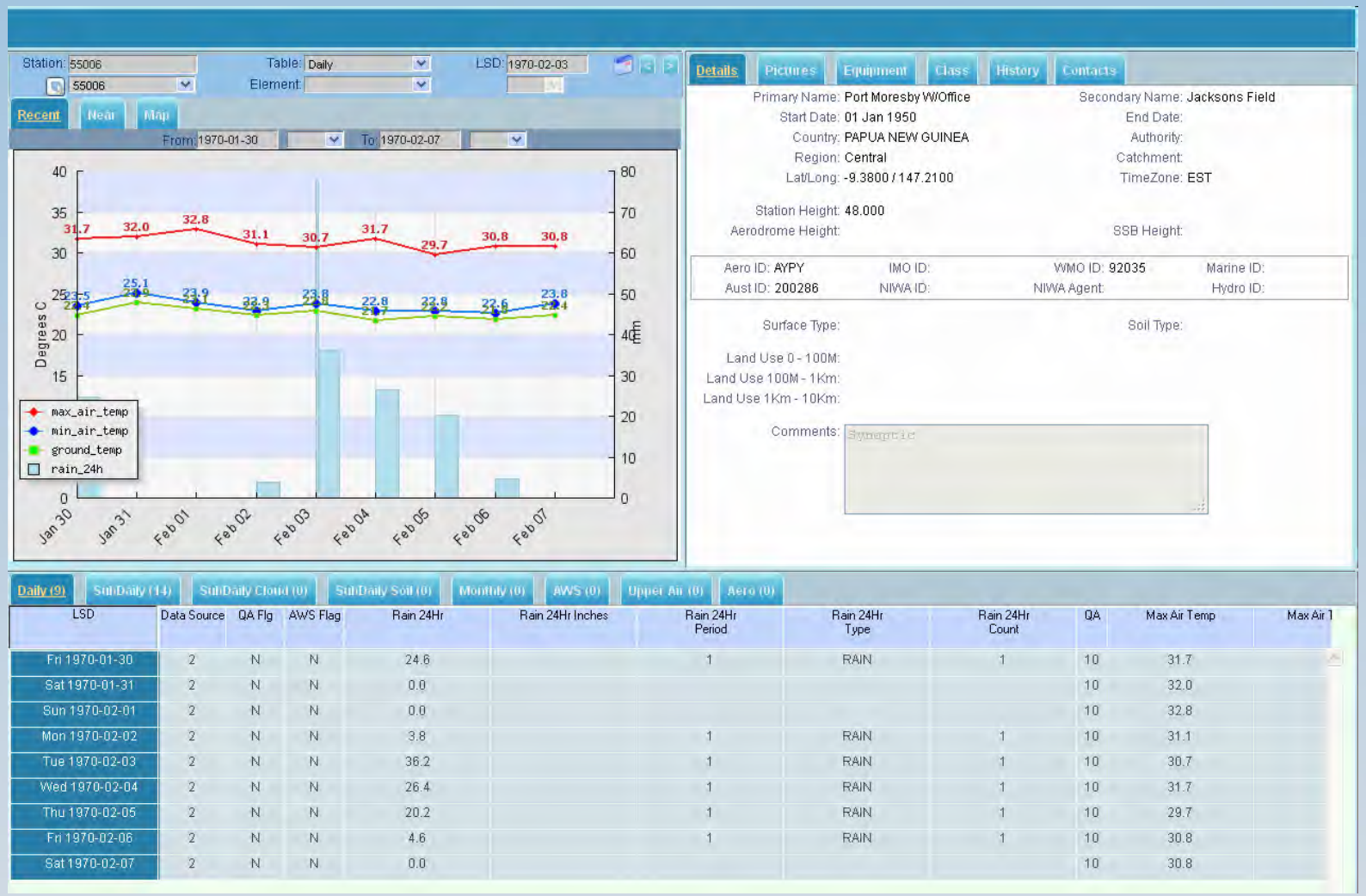
Monthly Summary Statistics for Port Moresby W/Office for the month of Jan 1972

Site Name: **Port Moresby W/Office** Site Number: **55006**
Latitude: **-9.3800** Longitude: **147.2100** Elevation: **48.000**
Commenced: **Jan 1950** Status: **Open**

Temperature	
Mean Maxiumum Temperature	30.7 °C
Mean Minimum Temperature	22.6 °C
Mean Daily Temperature	26.7 °C
Highest Maximum Temperature	33.0 °C on Mon 24th
Lowest Maximum Temperature	28.3 °C on Thu 20th
No of days Max Temperature >=30.0°C	23 days
Highest Minimum Temperature	24.4 °C on Thu 06th
Lowest Minimum Temperature	21.2 °C on Sat 15th
No of days Min Temperature <=20.0°C	0 days
Highest Minimum Terrestrial	23.4 °C on Thu 06th
Lowest Minimum Terrestrial	21.1 °C on Sun 30th
Mean Minimum Terrestrial	22.0 °C
Rainfall	
Total Monthly Rainfall	182.6 mm
Highest Daily Rainfall	34.4 mm on Wed 05th
No of days of Rainfall >=0.2mm	19 days
No of days of Rainfall >=1.0mm	14 days
No of days of Rainfall >=10.0mm	6 days
No of days of Rainfall >=50.0mm	0 days
Pressure	
Highest MSL Pressure	1011.2 hPa on Tue 18th
Lowest MSL Pressure	998.5 hPa on Thu 06th
Mean Monthly MSL Pressure	1006.5 hPa
Evaporation	
Total Monthly Evaporation	166.6 mm
Mean Monthly Evaporation	5.4 mm
Sunshine	
Total Monthly Sunshine	158.0 Hours

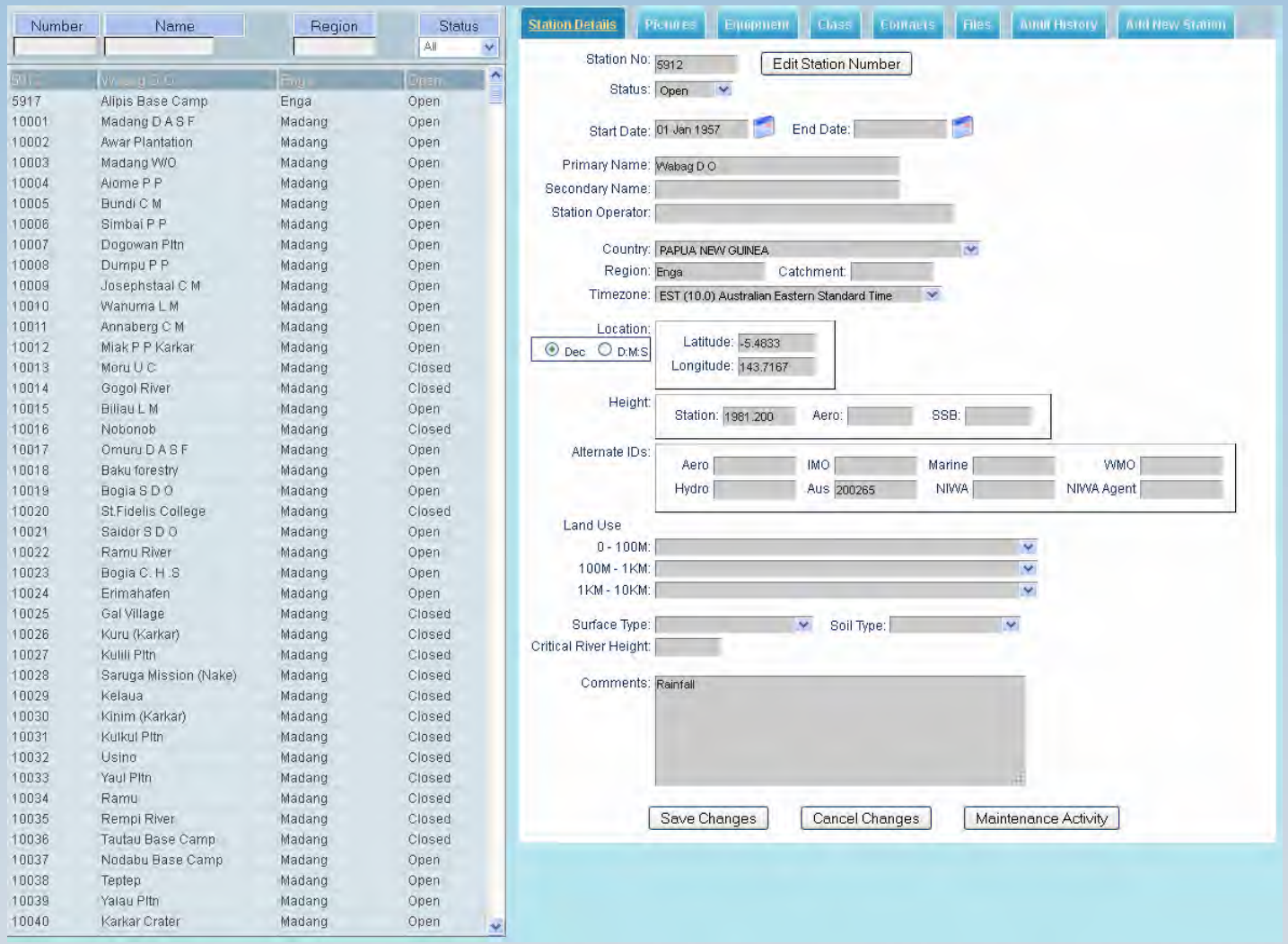
CLIMAT 01970
92035 111 10033 20086 30273007 403150232 5283 60140211 72153,071 8000000 9000000
222 06190 10050 20100 30260155 402900240 5200 6020015 7007 8010100 9010100
333 03127 31107 40400 9000001
444 0028620 1025301 2033423 3021910 4041422 5129003 60000 712323=

Data quality assurance



LSD	Data Source	QA Flg	AWS Flag	Rain 24Hr	Rain 24Hr Inches	Rain 24Hr Period	Rain 24Hr Type	Rain 24Hr Count	QA	Max Air Temp	Max Air T
Fri 1970-01-30	2	N	N	24.6		1	RAIN	1	10	31.7	
Sat 1970-01-31	2	N	N	0.0					10	32.0	
Sun 1970-02-01	2	N	N	0.0					10	32.8	
Mon 1970-02-02	2	N	N	3.8		1	RAIN	1	10	31.1	
Tue 1970-02-03	2	N	N	36.2		1	RAIN	1	10	30.7	
Wed 1970-02-04	2	N	N	26.4		1	RAIN	1	10	31.7	
Thu 1970-02-05	2	N	N	20.2		1	RAIN	1	10	29.7	
Fri 1970-02-06	2	N	N	4.6		1	RAIN	1	10	30.8	
Sat 1970-02-07	2	N	N	0.0					10	30.8	

Station metadata



Number	Name	Region	Status
			All

5917	Alipis Base Camp	Enga	Open
10001	Madang D A S F	Madang	Open
10002	Awar Plantation	Madang	Open
10003	Madang WO	Madang	Open
10004	Ajome P P	Madang	Open
10005	Bundi C M	Madang	Open
10006	Simbai P P	Madang	Open
10007	Dogowan Pltn	Madang	Open
10008	Dumpu P P	Madang	Open
10009	Josephstaal C M	Madang	Open
10010	Wanuma L M	Madang	Open
10011	Annaberg C M	Madang	Open
10012	Miak P P Karkar	Madang	Open
10013	Moru U C	Madang	Closed
10014	Gogol River	Madang	Closed
10015	Biliau L M	Madang	Open
10016	Nobonob	Madang	Closed
10017	Omuru D A S F	Madang	Open
10018	Baku forestry	Madang	Open
10019	Bogia S D O	Madang	Open
10020	St.Fidelis College	Madang	Closed
10021	Saidor S D O	Madang	Open
10022	Ramu River	Madang	Open
10023	Bogia C. H .S	Madang	Open
10024	Erimahafen	Madang	Open
10025	Gal Village	Madang	Closed
10026	Kuru (Karkar)	Madang	Closed
10027	Kulili Pltn	Madang	Closed
10028	Saruga Mission (Nake)	Madang	Closed
10029	Kelaua	Madang	Closed
10030	Kinim (Karkar)	Madang	Closed
10031	Kulkul Pltn	Madang	Closed
10032	Usino	Madang	Closed
10033	Yaul Pltn	Madang	Closed
10034	Ramu	Madang	Closed
10035	Rempi River	Madang	Closed
10036	Tautau Base Camp	Madang	Closed
10037	Nodabu Base Camp	Madang	Open
10038	Teptep	Madang	Open
10039	Yalau Pltn	Madang	Open
10040	Karkar Crater	Madang	Open

Station Details | Pictures | Equipment | Class | Contacts | Files | Audit History | Add New Station

Station No: 5912 Edit Station Number

Status: Open

Start Date: 01 Jan 1957 End Date:

Primary Name: Wabag D O

Secondary Name:

Station Operator:

Country: PAPUA NEW GUINEA

Region: Enga Catchment:

Timezone: EST (10.0) Australian Eastern Standard Time

Location: (•) Dec ( ) D:M:S

Latitude: -5.4833

Longitude: 143.7167

Height: Station: 1981.200 Aero: SSB:

Alternate IDs: Aero IMO Marine WMO

Hydro Aus 200265 NIWA NIWA Agent

Land Use

0 - 100M:

100M - 1KM:

1KM - 10KM:

Surface Type: Soil Type:

Critical River Height:

Comments: Rainfall

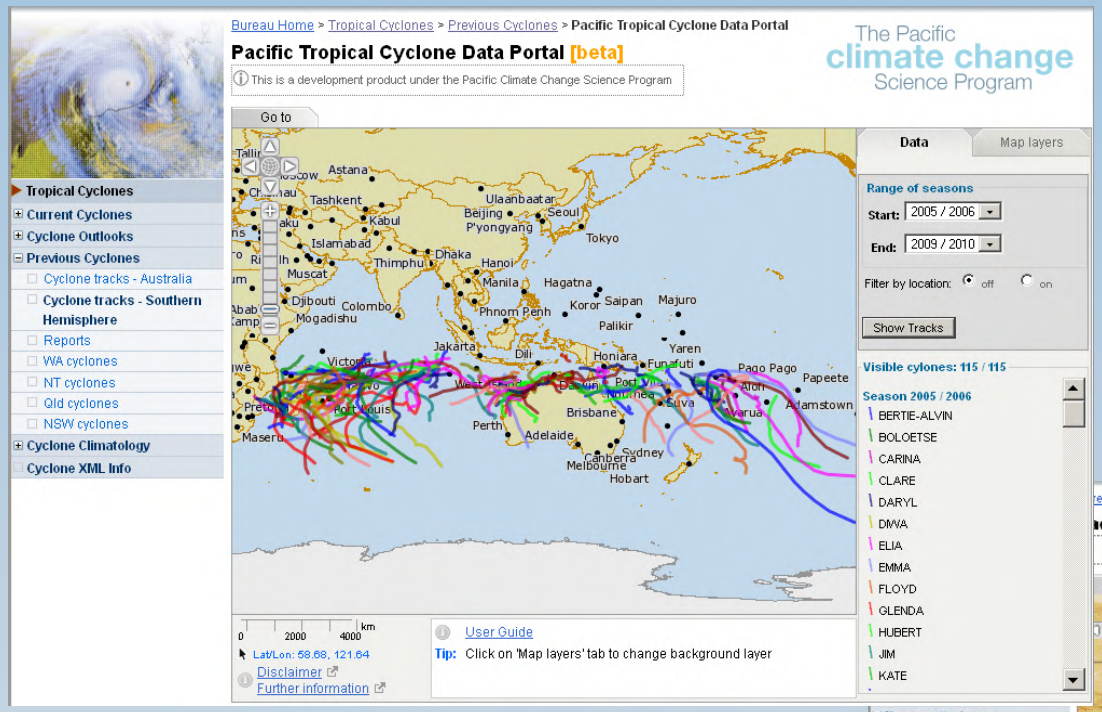
Save Changes | Cancel Changes | Maintenance Activity

Climate Services Toolkit / The Pacific Portal

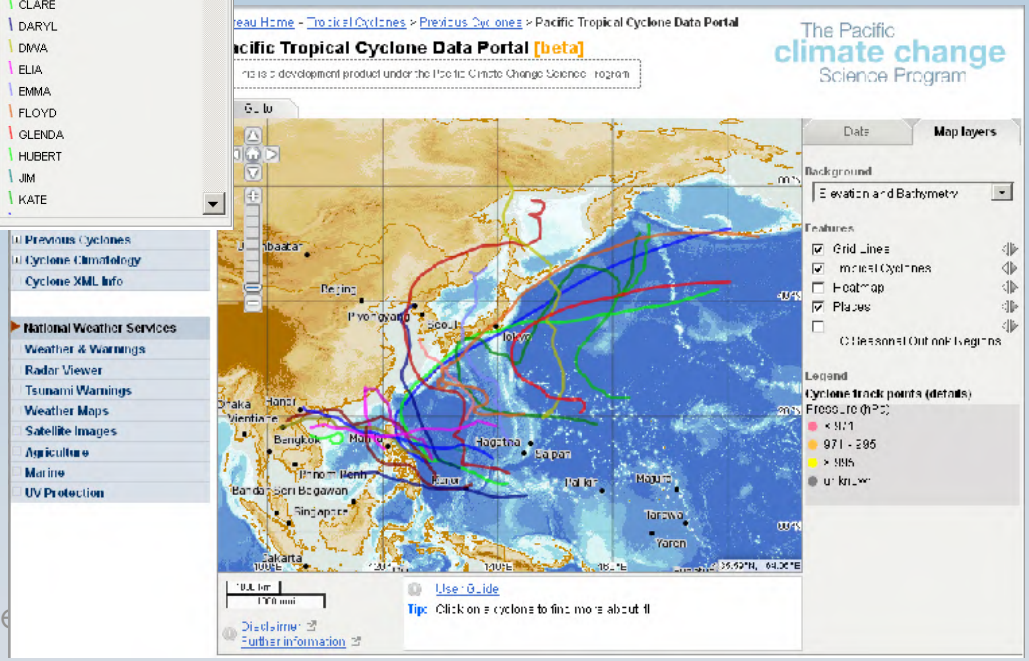
- Data Management tools, including
  - ✓ Data portal for access to and analysis of observations and GCM outputs
  - ✓ Database management tool for quality control and simple manipulation of data
- Climate analysis tool for diagnostic analyses
- Climate monitoring tools for calculation of anomalies, percentiles, return periods etc.
- Forecasting, downscaling and verification tools for statistical and MOS models, and with flexibility to interface to impacts models.

- Climate Data for the Environment (CliDE)
- Pacific climate change data portal
- Seasonal climate prediction portal (currently WMO GPCLRF portal)
- Pacific tropical cyclone data portal
- Sea level anomalies
- Ocean temperature extremes

Tropical Cyclone Data Portal

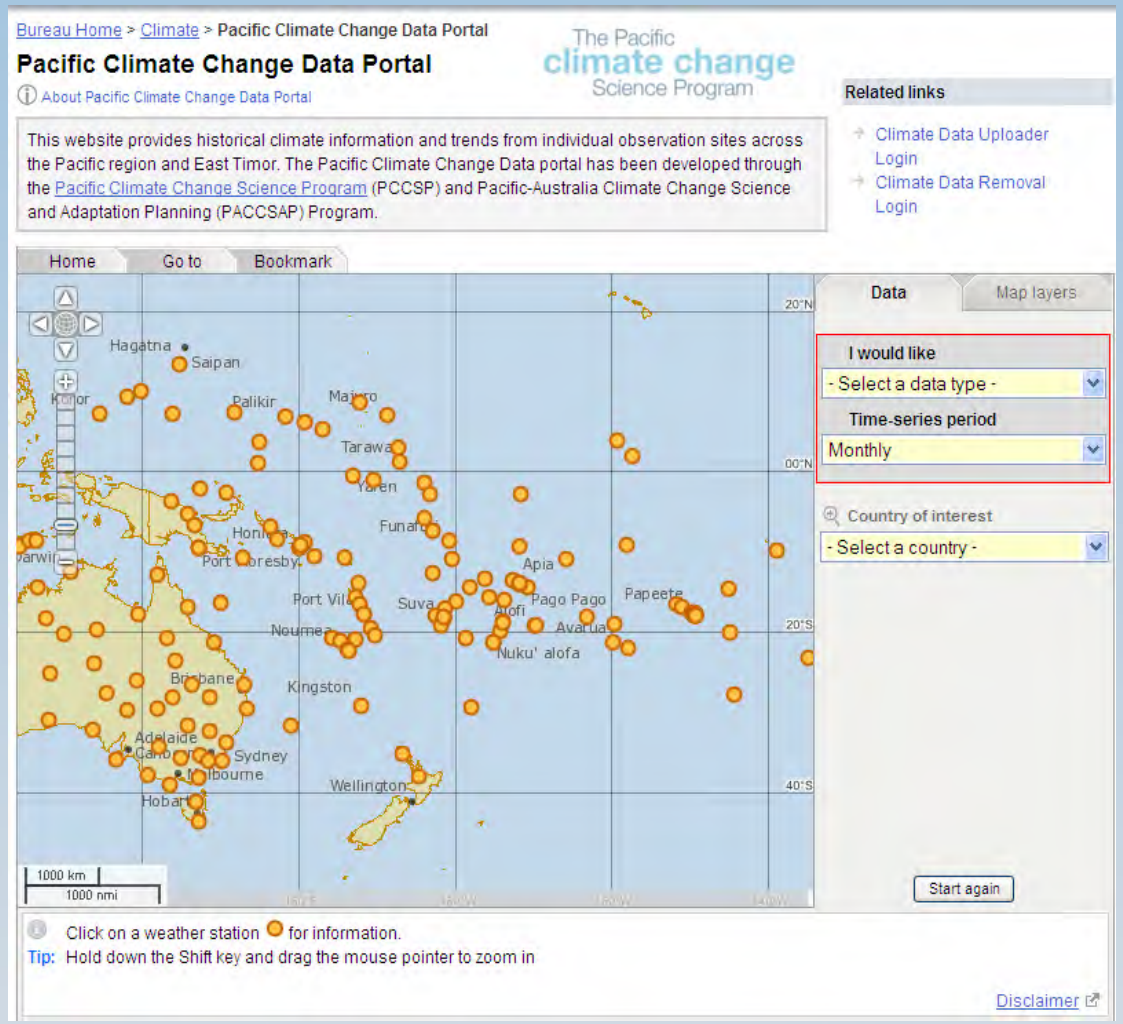


Southern Hemisphere – Regional Specialised Meteorological Centres Nadi, Fiji and La Reunion, France; Tropical Cyclone Warning Centres in Brisbane, Darwin and Wellington



Western North Pacific – Regional Specialised Meteorological Centre Tokyo, Japan

Pacific Climate Change Data Portal



Currently, 92 station records for 23 countries and territories

Data uploaded by Partner Countries where possible

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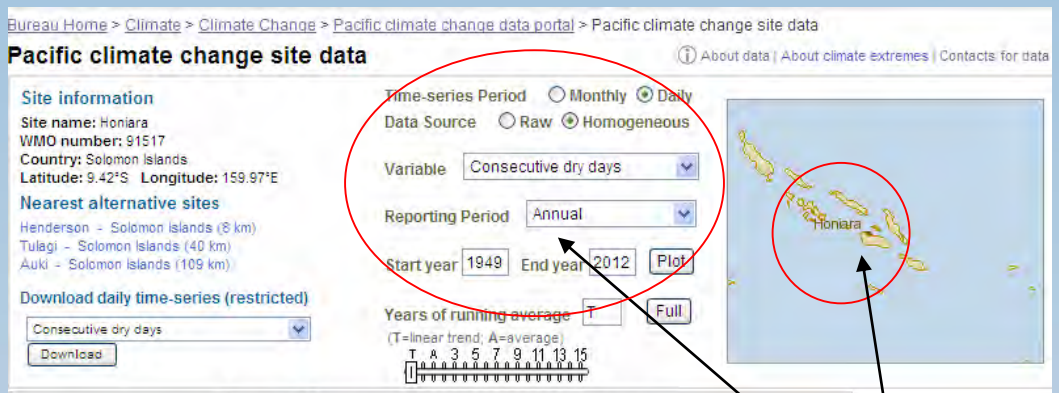
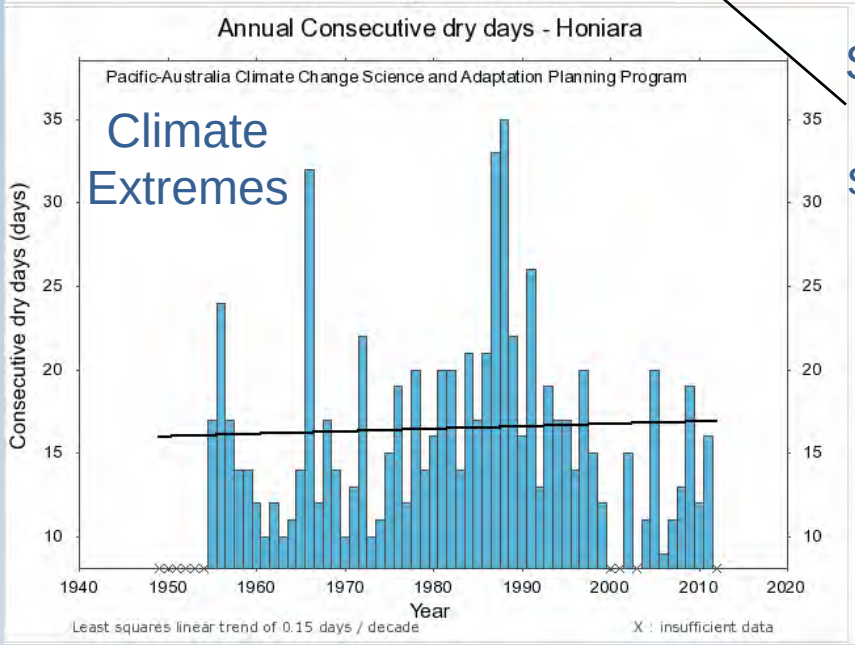
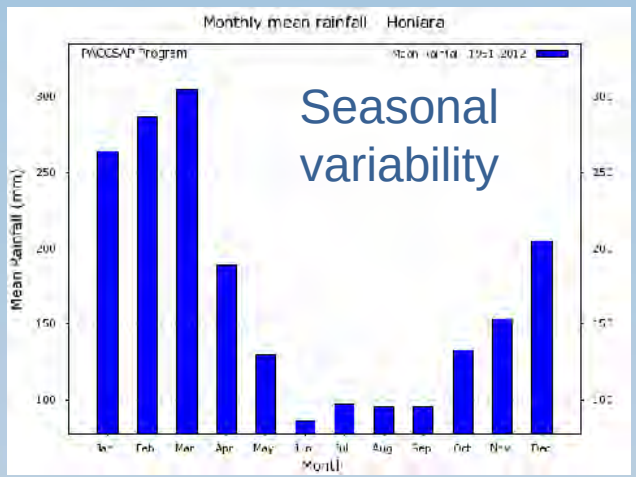
Bureau of Meteorology

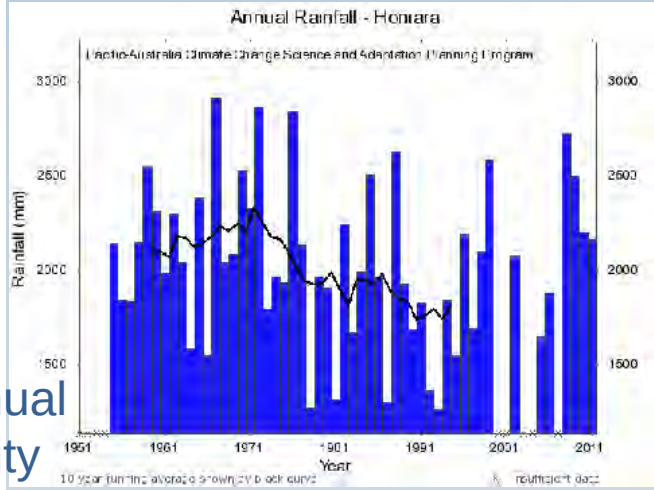
Pacific Climate Change Data Portal - Functionality



Station & data selection

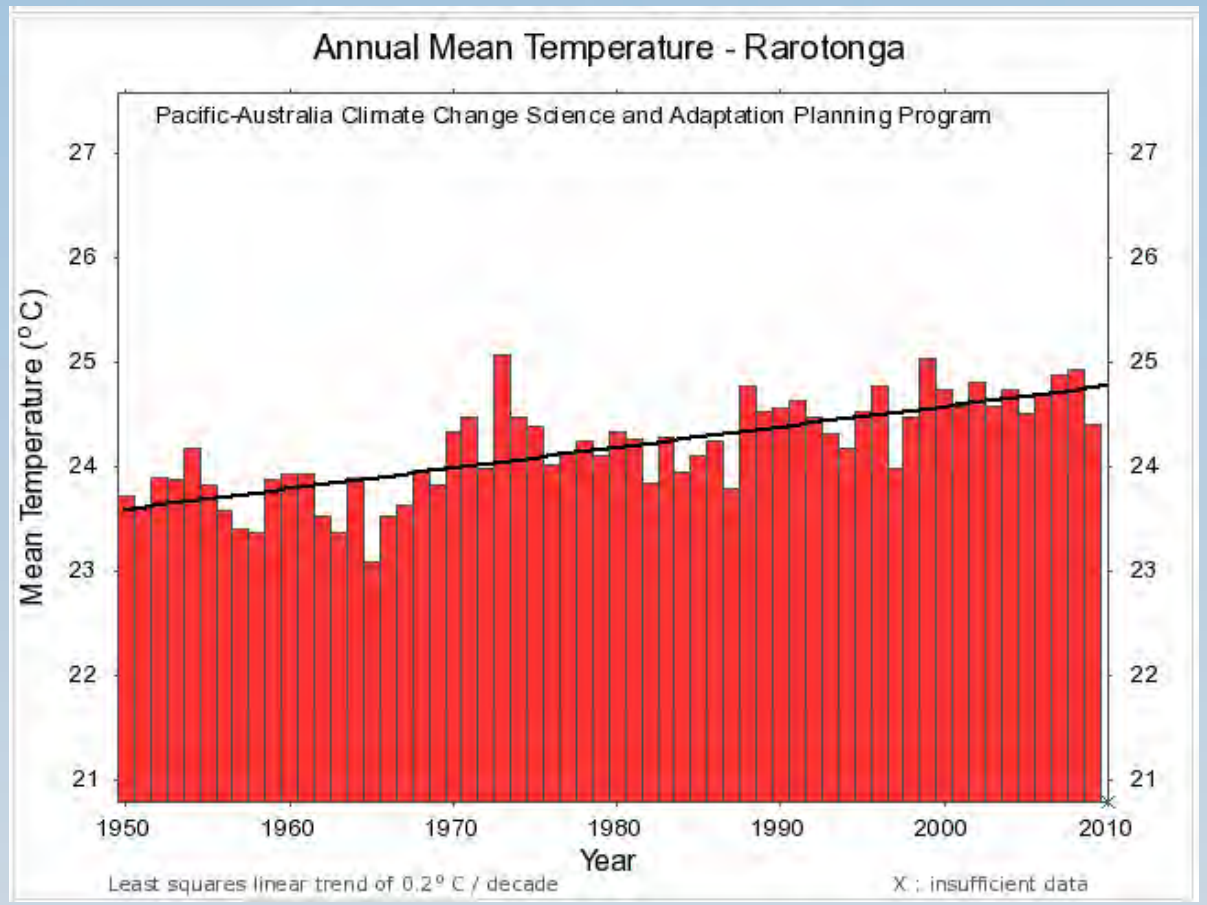






Inter annual variability and trends

Pacific Climate Change Data Portal: Temperature trends



- Cook Islands: Mean temperature 1950 - 2010
- 0.2 ° C / decade

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Pacific Climate Change Data Portal: Temperature trends

Country:	Temperature trend:
• Australia / Cairns	•0.15 ° C / decade (1950 – 2008)
• Cook Islands / Rarotonga	•0.2 ° C / decade (1950 – 2010)
• Fiji / Nadi	•0.09 ° C / decade (1950 – 2015)
• Marshall Islands / Majuro	•0.17 ° C / decade (1955 – 2015)
• New Caledonia / Noumea	•0.15 ° C / decade (1951 – 2015)
• Palau / Koror	•0.11 ° C / decade (1951 – 2015)
• Papua New Guinea / Port Moresby	•0.12 ° C / decade (1950 – 2013)
• Samoa / Apia	
• Tonga / Nuku'alofa	•0.21 ° C / decade (1950 – 2015)
• Tuvalu / Funafuti	•0.14 ° C / decade (1950 – 2013)
• Vanuatu / Port Vila	•0.13 ° C / decade (1950 – 2010)

Regional mean temperature trend : 0.15 ° C / decade since the 1950s

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Bureau of Meteorology

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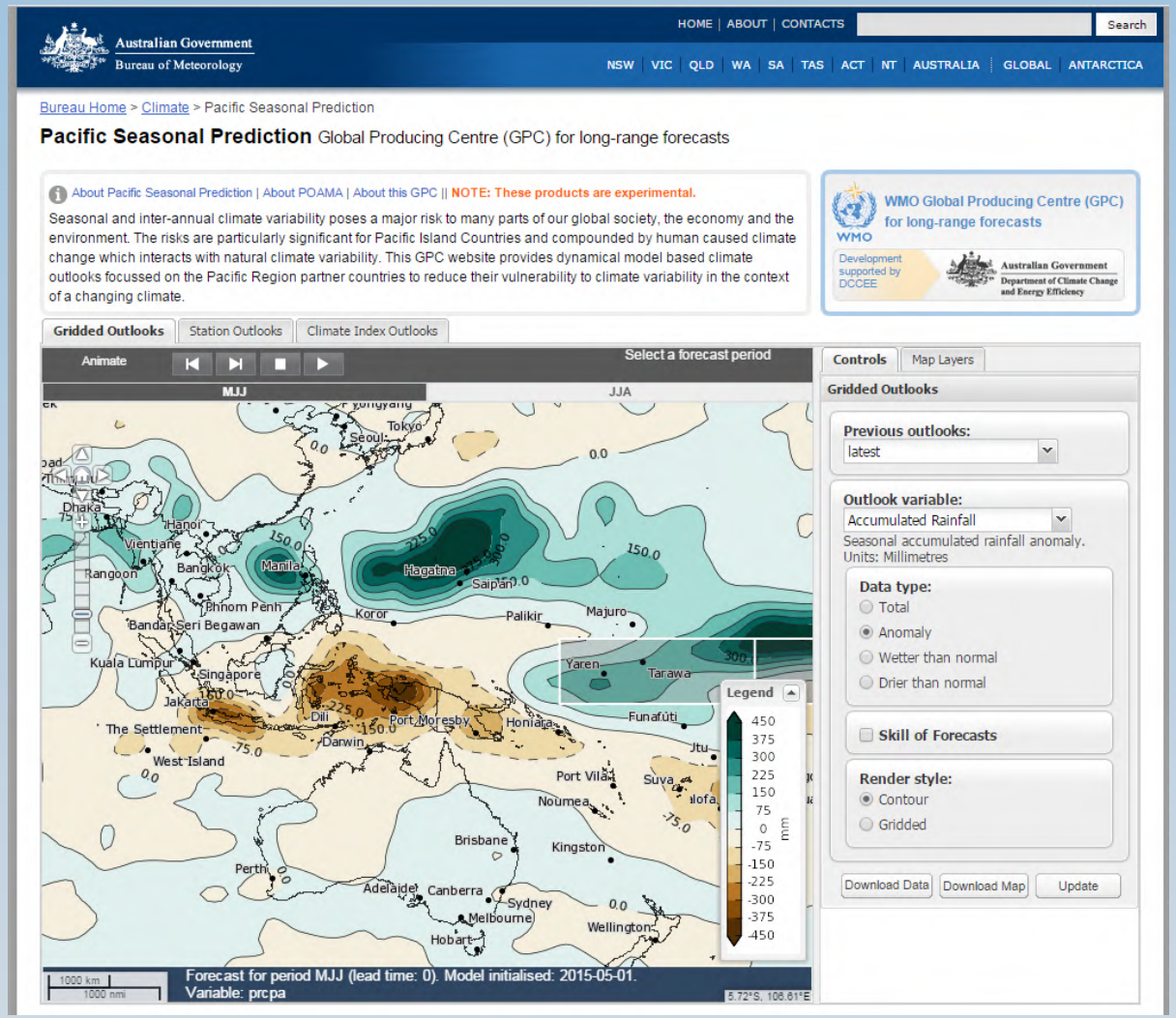
- Ocean temperature extremes

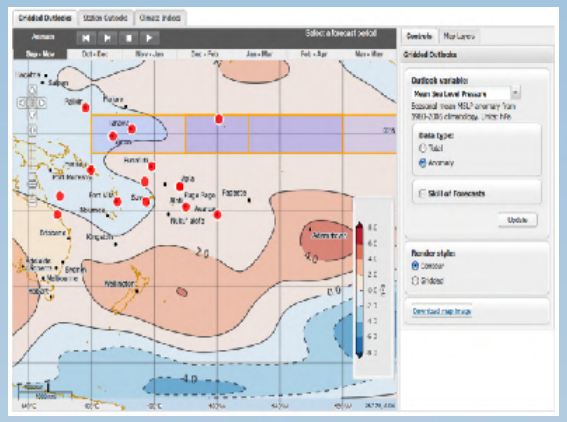
WMO GPCLRF Pacific Climate Prediction Portal

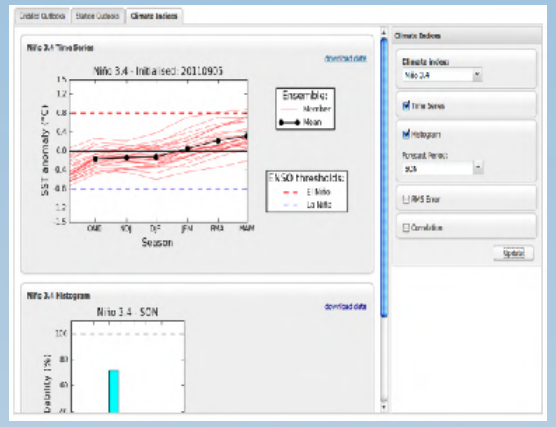


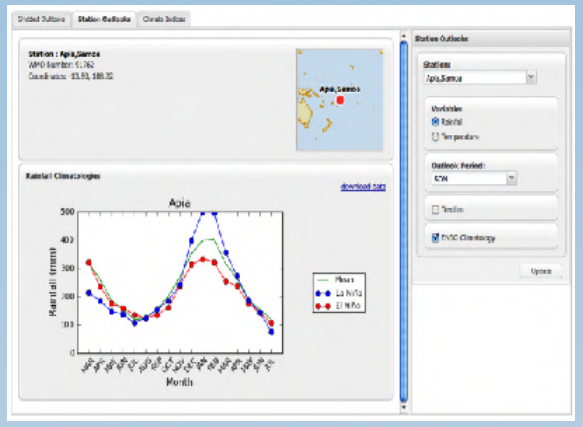
The dynamic climate model-based forecast products are now disseminated to the NMHSs of 15 island countries in the Western Pacific through the WMO GPCLRF Portal.

http://poama.bom.gov.au/experimental/pasap

WMO GPCLRF Pacific Climate Prediction Portal



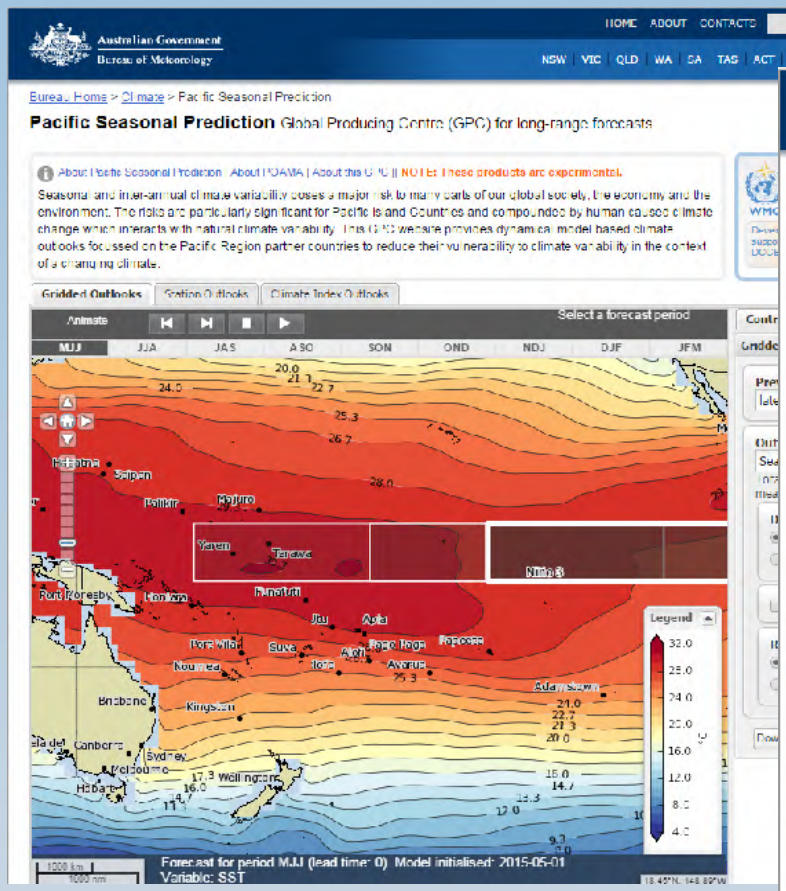


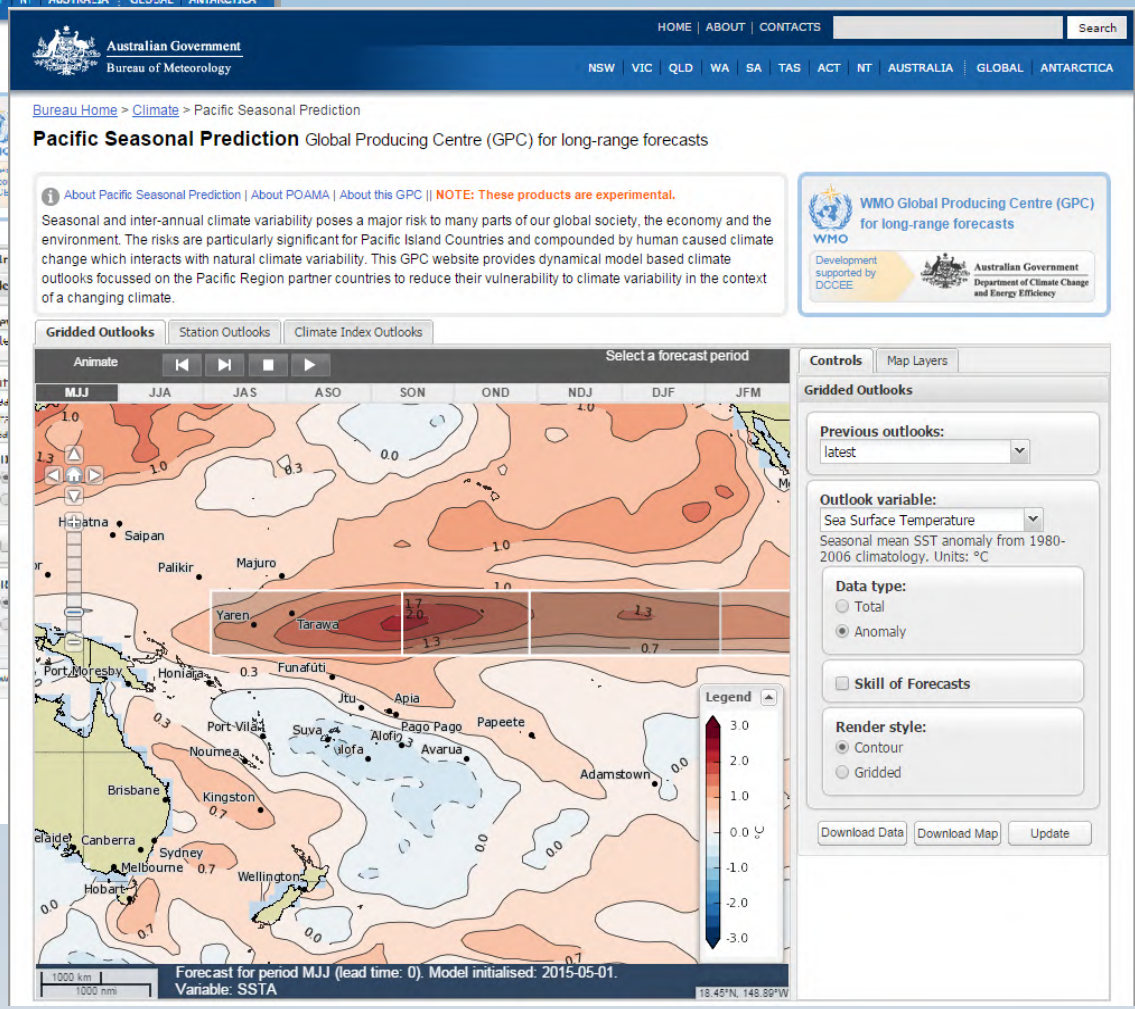


The Portal provides access to outlooks for

- Broad scale fields (SSTs, rainfall etc.)
- Climate drivers (ENSO)
- Rainfall and temperature tercile probabilities for selected sites
- Hindcast skill scores for all outlooks

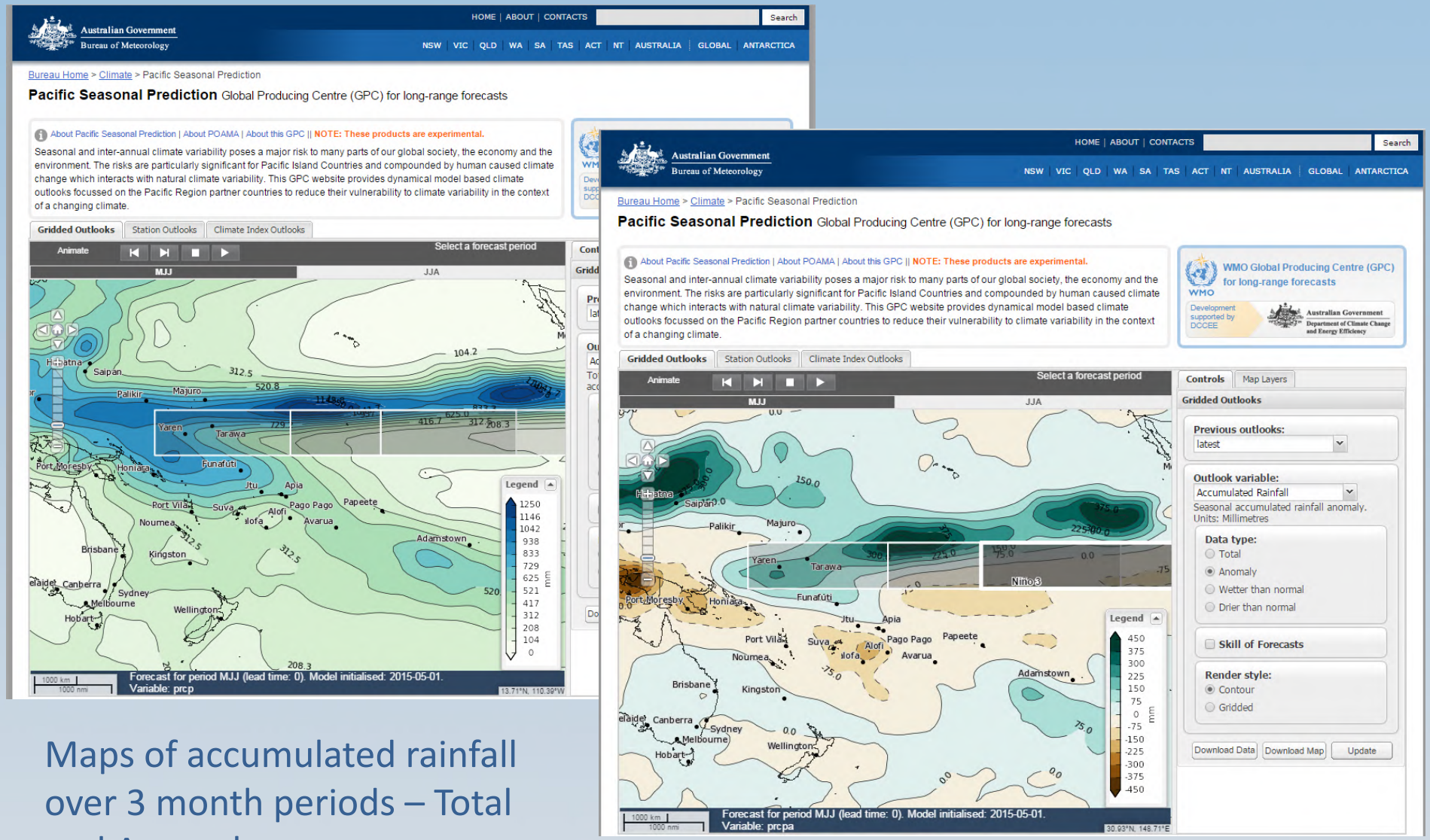
Sea Surface Temperature – evolution of ENSO





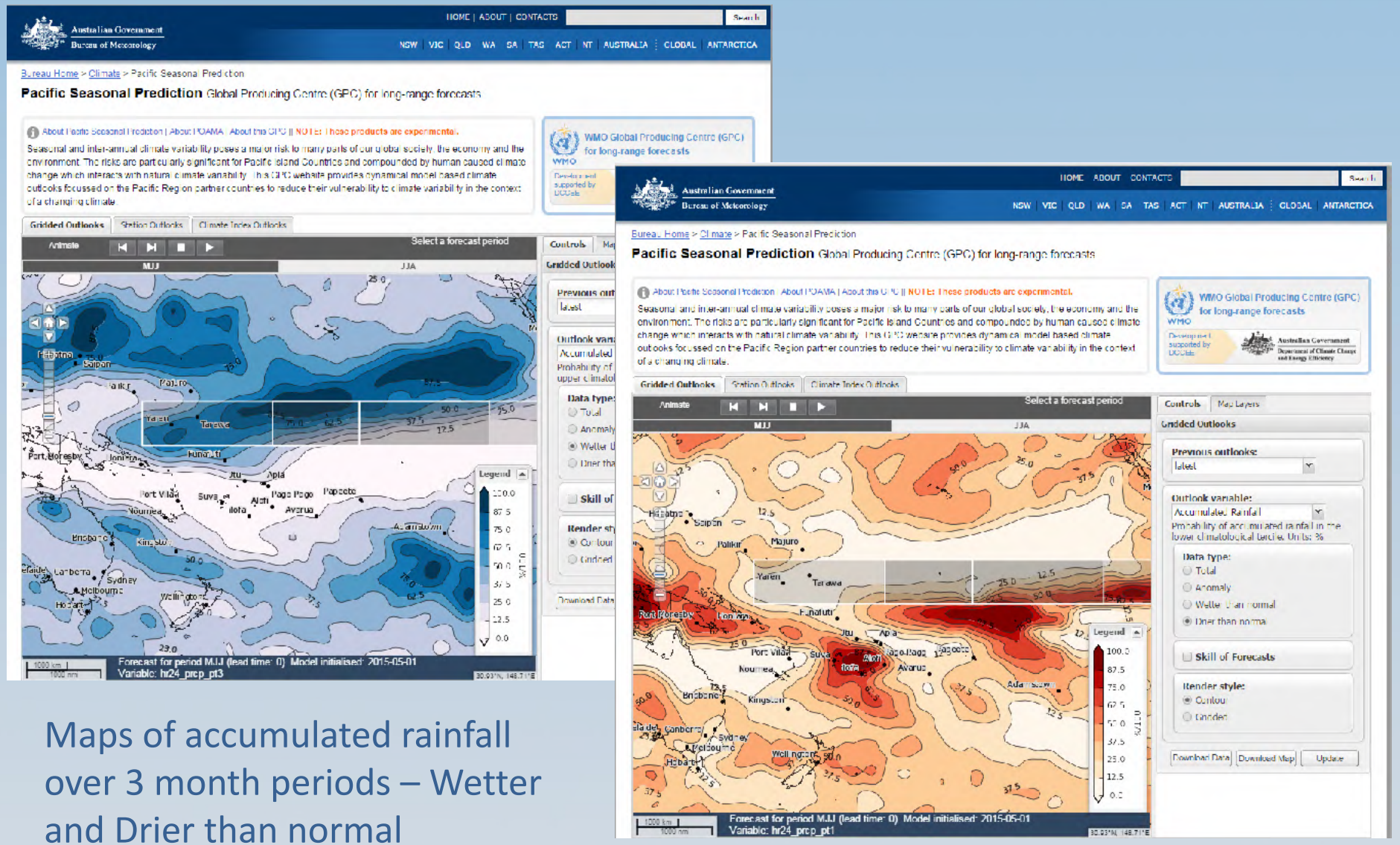
Maps of Sea Surface Temperature
- Total and Anomaly

Rainfall



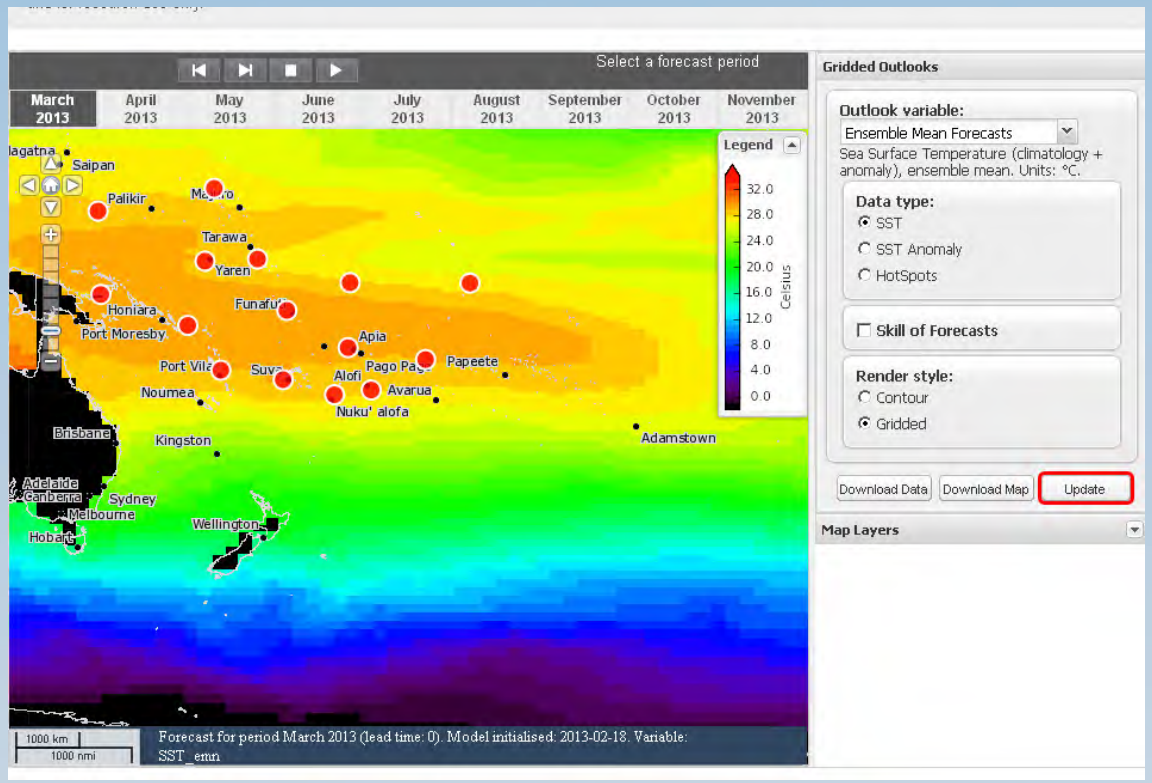
Maps of accumulated rainfall over 3 month periods – Total and Anomaly

Rainfall



Maps of accumulated rainfall over 3 month periods – Wetter and Drier than normal

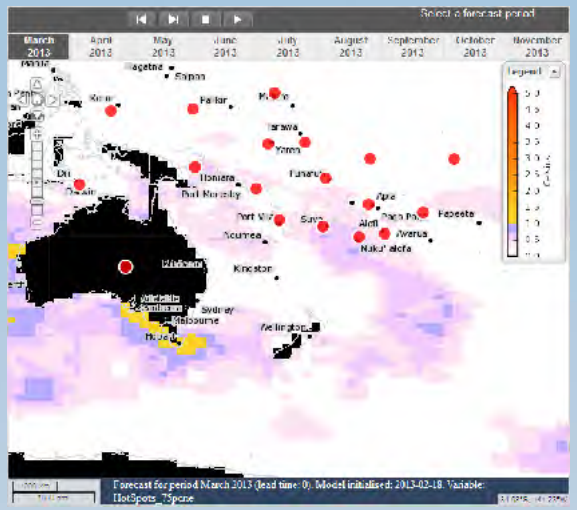
Sea Surface Temperature Seasonal Prediction



Seasonal prediction of extreme ocean temperatures and associated coral bleaching project provides seasonal forecasts of ocean temperature and coral bleaching risk.

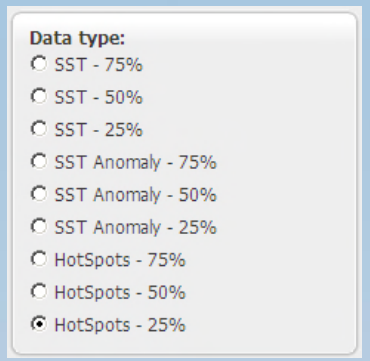
Australian Government
Bureau of Meteorology

Sea Surface Temperature Seasonal Prediction

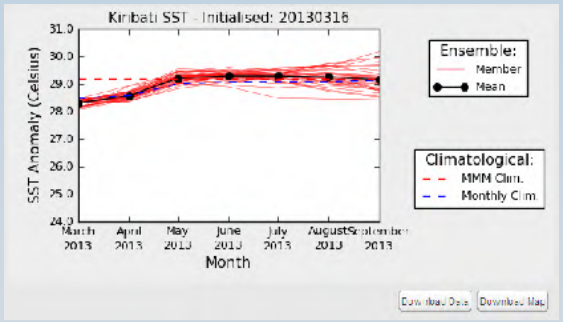


coral risk metrics

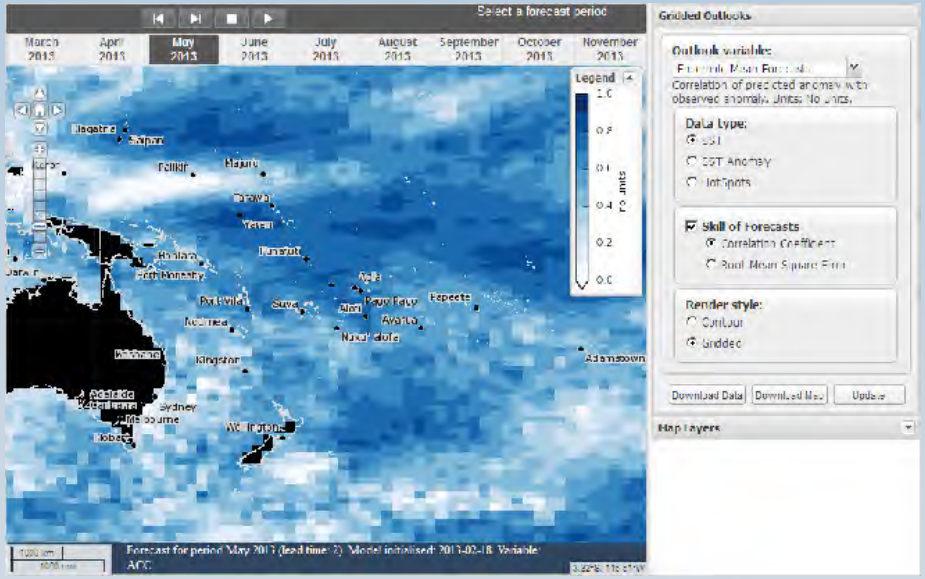
probabilistic forecasts



time-series for countries



skill scores



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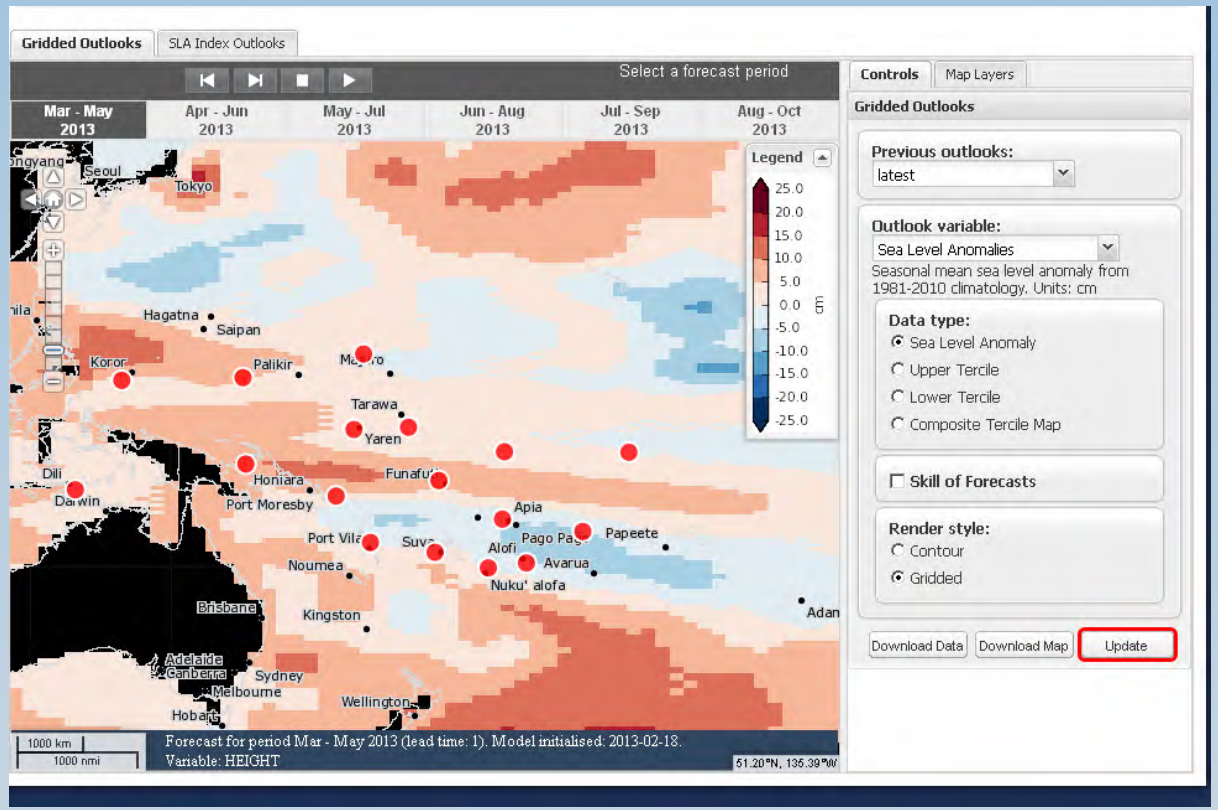
Sea Level Seasonal Prediction



Seasonal prediction of sea-level anomalies in the Western Pacific project is focused on the development and verification of seasonal forecasts for sea level for Pacific Partner Countries.

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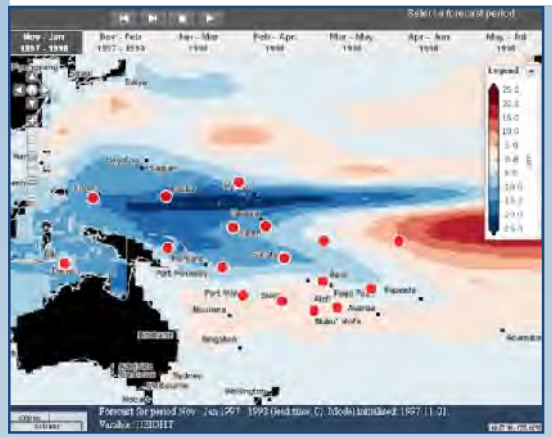
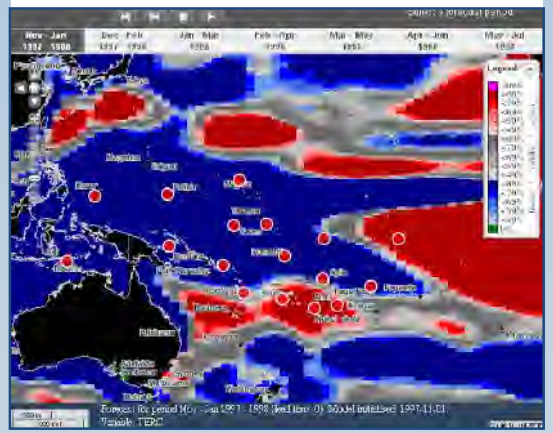
Sea Level Seasonal Prediction

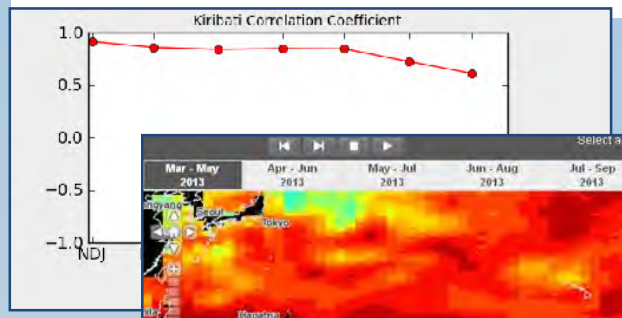
Sea level anomaly forecasts

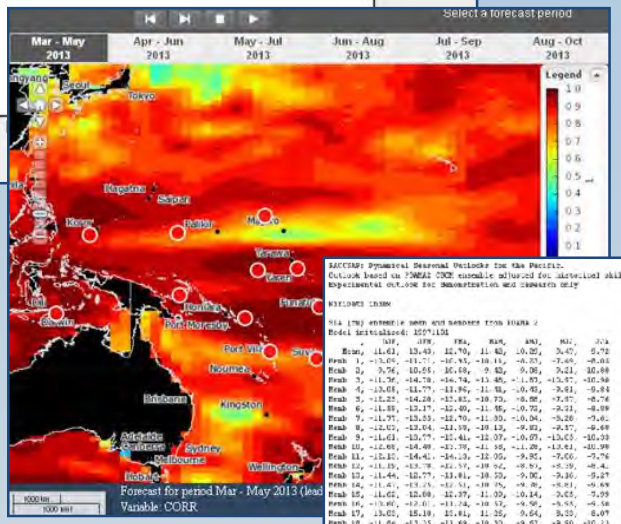


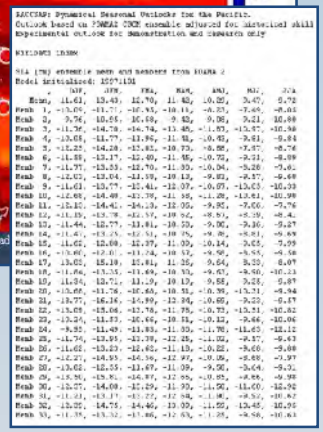
Tercile predictions



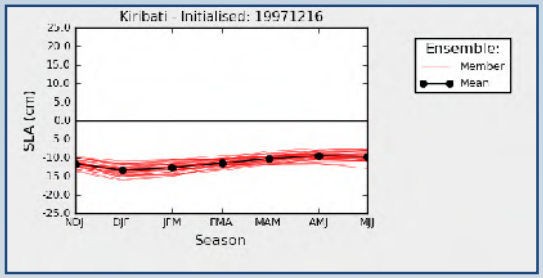
Skill scores for all forecasts
Data available in netcdf and text format







Timeseries for Exclusive Economic Zones of Partner Countries



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Working with people

- Extensive training of the Pacific National Meteorological Services personnel during in-country visits
- Pacific Science Programs numerous workshops

Working for people

VISITING CLIMATOLOGIST: Australian High Commissioner, Dr Stephen Henningham, welcomes Professor Yuriy Kuleshov to Samoa.
http://www.samoaobserver.ws/public-service/5369-top-aussie-climate-scientist-visits

Samoa Observer, 12 June 2013

"A top of Australian scientist is in Samoa to help the country tackle climate change. Professor Yuriy Kuleshov, from the Australian Bureau of Meteorology, is the leader of an international team of scientists developing seasonal climate prediction capability for the Pacific region.

"Climate change is one of the biggest problems faced by humanity," says Professor Kuleshov.

"Urgent adaptation measures to climate change are required to address issues of warming temperatures, rising sea levels and increasing frequency of climate extremes such as floods and droughts."

The tsunami devastated parts of Samoa's coastline on 29 September 2009, claimed 143 lives, ravaged the landscape and changed the way of life for hundreds of families.

Visiting communities of Lepa and Saleapaga villages in Samoa affected by 2009 tsunami.

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Summary

- The projected increase in the frequency of weather and climate extremes is one of the expected consequences of the observed increase in anthropogenic greenhouse gas concentration and will likely have even stronger negative impacts on the natural environment and society in the future.

- This should be taken into consideration by decision makers when developing strategies to adapt to the increasing risk of climate extremes.

- Modern science of climate prediction is well developed, with current dynamical climate models being able to provide users with skilful predictions of meteorological variables well in advance.

Summary

- The dynamic climate model-based forecast products are now disseminated through the WMO Global Producing Centres for Long-range Forecasts (WMO GPCLRFs) to the Regional Climate Centres and National Meteorological and Hydrological Services.

- We conclude with confidence that seasonal climate prediction could be an effective solution to provide users (e.g. governments, disaster managers, local communities etc.) with valuable assistance for informed decision making in adaptation to climate variability and change.

Research Team

Prof Yuriy Kuleshov
Dr Andrew Charles
Dr Kay Shelton
Mr Roald de Wit
Dr Andrew Cottrill
Dr Toshiyuki Nakaegawa

Dr David Jones
Dr Lisa Alexander
Mr Rod Hutchinson
Mr Simon McGree
Mr David Martin
Mr Andrew Howard
Dr Kirien Whan
Ms Agata Imielska

Dr Harry Hendon
Dr Eun-Pa Lim
Dr Peter McIntosh
Dr John Church
Dr Claire Spillman
Ms Elaine Miles
Mr Aurel Griesser

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Thank you