CLIMATE SERVICES AND DIALOG OVERVIEW

Climate Services for the Health Sector: RMI 2020

John Marra, NOAA

BACKGROUND

- What is the difference between Weather and Climate
- What is the difference between Climate Change and Climate Variability
- What are Climate Services

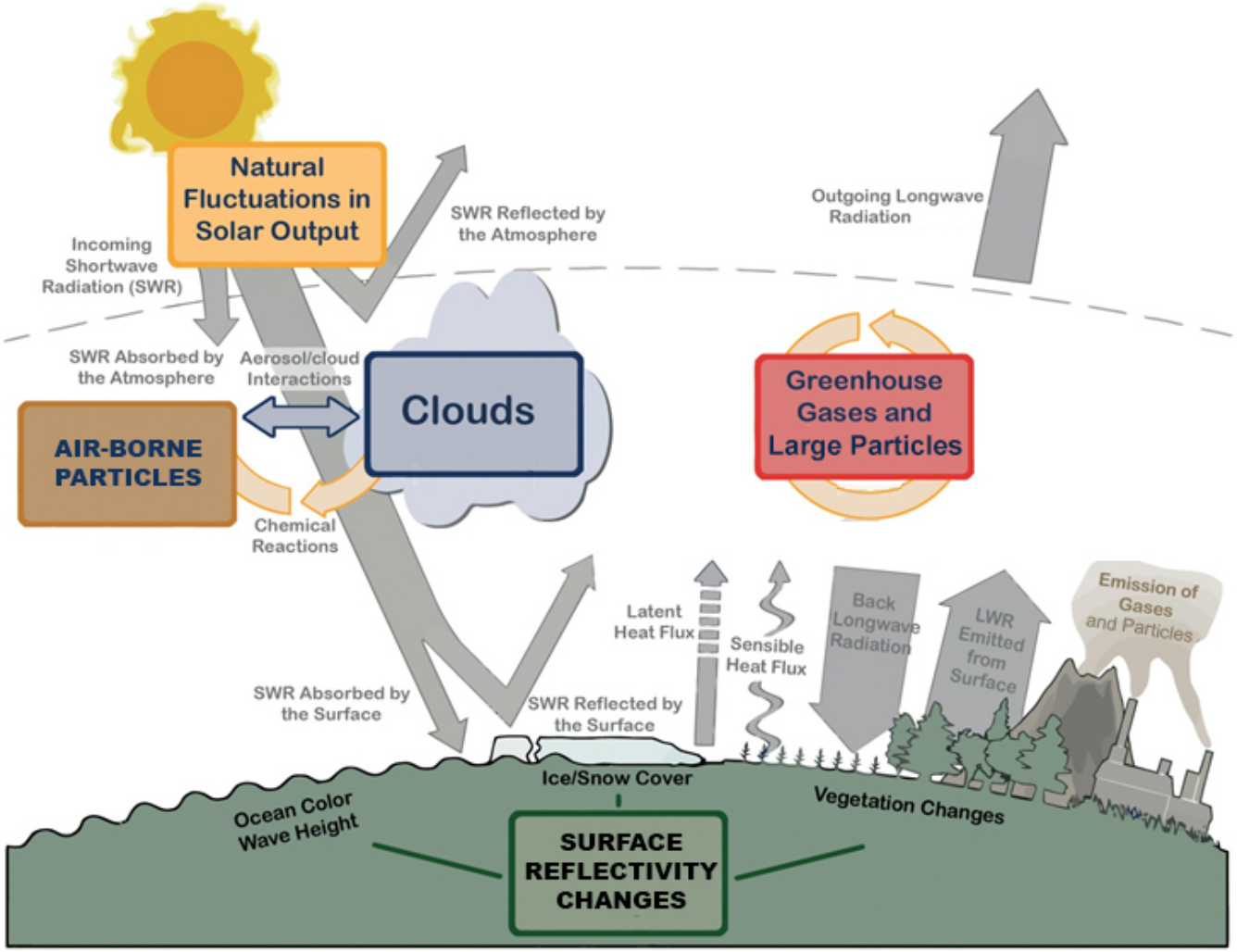
WEATHER & CLIMATE

Weather is the atmospheric conditions at a specific time and place with reference to temperature, wind, pressure, humidity, cloud cover, precipitation.

Climate is the overall weather conditions during periods of multiple seasons or years (long term average).

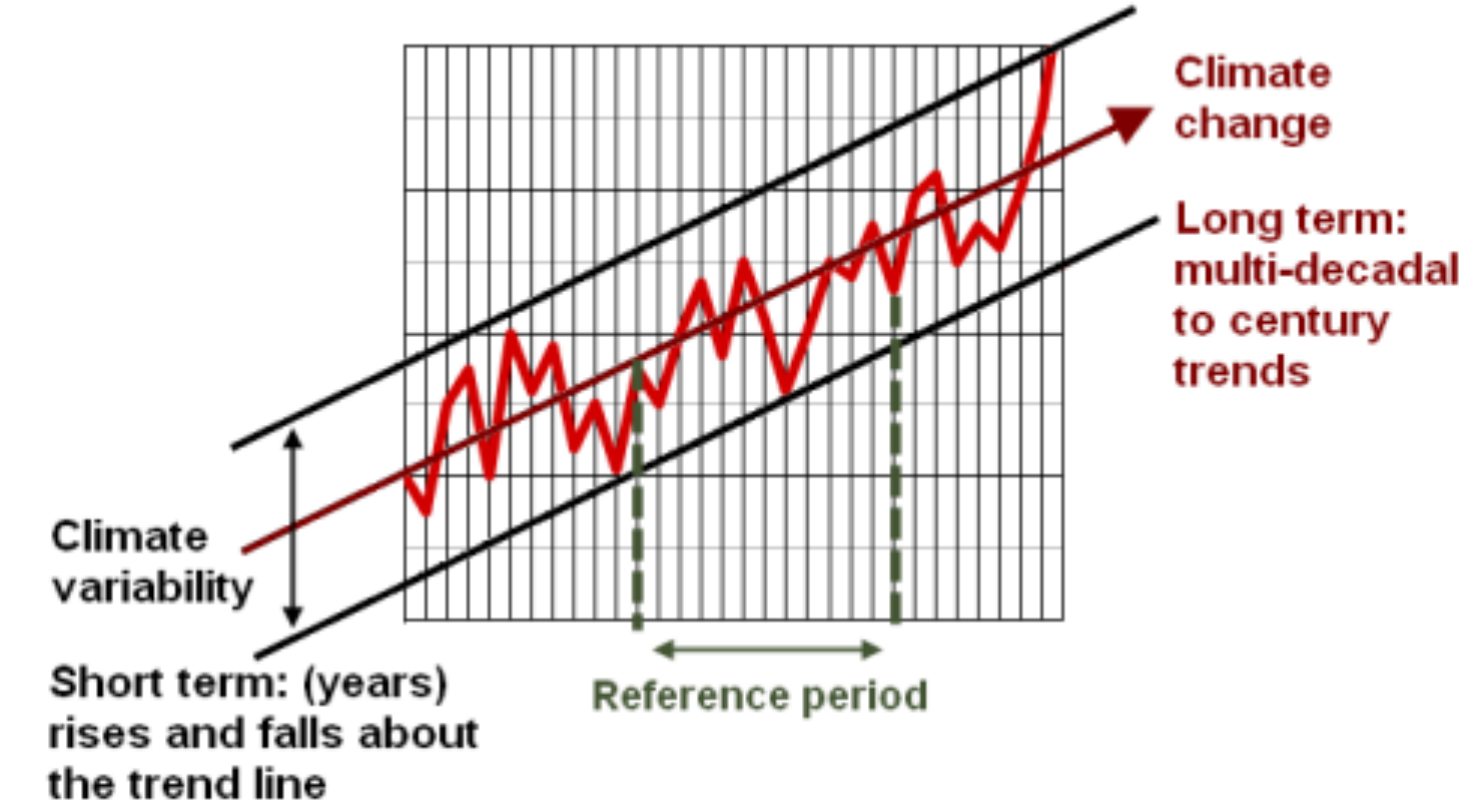
"Climate is what you expect. Weather is what you get."

THE CLIMATE SYSTEM



Adapted from IPCC, AR5

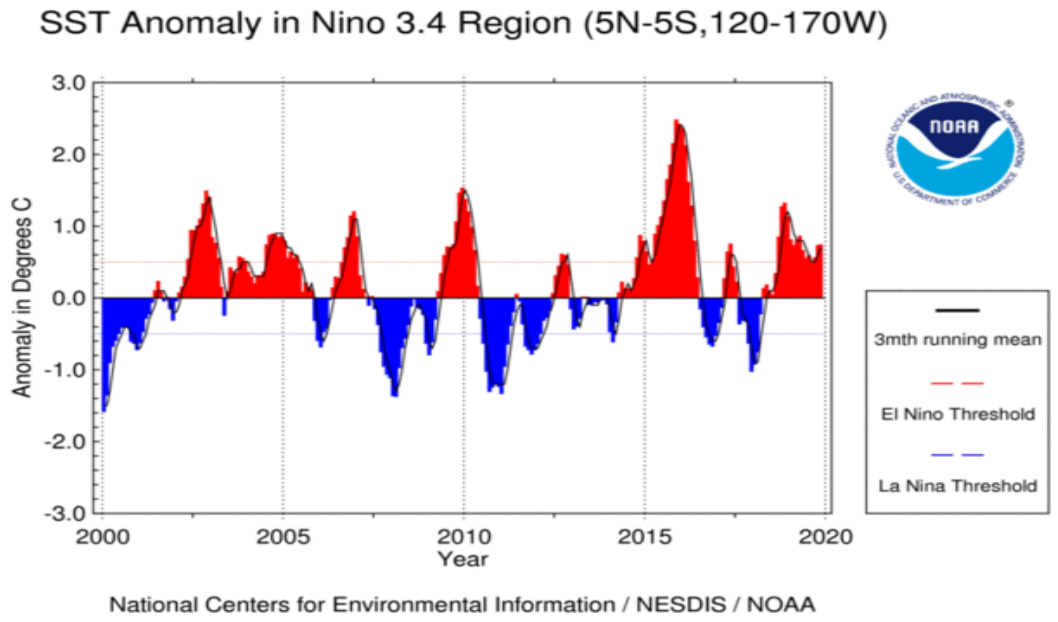
CLIMATE CHANGE & VARIABILITY

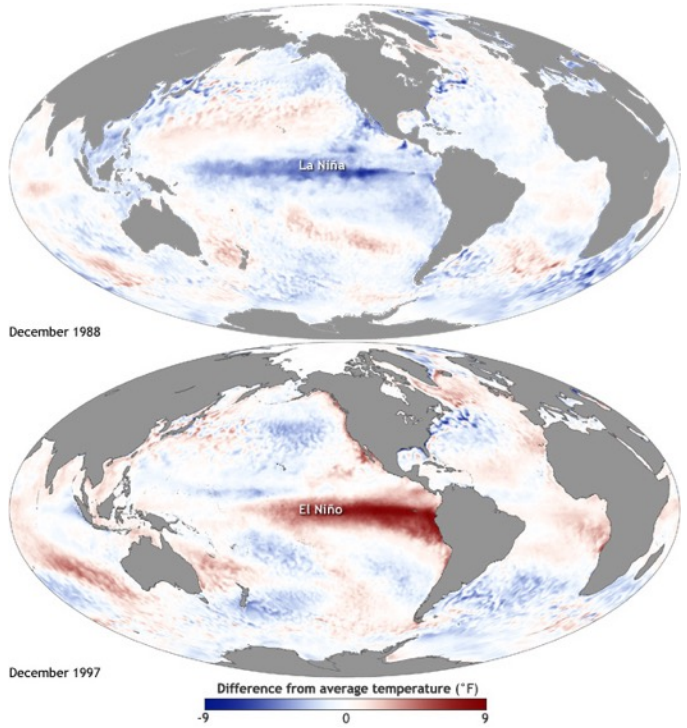


Source: Environment Canada; courtesy of Elaine Barrow

CLIMATE VARIABILITY

Patterns of change are primarily due to internal forcing (i.e., natural variability), and are associated with climate indices and teleconnections (e.g. ENSO - El Niño Southern Oscillation; PDO - Pacific Decadal Oscillation).

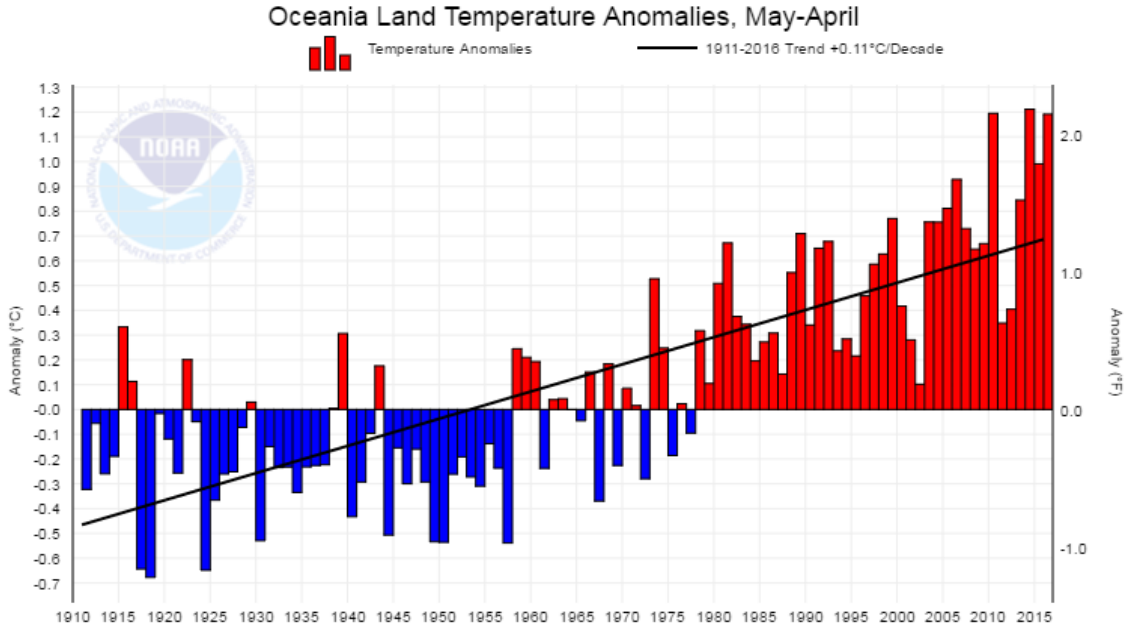




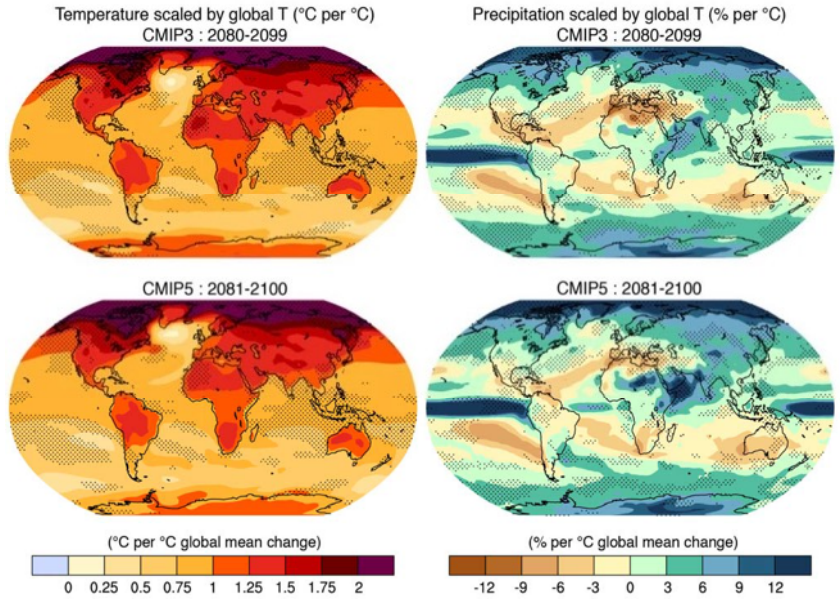
http://spark.ucar.edu/video/dog-walking-weather-and-climate

CLIMATE CHANGE

The **Trend** of change is primarily in response to an external forcing (i.e., increasing concentrations of greenhouse gasses in the atmosphere).



Land-Surface temperature trends in Oceania since 1910

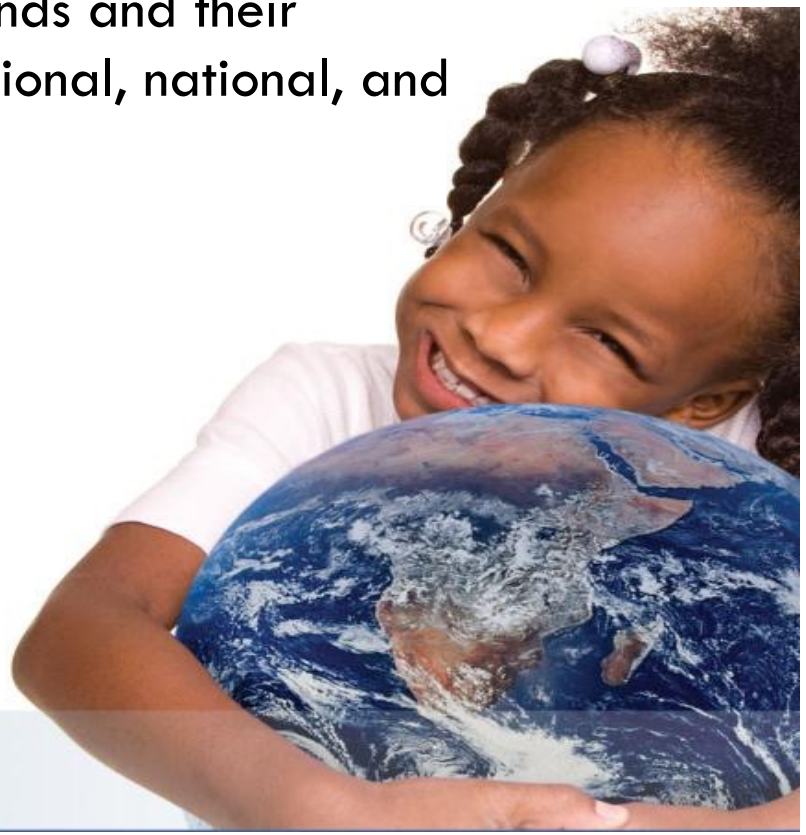


Adapted from IPCC, AR5

CLIMATE SERVICES

"A mechanism to identify, produce, and deliver authoritative and timely – **actionable** – information about climate variations and trends and their impacts on built, social-human, and natural systems on regional, national, and global scales to support decision making." (NRC, 2009)

Goal: Enable better management of the risks of climate variability and change and support adaptation so as to **enhance resilience** at all levels.



WCC · 3

IMPORTANT ROLE OF NATIONAL METEOROLOGICAL SERVICES

- NMS are ideally placed to play a major role in the delivery of climate services by:

  - Serving as a national source for high-quality weather and climate observations that are archived into climate databases and available for analysis to underpin climate services

  - Collecting and managing climatological data and producing many seasonal climate outlooks for climate variablility

DIALOG OVERVIEW

Strengthening the development and delivery of end-to-end climate services

OBJECTIVES

- Raise awareness of the state of knowledge of climate science, impacts, and adaptation for all key stakeholders in RMI, with an emphasis on the health sector.
- Explore and learn about climate and weather service products and services that can be used to support health-related planning and response In RMI.
- Inform the providers of climate products and services about the unique requirements in terms of format, content and timing of information necessary to inform decision-making as it pertains to the health sector in the RMI.
- Jointly identify improvements can be made with respect to products and processes that can be used to enhance situational awareness and support decision-making as it pertains to climate and the health sector in the RMI.

PROCESS FLOW

- Develop focus for dialog
- Identify sectors and participants
- Identify objectives and outcomes
- Initiate description of existing climate services

Day 1: Session 1

- Share stories to help identify issues, illustrate key messages and best practices
- Share and document experiential and technical information on climate-related events and impacts

Day 2: Session 2

- Describe and evaluate existing climate services products and processes
- Outline a plan to enhance the development and delivery of climate services

Day 2: Session 3

- Synthesize the discussion of issues, highlighting needs and opportunities
- Incorporate key messages and best practices.
- Identify immediate actions to be taken

SHARE

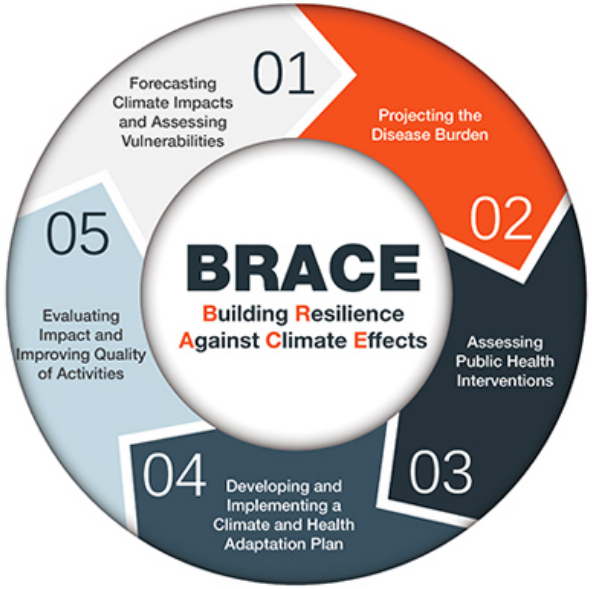
Day 1: Session 1

- Share stories to help identify issues, illustrate key messages and best practices
- Share and document experiential and technical information on climate-related events and impacts

DIAGNOSE

Day 2: Session 2

- Describe and evaluate existing climate services products and processes
- Outline a plan to enhance the development and delivery of climate services



CDC's Building Resilience Against Climate Effects (BRACE) Framework

https://www.cdc.gov/climateandhealth/BRACE.htm

IRI and Red Cross

https://iri.columbia.edu/news/new-paper-highlights-applications-for-subseasonal-forecasts/

BUILD

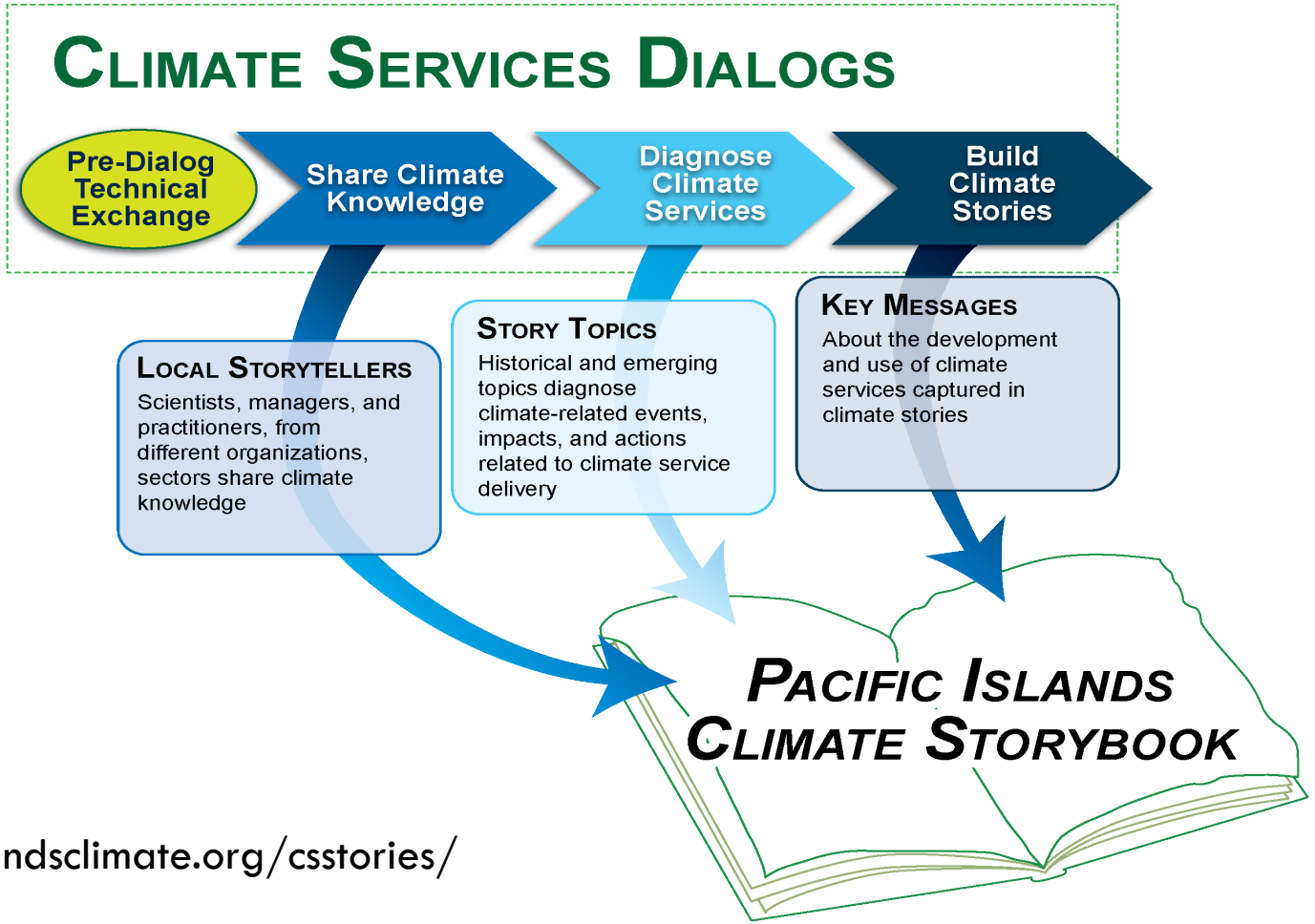
Day 2: Session 3

- Synthesize the discussion of issues, highlighting needs and opportunities
- Incorporate key messages and best practices.
- Identify immediate actions to be taken

OUTCOMES

- Improved ability to generate accurate, timely and regionally-relevant information about climate change and variability and climate impacts to the health sector in RMI
- A user community that is better informed about the current state of knowledge about climate variability and change and its impacts on human health in the RMI, and as a result are able to make better decisions as they set priorities and allocate resources
- A provider community that is better informed about what problems and questions are most relevant with respect to human health in the RMI and, as a result, are better able to match climate and weather-related products and services to user requirements.
- Identification of key messages and best practices for the health sector and key stakeholders in the RMI in responding to climate impacts

CLIMATE SERVICES DIALOGS & STORYBOOK



http://pacificislandsclimate.org/csstories/

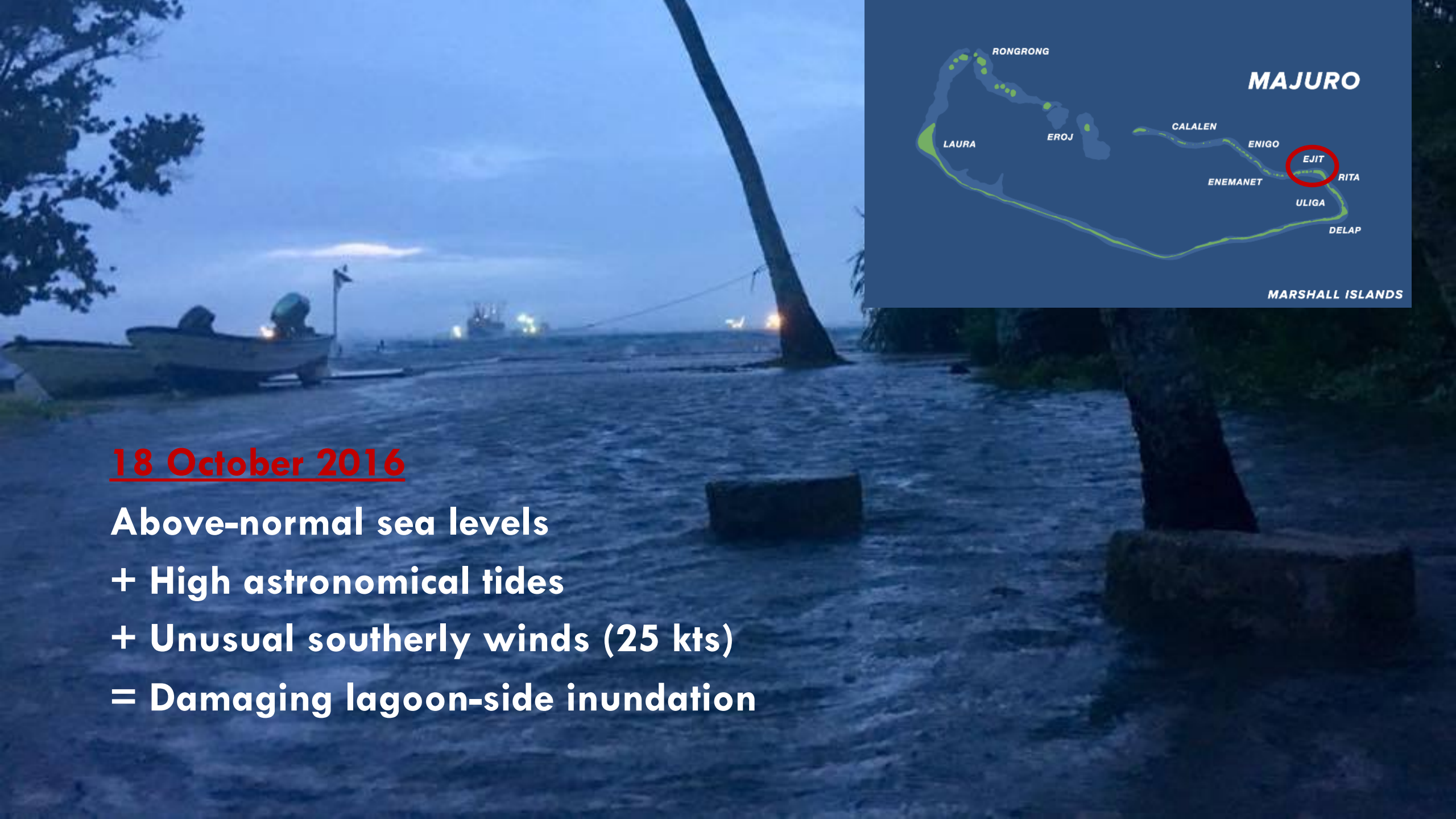
Climate variability and change in the Marshall Islands

1) Understanding
2) Forecasting
3) Communicating

Matthew Widlansky
mwidlans@hawaii.edu

UNIVERSITY OF HAWAII
SEA LEVEL CENTER

Photo of Majuro flooding communicated via
Pacific ENSO Applications Climate Center (PEAC)
4th Quarter 2016 "Pacific ENSO Update"



18 October 2016

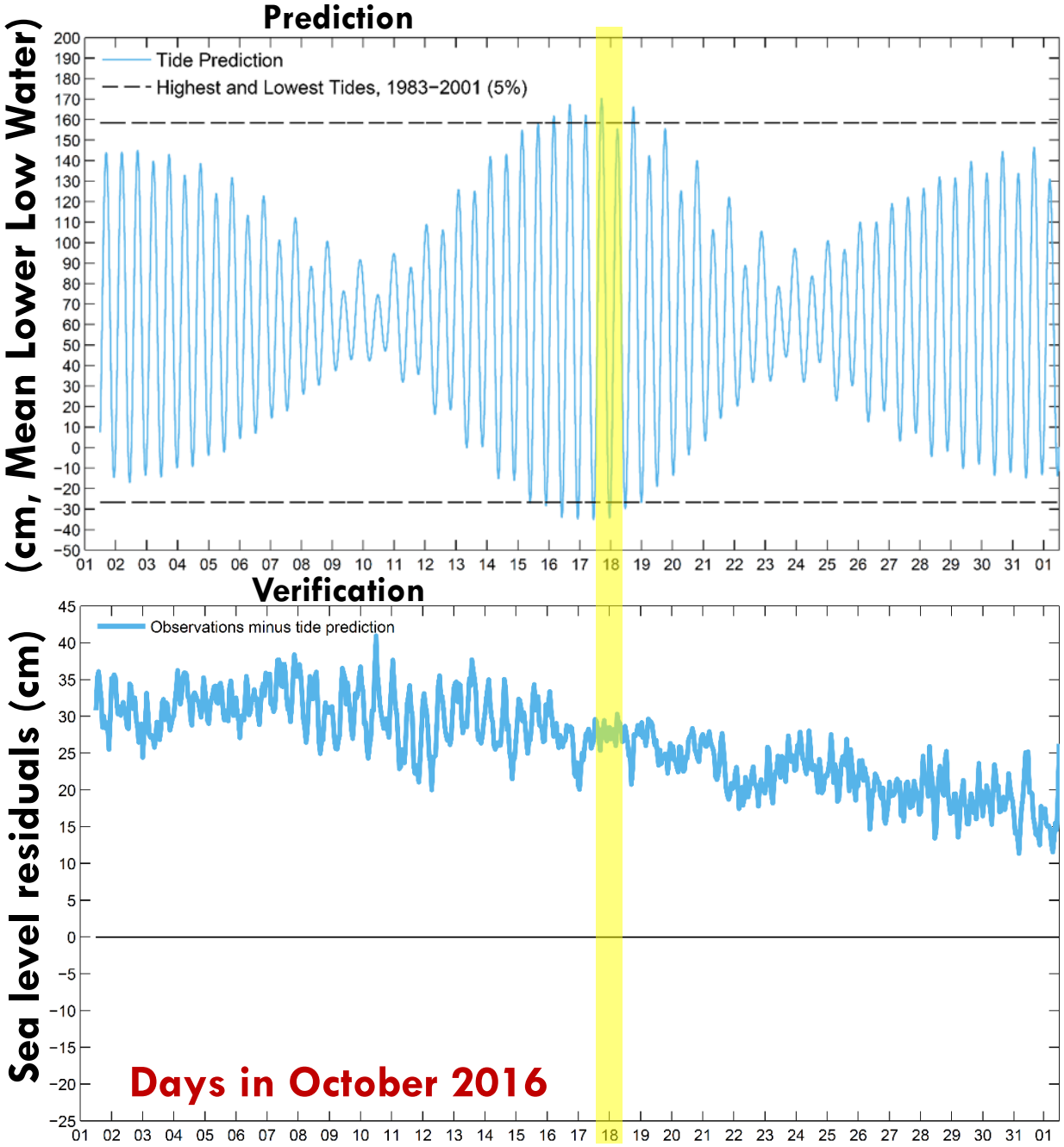
Above-normal sea levels

+ High astronomical tides

+ Unusual southerly winds (25 kts)

= Damaging lagoon-side inundation

Majuro tides

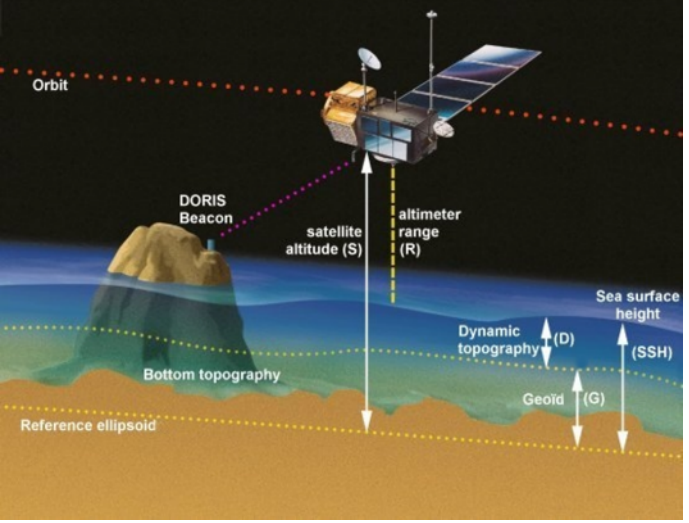


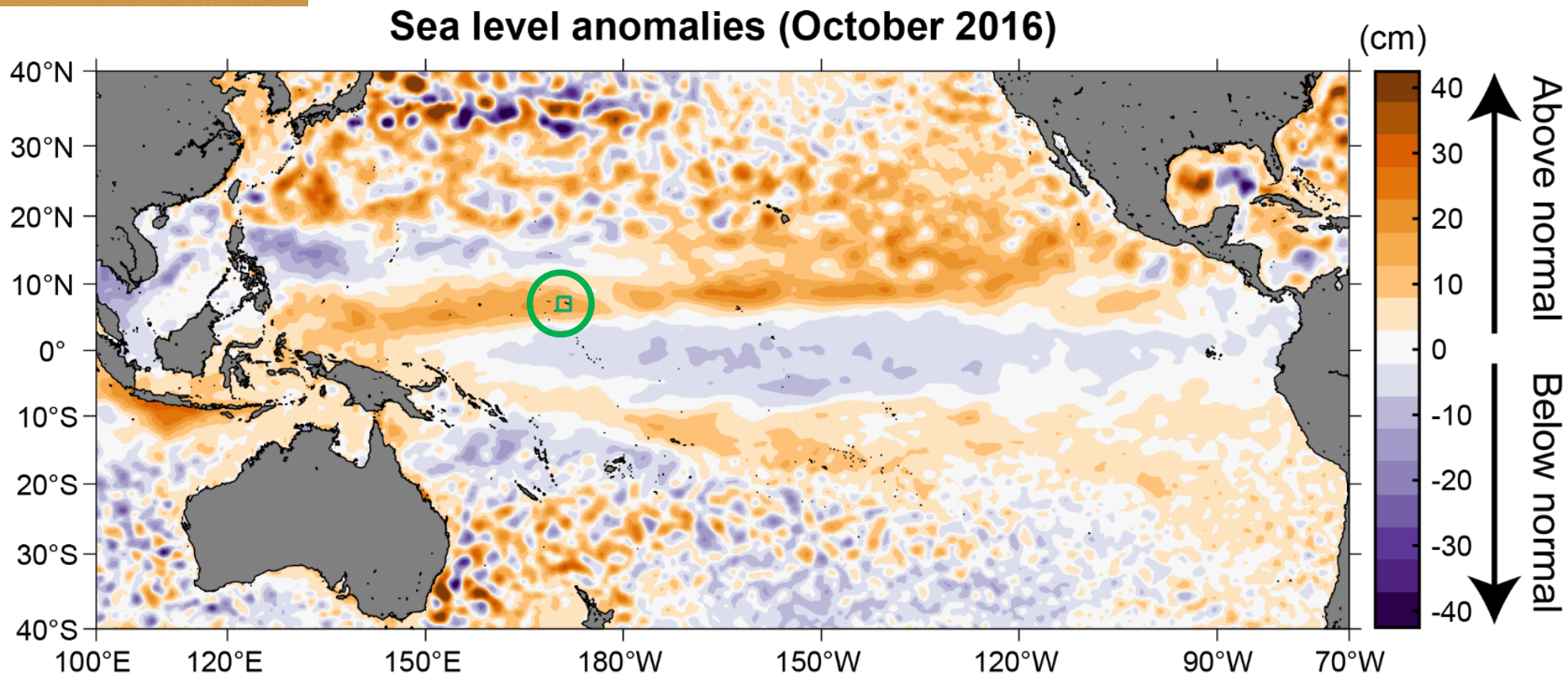
Extreme high tides

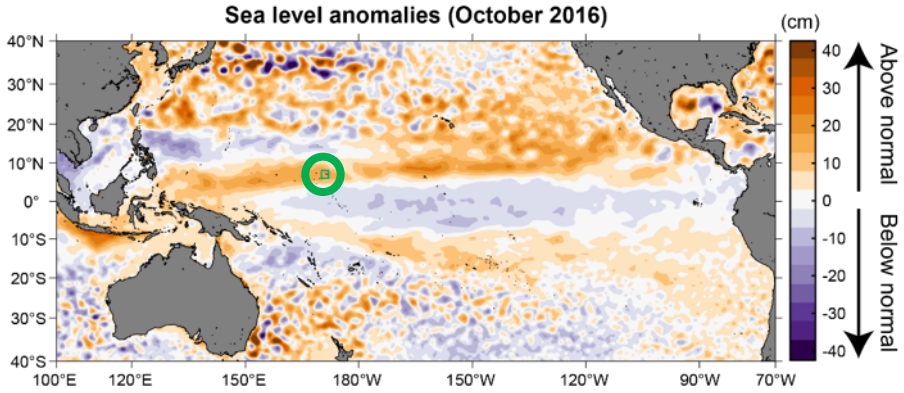
Observed hourly water levels ~30 cm above classical tide prediction

Observations provided by *Australia's BOM Tides Unit*

Unusually high sea levels



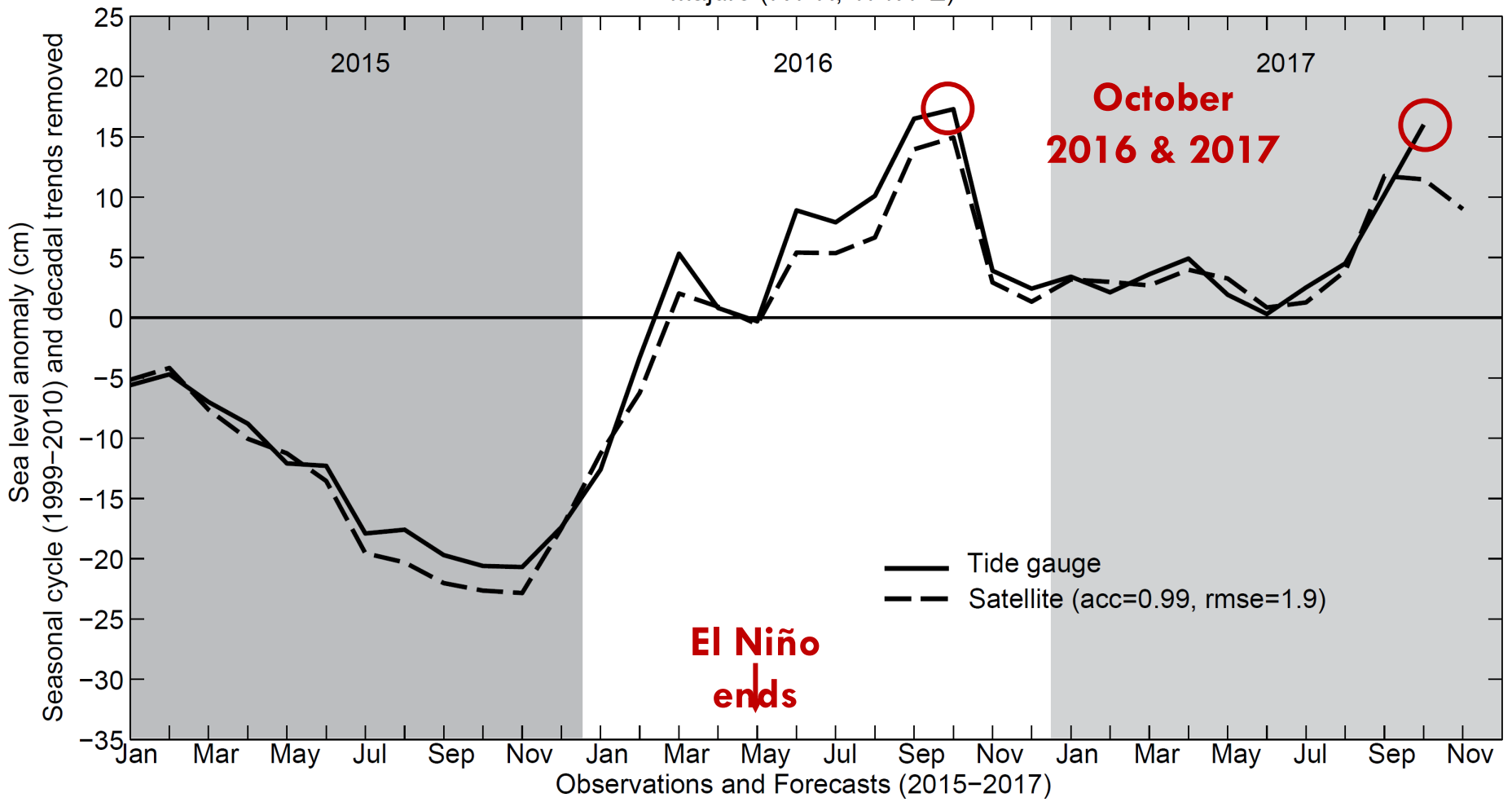




High sea level events after 2015 El Niño

Marshall Islands

Majuro (7.1°N, 171.4°E)



Part 1

Understanding climate variability and change

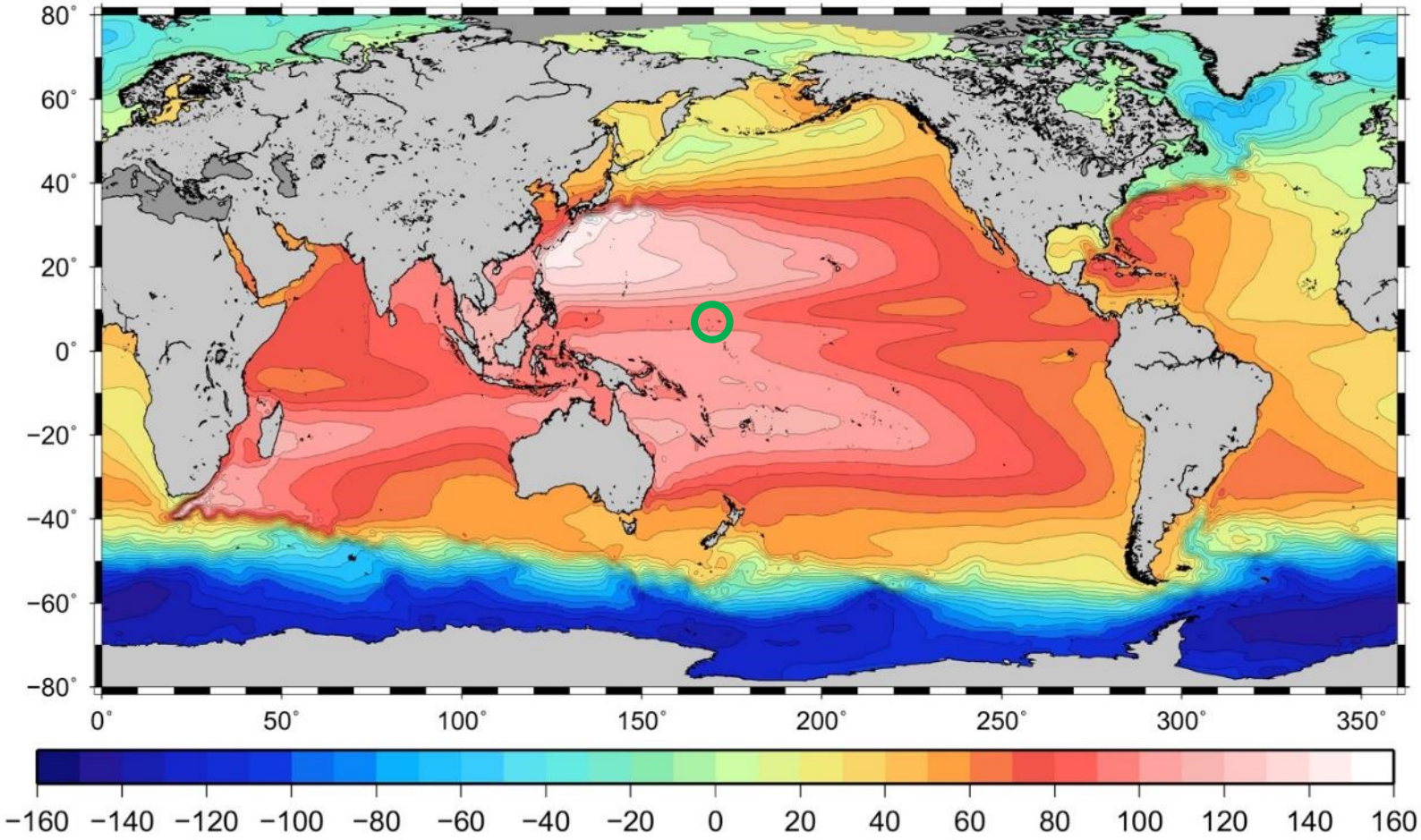
a) Sea level

b) Temperature (sea surface)

c) Rainfall

Mean annual climatology

Sea surface height



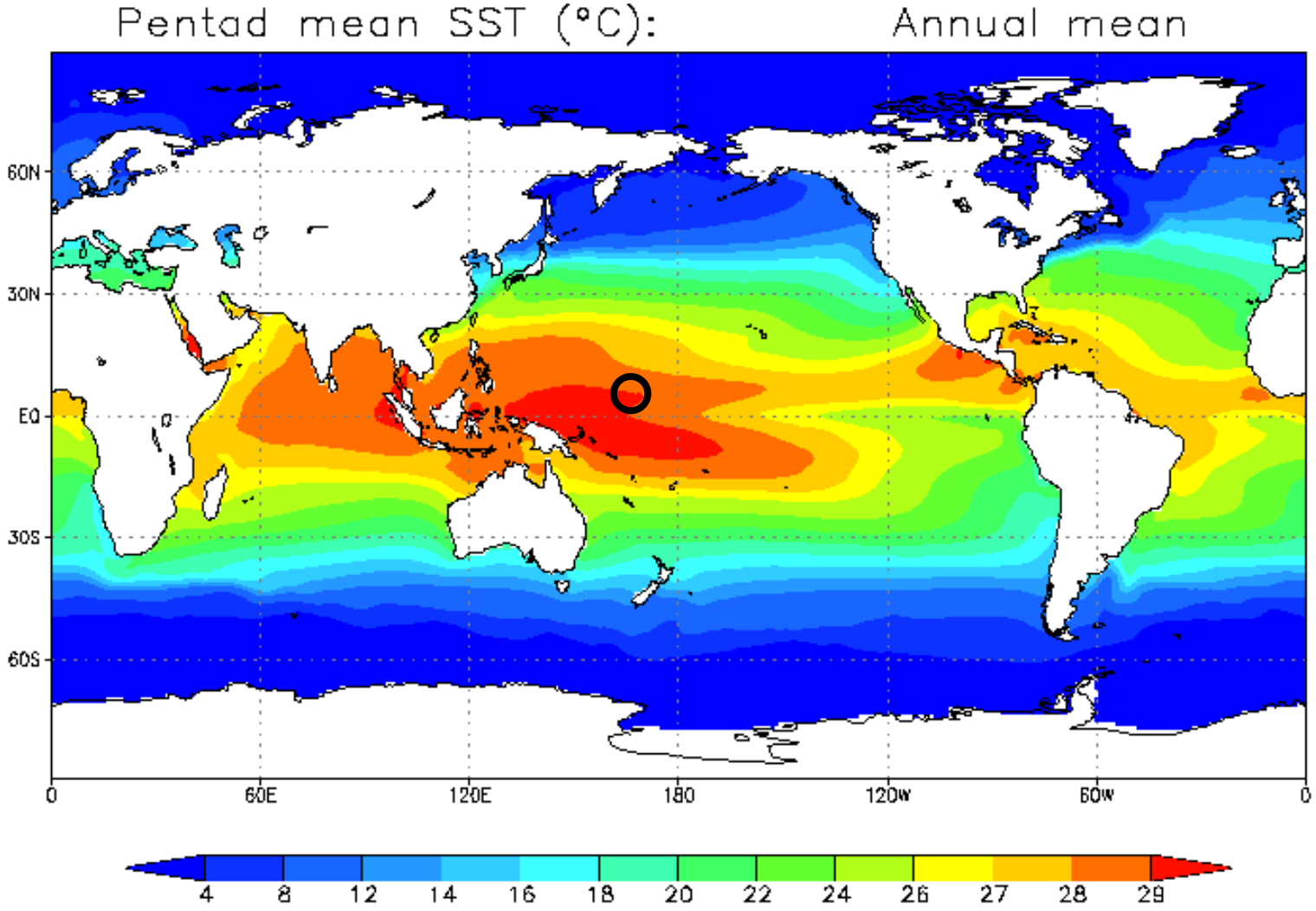
Satellite measured mean dynamic topography (cm)

Why are sea levels higher in the West Pacific?

A) Ocean temperatures **B) Ocean salinities** **C) Surface winds**

Mean annual climatology

Sea surface temperature (West Pacific warm pool)

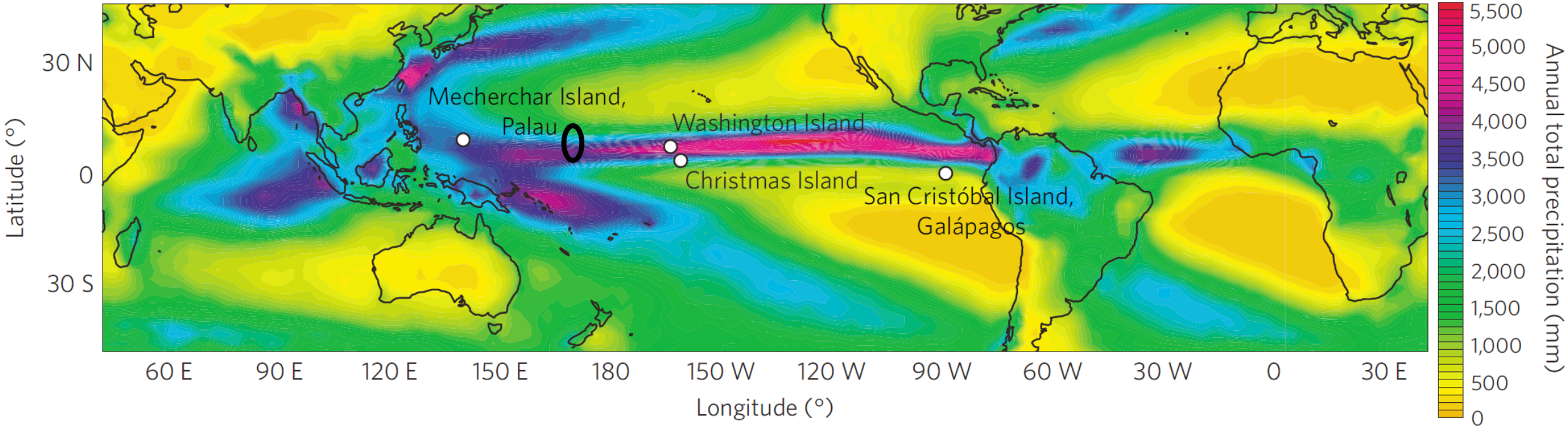


NOAA's
Climate Prediction Center

Mean annual climatology

Rainfall

(Intertropical Convergence Zone, ITCZ)



Sachs et al. 2009, *Nature Geoscience*

We are interested in departures from "Normal"

$$\text{Anomaly} = \text{Observation} - \text{Climatology}$$

For example,

$$\text{Anomaly}_{\text{Oct 2016}} = \text{Observation}_{\text{Oct 2016}} - \text{Climatology}_{\text{Oct 1981–2010}}$$

That is,

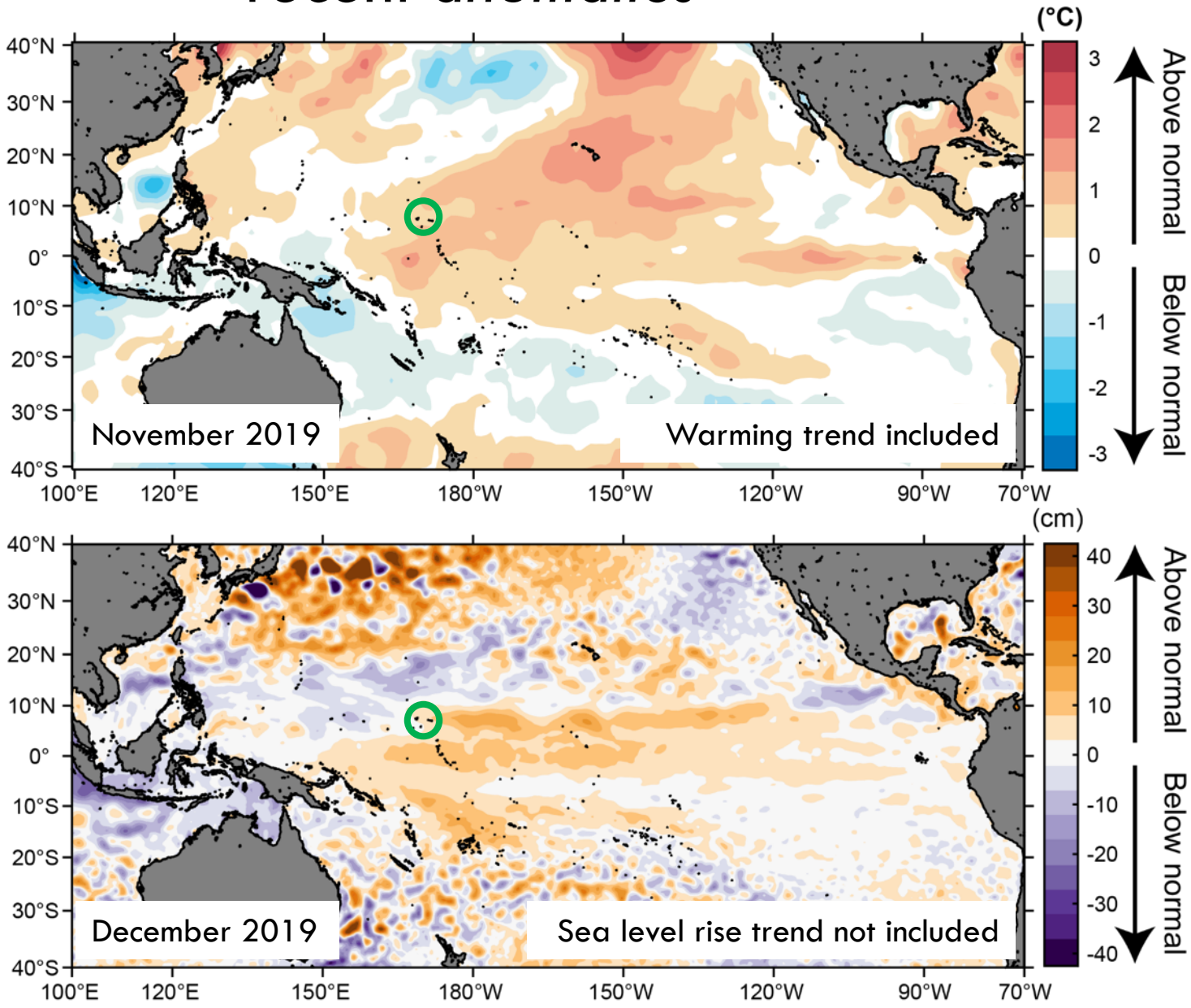
If a month is **higher (warmer, or wetter)** than normal,
that month's anomaly is **positive**

If a month is **lower (cooler, or drier)** than normal,
that month's anomaly is **negative**

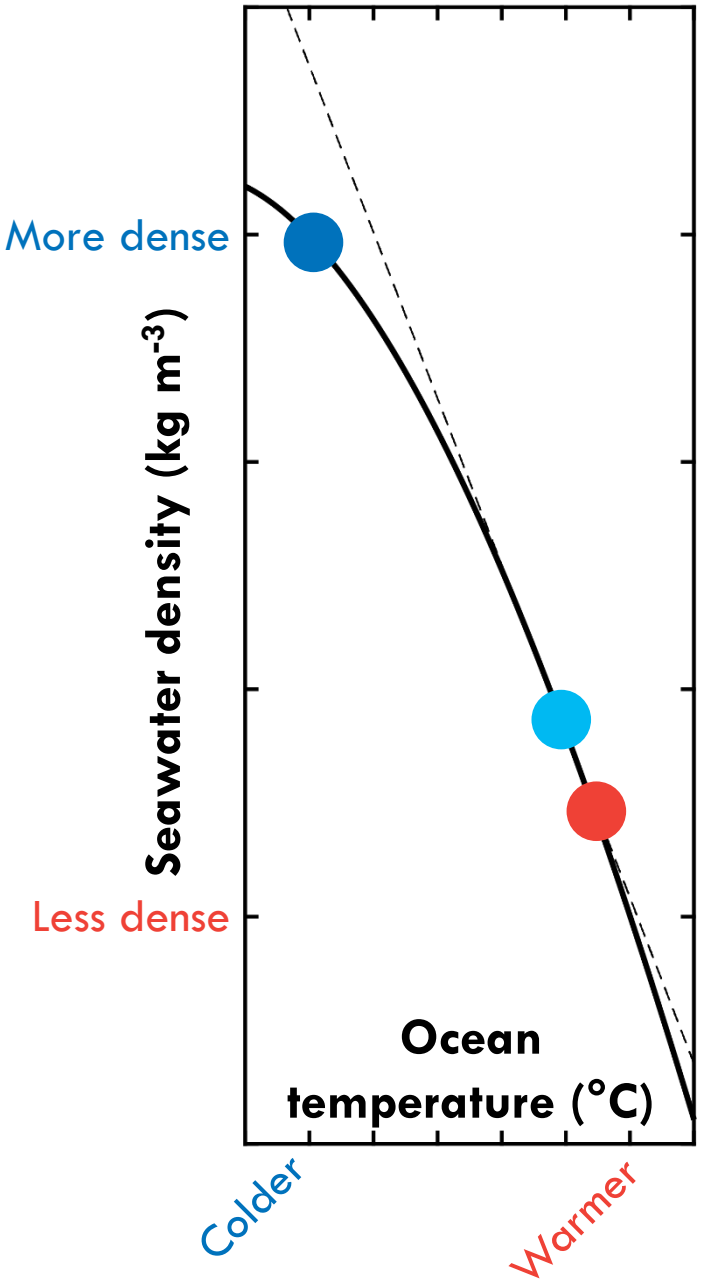
Pacific-wide patterns of **Sea Surface Temperature** and **Sea Level** recent *anomalies*

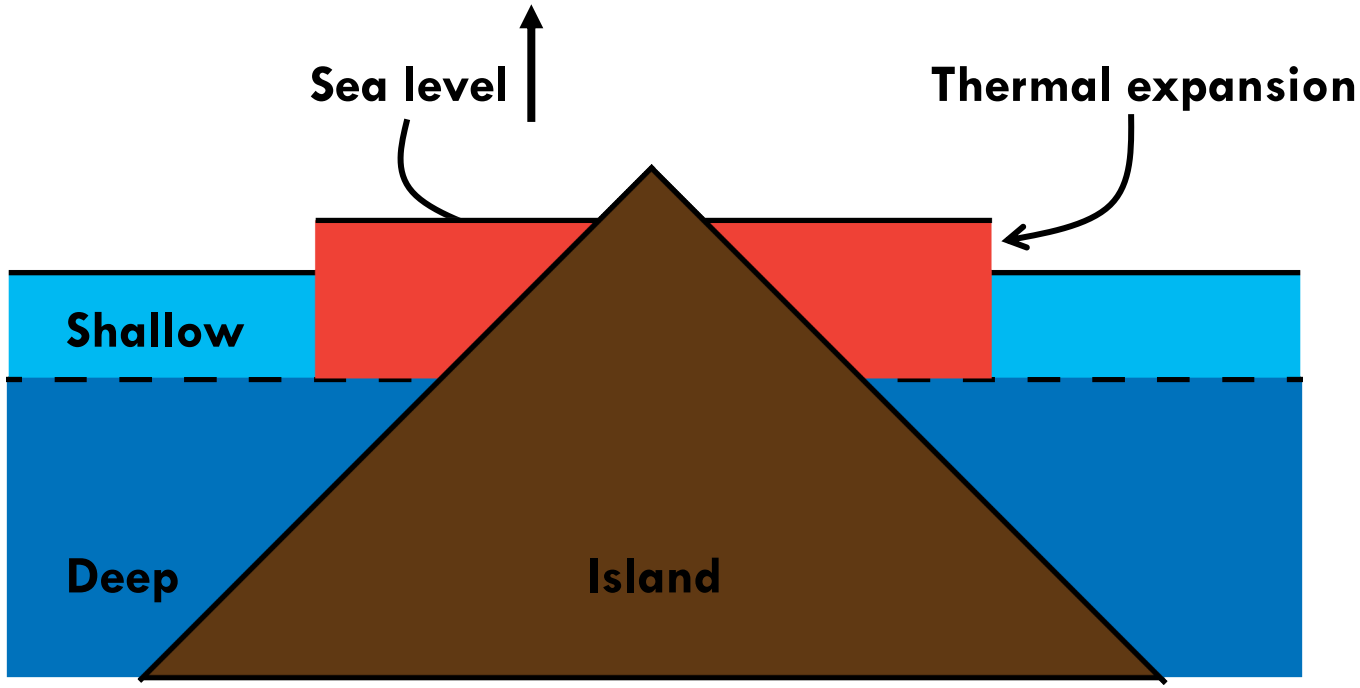
Sea surface <u>temperature</u>

Sea surface <u>height</u>

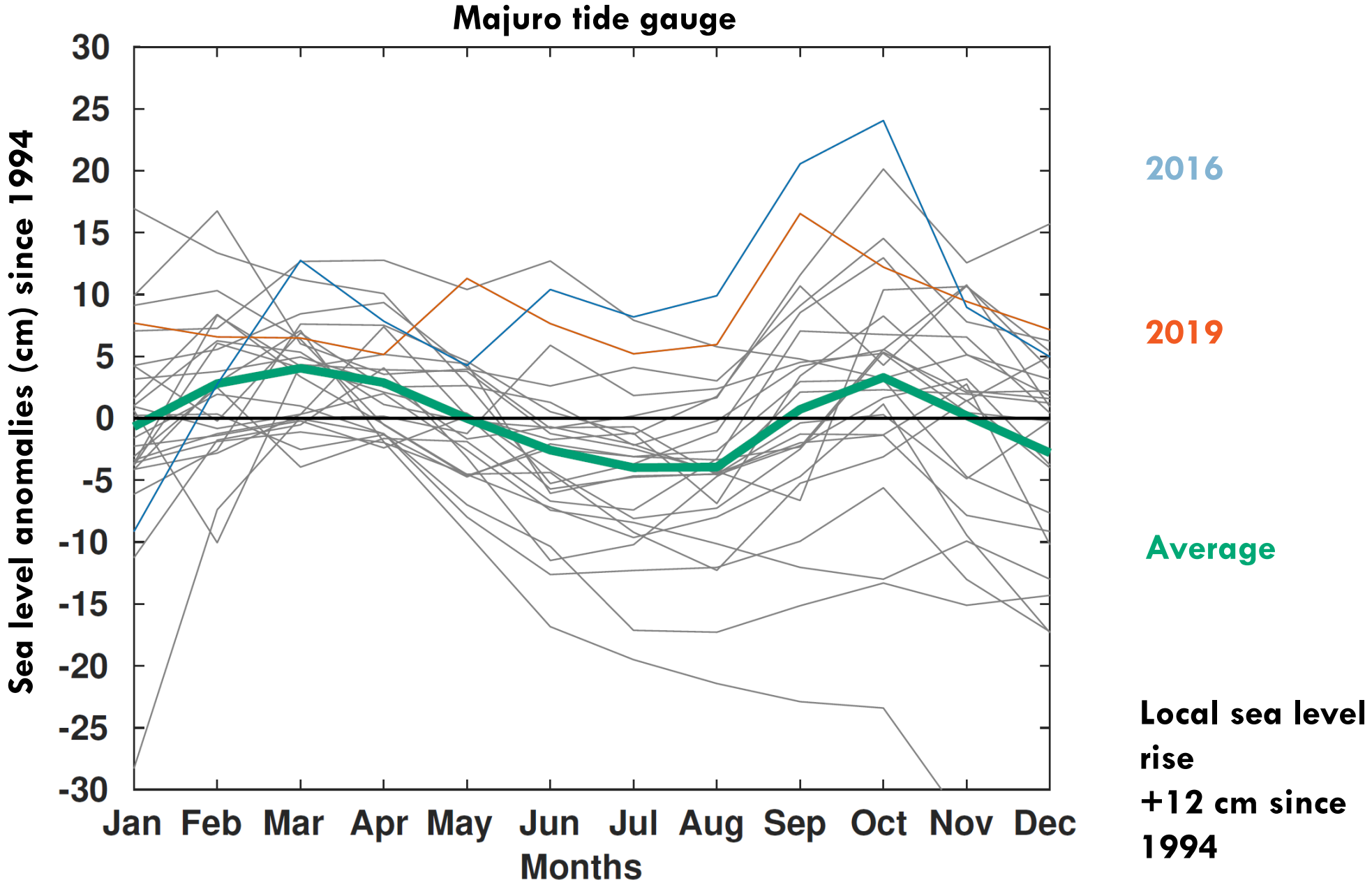


Warm ocean temperatures and high sea levels are physically related

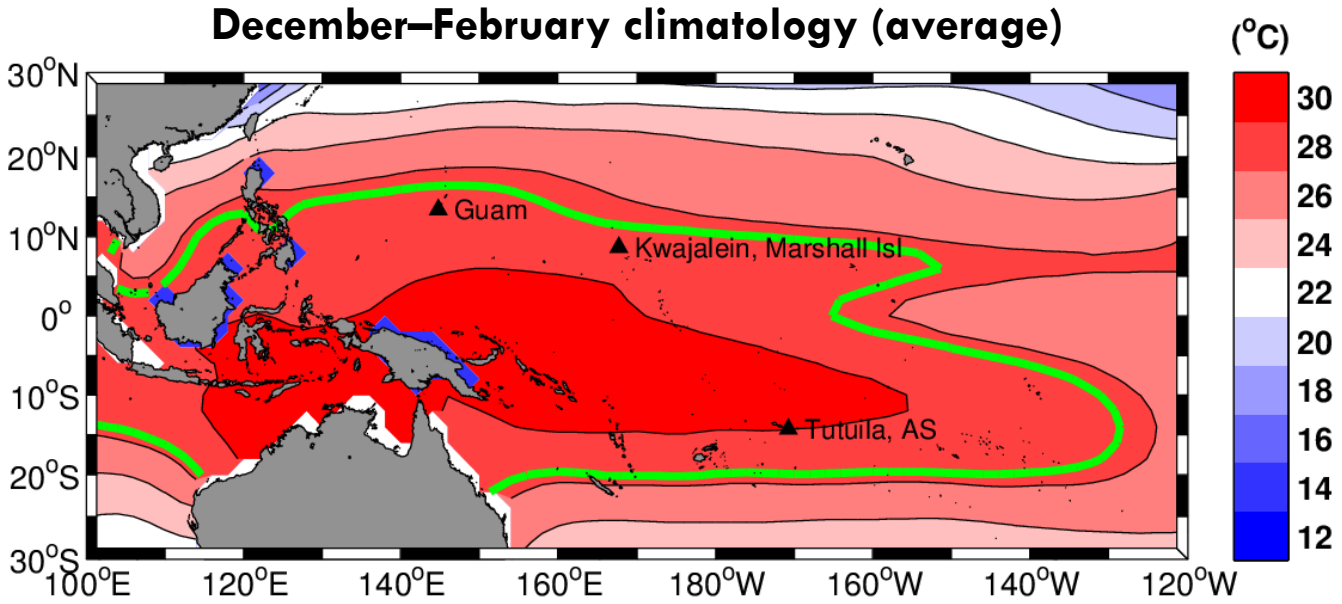


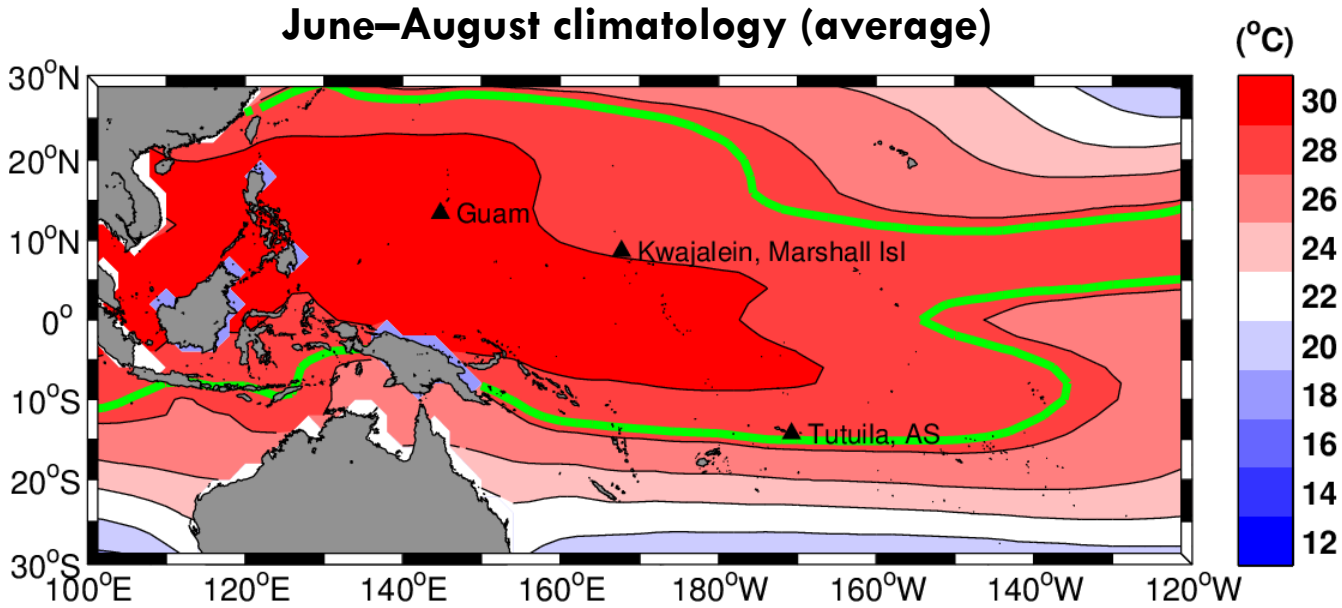


Annual cycle and year-to-year variability of RMI sea levels

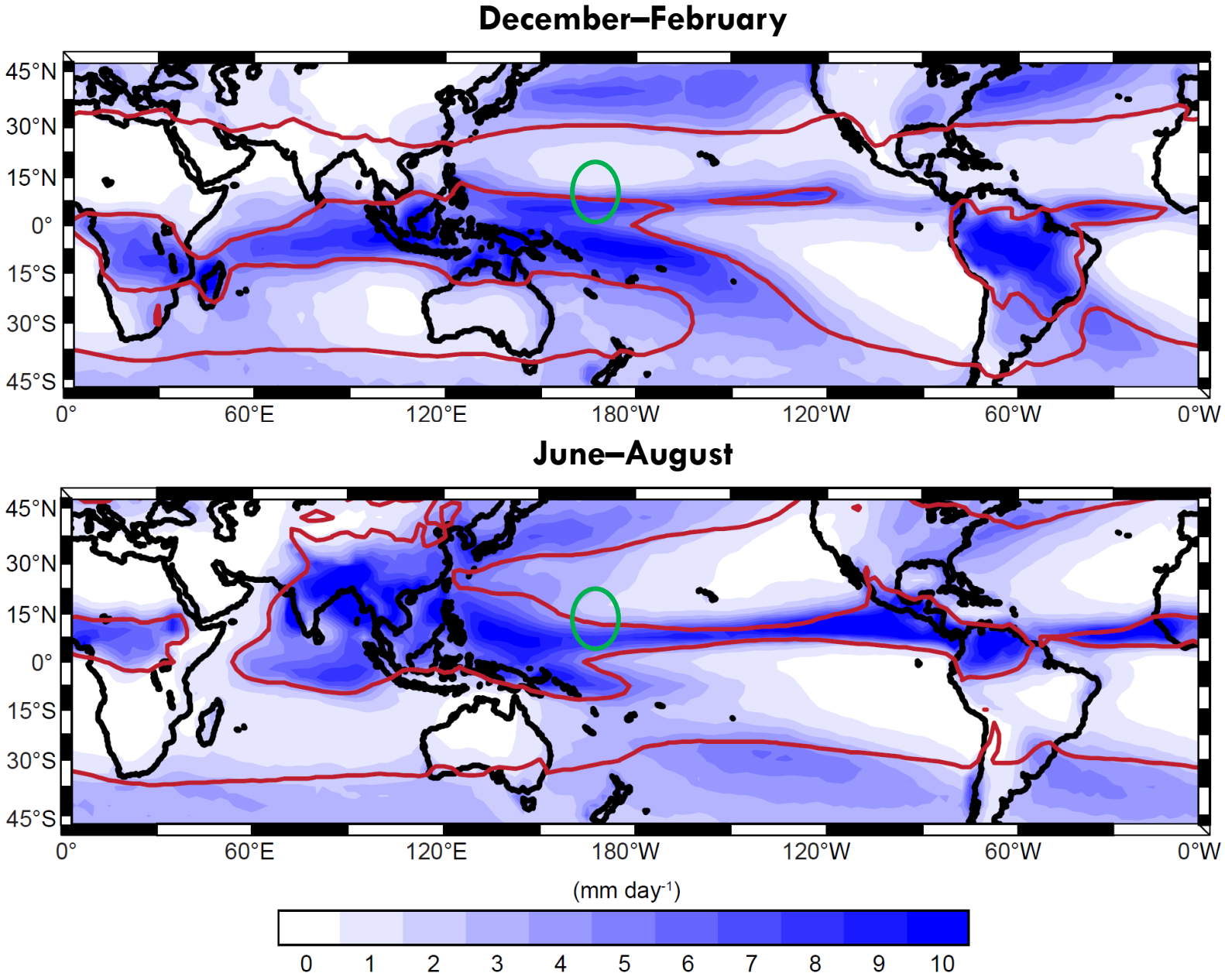


Annual cycle of the Warm Pool (high sea surface temperatures)

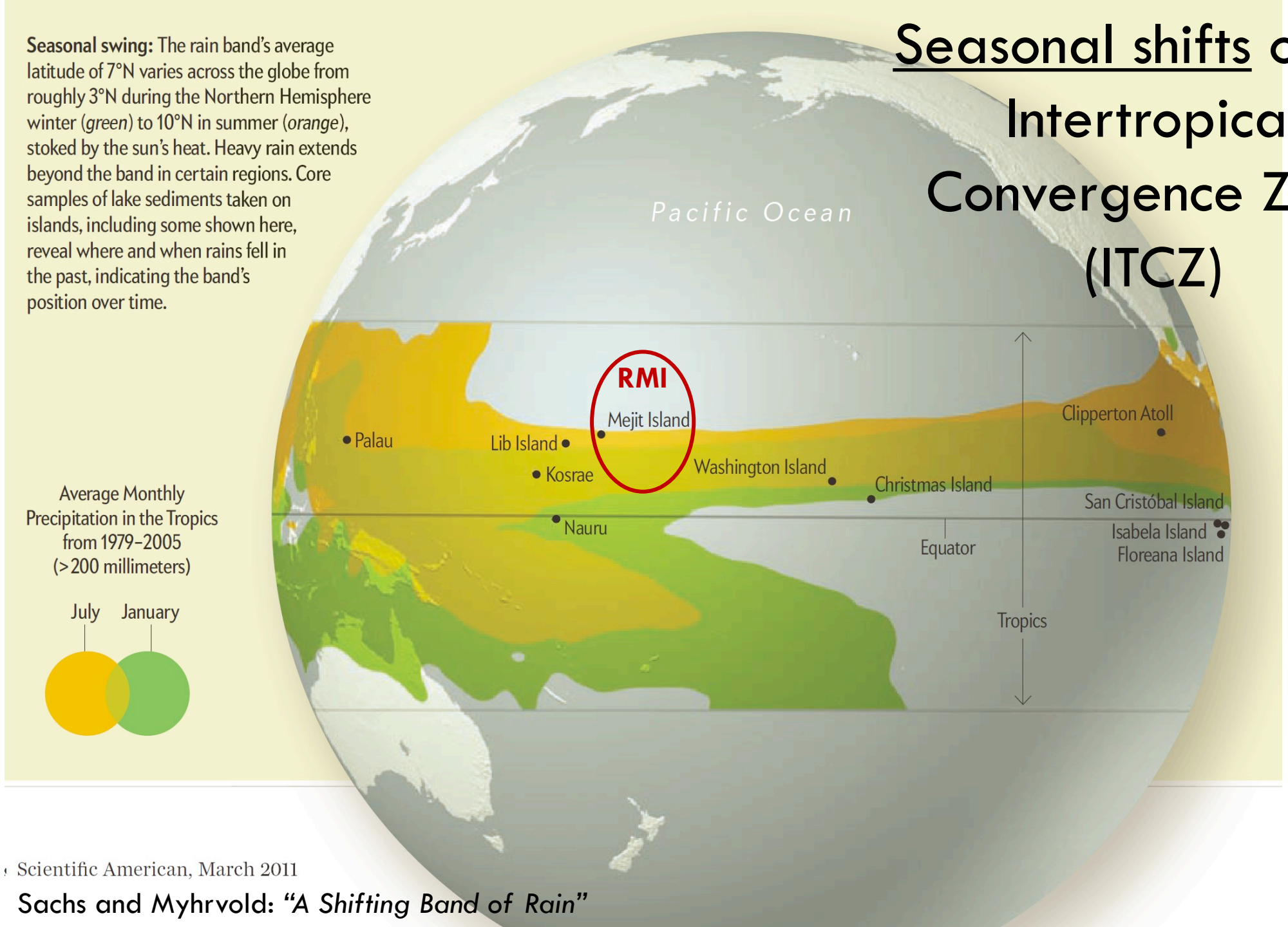




Annual cycle of rainfall (satellite measured)



Seasonal shifts of the Intertropical Convergence Zone (ITCZ)

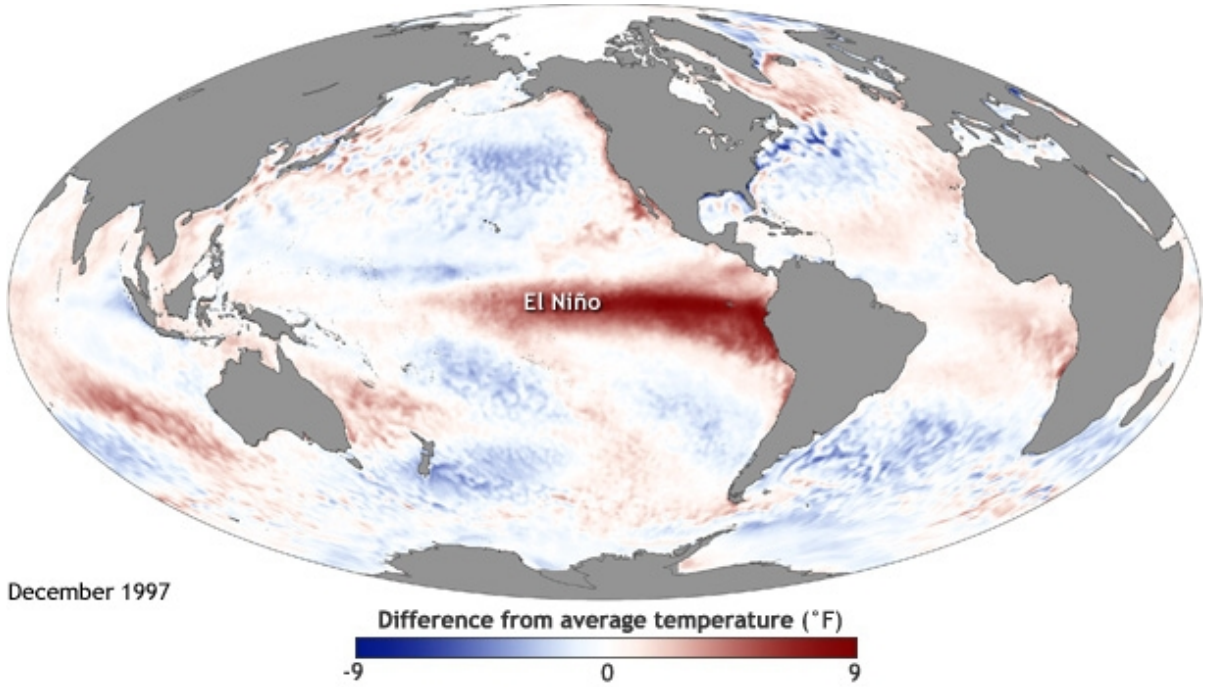


Scientific American, March 2011

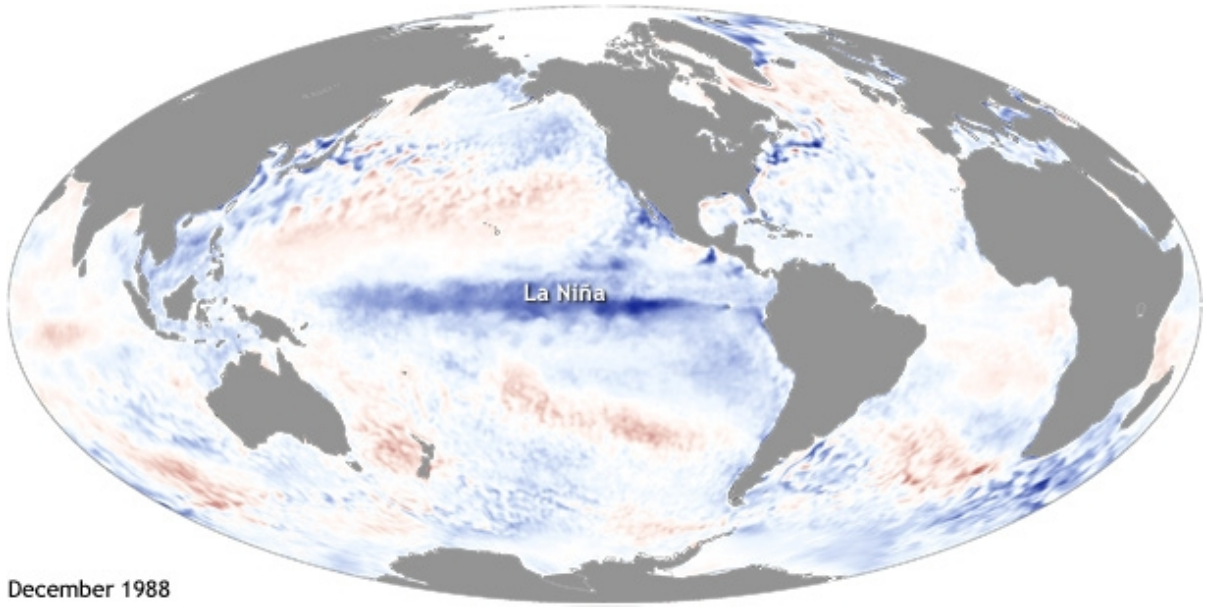
Sachs and Myhrvold: *"A Shifting Band of Rain"*

Year-to-year variability (sea surface temperature)

1997



1988

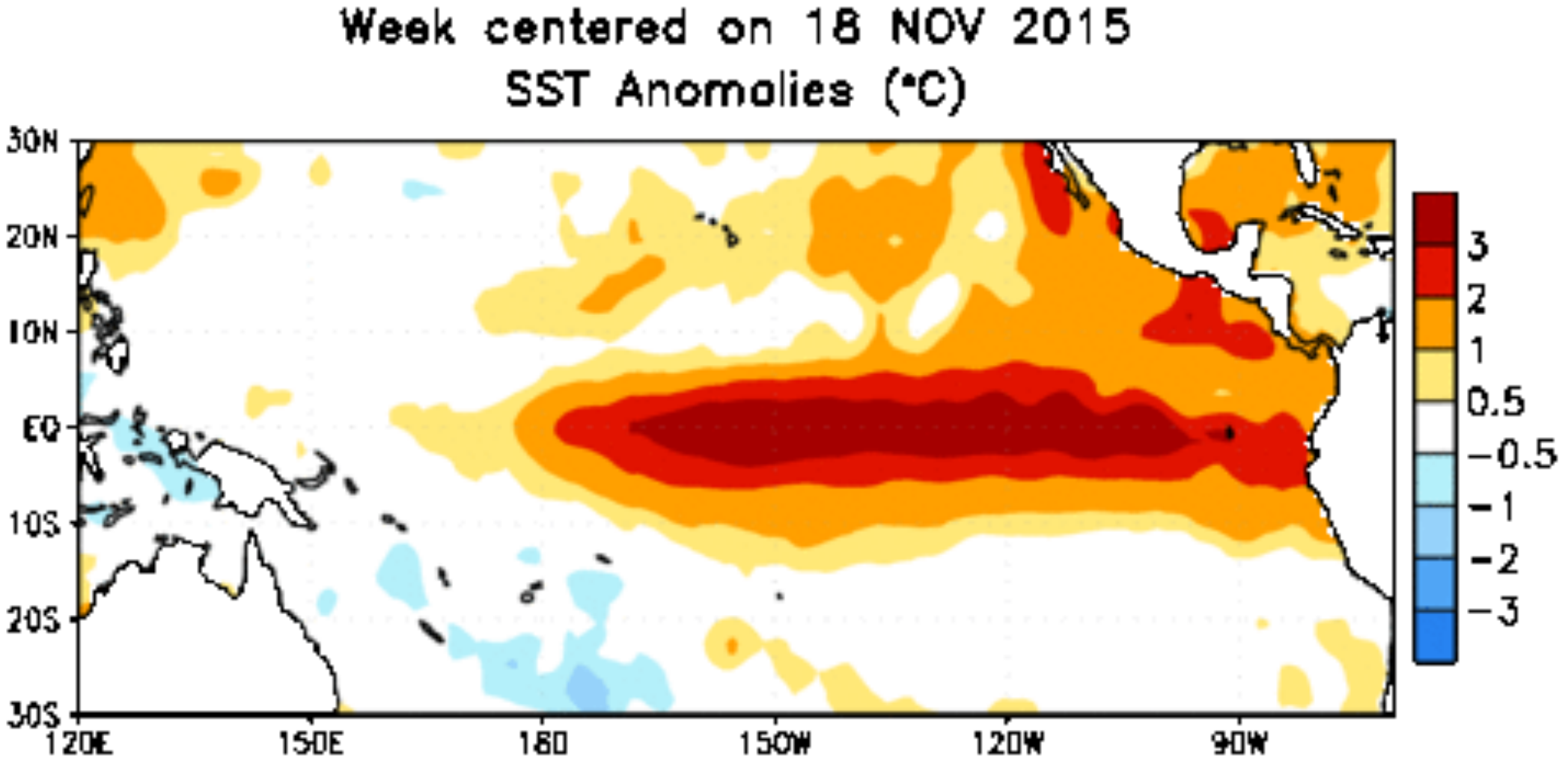


El Niño-Southern Oscillation (ENSO)

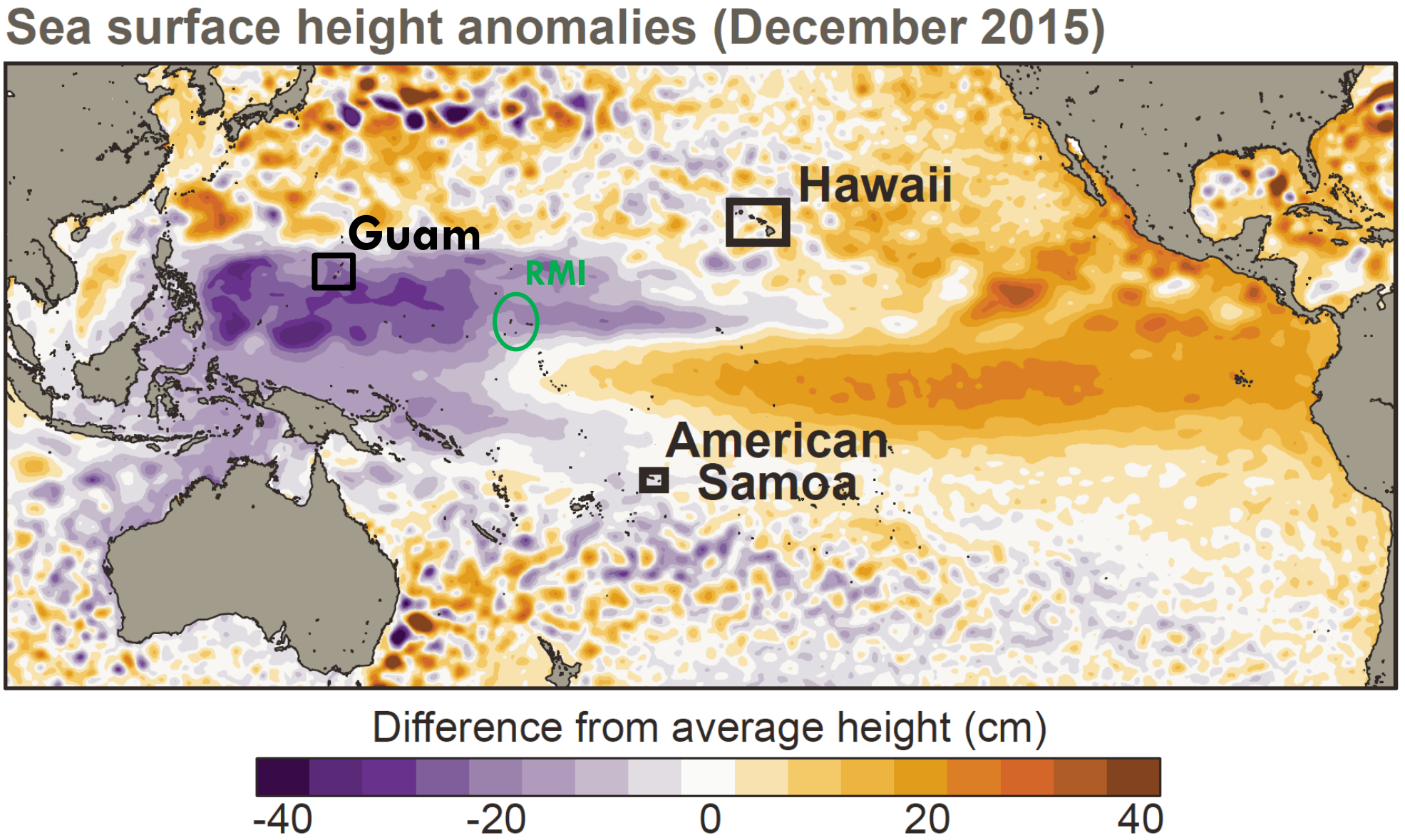
ENSO Blog

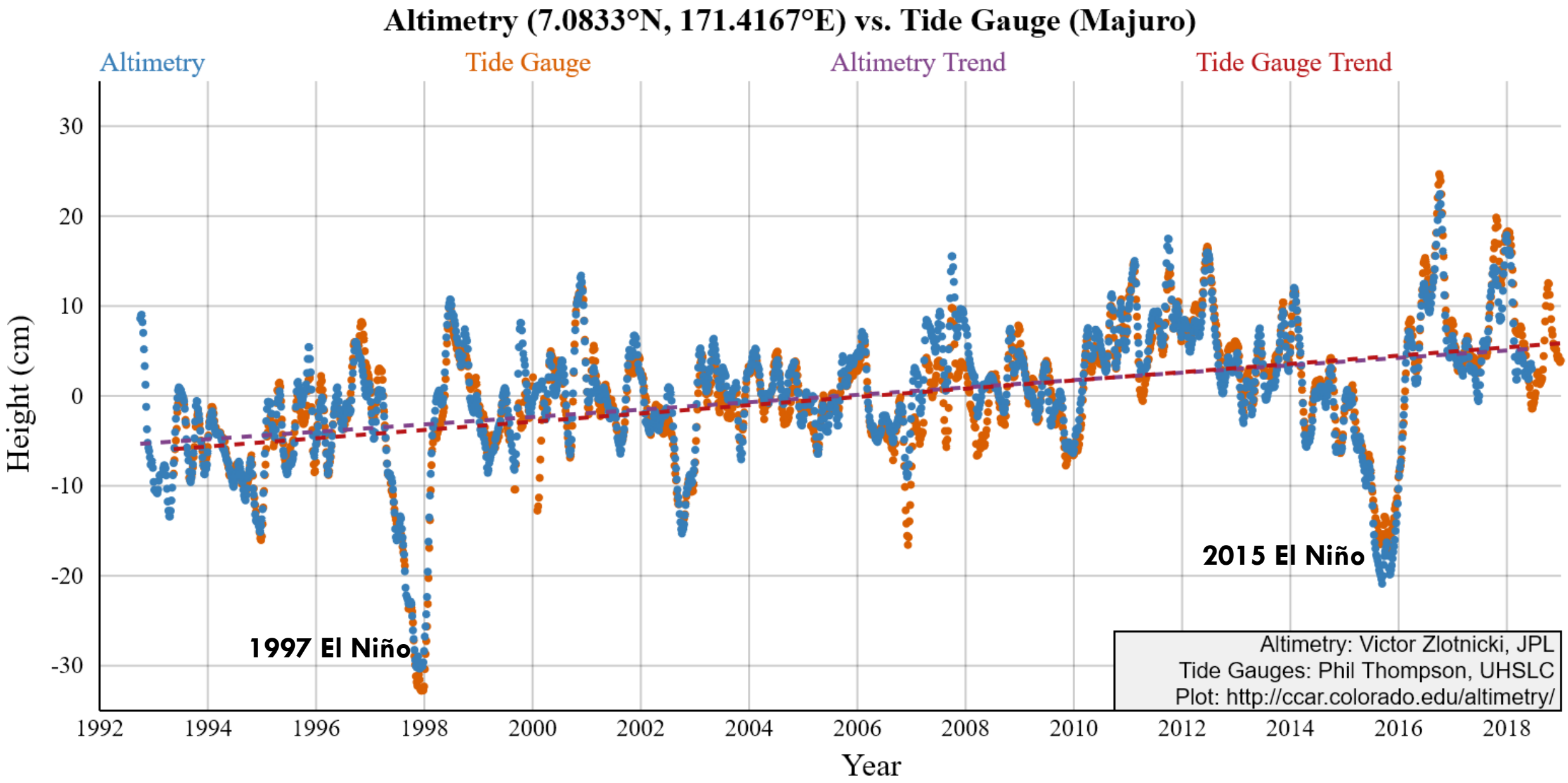
https://www.climate.gov/news-features/blogs/enso

2015–2016 El Niño:
Warmest sea surface temperature in equatorial eastern Pacific



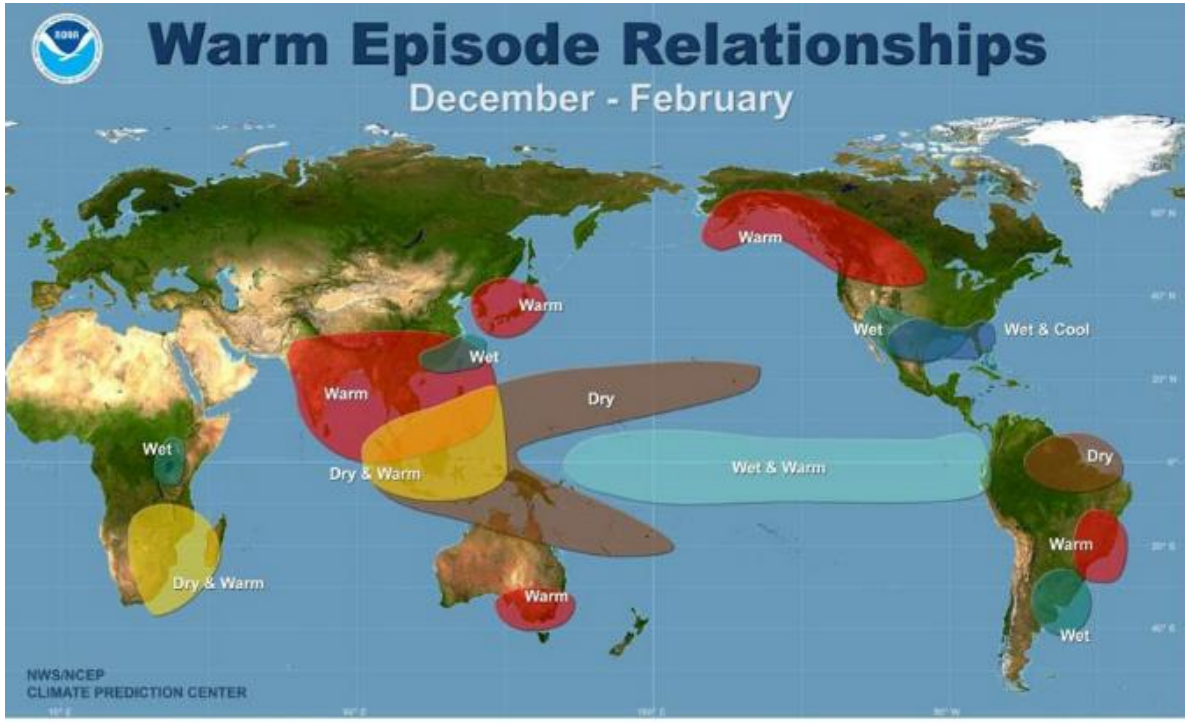
2015–2016 El Niño:
Extreme sea levels (low and high stands)



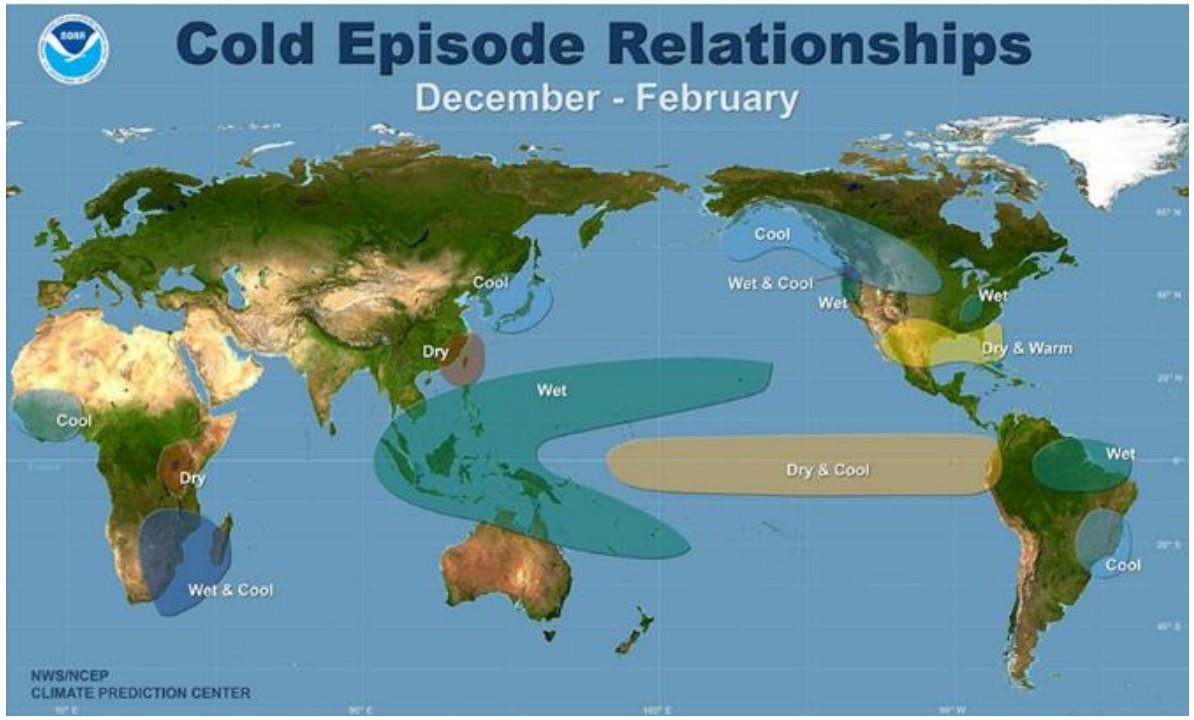

Altimetry (7.0833°N, 171.4167°E) vs. Tide Gauge (Majuro)
Altimetry
Tide Gauge
Altimetry Trend
Tide Gauge Trend
Height (cm)
30
20
10
0
-10
-20
-30
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
Year
1997 El Niño
2015 El Niño
Altimetry: Victor Zlotnicki, JPL
Tide Gauges: Phil Thompson, UHSLC
Plot: http://ccar.colorado.edu/altimetry/

El Niño-Southern Oscillation (ENSO)

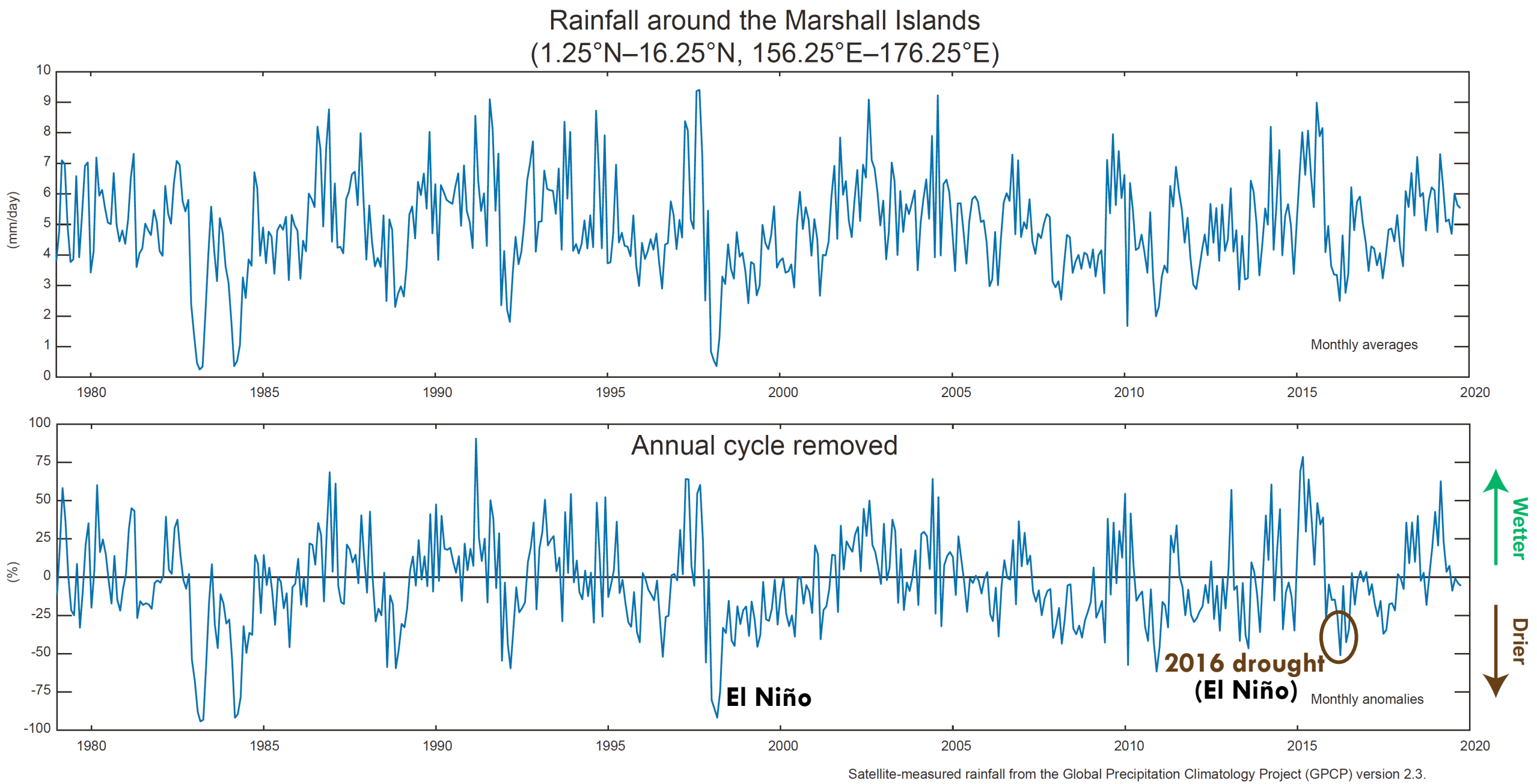
El Niño



La Niña

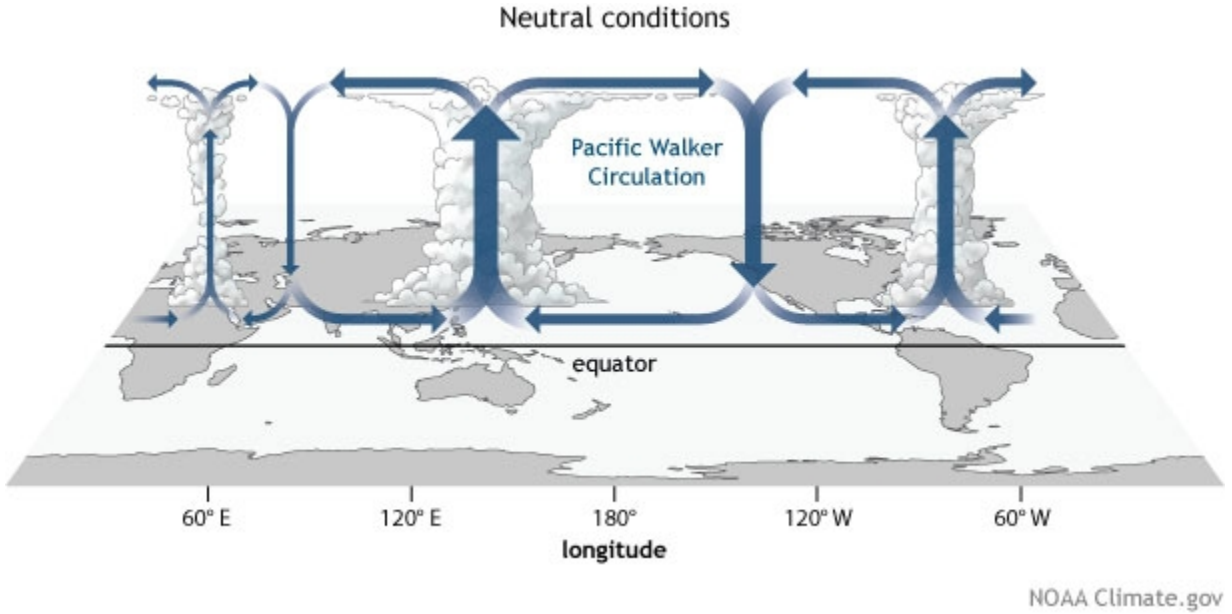


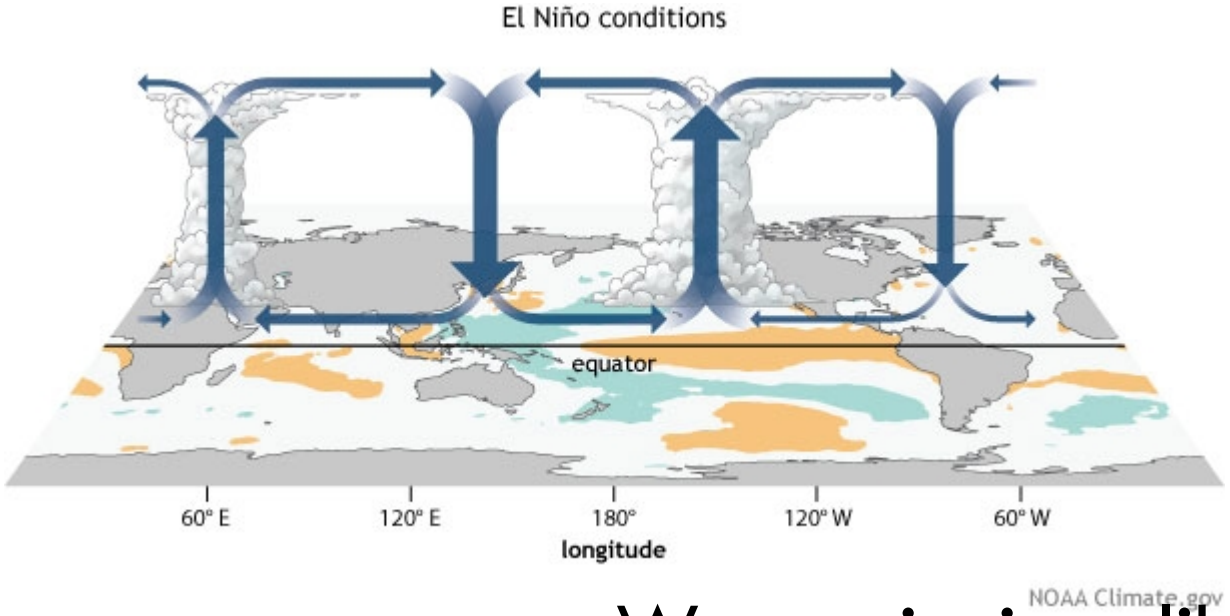
Climate.gov
science & information for a climate-smart nation

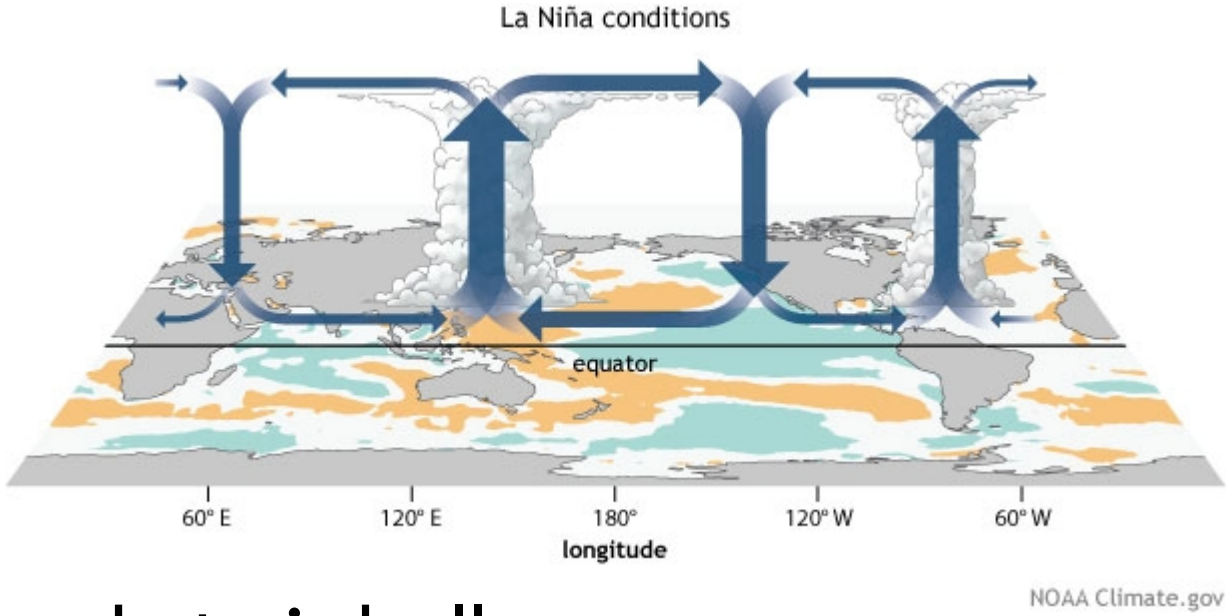


Satellite-measured rainfall from the Global Precipitation Climatology Project (GPCP) version 2.3.

Sea surface temperature drives global atmospheric circulation





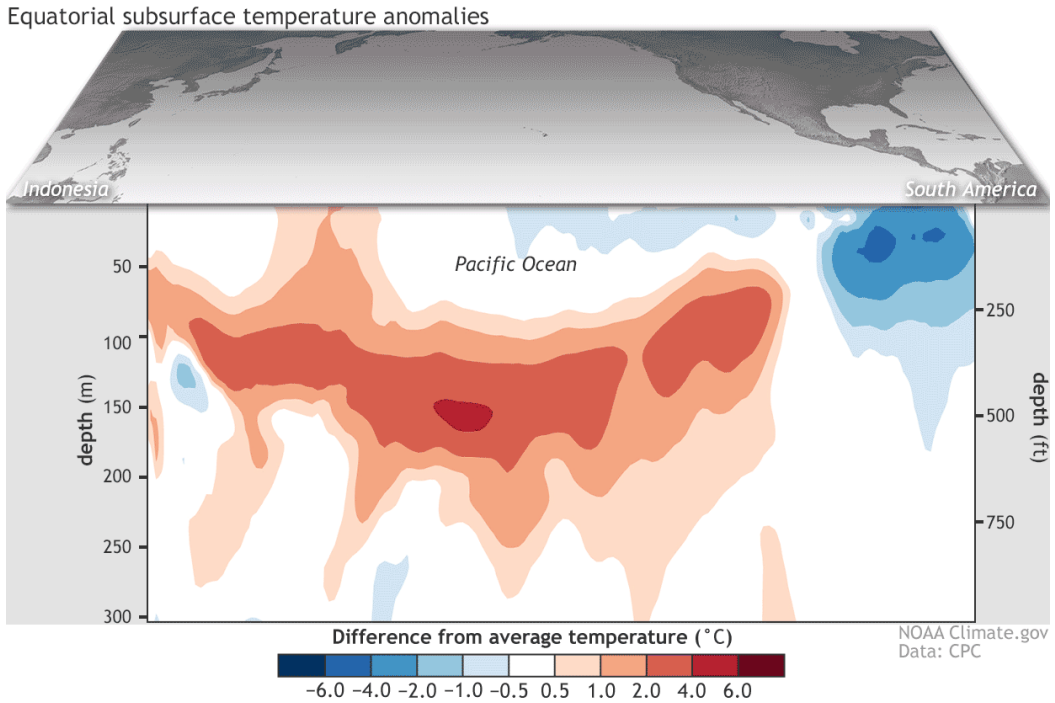


Warm air rises, like a hot air balloon

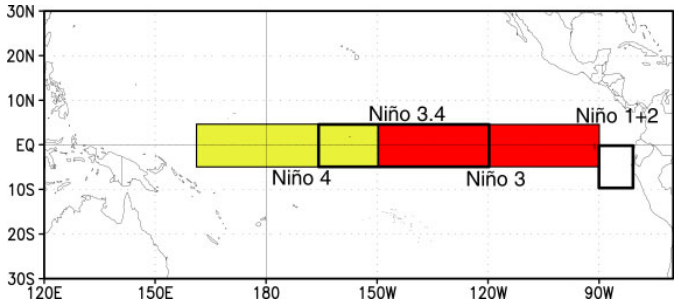
Ocean & Atmosphere are coupled:

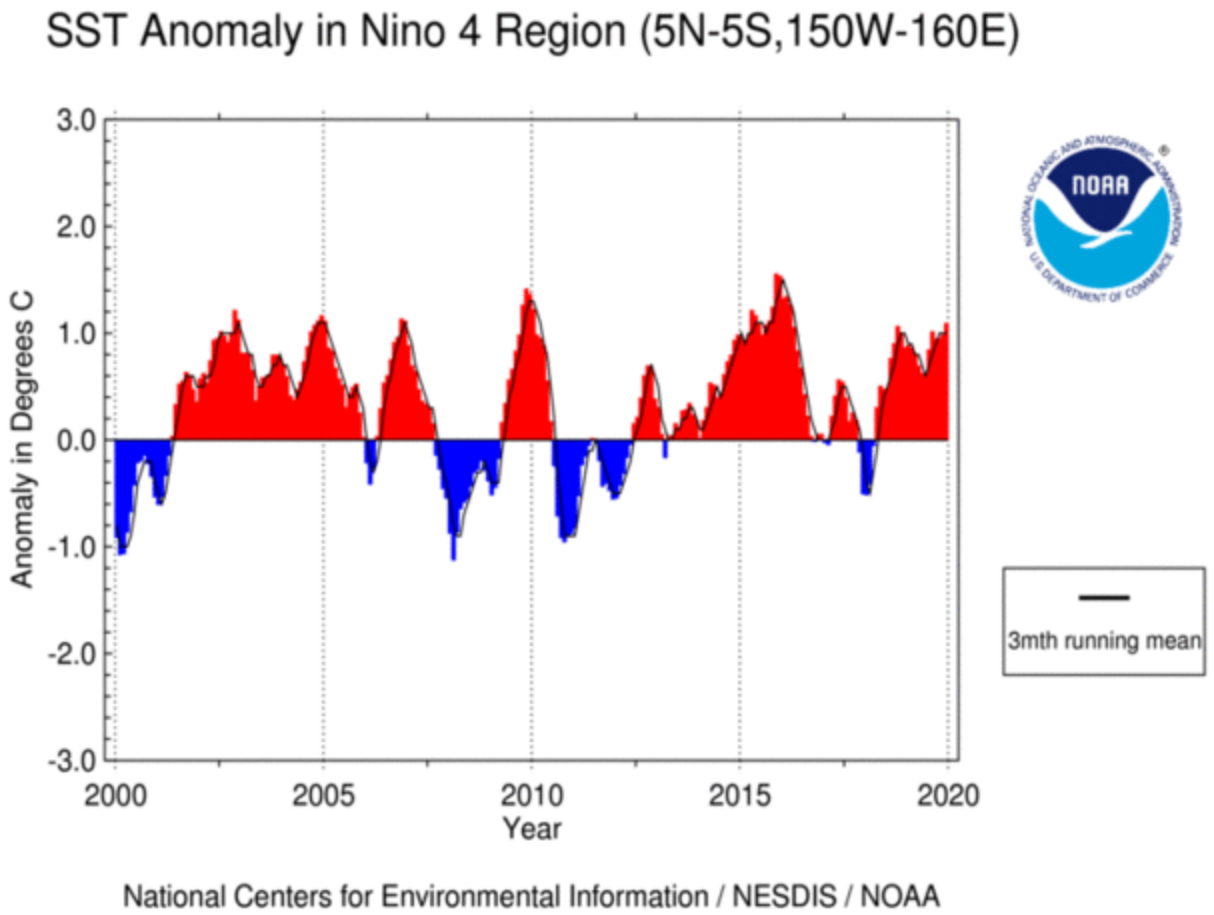
For example, **warmer** Sea Surface Temperature anomalies cause **larger** wind anomalies (weaker Trade Winds) which cause further **warming**.

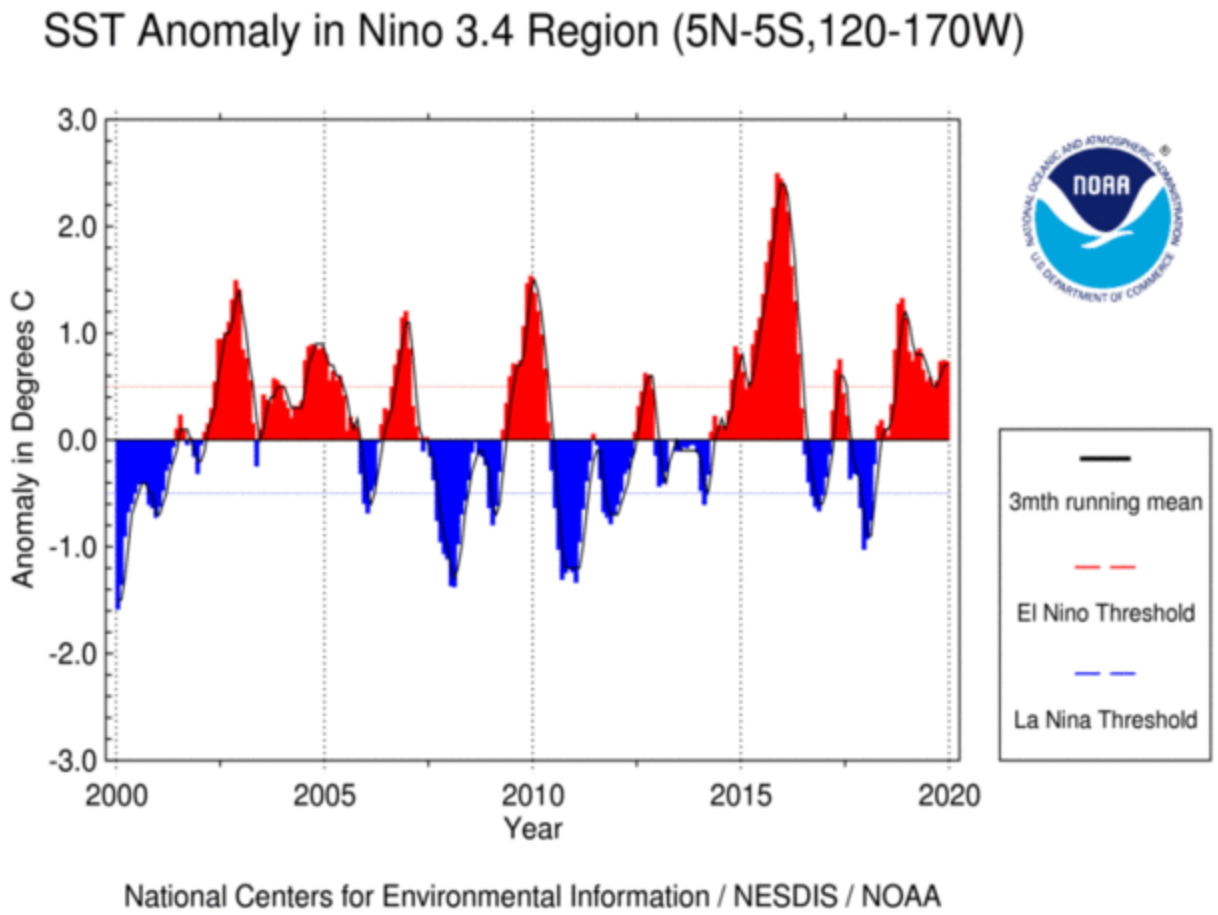
Positive feedback ("chain reaction") = Bigger event



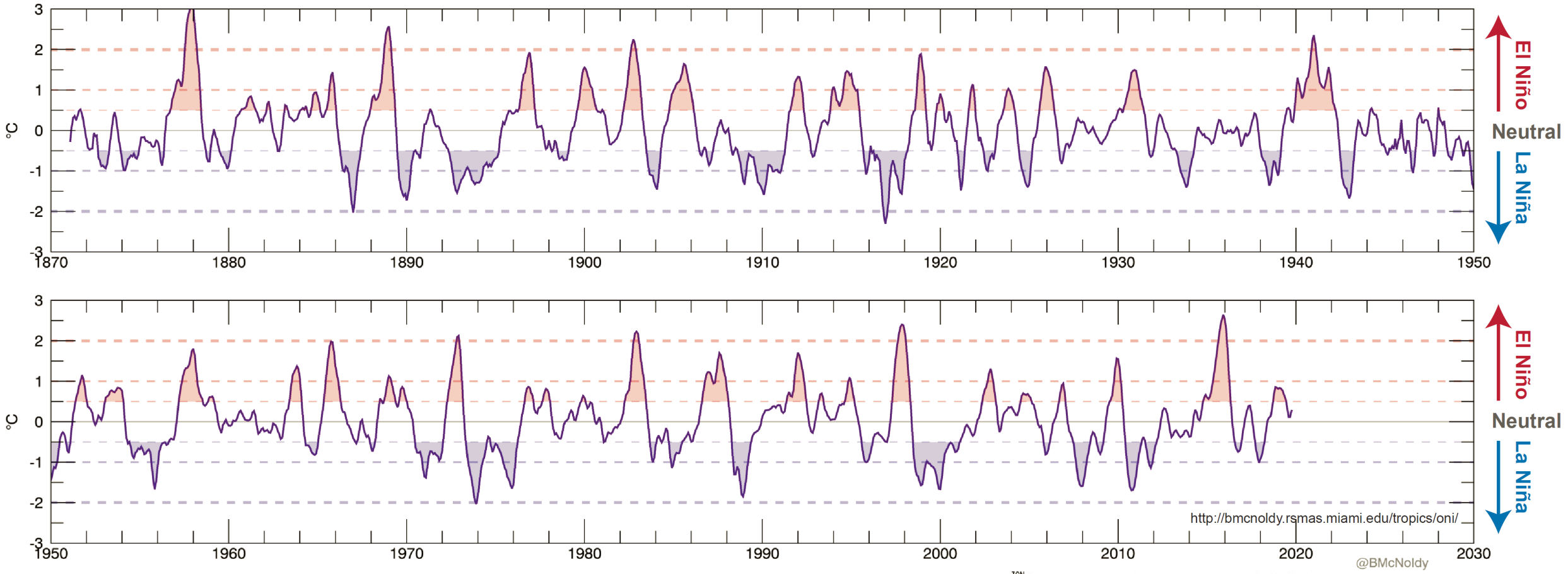
Measuring ENSO
(sea surface temperature index)



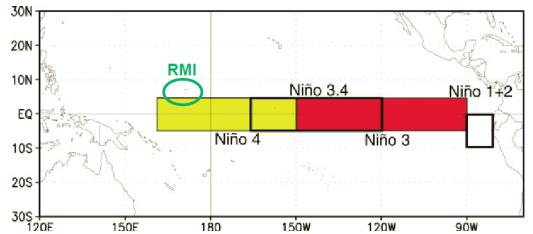




Oceanic Niño Index

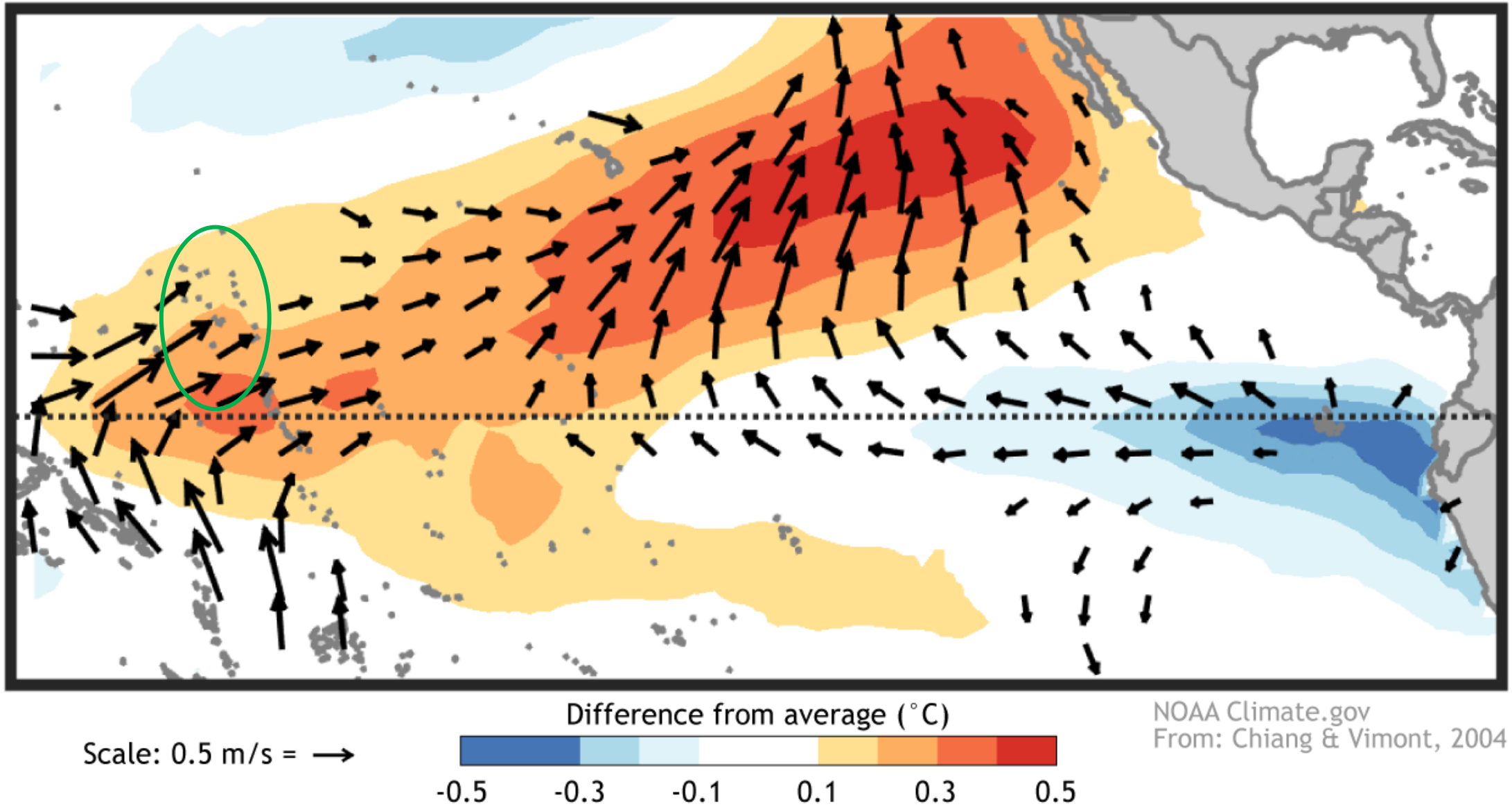


The **Oceanic Nino Index (ONI)** is one of the primary indices used by NOAA to monitor the **El Niño-Southern Oscillation (ENSO)**. The ONI is calculated by averaging **sea surface temperature** anomalies in an area of the east-central equatorial Pacific Ocean, which is called the **Niño-3.4 region** (5°S to 5°N; 170°W to 120°W). Monthly anomalies are with respect to a 30-year climatology, updated every 5 years (1856–1885, ..., 1981–2010, 1986–2015). Also, a 3-month time average (running mean) is calculated in order to better isolate variability closely related to the ENSO phenomenon.

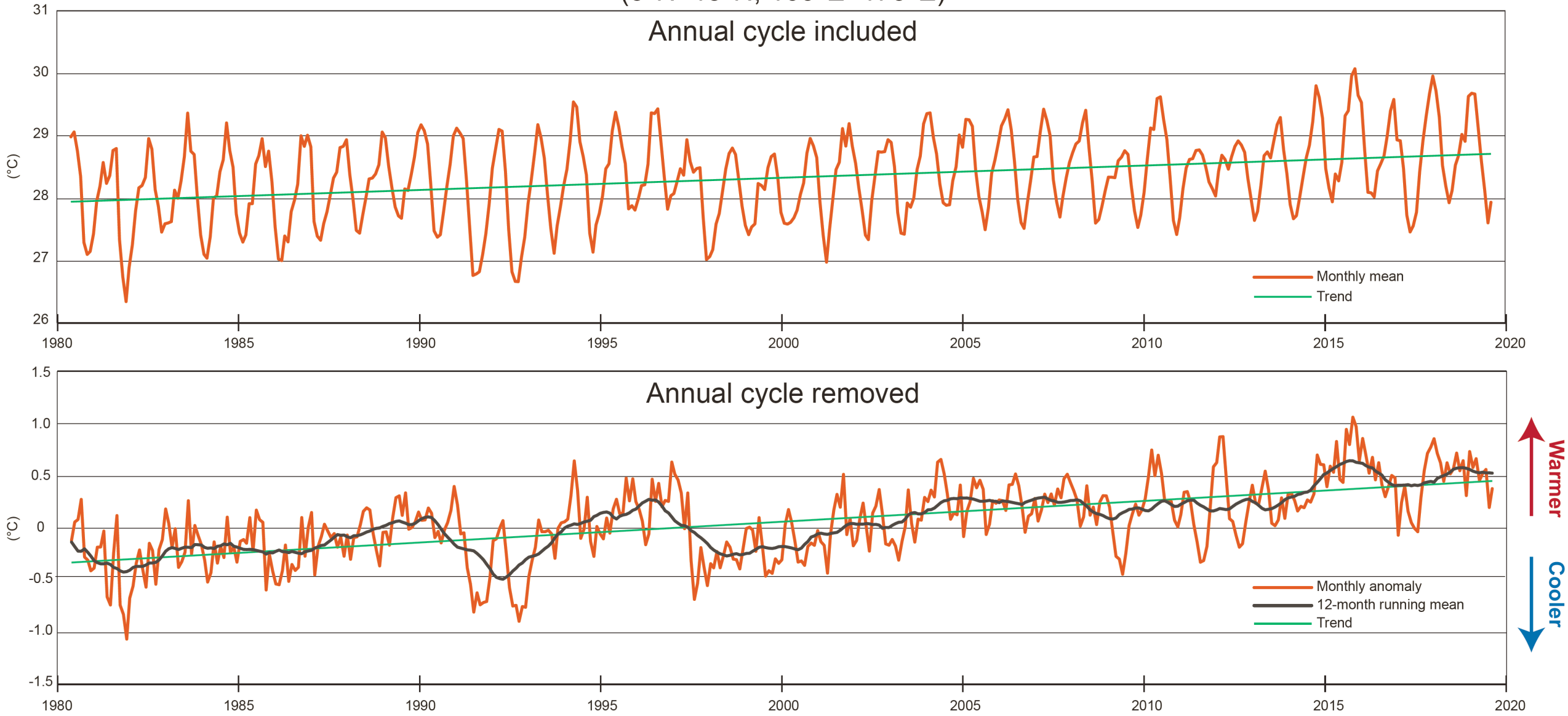


There are other modes (patterns and timescales) of variability

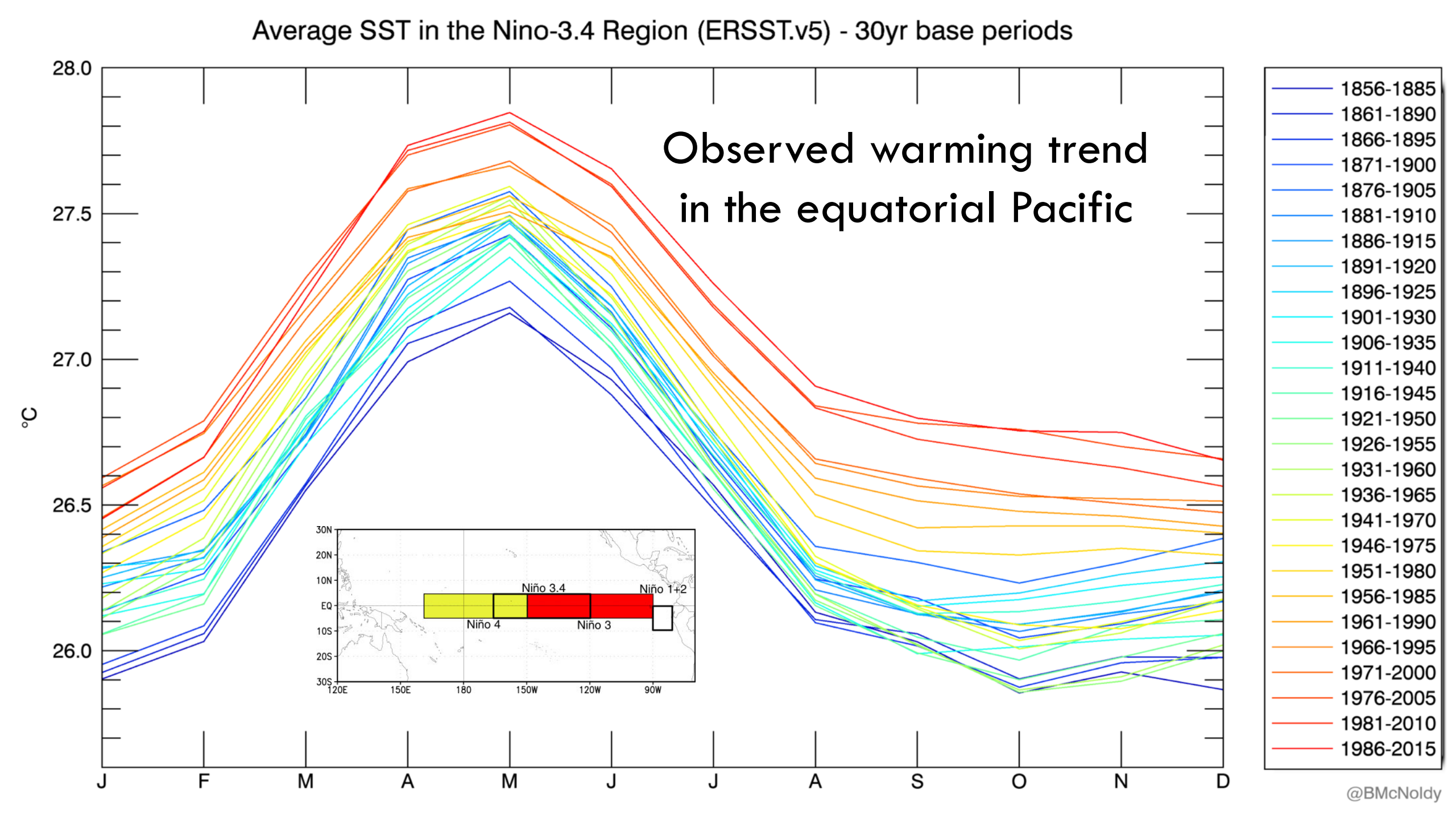
Pacific Meridional Mode sea surface temperature and 10m wind anomalies



Sea surface temperature around the Marshall Islands
(5°N–15°N, 160°E–173°E)



Global Blended Sea Surface Temperature (GHRSST) product from NOAA-NCEI plotted using the NASA Sea Level Portal Data Analysis Tool *https://sealevel.nasa.gov/data-analysis-tool/*.


Average SST in the Nino-3.4 Region (ERSST.v5) - 30yr base periods
Observed warming trend
in the equatorial Pacific
28.0
27.5
27.0
26.5
26.0
°C
J
F
M
A
M
J
J
A
S
O
N
D
Niño 3.4
Niño 1+2
Niño 4
Niño 3
30N
20N
10N
EQ
10S
20S
30S
120E
150E
180
150W
120W
90W
1856-1885
1861-1890
1866-1895
1871-1900
1876-1905
1881-1910
1886-1915
1891-1920
1896-1925
1901-1930
1906-1935
1911-1940
1916-1945
1921-1950
1926-1955
1931-1960
1936-1965
1941-1970
1946-1975
1951-1980
1956-1985
1961-1990
1966-1995
1971-2000
1976-2005
1981-2010
1986-2015
@BMcNoldy

Impacts of **high sea levels, ocean warming,** and **rainfall variability**

Huge waves and disease turn Marshall Islands into 'war zone,' health official says

By Los Angeles Times · Dec. 5, 2019

Opportunity for future outlooks (forecasts) of climate anomalies to benefit society

Part 2

Forecasting climate variability and change

a) Sea level

b) Temperature (sea surface)

c) Rainfall

How are climate forecasts made?

EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

issued by
CLIMATE PREDICTION CENTER/NCEP/NWS
and the International Research Institute for Climate and Society

9 January 2020

ENSO Alert System Status: Not Active

Synopsis: **ENSO-neutral is favored through Northern Hemisphere spring 2020 (~60% chance), continuing through summer 2020 (~50% chance).**

During December 2019, near-to-above-average sea surface temperatures (SSTs) were evident over the equatorial Pacific Ocean [Fig. 1]. Most SST indices increased in the past week, with the eastern Niño-1+2 and Niño-3 regions remaining near average (+0.1°C to +0.3°C), while the Niño-4 and Niño-3.4 regions were warmer at +1.2°C and +0.7°C, respectively [Fig. 2]. The recent increase in SST anomalies was partially driven by a combination of low-level westerly wind anomalies and the growth in positive equatorial subsurface temperature anomalies (averaged across 180°-100°W; [Fig. 3]). The latter indicates a downwelling Kelvin wave, which was evident in the above-average temperatures in the central and east-central Pacific Ocean [Fig. 4]. Over the month, westerly wind anomalies persisted over small regions of the western and eastern equatorial Pacific Ocean, while upper-level winds were near average over most of the equator. Tropical convection remained suppressed over Indonesia and east of the Date Line, and was enhanced to the west of the Date Line [Fig. 5]. The overall oceanic and atmospheric system was consistent with ENSO-neutral, though recent observations reflected a trend toward warmer conditions that will be monitored.

The majority of models in the IRI/CPC plume [Fig. 6] continue to mostly favor ENSO-neutral (Niño-3.4 index between -0.5°C and +0.5°C) through the Northern Hemisphere summer. For the December 2019-February 2020 season, the Niño-3.4 index is predicted to be near +0.5°C, which is consistent with the latest observations. The forecasters also favor above-average ocean temperatures to continue in the next month or two, but, in alignment with most model guidance, do not foresee a continuation over several consecutive seasons or shifts in the atmospheric circulation that would indicate El Niño. In summary, ENSO-neutral is favored through Northern Hemisphere spring 2020 (~60% chance), continuing through summer 2020 (~50% chance; click CPC/IRI consensus forecast for the chance of each outcome for each 3-month period).

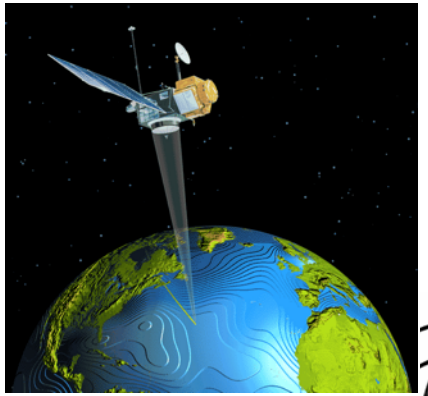
This discussion is a consolidated effort of the National Oceanic and Atmospheric Administration (NOAA), NOAA's National Weather Service, and their funded institutions. Oceanic and atmospheric conditions are updated weekly on the Climate Prediction Center web site (El Niño/La Niña Current Conditions and Expert Discussions). Forecasts are also updated monthly in the Forecast Forum of CPCs Climate Diagnostics Bulletin. Additional perspectives and analysis are also available in an ENSO blog. The next ENSO Diagnostics Discussion is scheduled for 13 February 2020.

To receive an e-mail notification when the monthly ENSO Diagnostic Discussions are released, please send an e-mail message to: ncep.list.enso-update@noaa.gov.

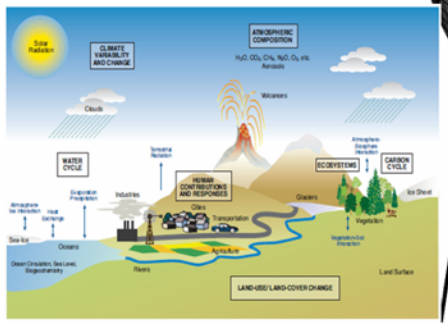
Climate Prediction Center
5830 University Research Court
College Park, Maryland 20740

Pathway to making a seasonal climate forecast

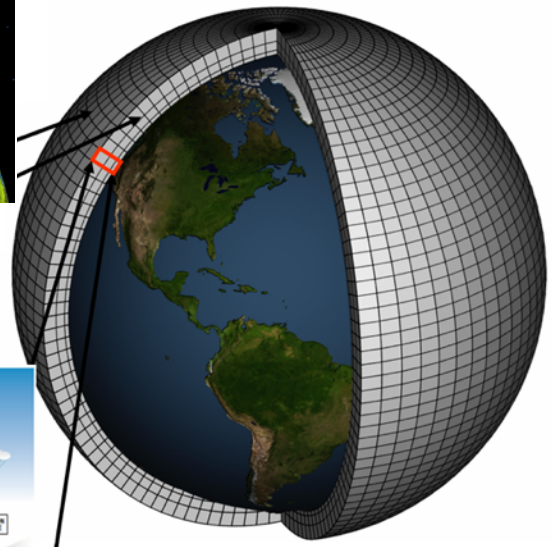
Observing → **Modeling** → **Computing** → **Processing** → **Communicating**



Forecasts start from observations.



Computer code to **solve equations of physical processes.**



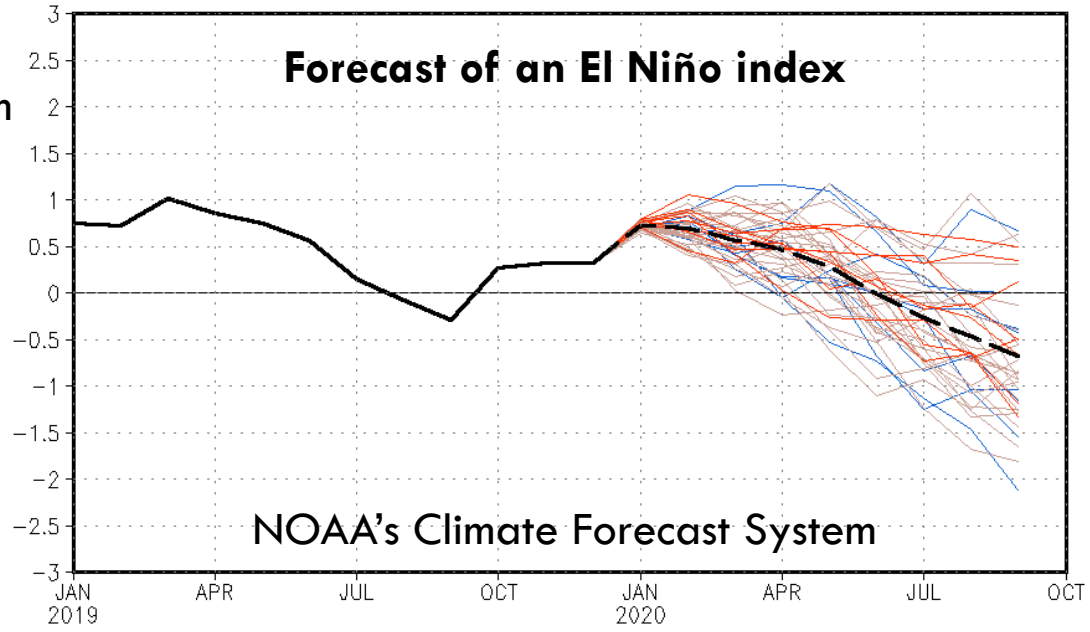
NOAA's weather and climate computing system can perform > **8 quadrillion (10^{15}) calculations per second** (*petaflops*).

Many simulations (ensembles) are assessed to **calculate skill** compared to past observations and statistically adjusted.

Interpretation?

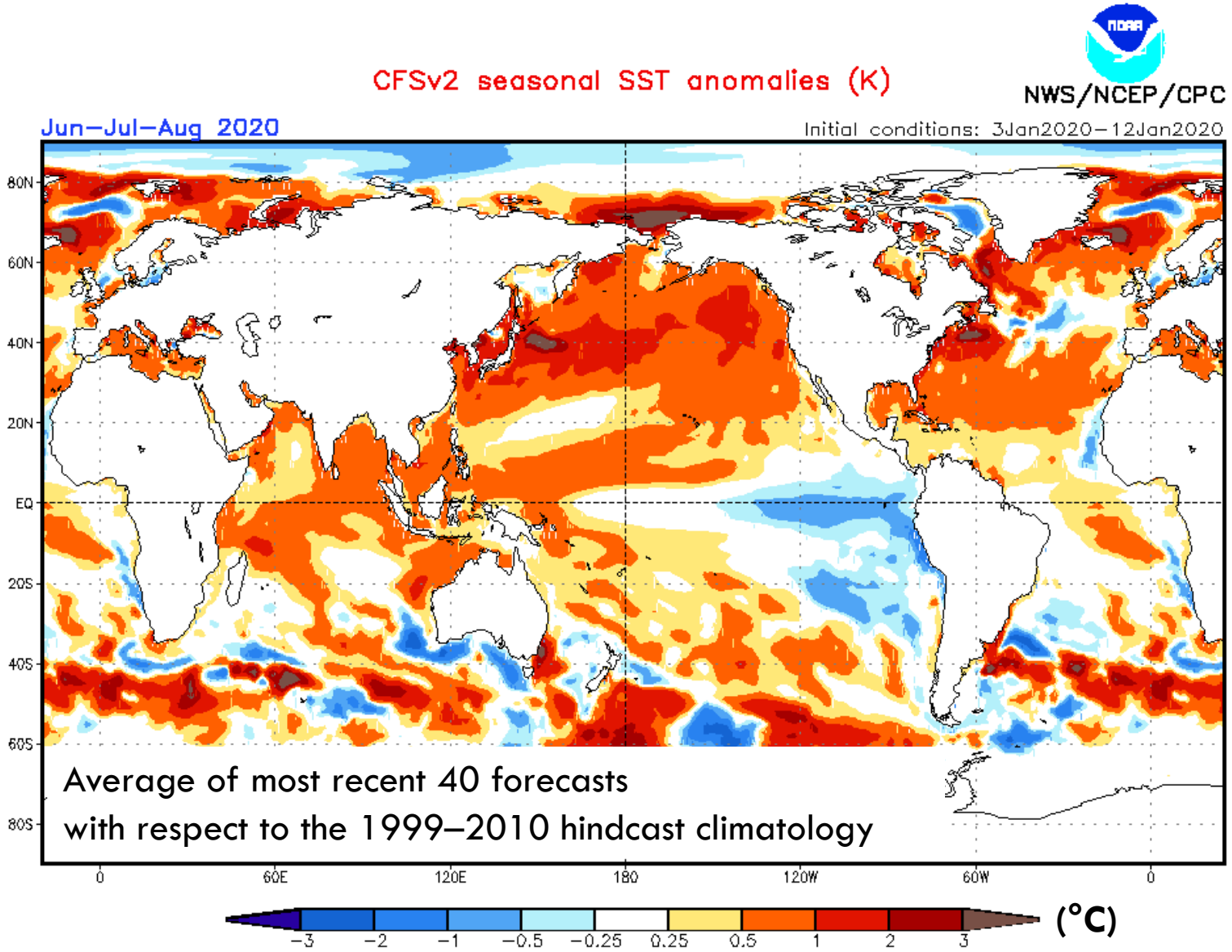
Application?

Uncertainty?



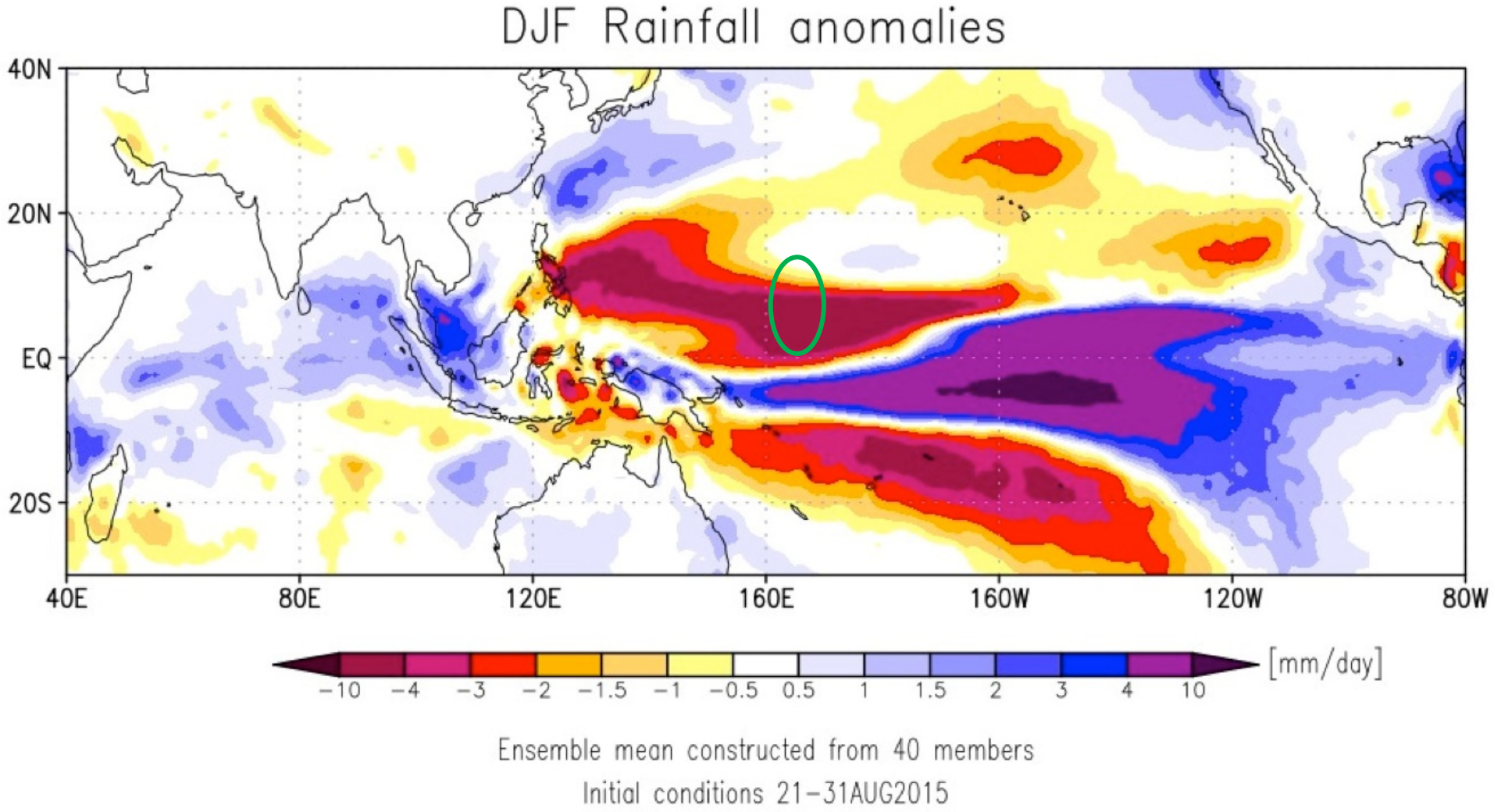
NOAA Climate Prediction Center's

Sea Surface Temperature forecast for summer 2020



Warmer than normal for RMI

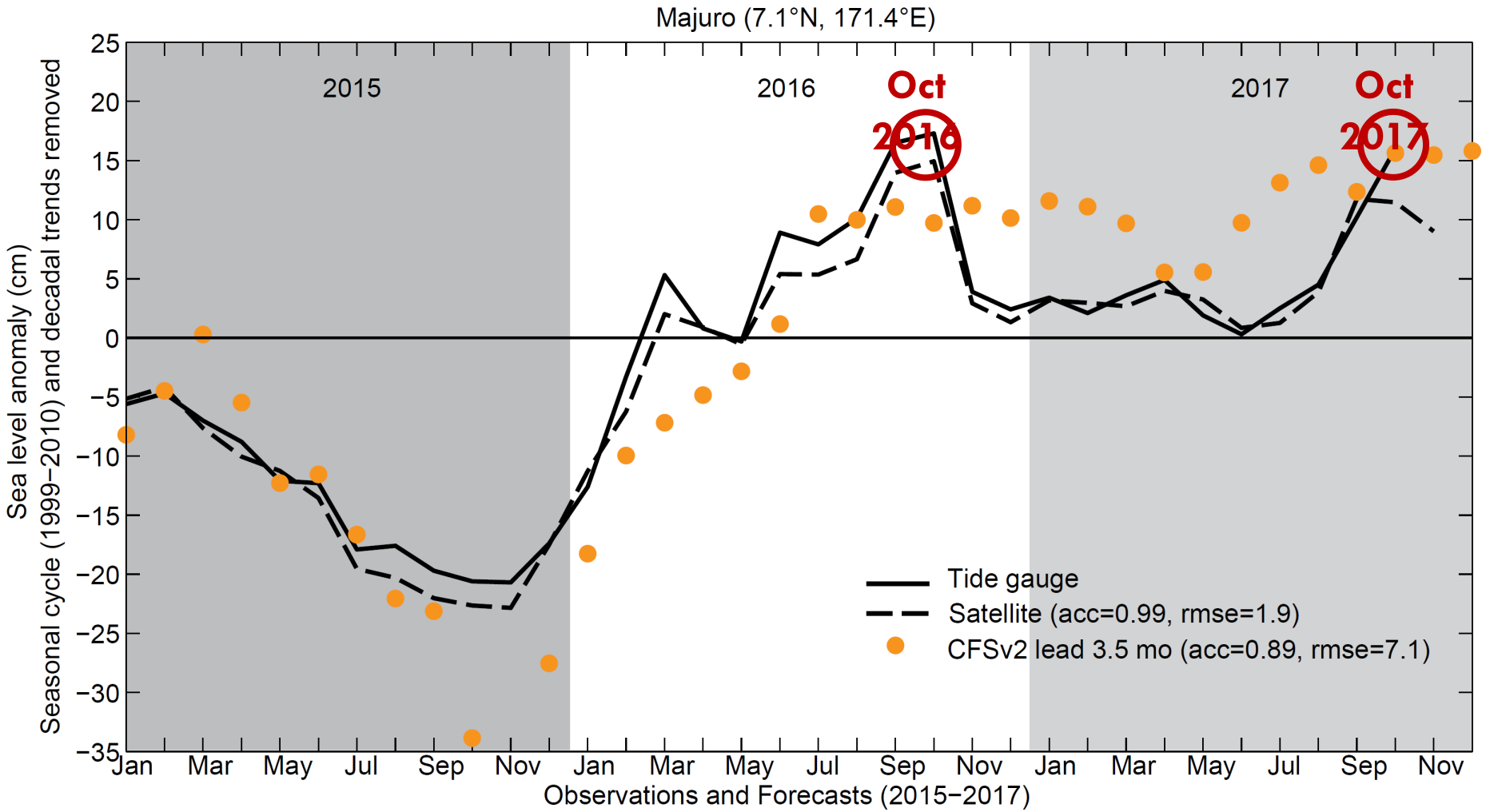
Marshall Islands 2016 drought was well predicted



Climate model forecast from August 2015 for Dec–Feb

Annamalai et al. 2015, *AsiaPacific Issues*

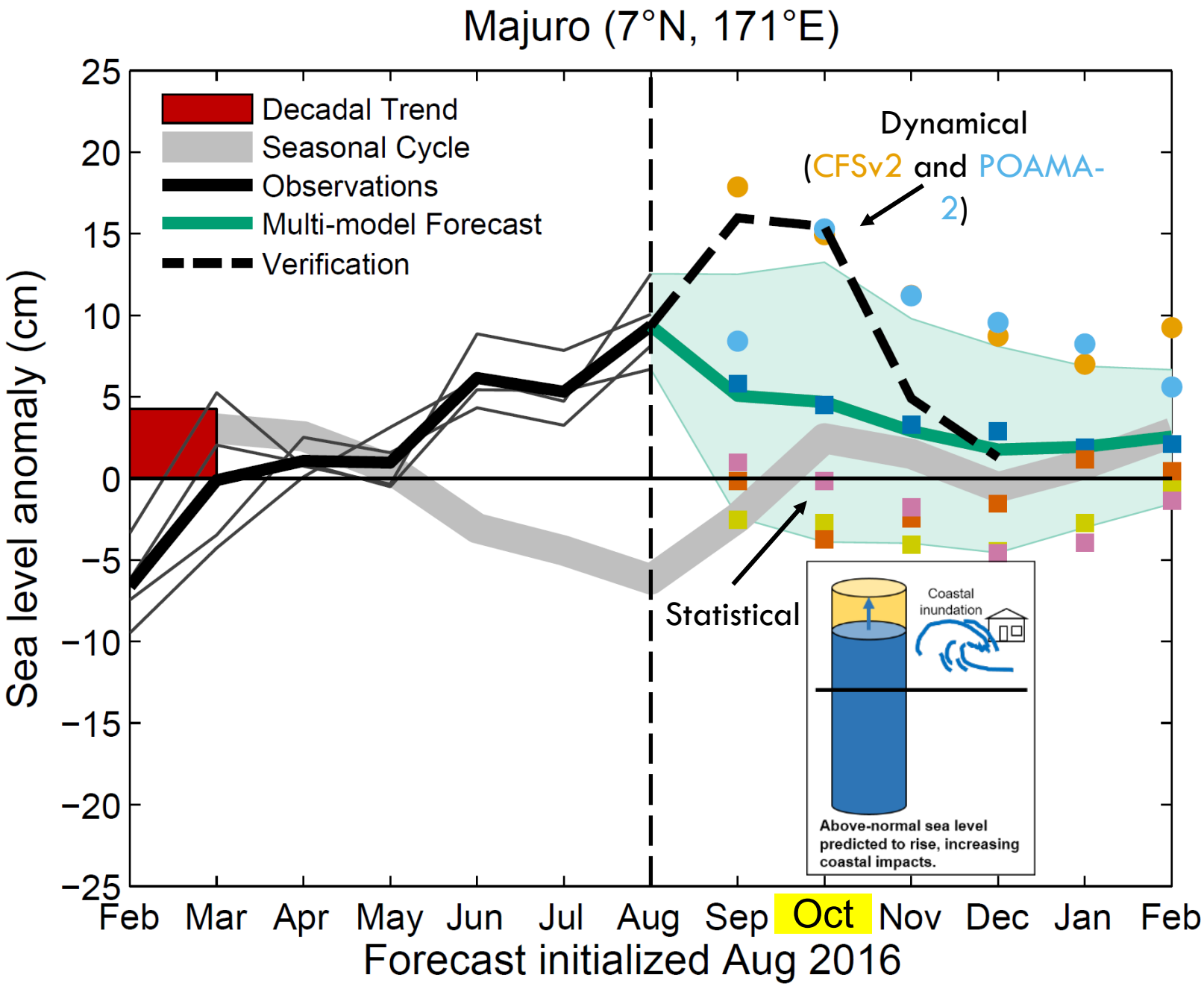
Forecasting high sea levels in southern Micronesia



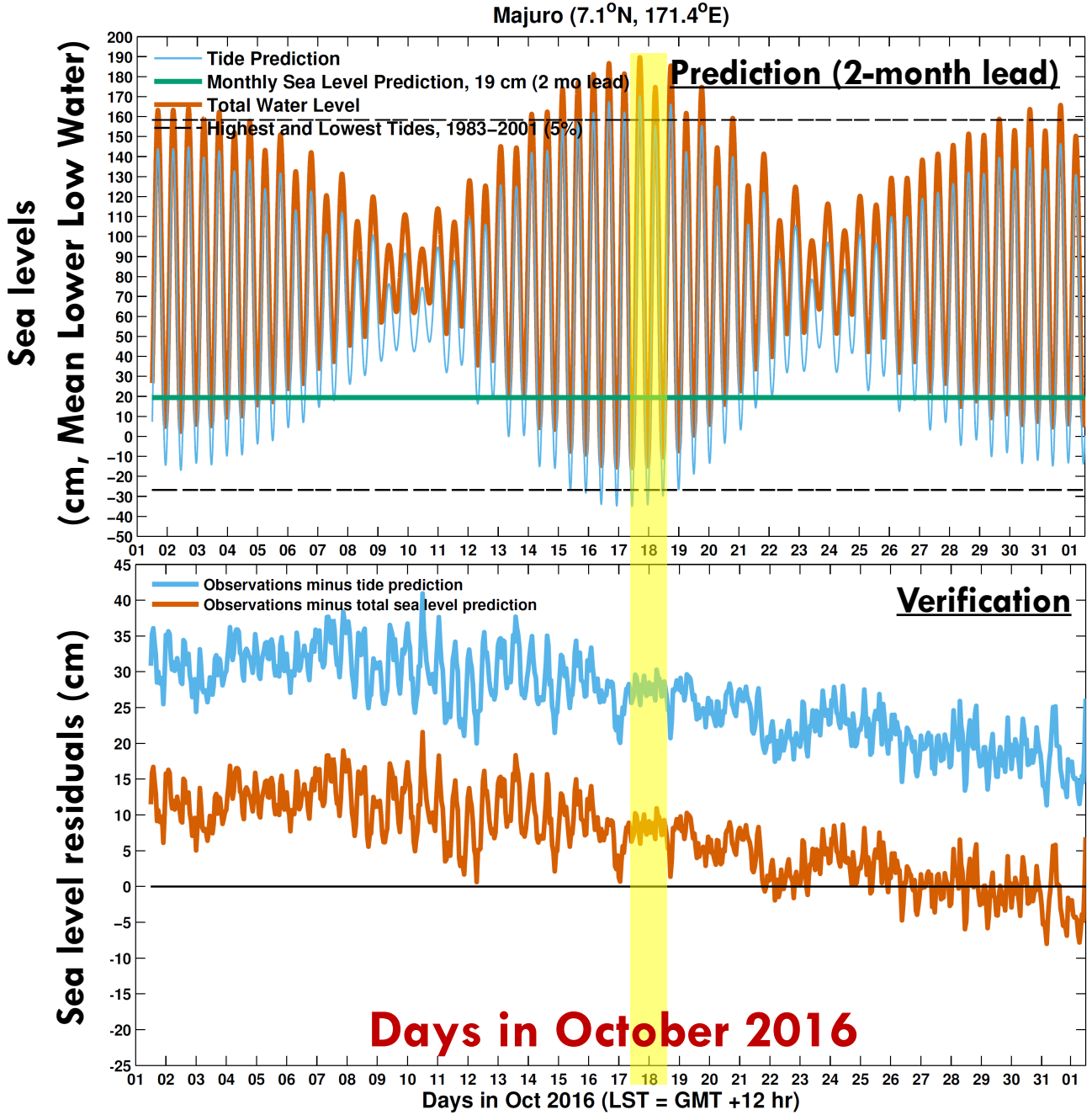
Lead 3 month real-time forecasts

**with post-processing (bias-correction and model-drifts removed)*

August 2016 forecast



Above-normal sea levels elevated October tides



Higher water levels, more extremely high tides

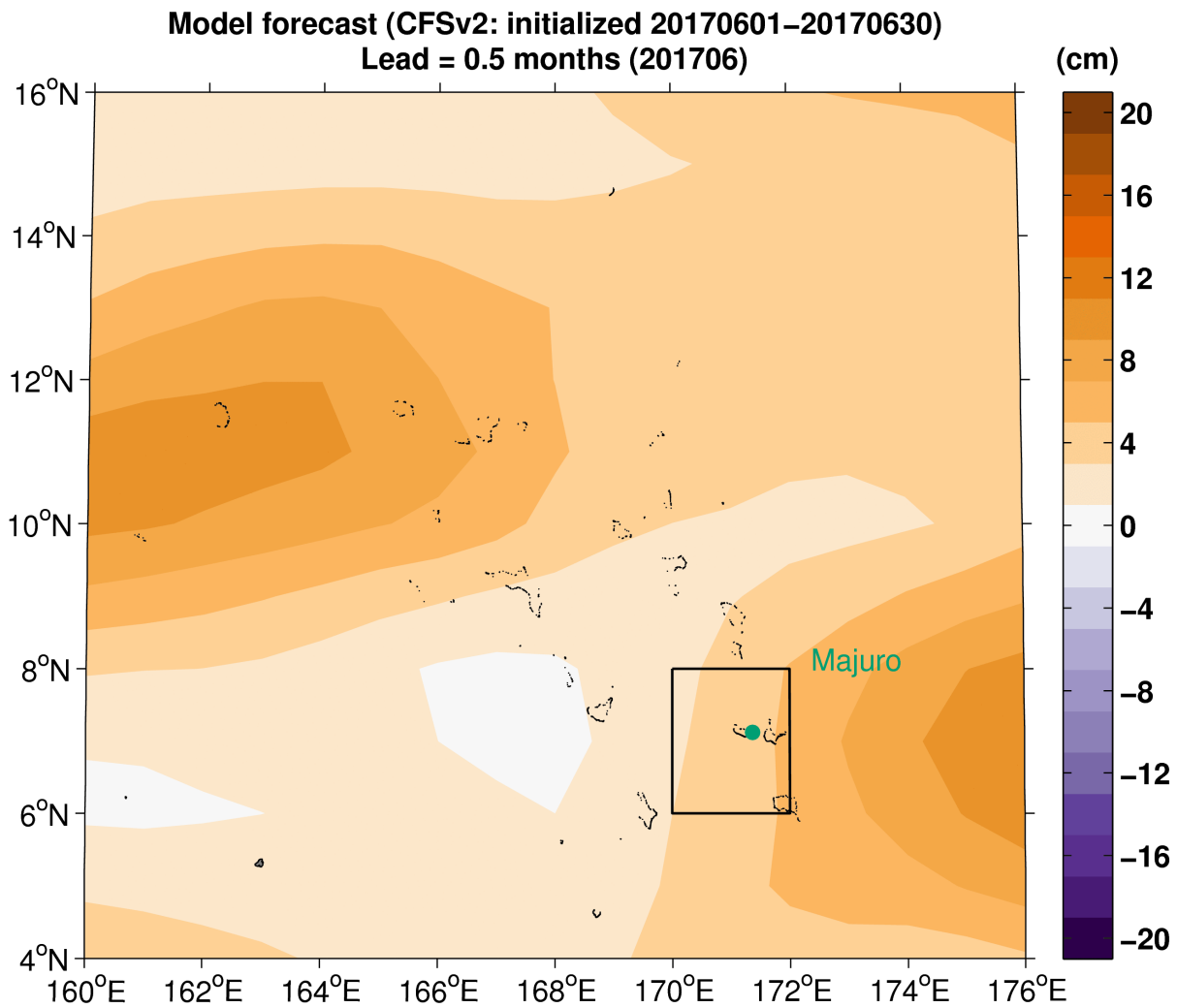
+19 cm (decadal trend + monthly forecast anomaly)
dynamical models only

Observed hourly water levels ~30 cm above classical tide prediction

Total sea level prediction closer to observed

Fall 2017: *"Recurrent"* flooding likely for southern Marshall Islands

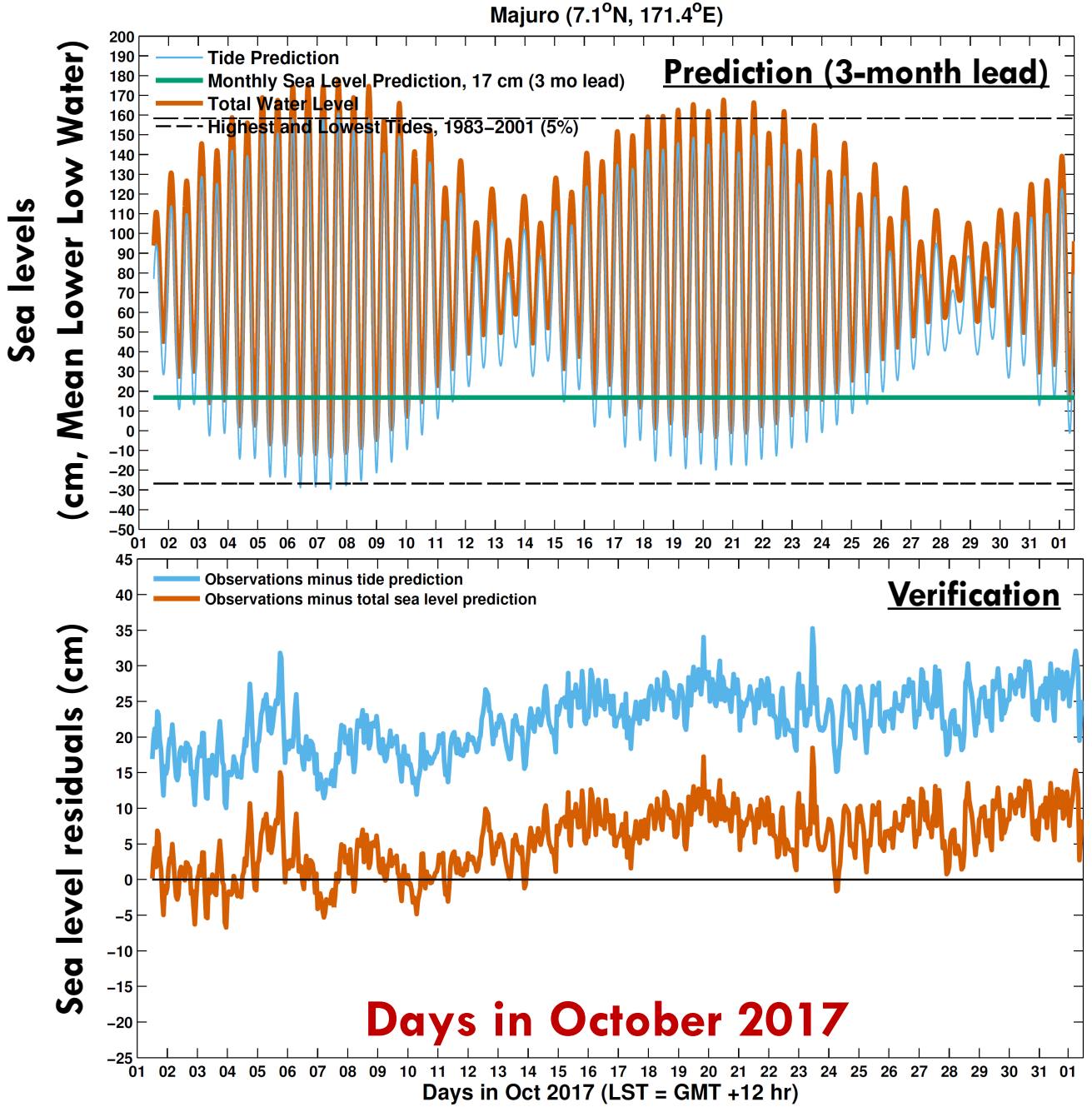
Average of 120-forecast members from NOAA's CFSv2 for June–December 2017



Verification

	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TG'	0 cm	3 cm	5 cm	10 cm	16 cm		
SAT'	1 cm	1 cm	4 cm	12 cm	12 cm	9 cm	14 cm

Above-normal sea levels elevated October tides



Higher water levels, more extremely high tides

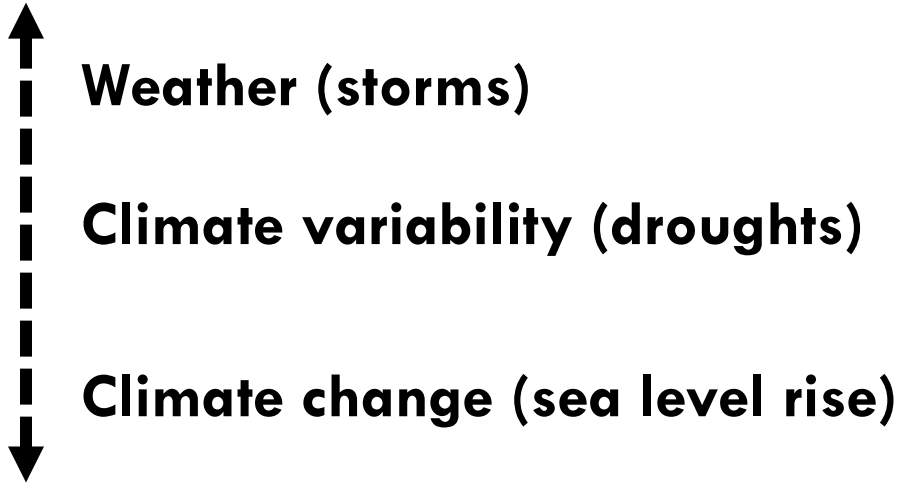
+17 cm (decadal trend + monthly forecast anomaly)
CFSv2 model only

Observed hourly water levels ~25 cm above classical tide prediction

Total sea level prediction closer to observed

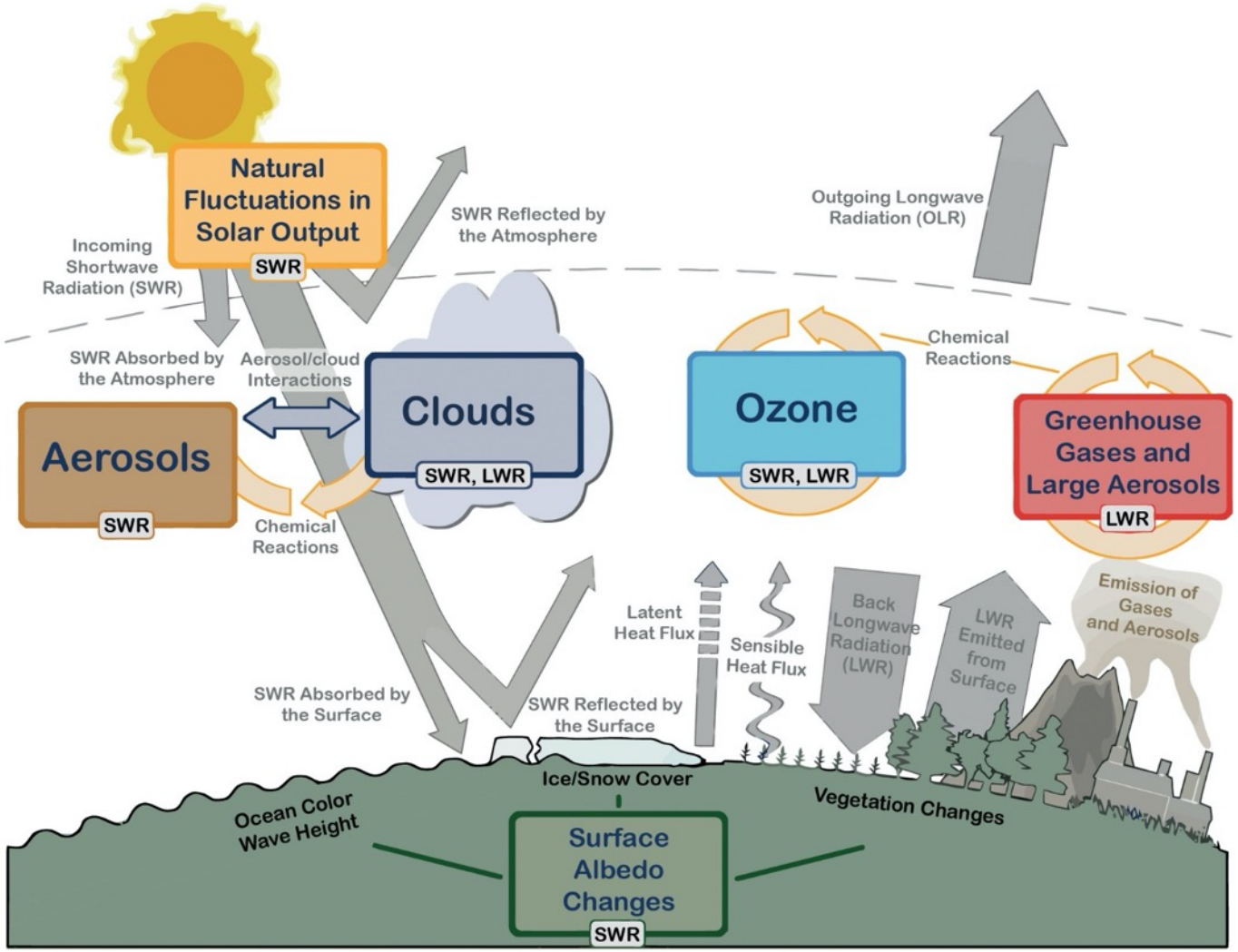
Forecast timescales

Predictions start from best understanding of *current* conditions **(observation)** and advance forward in time **(forecast).**



Projections start from any *realistic* condition **(climate)** and advance forward in time following a **scenario.**

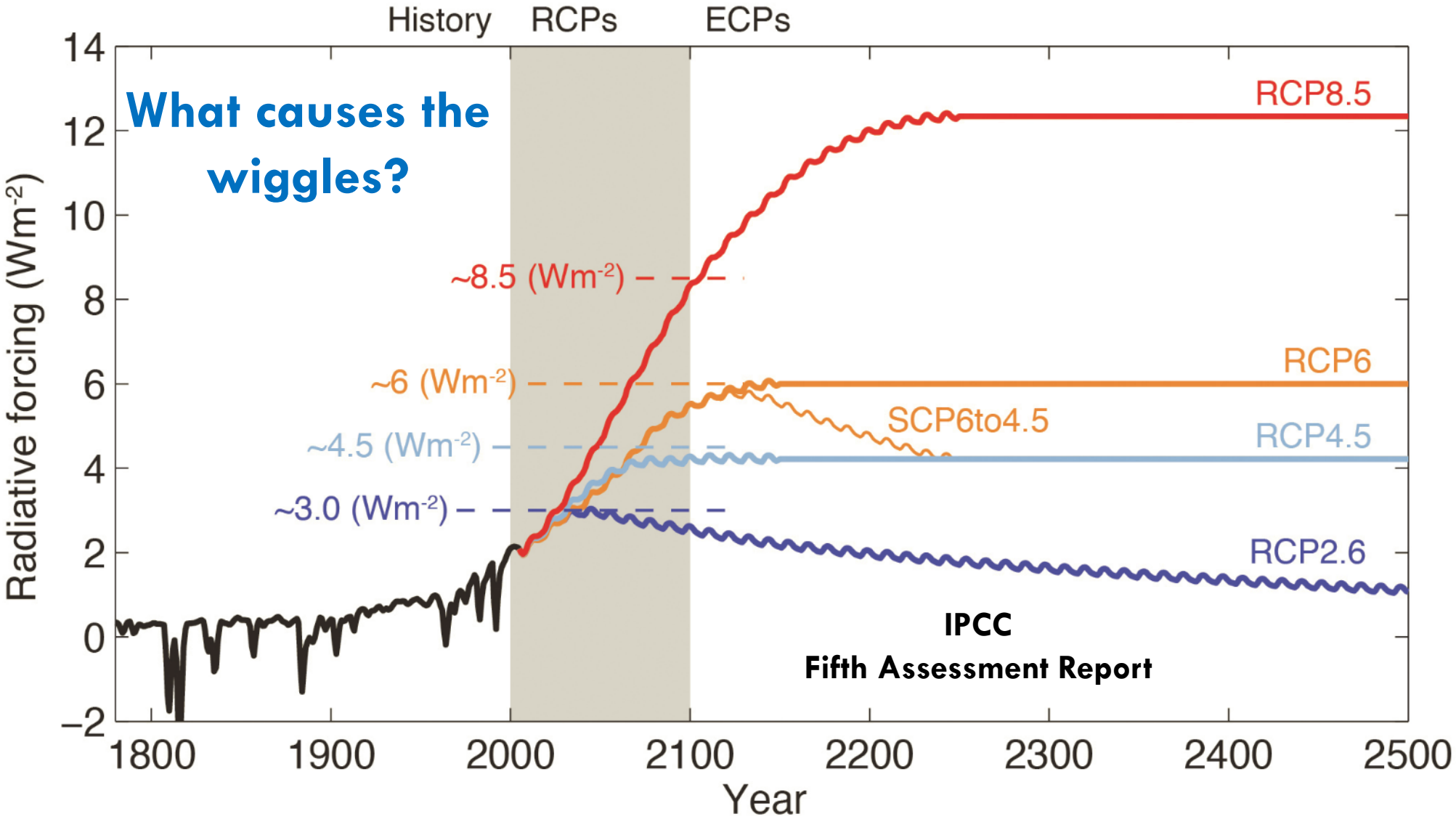
Main drivers of climate change (decades to centuries)



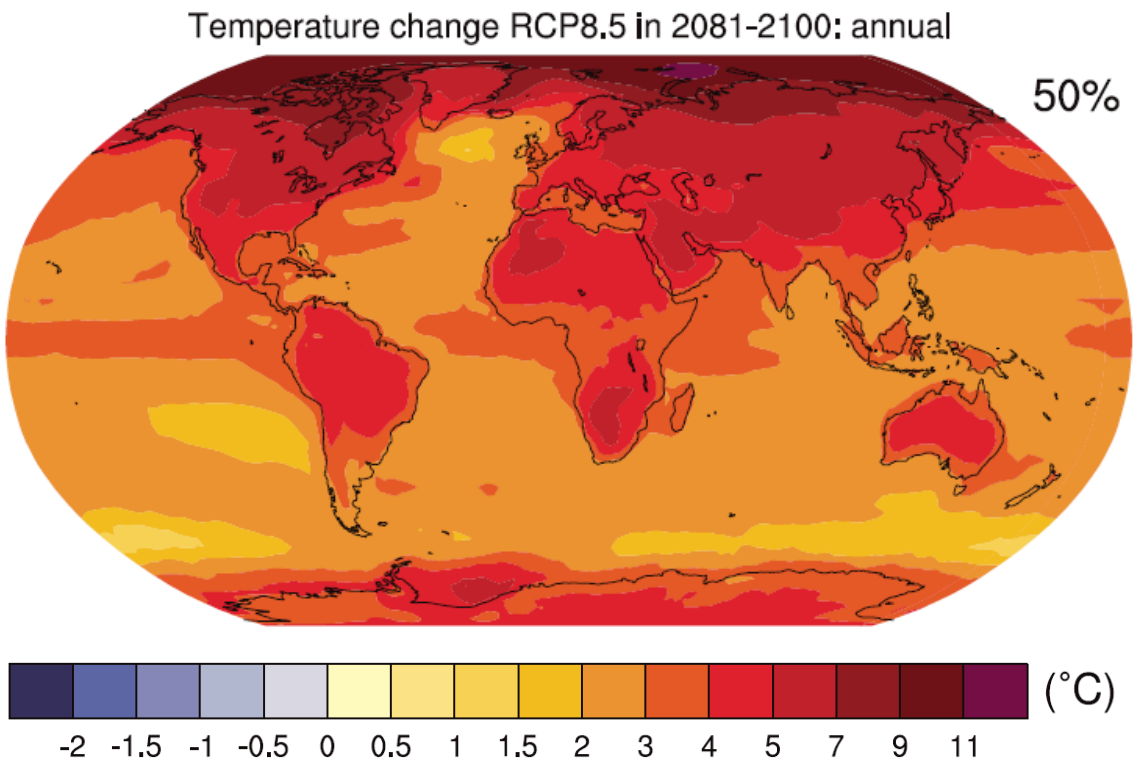
IPCC
Fifth Assessment Report
Figure 1

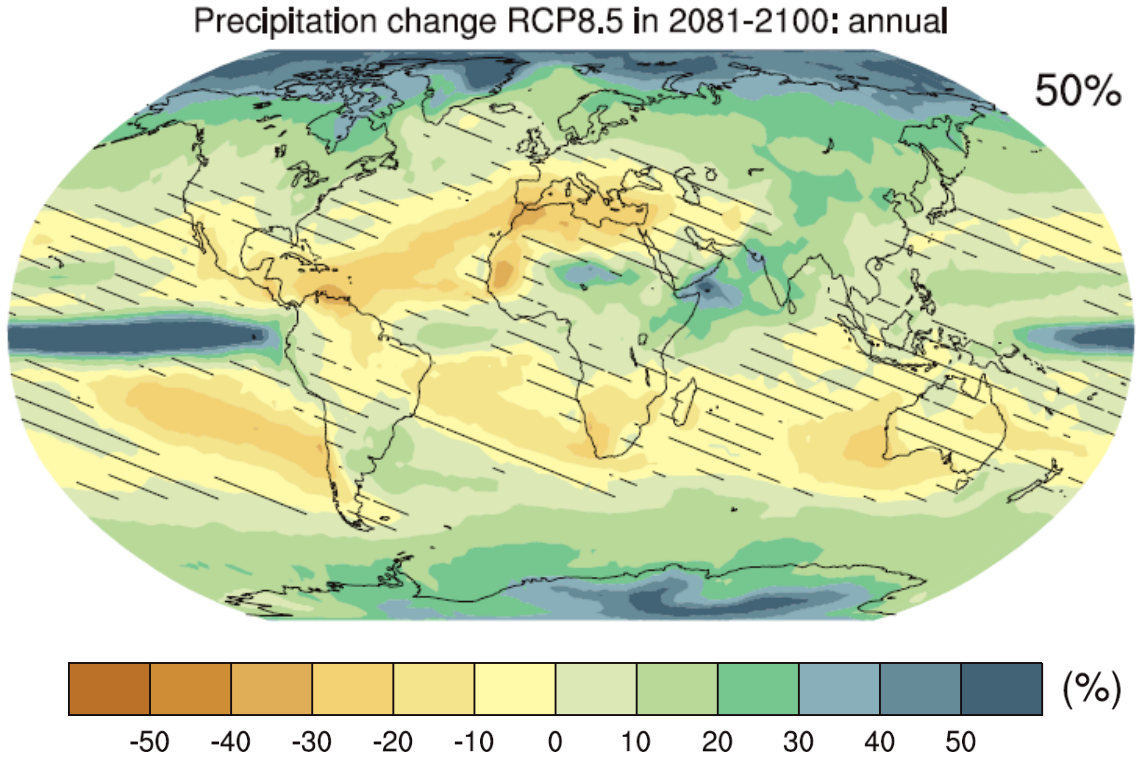
Radiative balance between incoming solar shortwave radiation (SWR) and outgoing longwave radiation (OLR)

Representative Concentration Pathway (RCP) Scenarios: How much greenhouse warming?



End-of-century **projections** from climate models





3°C ≈ 5°F

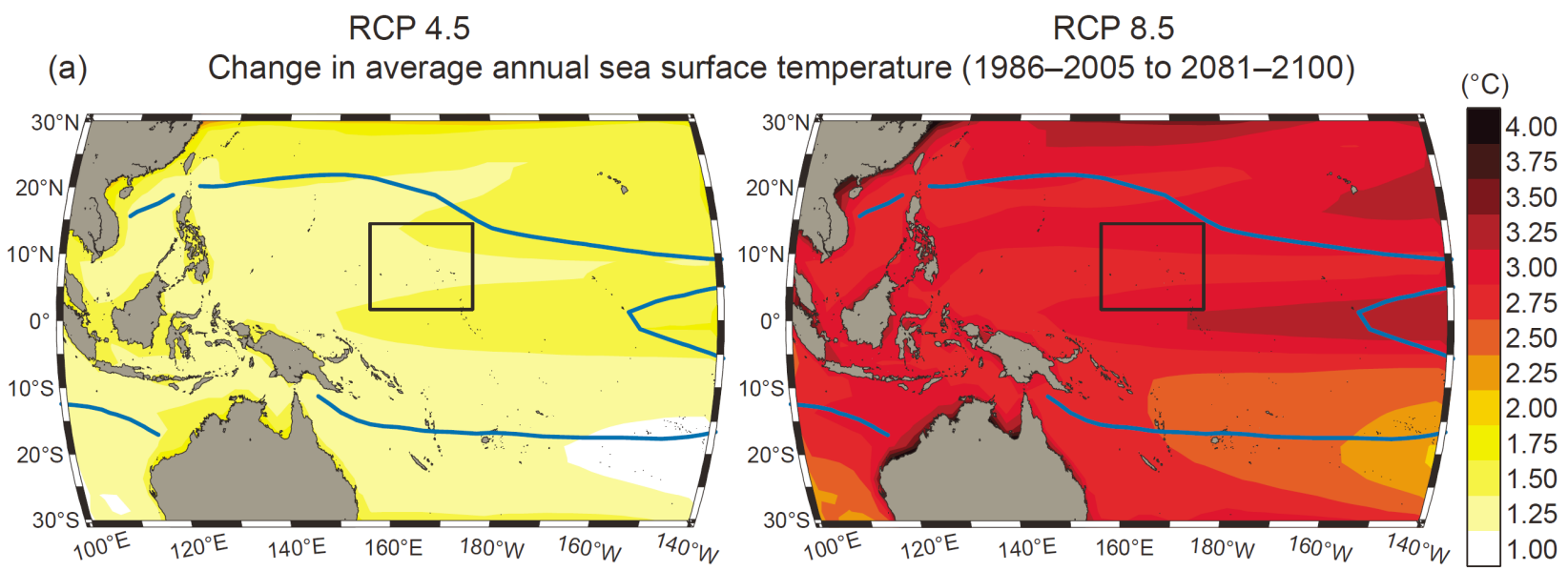
Hatching indicates ***uncertainty***

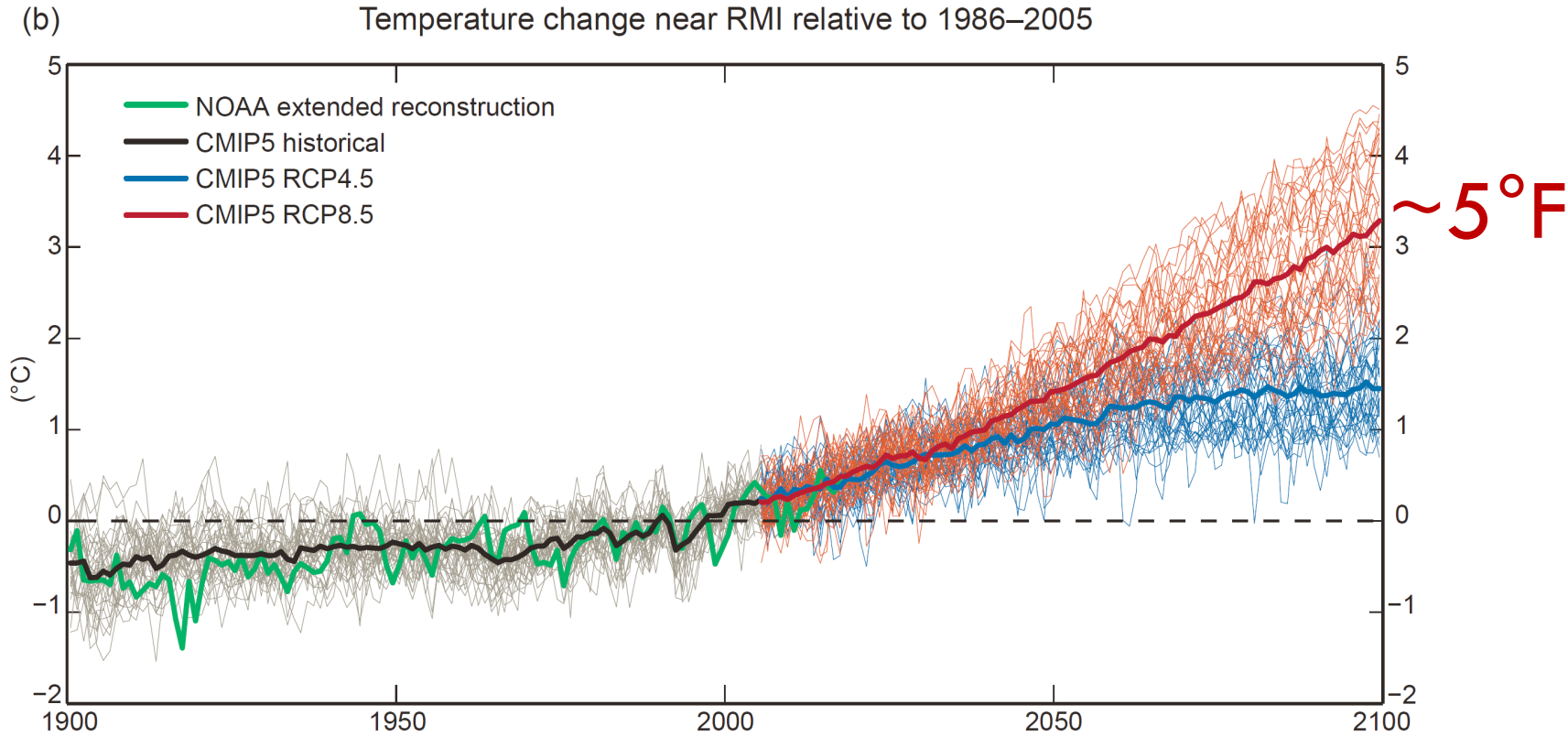
IPCC
Fifth Assessment Report

Continued warming

almost certain

for RMI



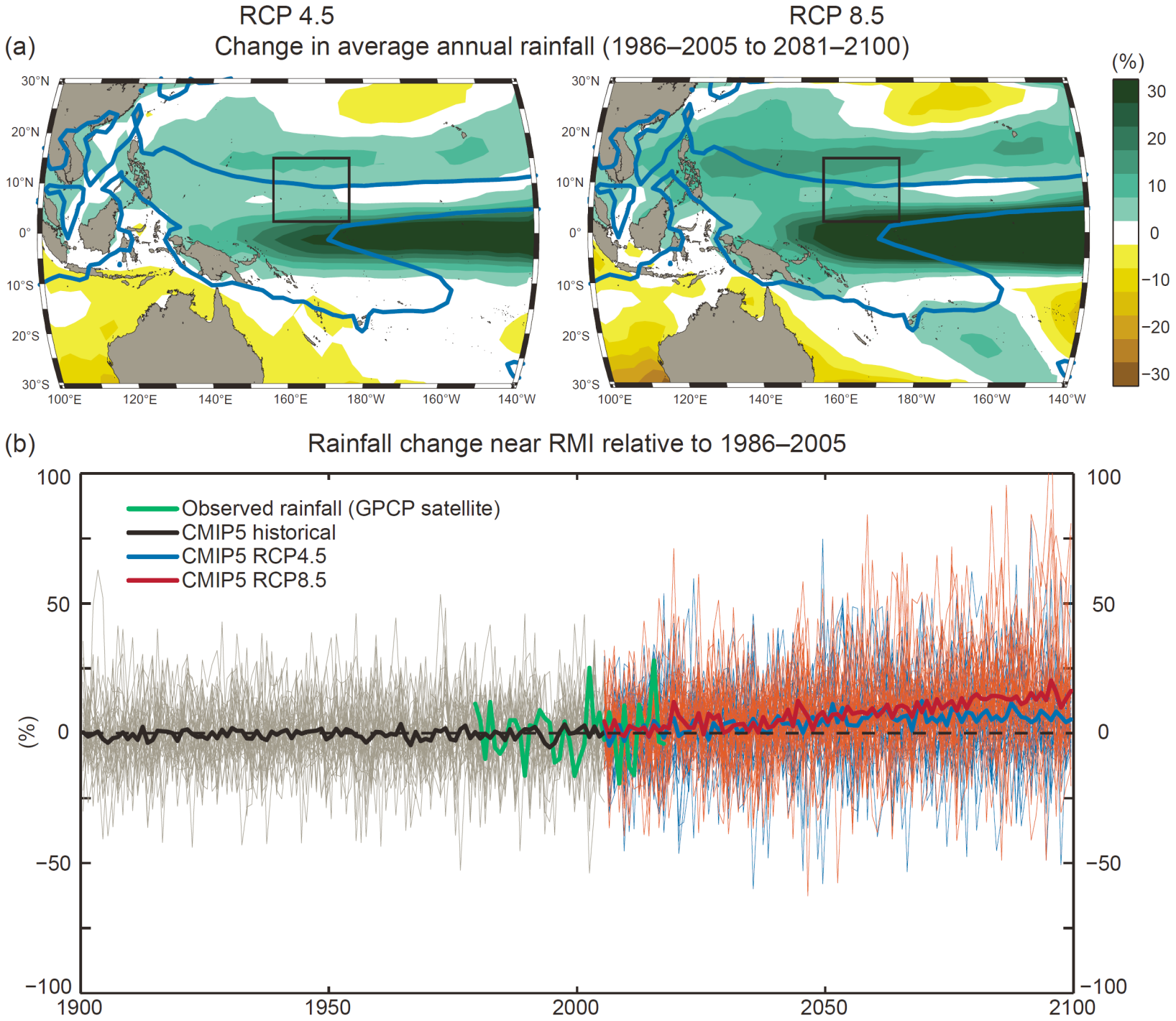


~5°F

Increased rainfall

likely

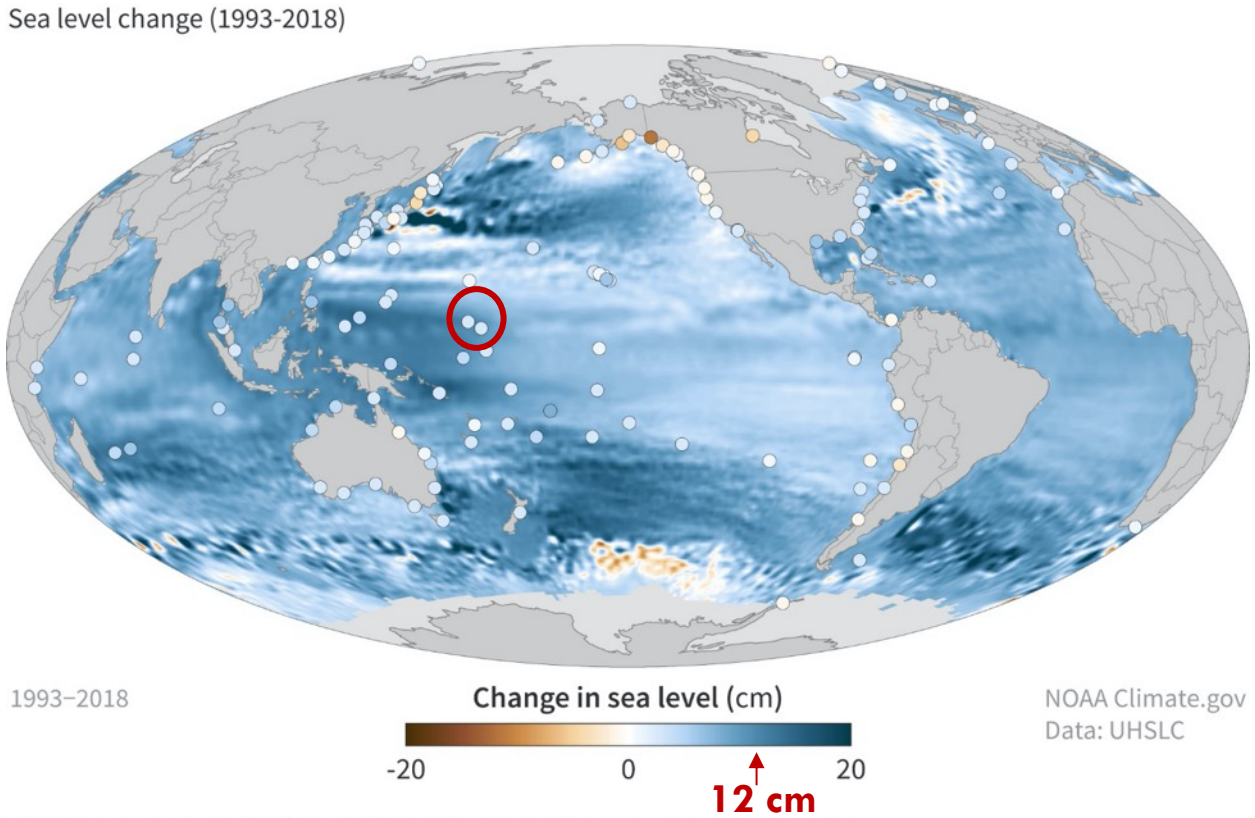
for RMI

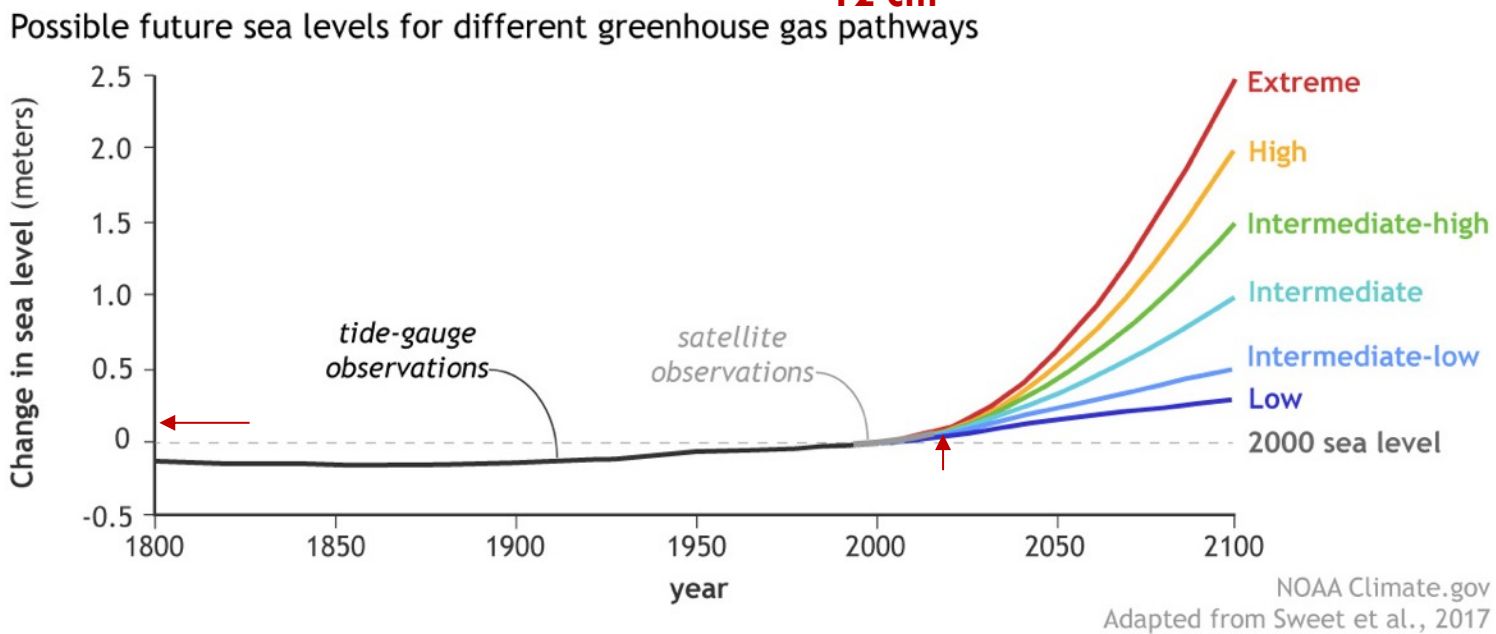


Continued sea level rise

almost certain

for RMI





Part 3

Communicating climate variability and change

Resources

NATIONAL WEATHER SERVICE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HOME | FORECAST | PAST WEATHER | SAFETY | INFORMATION | EDUCATION | NEWS | SEARCH | ABOUT

Local forecast by "City, St" or ZIP code

Enter location ... Go

Location Help

News Headlines

- Hafa Adai from the Guam Weather Forecast Office!

Active Watches, Warnings, and Advisories

Tiyan, GU
Weather Forecast Office

Click on a box below to see the watches, warnings and advisories in effect for that area.

Marianas

Guam | Rota | Tinian | Saipan

Palau / Yap / Micronesia / Marshall Islands

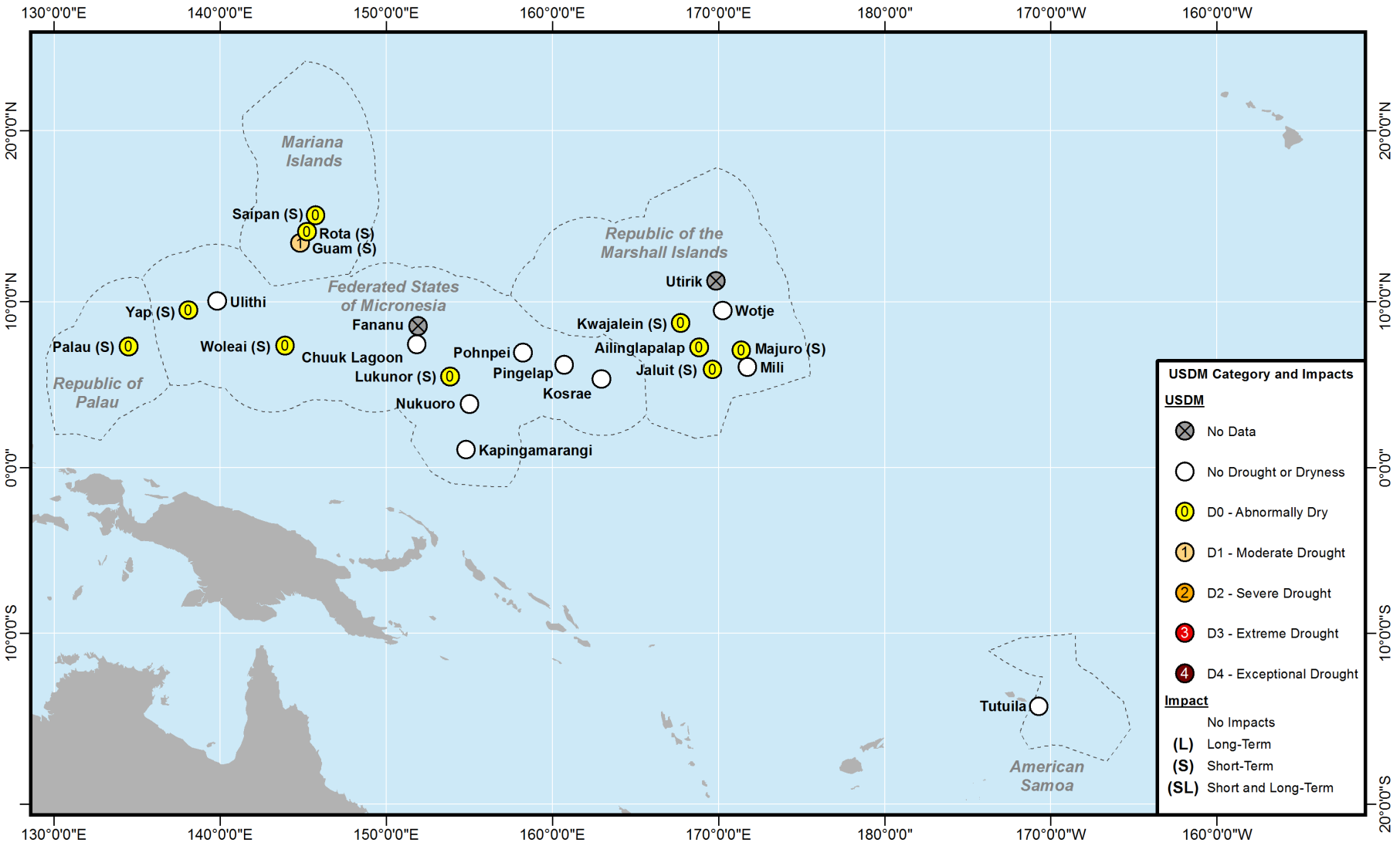
Palau | Yap | Chuuk | Pohnpei / Kosrae | Majuro

No Active Watches and Warning for Majuro

U.S. Drought Monitor

U.S. Affiliated Pacific Islands

January 21, 2020



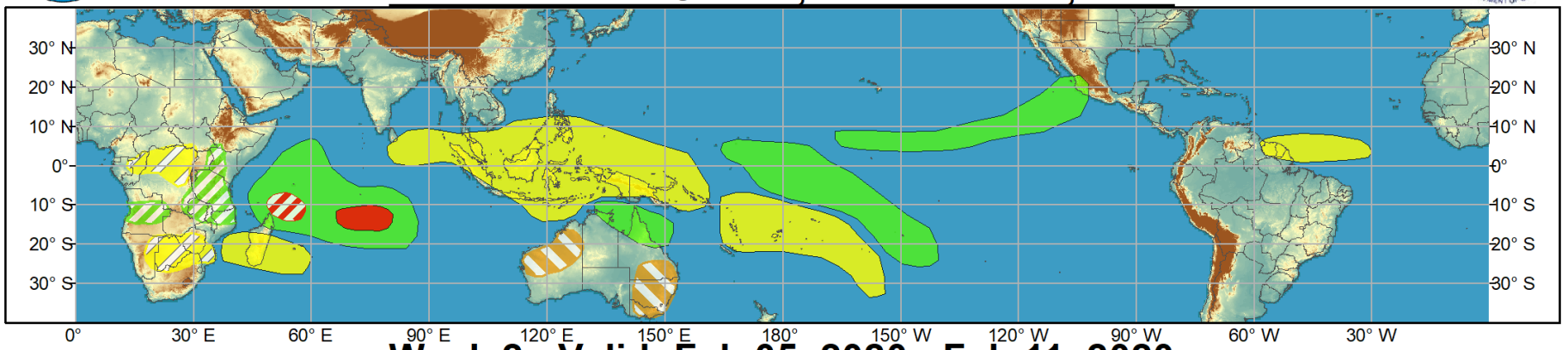
Author:
Ahira Sanchez-Lugo
NCEI/NOAA

droughtmonitor.unl.edu

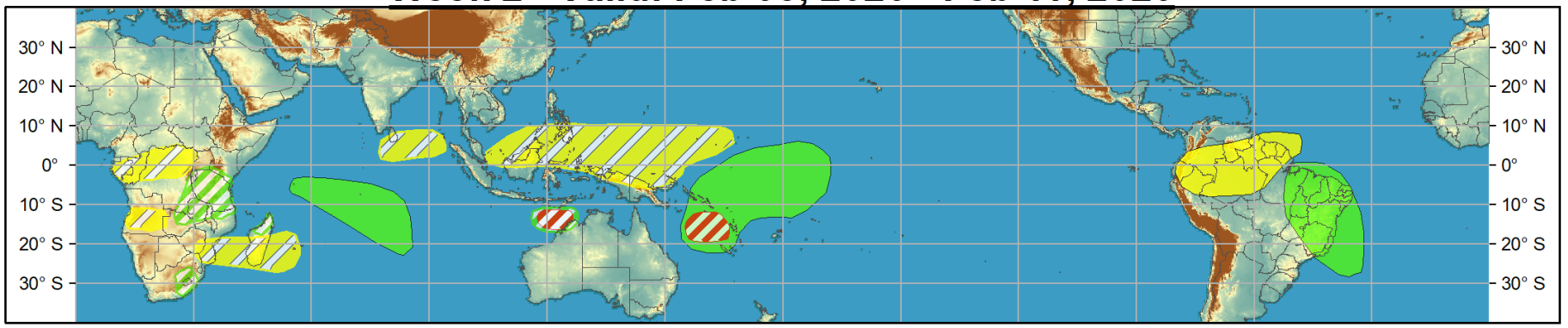
National Weather Service
Climate Prediction Center

Global Tropics Hazards and Benefits Outlook - Climate Prediction Center

Week 1 - Valid: Jan 29, 2020 - Feb 04, 2020



Week 2 - Valid: Feb 05, 2020 - Feb 11, 2020



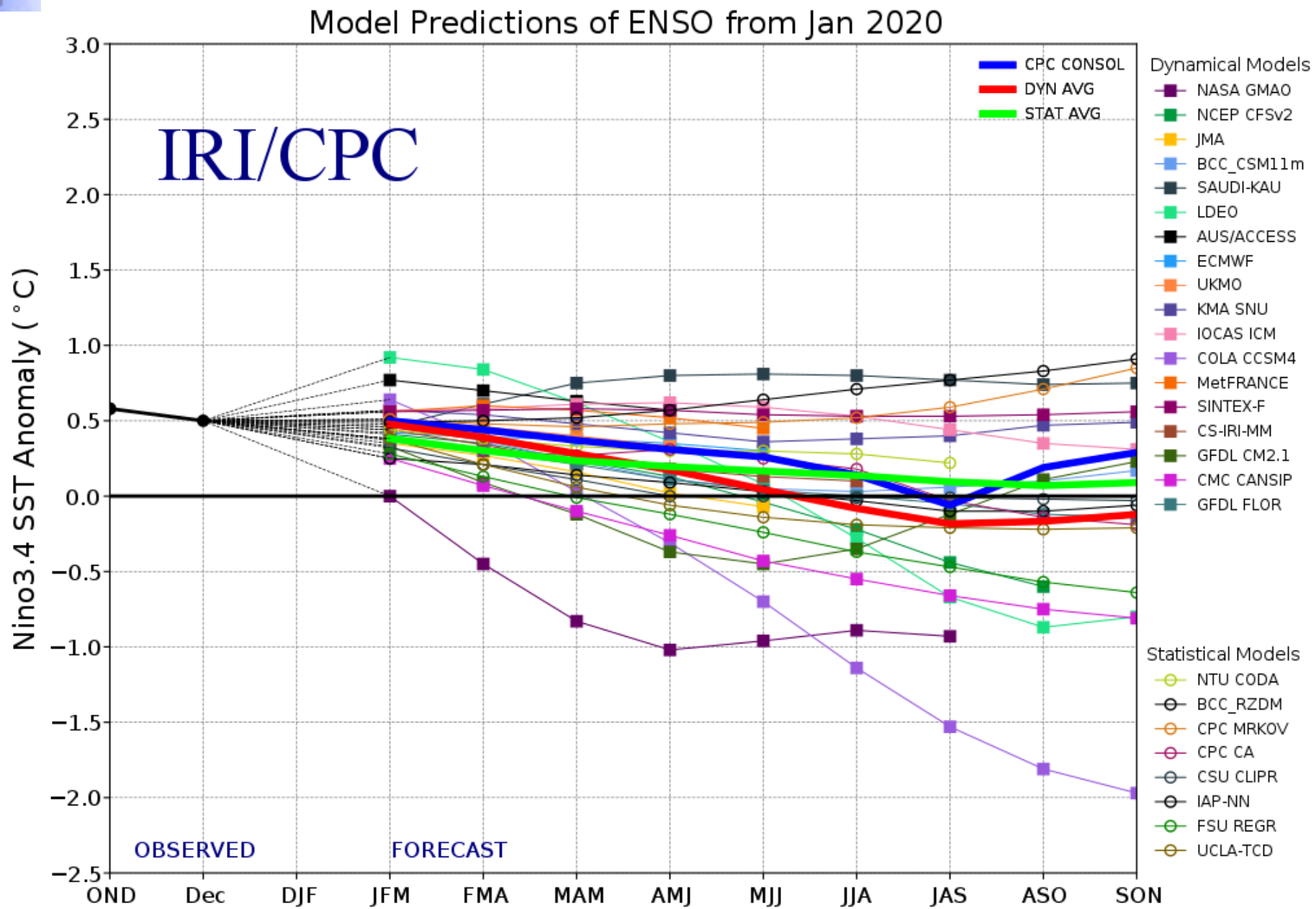
Produced: 01/28/2020
Forecaster: Novella

	Confidence: High	Confidence: Moderate	
Tropical Cyclone Formation			Development of a tropical cyclone (tropical depression - TD, or greater strength).
Above-average rainfall			Weekly total rainfall in the upper third of the historical range.
Below-average rainfall			Weekly total rainfall in the lower third of the historical range.
Above-normal temperatures			7-day mean temperatures in the upper third of the historical range.
Below-normal temperatures			7-day mean temperatures in the lower third of the historical range.

Product is updated once per week, except from 6/1 - 11/30 for the region from 120E to 0, 0 to 40N. The product targets broad scale conditions integrated over a 7-day period for US interests only. Consult your local responsible forecast agency.

中央氣象局 Central Weather Bureau
UNIVERSITY AT ALBANY State University of New York
EARTH SYSTEM SCIENCE INTERDISCIPLINARY CENTER ESSIC UNIVERSITY OF MARYLAND
Australian Government Bureau of Meteorology
cics.nc
NPS PRAESTANTIA PER SCIENTIAM

National Weather Service
Climate Prediction Center

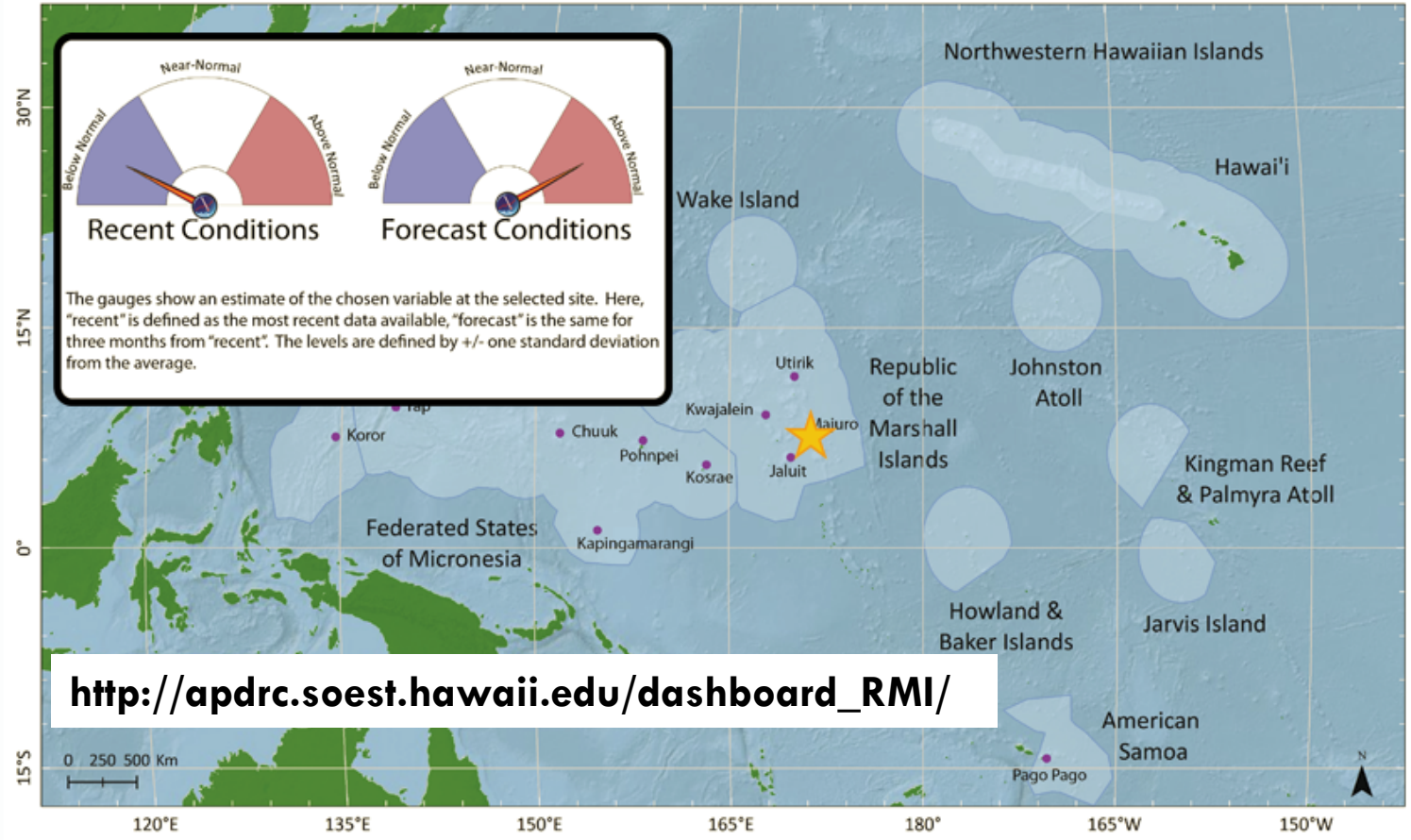


Marshall Islands Climate Outlook

This website provides access to a broad range of information related to seasonal climate variability in the Republic of the Marshall Isalnds. It includes a quick-look at current and future conditions for a range of climate indicators, direct access to more detailed outlook-related information from stations and statellites, and products that place this information in a histrorical context. It also includes links to addtional sources of information.

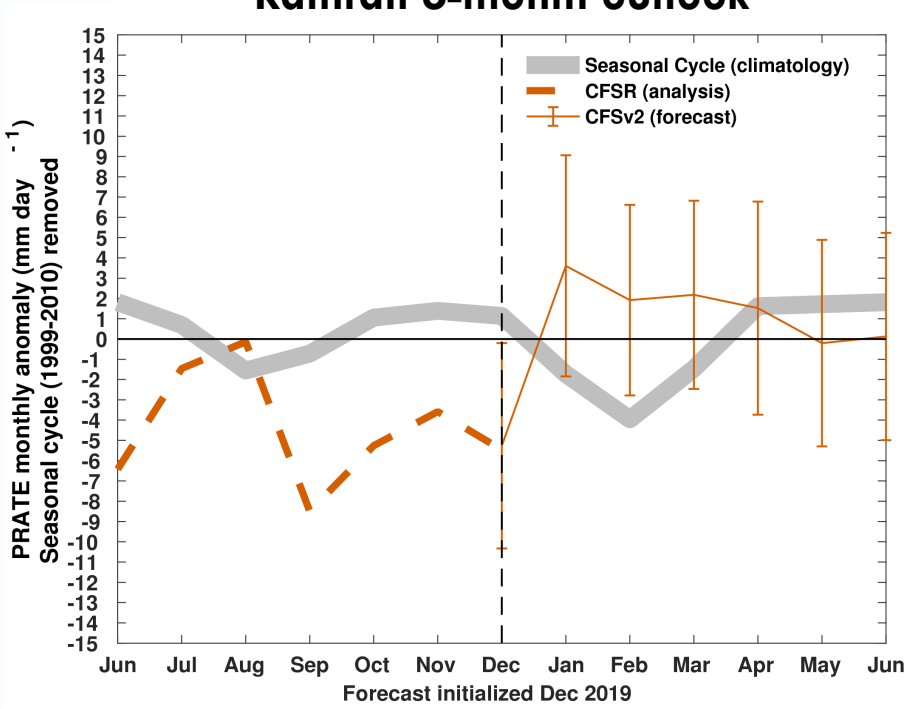
NOAA State of the Ocean

Temperature and Rainfall | Tropical Cyclones and Storms | Sea Level and Waves | Ocean Conditions | Indices



http://apdrc.soest.hawaii.edu/dashboard_RMI/

Rainfall 6-month outlook



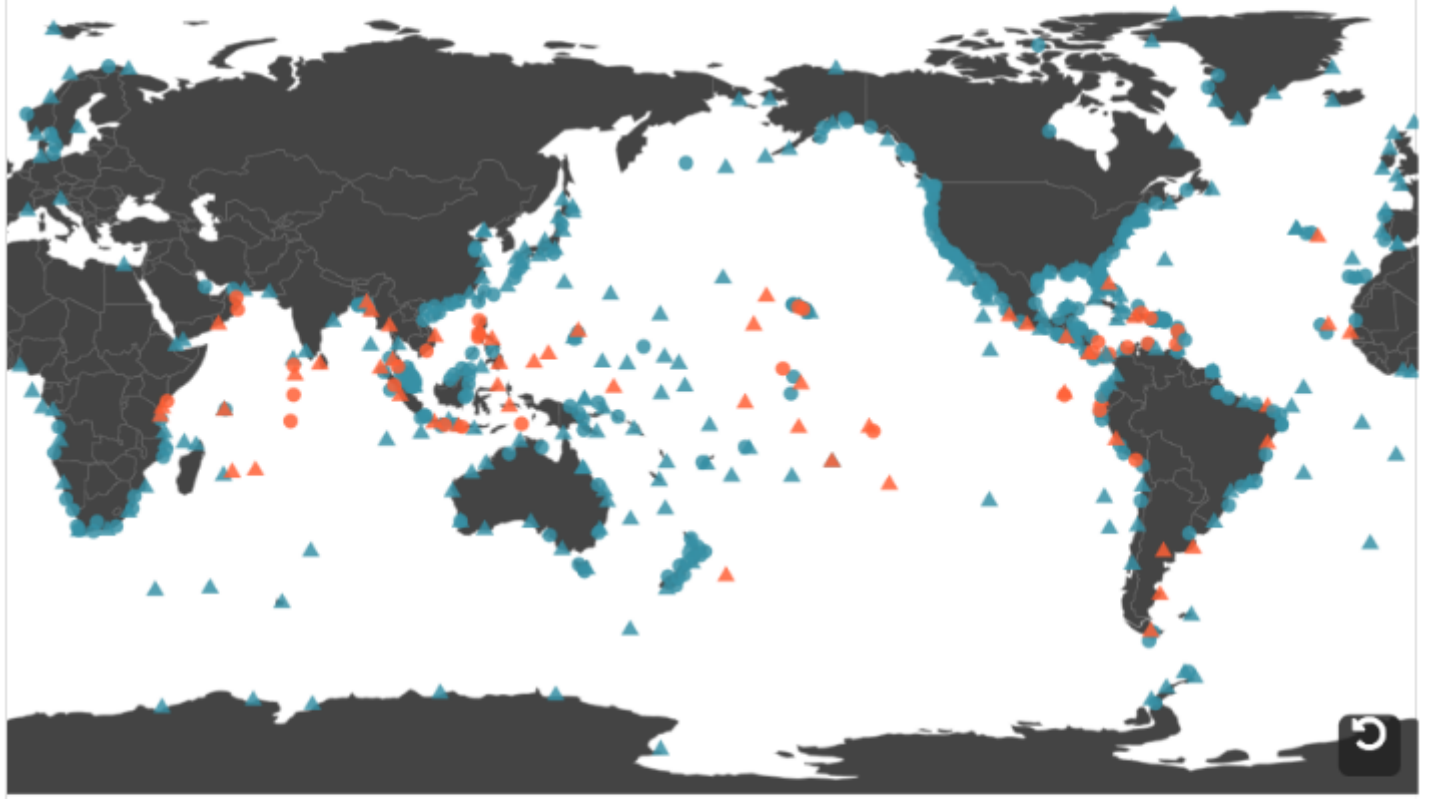
Tide gauges and more….

https://uhslc.soest.hawaii.edu

UNIVERSITY OF HAWAII
SEA LEVEL CENTER

Data Network Research Products

All GLOSS UHSLC Fast Delivery Research Quality (JASL)



UHSLC stations (84)
Other station operators (484)
GLOSS Core Network stations (266)
Other stations

Zoom in: double click or scroll up
Zoom out: scroll down
Pan: click-and-drag
Reset: click reset button

Map details: This map shows the locations of all 568 tide gauge stations for which there is data in the University of Hawaii Sea Level Center (UHSLC) database.

→ The UHSLC operates and/or maintains 84 of these stations (orange markers).

UNIVERSITY OF HAWAII
SEA LEVEL CENTER

STATION EXPLORER

Station: 005 Majuro, Marshall Islands (the)

Water Levels | Tide Calendars | Datums

COUNTRY:	Marshall Island...
NAME:	Majuro
UHSLC ID:	5
GLOSS ID:	112
LAT:	7.108
LON:	171.372

QUALITY CONTROLLED STATION DATA

	Fast Delivery	Research Quality
HOURLY:	.dat .csv .nc	.dat .csv .nc
DAILY:	.dat .csv .nc	.dat .csv .nc
METADATA		

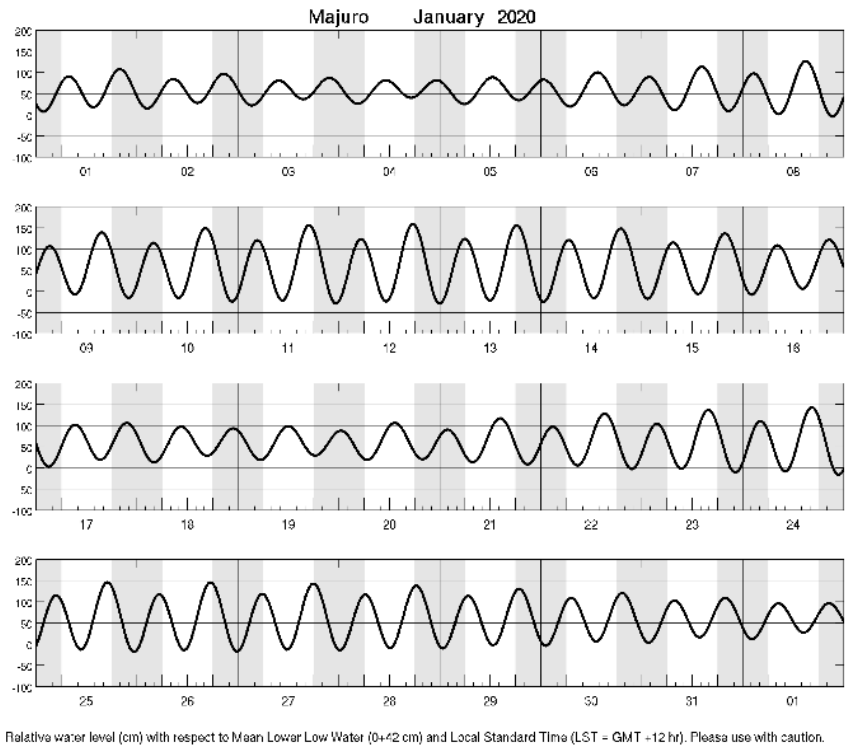
Metric | English

MLLW | MHHW

GMT | LST

Graphical calendar | Text calendar | Information

Download



Relative water level (cm) with respect to Mean Lower Low Water (0+42 cm) and Local Standard Time (LST = GMT +12 hr). Please use with caution.

« 2020 »

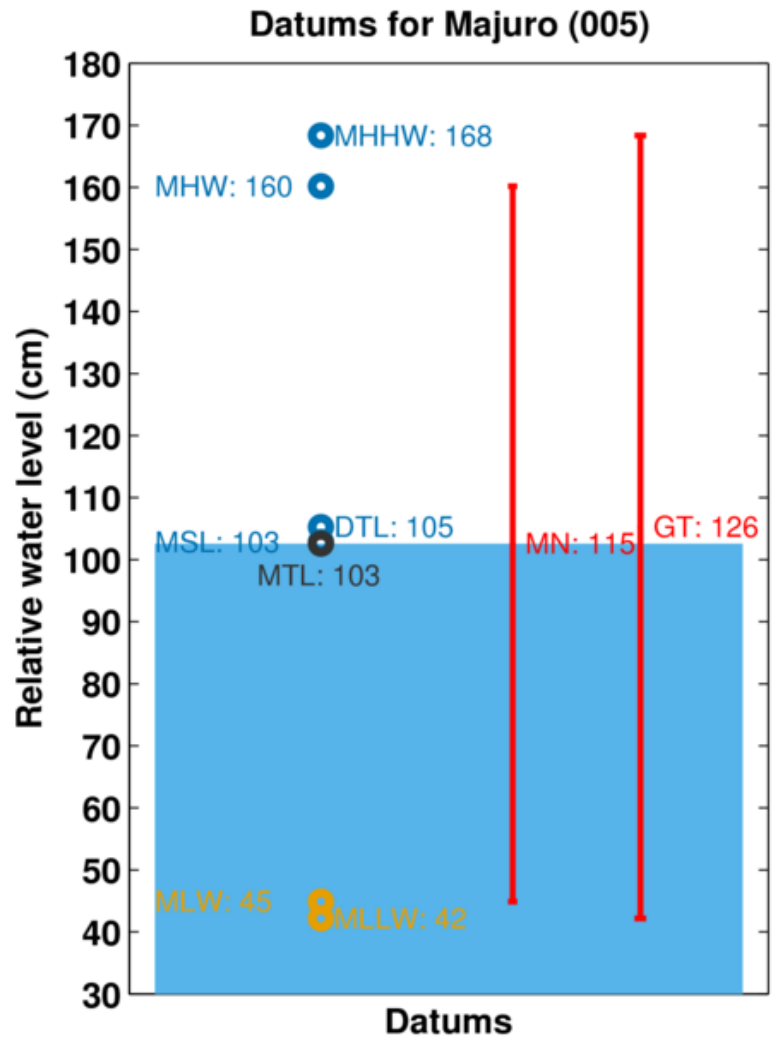
Jan | Feb | Mar | Apr

May | Jun | Jul | Aug

Sep | Oct | Nov | Dec

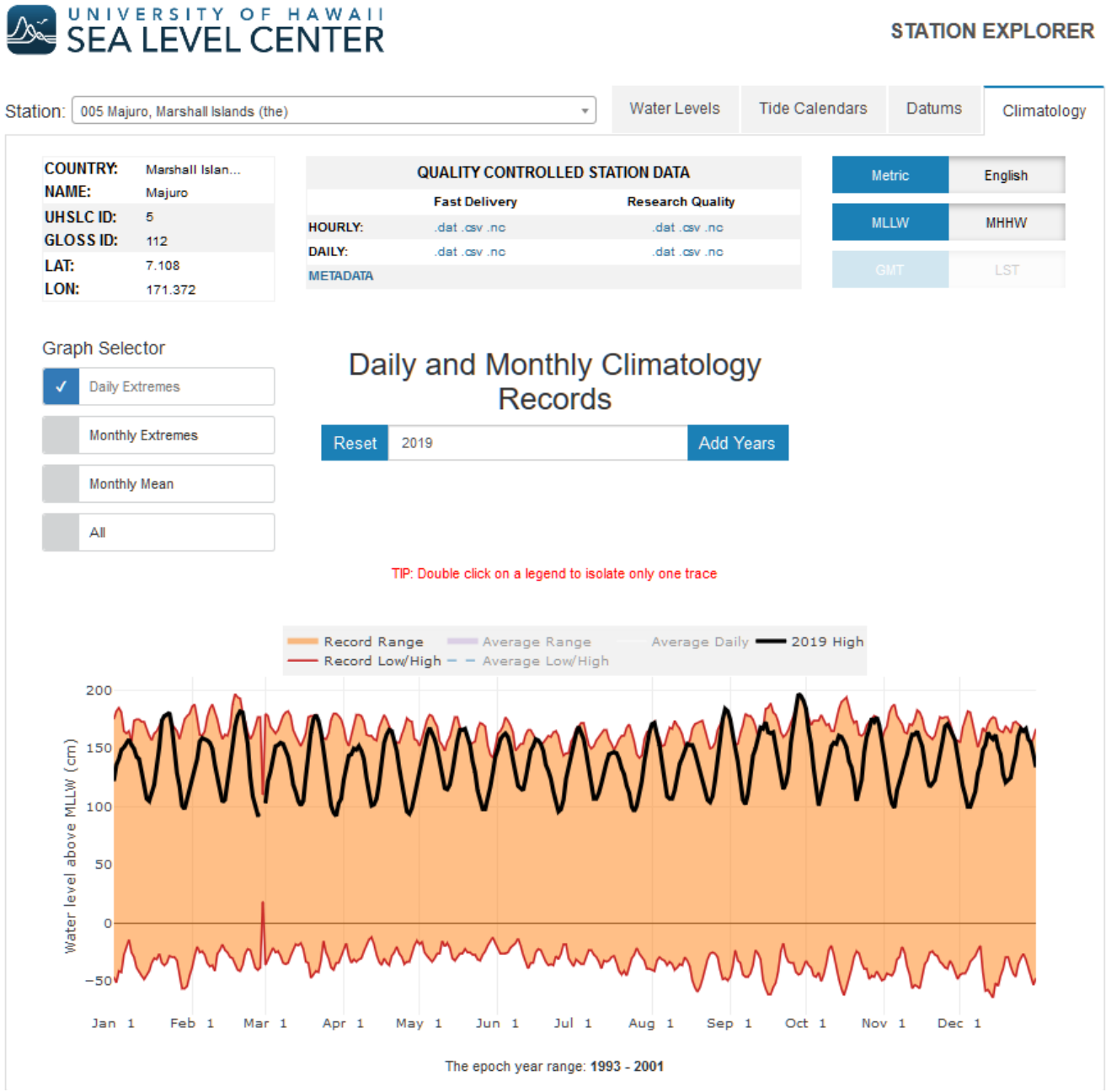
Stay up-to-date

To receive updates when the latest tide predictions are generated, subscribe to our email updates. To subscribe, send an email to: tide-grp+subscribe@hawaii.edu.



Record high water levels in Majuro

New product



Record high & low water levels (relative to Mean Higher High Water "high tide")

UNIVERSITY OF HAWAII
SEA LEVEL CENTER

Monthly processing of sea level forecasts for tropical Pacific Islands

This product provides an outlook of monthly sea level anomalies for the next one to two seasons. We combine sea level forecasts with astronomical tide predictions to provide more accurate predictions of coastal water level compared to tide predictions alone.

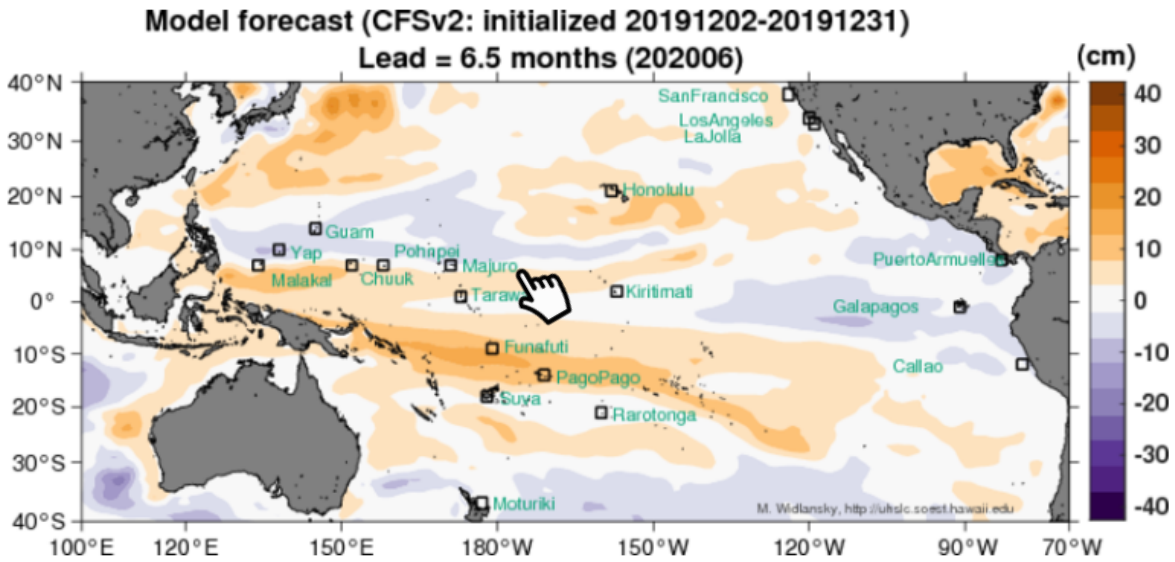
READ MORE

This seasonal forecast product is *experimental*. For short-term forecasts (daily to weekly), please see the High Sea Level Forecast for your region. Neither the seasonal nor the weekly product is accurate when a tsunami or tropical cyclone threatens your coastline.

Click for

1) Island forecasts
2) Tide predictions
3) Forecast discussion

June 2020 forecast of sea level anomalies



-6 -5 -4 -3 -2 -1 0 0 1 2 3 4 5 6

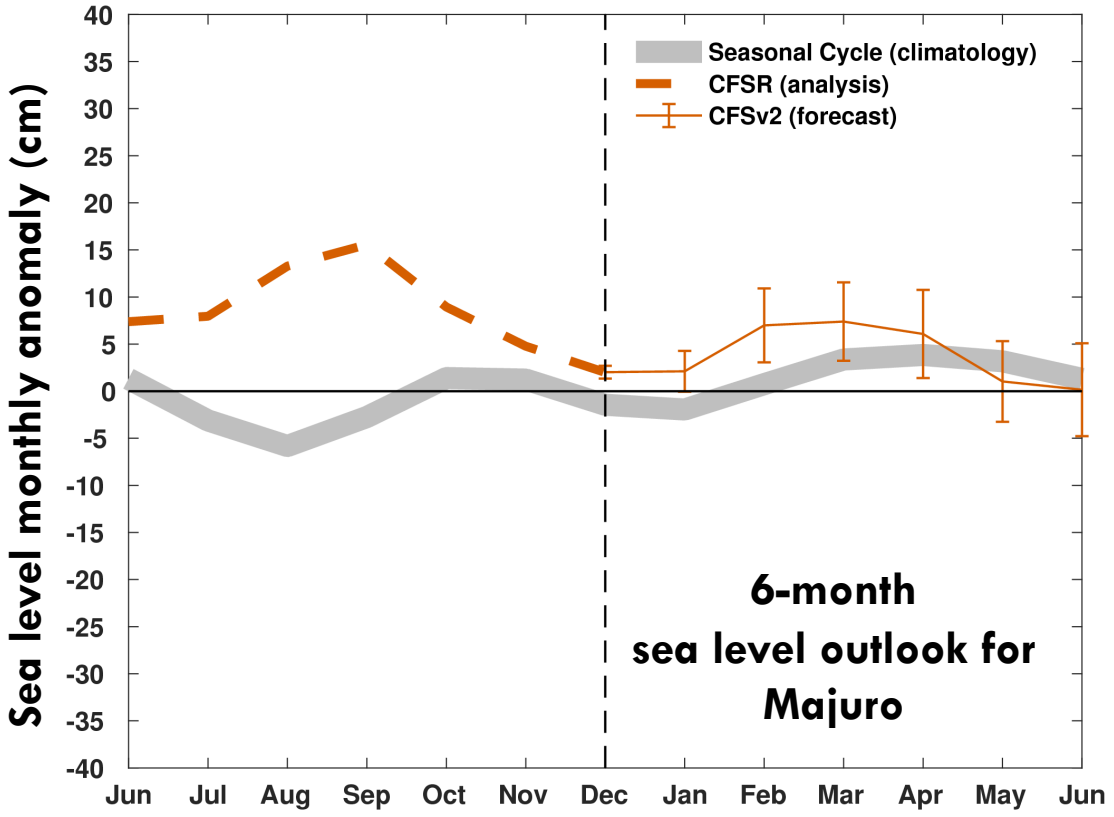
Mouseover for past and future months.

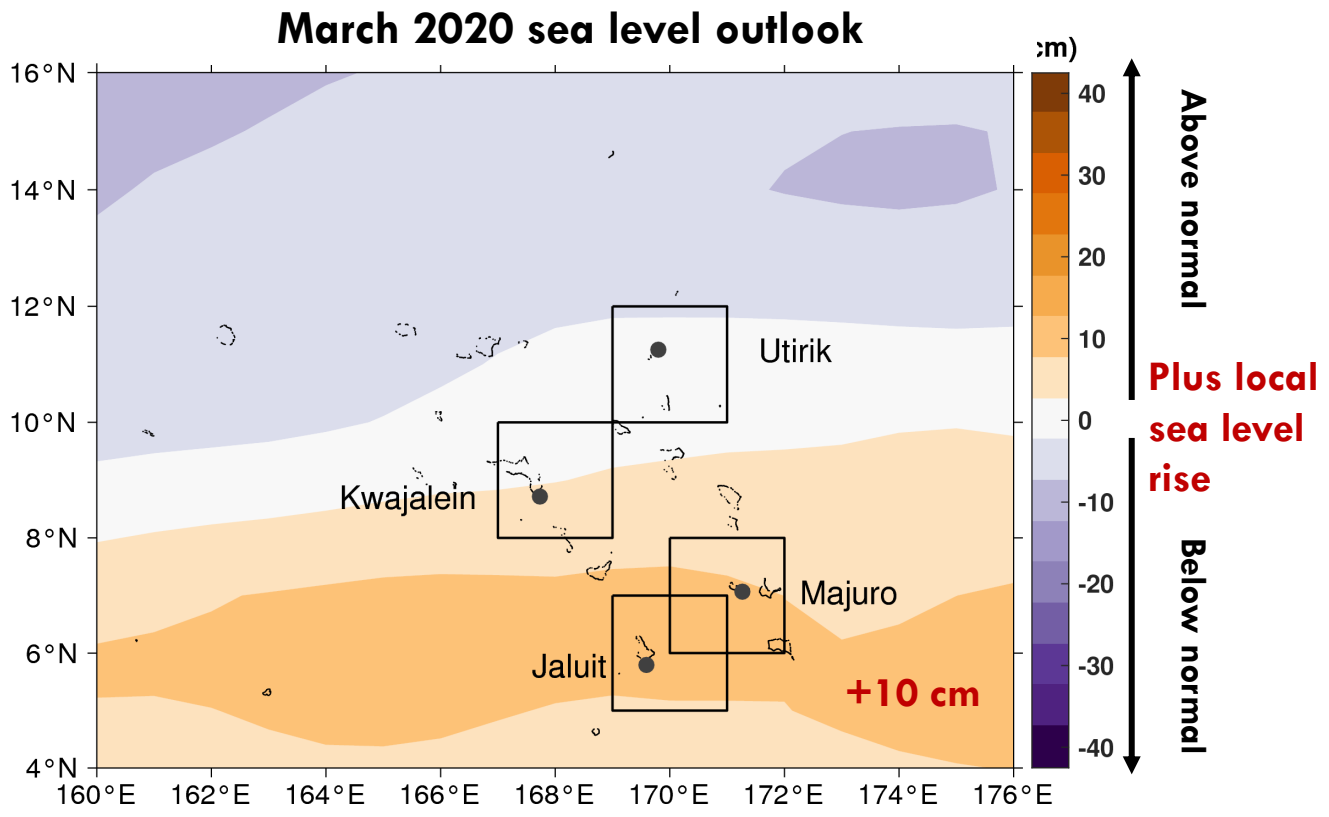
How to use this page ...

- Visualize recent sea level observations from satellites (past 6 months) and predictions from one model (next 6 months) by moving the mouse over the row of numbers below the map.
- View multi-model forecasts for many islands in the tropical Pacific by clicking tide gauge station labels on the map.
- Click on the "Tides" or "Impacts" tabs to see how the predicted relative sea level anomaly is likely to alter the astronomical tide cycle and affect the coastline.

http://uhslc.soest.hawaii.edu/sea-level-forecasts/

Above-normal sea levels are forecast around Majuro through April 2020





Thank you

Matthew Widlansky
mwidlans@hawaii.edu

UNIVERSITY OF HAWAII
SEA LEVEL CENTER

RMI Weather Service Office

RMI's Climate, What is Climate Change, What are the impacts of CC on RMI and Health

RMI NATIONAL CLIMATE CHANGE AND HEALTH DIALOGUE

30TH -31ST JANUARY 2020 AT ICC

REGINALD WHITE
METEOROLOGIST-IN-CHARGE

MAJURO, NATIONAL WEATHER SERVICES

Presentation Outline

- Climate change and Climate variability
- Weather and Climate
- Climate of the Marshall Islands
- Historical Climate related Events
- Impacts of Climate Change on RMI's Climate and Health
- Existing sources of Climate information

Climate Change and Climate Variability

- **Climate change** is a long-term shift or trend in climate conditions (e.g. global warming) and can produce shifts in averages, extremes and variability of temperature, rainfall, sea level and other environmental variables.
- Climate variability can be monthly, yearly and decadal variability due to natural processes and feedbacks. The main driver of climate variability in the Pacific region is the El Niño Southern Oscillation (ENSO)
- Climate variability and climate change can occur independently, but also at the same time.

Weather and Climate

- Weather describes the current atmospheric conditions, e.g. rainfall, temperature or wind speed at a particular place and time
- Climate is the average pattern of weather for a particular place over a long period of time (e.g. 30 years)

- ‘Climate is what we expect. Weather is what we get!’

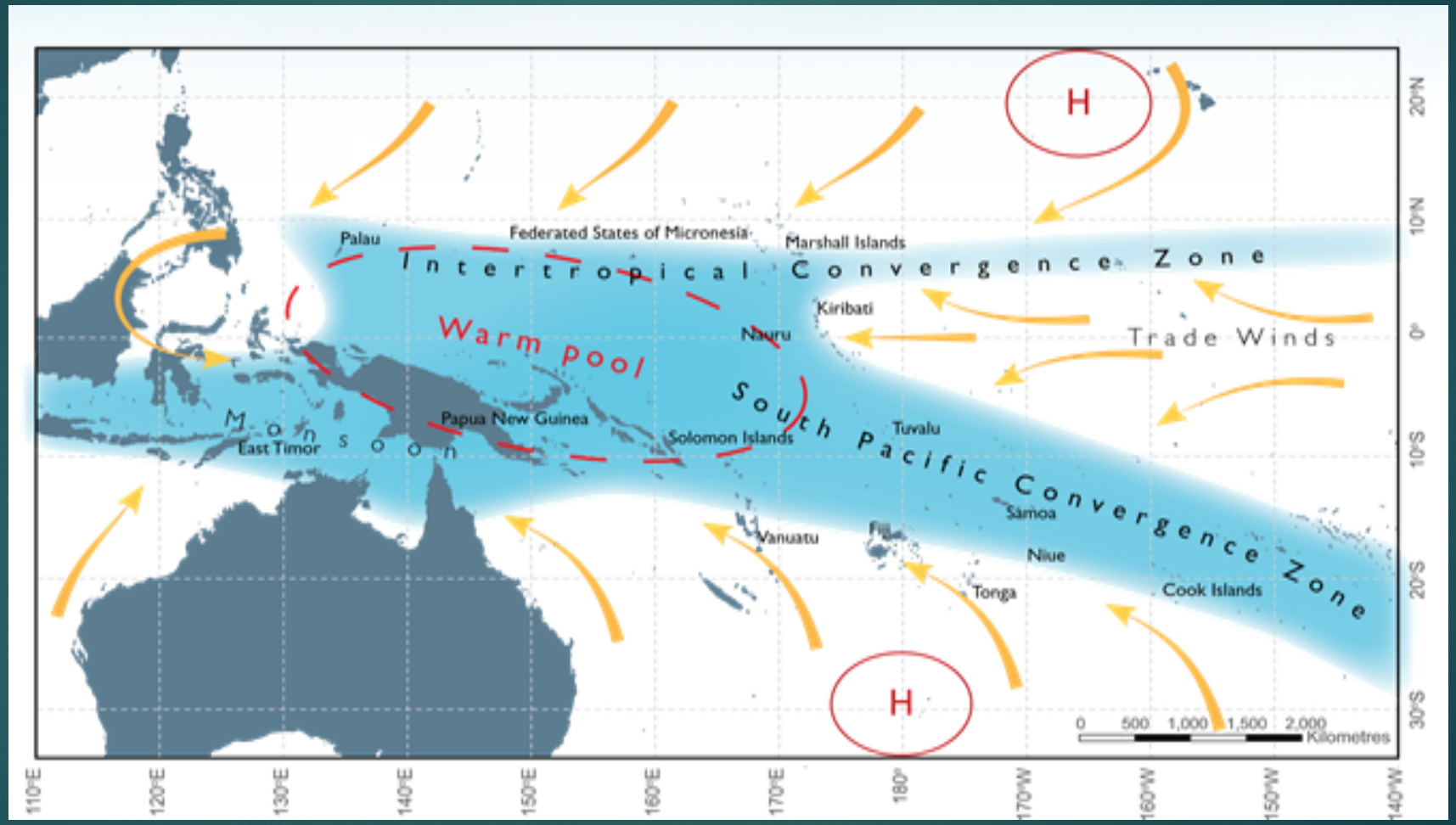
Climate of the Marshall Islands

- RMI's climate is classified as maritime tropical
- Humid with moderate temperatures
- Day-night temperature differences greater than seasonal temperature differences
- Seasons-wet and wetter for southern islands; wet and dry seasons for the northern islands;
- Spring and Fall transitions
- Occasionally in a transitional Monsoon Regime
- Susceptible to typhoons, monsoons, and droughts

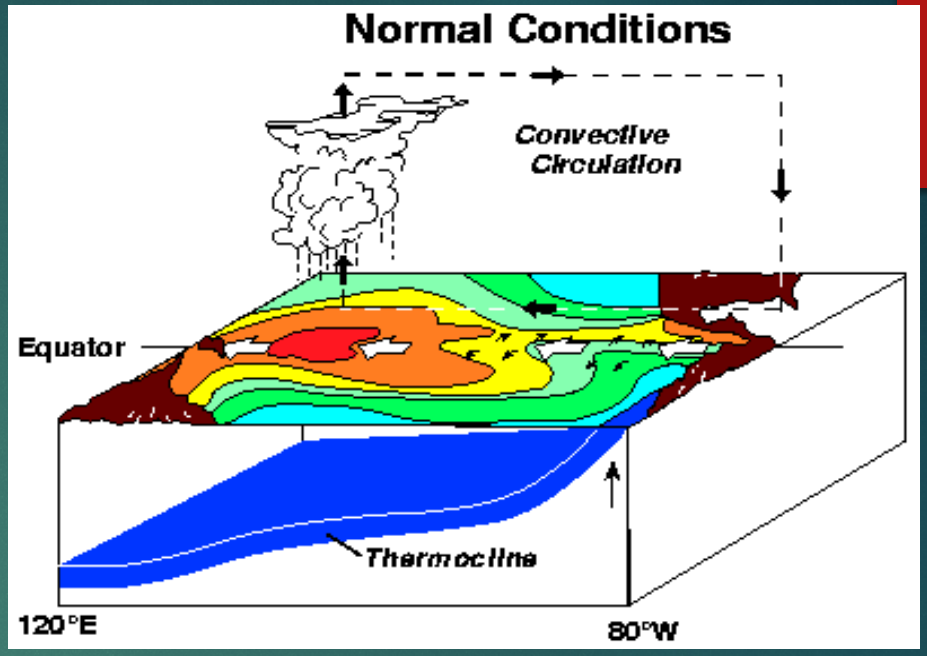
RMI's Climate Drivers

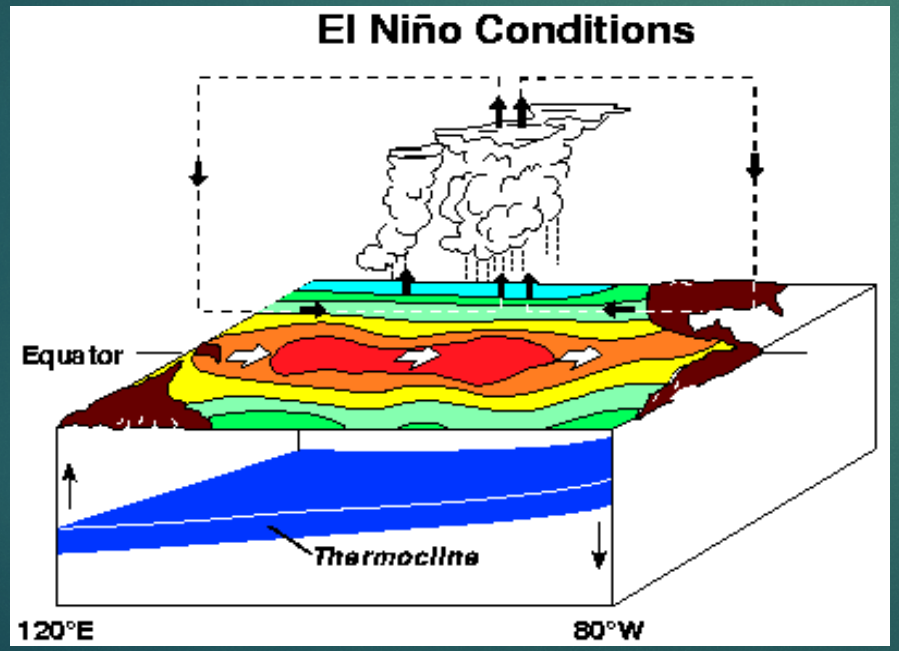
El Niño	July to March	• Drought • Monsoon Surges to RMI • More Chance for TCs
North West Monsoon	September to January	• Rainfall
MJO	All year, mainly wet season	• Brings active weather with much rain
ITCZ	May to December	• Increase Rainfall
North East Subtropical High	January to April	• Increase in Trades • Subsiding dry air

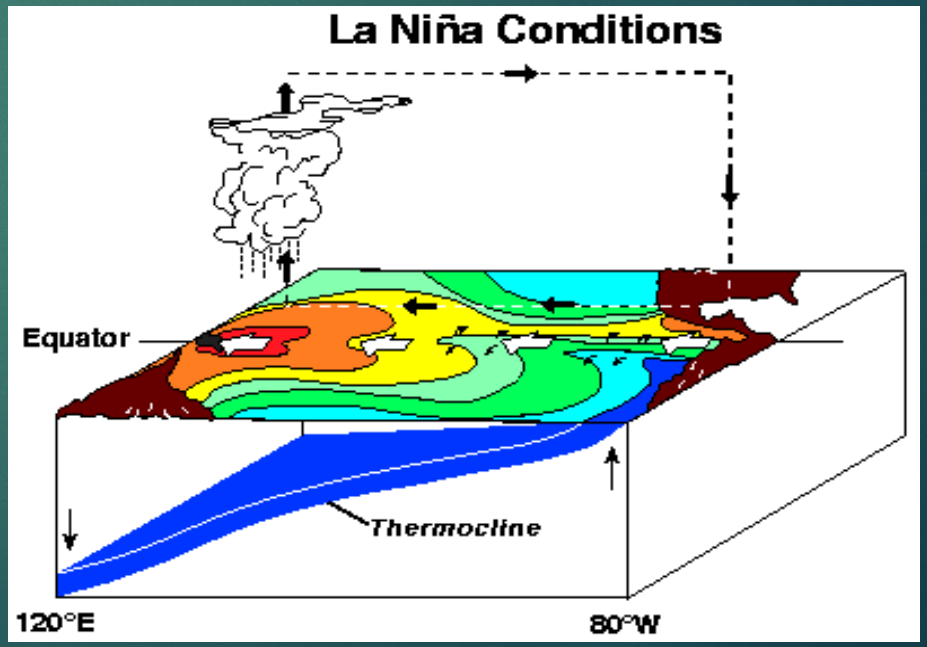
Climate Drivers



ENSO


Normal Conditions
Convective Circulation
Equator
Thermocline
120°E
80°W


El Niño Conditions
Equator
Thermocline
120°E
80°W


La Niña Conditions
Equator
Thermocline
120°E
80°W

Historical Climate-related Events

- 1982-83 Drought
- 1991-92 Drought
- 1997-98 Drought
- 2008 Inundation
- 2010 Inundation
- 2013 Inundation
- 2014 Inundation
- 2015-16 Drought

Historical Climate-related Events

26th November 1979	Typhoon (Alice)	Majuro, D-U-D area
4th December 1979	Tropical Storm	Unknown
8th January 1988	Tropical Storm (Roy)	Kwajalein
1989		Majuro
1990		Majuro
1991		Majuro
28th November 1991	Typhoon (Zelda)	All of RMI
6th January 1992	Tropical Storm (Axel)	All of RMI
June 9th to 10th 1994 (South Pacific Disaster Reduction Programme 1997)	swell/spring tide	Ajeltake, Majuro
10th December 1997	Typhoon (Paka)	Majuro, Ailinglaplap, and Namu
13th January 2001 (Velde 2003)	Swell/spring tide	Majuro
December 2007	swell/spring tide	Kwajalein
9th December 2008	large swell	Majuro, Arno, and Kili Island
14th/15th December 2008	swell/spring tide	Majuro, Arno, and Kili Island
20th February 2011	large residual	Majuro
14th March 2013	swell/spring tide	Majuro
25th June 2013 6:00	Tropical Storm	Majuro, Arno, and Kili
3rd March 2014	swell/spring tide	Majuro, Arno, and Kili
October 2014	swell/spring tide	Jable side of Majuro
23rd December 2014	swell/spring tide	Majuro
21st January 2015	swell/spring tide	Majuro and four outer islands
19th February 2015	swell/spring tide	
3rd July 2015	Tropical Storm (Nangka)	Majuro

Impacts of Climate Change on Health

- El Nino

  (Below average rainfall, drought, low sea level)

- Scarcity of suitable drinking water
- The incidence of diarrheal, pink eye, conjunctivitis, scabies and influenza

- La Nina

  (Above Average rainfall, Windy, high sea level)

- Dengue fever

- Other climate related event such as warmer sea surface temperature leads to coral bleaching

- Ciguatera (fish poisoning)

Sources of Climate information

- **NOAA**
  - -Pacific ENSO Applications Climate Center (PEACC)

https://www.weather.gov/peac/

  - -PacIOOS

http://www.pacioos.hawaii.edu/shoreline/runup-majuro/

- **Australian Bureau of Meteorology**

http://www.bom.gov.au/climate/

  - -Online Climate Outlook Forum (OCOF)

https://www.pacificmet.net/products-and-services/online-climate-outlook-forum

  - Ocean Portal

http://oceanportal.spc.int/portal/ocean.html

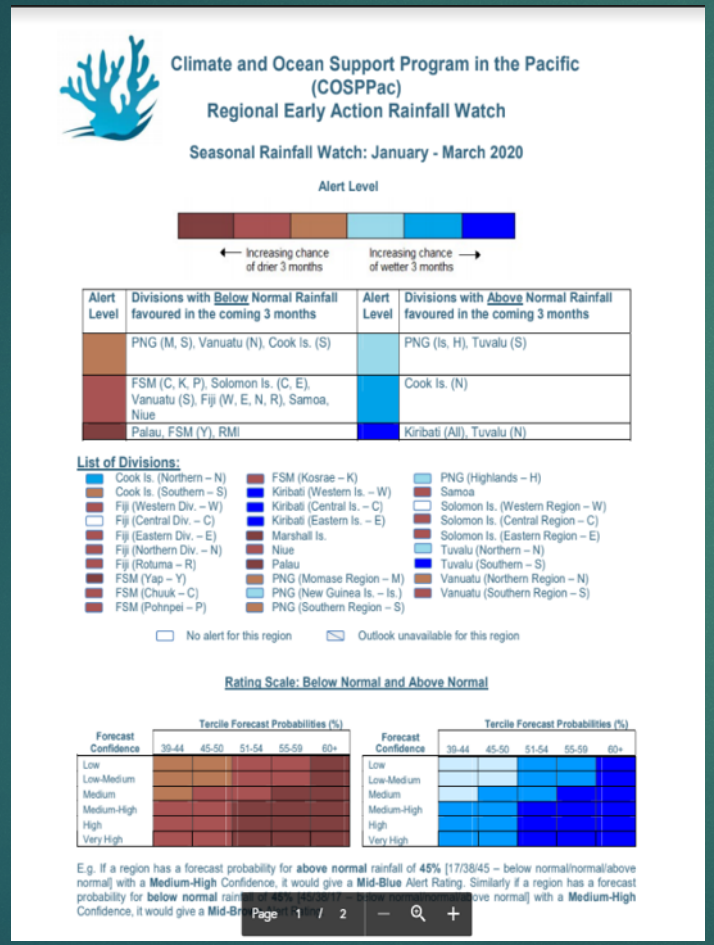
- **NIWA New Zealand**
  - - Island Climate Update (ICU)

https://niwa.co.nz/our-science/climate

- **Korean**
  - -APEC Climate Center (APCC)

https://www.apcc21.org/climate

Some of the actual Products



Climate and Ocean Support Program in the Pacific (COSPPac)
Regional Early Action Rainfall Watch

Seasonal Rainfall Watch: January - March 2020

Alert Level

← Increasing chance of drier 3 months

Increasing chance of wetter 3 months →

Alert Level	Divisions with Below Normal Rainfall favoured in the coming 3 months	Alert Level	Divisions with Above Normal Rainfall favoured in the coming 3 months
	PNG (M, S), Vanuatu (N), Cook Is. (S)		PNG (Is, H), Tuvalu (S)
	FSM (C, K, P), Solomon Is. (C, E), Vanuatu (S), Fiji (W, E, N, R), Samoa, Niue		Cook Is. (N)
	Palau, FSM (Y), RMI		Kiribati (All), Tuvalu (N)

List of Divisions:

- Cook Is. (Northern – N)
- Cook Is. (Southern – S)
- Fiji (Western Div. – W)
- Fiji (Central Div. – C)
- Fiji (Eastern Div. – E)
- Fiji (Northern Div. – N)
- Fiji (Rotuma – R)
- FSM (Yap – Y)
- FSM (Chuuk – C)
- FSM (Pohnpei – P)
- FSM (Kosrae – K)
- Kiribati (Western Is. – W)
- Kiribati (Central Is. – C)
- Kiribati (Eastern Is. – E)
- Marshall Is.
- Niue
- Palau
- PNG (Momase Region – M)
- PNG (New Guinea Is. – Is.)
- PNG (Southern Region – S)
- PNG (Highlands – H)
- Samoa
- Solomon Is. (Western Region – W)
- Solomon Is. (Central Region – C)
- Solomon Is. (Eastern Region – E)
- Tuvalu (Northern – N)
- Tuvalu (Southern – S)
- Vanuatu (Northern Region – N)
- Vanuatu (Southern Region – S)

No alert for this region Outlook unavailable for this region

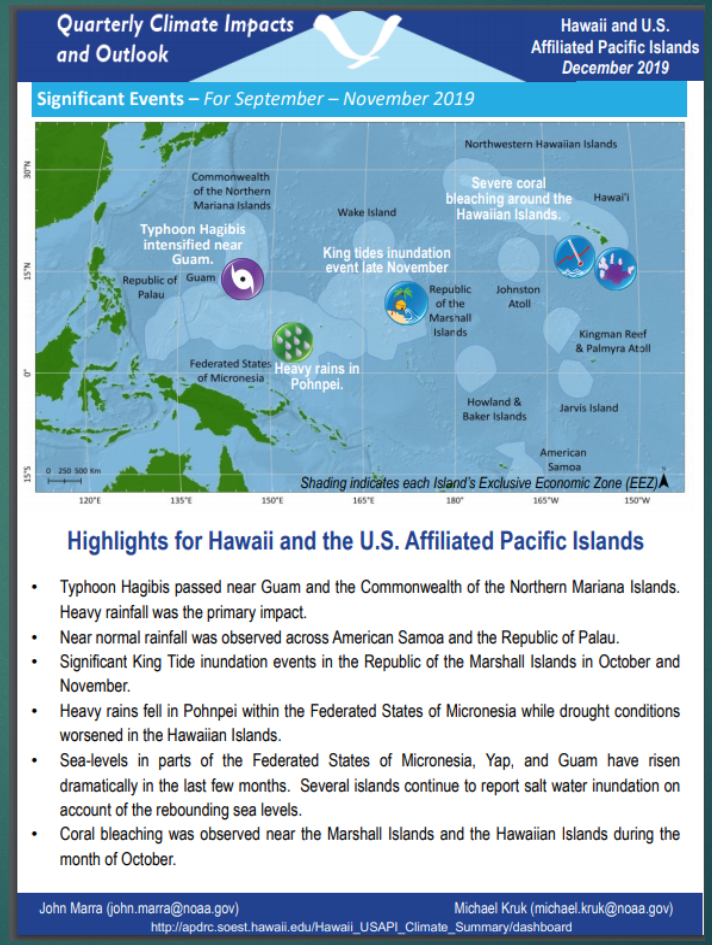
Rating Scale: Below Normal and Above Normal

Forecast Confidence	Tercile Forecast Probabilities (%) 39-44	45-50	51-54	55-59	60+
Low					
Low-Medium					
Medium					
Medium-High					
High					
Very High					

Forecast Confidence	Tercile Forecast Probabilities (%) 39-44	45-50	51-54	55-59	60+
Low					
Low-Medium					
Medium					
Medium-High					
High					
Very High					

E.g. If a region has a forecast probability for **above normal** rainfall of **45%** [17/38/45 – below normal/normal/above normal] with a **Medium-High** Confidence, it would give a **Mid-Blue** Alert Rating. Similarly if a region has a forecast probability for **below normal** rainfall of 45% [45/38/17 – below normal/normal/above normal] with a **Medium-High** Confidence, it would give a **Mid-Br**

Page 1 / 2



Quarterly Climate Impacts and Outlook

Hawaii and U.S. Affiliated Pacific Islands
December 2019

Significant Events – *For September – November 2019*

Highlights for Hawaii and the U.S. Affiliated Pacific Islands

- Typhoon Hagibis passed near Guam and the Commonwealth of the Northern Mariana Islands. Heavy rainfall was the primary impact.
- Near normal rainfall was observed across American Samoa and the Republic of Palau.
- Significant King Tide inundation events in the Republic of the Marshall Islands in October and November.
- Heavy rains fell in Pohnpei within the Federated States of Micronesia while drought conditions worsened in the Hawaiian Islands.
- Sea-levels in parts of the Federated States of Micronesia, Yap, and Guam have risen dramatically in the last few months. Several islands continue to report salt water inundation on account of the rebounding sea levels.
- Coral bleaching was observed near the Marshall Islands and the Hawaiian Islands during the month of October.

John Marra (john.marra@noaa.gov) Michael Kruk (michael.kruk@noaa.gov)
http://apdrc.soest.hawaii.edu/Hawaii_USAPI_Climate_Summary/dashboard

Some of the actual Products

NWS Climate Services

December PEAC Audio Conference Call Summary

12 December, 1430 HST (15 November 2019, 0030 GMT)

November rainfall totals reported (Sony)

% Normal: blue above normal & red below normal. Departure from normal: blue-above & red-below

	Rainfall	% Normal	Normal	Departure	3 mon
	Inches	November	Inches	inches	SON
Koror	11.29	99	11.39	-0.10	33.97
Yap	9.30	105	8.83	0.47	26.66
Chuuk	9.26	87	10.61	-1.35	30.62
Pohnpei	24.91	168	14.83	10.08	65.39
Kosrae	13.55	98	13.83	-0.28	34.02
Kwajalein	12.52	111	11.28	1.24	32.94
Majuro	14.83	110	13.44	1.39	41.51
Guam NAS	15.76	214	7.38	8.38	47.38
Saipan	7.06	126	5.61	1.45	46.97
Pago Pago	7.48	74	10.14	-2.66	22.47
Lihue	4.98	141	3.53	1.45	13.61
Honolulu	2.58	190	1.36	1.22	5.86
Kahului	0.21	11	1.84	-1.63	0.63
Hilo	10.28	90	11.38	-1.10	32.24

American Samoa: (not present)

Currently in rainy season but appears drier than normal. No significant weather impacts to be reported other than a flood watch issued..

Kwajalein: (not present)

Kwajalein had one day of large downpour accounting for higher rain total for November. No significant impacts reported.

Majuro: (Nover)

Majuro had some inundated areas due to rainy season. During December 4th, Majuro received over 4.39 inches of rain and December 12th over 12 inches of rain. See images below for pictures related to inundation damages (date of pictures November 27th)

Some of the actual Products

Pacific Islands - Online Climate Outlook Forum (OCOF) No. 119

Country Name: Republic of the Marshall Islands (RMI)

TABLE 1: Monthly Rainfall

Station (include data period)			July 2017				
	May 2017 Total	June 2017 Total	Total	33%tile Rainfall (mm)	67%tile Rainfall (mm)	Median Rainfall (mm)	Ranking
MAJURO	125.2	331.0	318.0	261.7	359.3	300.9	36/64
KWAJALEIN	132.1	274.3	175.5	223.0	287.7	252.8	10/73

TABLE 2: Three-monthly Rainfall
May to July 2017
[Please note that the data used in this verification should be sourced from table 3 of OCOF #115]

Station	Three-month Total	33%tile Rainfall (mm)	67%tile Rainfall (mm)	Median Rainfall (mm)	Ranking	Forecast probs.* (include LEPS)	Verification* (Consistent, Near-consistent Inconsistent)?
MAJURO	774.2	782.7	944.9	842.0	20/63	**34**%/33%/33% (-0.3)	Near-Consistent
KWAJALEIN	581.9	589.4	799.5	698.1	24/73	33%/33%/**34**% (-0.1)	Near-Consistent

Period:*below normal/normal/above normal

Predictors and Period used for May to July 2017 Outlooks (refer to OCOF #115):

2-Months NINO3.4SSTA (February to March 2017)

*Forecast is consistent when observed and predicted (tercile with the highest probability) categories coincide (are in the same tercile).
Forecast is near-consistent when observed and predicted (tercile with the highest probability) differ by only one category (i.e. terciles 1 and 2 or terciles 2 and 3).
Forecast is inconsistent when observed and predicted (tercile with the highest probability) differ by two categories (i.e. terciles 1 and 3).

TABLE 3: Seasonal Climate Outlooks using SCOPIC for September to November 2017

Predictors and Period used: 2-Month NINO3.4SSTA (June to July 2017)

Station	Below Median (prob)	Median Rainfall (mm)	Above Median (prob)		LEPS	Hit-rate
MAJURO	57%	988.7	43%		7.3%	65.1%
KWAJALEIN	55%	845.6	45%		1.7%	53.7%

Station	Below Normal (prob)	33%ile rainfall (mm)	Normal (prob)	67%ile rainfall (mm)	Above Normal (prob)	LEPS	Hit-rate
MAJURO	37%	896.5	36%	1088.6	27%	2.6%	27.0%
KWAJALEIN	38%	788.1	37%	931.8	25%	4.5%	38.8%

TABLE 4: Seasonal Climate Outlooks using POAMA2 for September to November 2017

Station	Lower Tercile (prob)	33%ile rainfall (mm)	Middle Tercile (prob)	67%ile rainfall (mm)	Upper Tercile (prob)		
MAJURO	79%	877.0	9%	1017.0	12%		
KWAJALEIN	52%	780.0	18%	884.0	30%		

Some of the actual Products

NATIONAL WEATHER SERVICE
REPUBLIC OF MARSHALL ISLANDS

Ocean Outlook

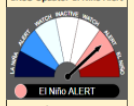
Marshall Meteorological Service
Member of WMO
Contacts
General:
Forecast:
Climate:
Tech:
Email:
Website:

Issue: Summary March 2019

- Sea surface temperature is expected increase slightly by 0.5 degrees Celsius.
- The fisheries convergence zone is expected to lie just below the Marshall Islands for the month of March.
- Coral bleaching outlook shows low level stress for the northern most islands with generally no stress overall.
- Chances of sea level to be as low as -150mm and as high as 50mm for most parts of the oceans surrounding Marshall Islands

Issue Outline:
- Ocean Summary
- Ocean Temperature
- Convergence Zone
- Coral Bleaching
- Sea Level Forecast

Climate Status:
ENSO Update: El Nino Alert

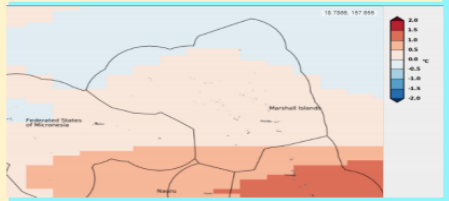


Sea Surface Temperature:

Sea Level Anomaly Forecast:

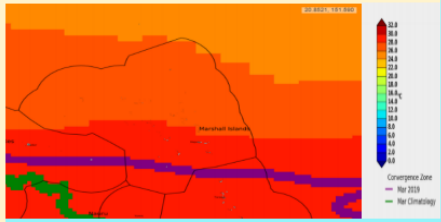
Major Contributors:
- Pacific Ocean Portal oceanportal.spc.int
- Bureau of Meteorology- ENSO Wrap-up: http://www.bom.gov.au/climate/enso/

Sea Surface Temperature Forecast Anomaly



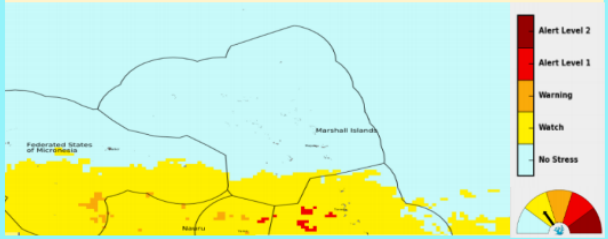
Sea surface temperature (SST) anomaly forecast for the month of March shows a warmer than normal of 0.5 degree Celsius for Marshall Islands.

Sea Surface temperature forecast with convergence zone



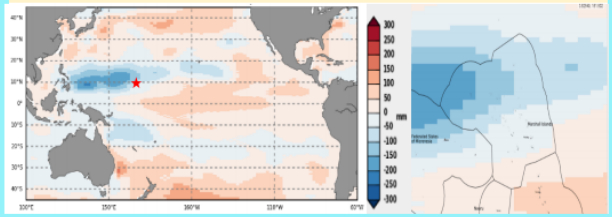
The Fisheries Convergence zone is forecasted to lie just south of the Marshall Islands . Convergence zones are where cold and warm water meet, and are rich in nutrients, attracting lots of fish.

Coral Bleaching



The outlook for March indicates that for the most parts there is no stress or thermal pressure, however, there is a Watch alert which would mean that there would be low level thermal stress for the southern most parts of the Marshall Islands but it would be important to monitor daily bleaching alerts and bleaching outlooks to track the duration of stress. Fisheries management can help reduce pressure on the reef during this time.

Seasonal Sea Level Forecast



The sea level forecast for March – June shows a gradient of decreasing sea level from the southernmost islands with a reading of 50mm to the north by as low as -150mm for most Marshall Islands. This forecast is based on the combined long-term effects of temperature, salinity and wind on the water levels and do not include daily changes in tide or weather.

10 highest tides for 2019

Date	Time	Height (m)
20-Feb	17:12	2.25
21-Mar	16:52	2.22
21-Feb	17:50	2.22
19-Feb	16:31	2.20
20-Mar	16:15	2.19
22-Jan	17:24	2.18
29-Sep	4:26	2.18
31-Aug	4:47	2.18
22-Mar	17:29	2.18
01-Sep	5:27	2.18

From the 10 highest tides for RMI, there are three in the month of March. The higher tide levels coupled with higher than normal sea levels for the RMI group could cause inundation in low lying areas. For preparedness, coastal communities should be cautious during this period.

Thank you
Komol Tata

For more detailed information on the changes in the current and future climate of the RMI, contact us at the Weather Service Office.

Republic of the Marshall Islands' National Adaptation Plan

What is the National Adaptation Plan (NAP)

- (a) To reduce vulnerability to the impacts of climate change, by building adaptive capacity and resilience;
- (b) To facilitate the integration of climate change adaptation, in a coherent manner, into relevant new and existing policies, programmes and activities, in particular development planning processes and strategies, within all relevant sectors and at different levels, as appropriate

NAP Continued

- Be undertaken in accordance with the Convention;
- Follow a country-driven, gender-sensitive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems;
- Be based on and guided by the best available science and, as appropriate, traditional and indigenous knowledge, and by gender-sensitive approaches, with a view to integrating adaptation into relevant social, economic and environmental policies and actions, where appropriate;
- Not be prescriptive, nor result in the duplication of efforts undertaken in-country, but facilitate country-owned, country-driven action.

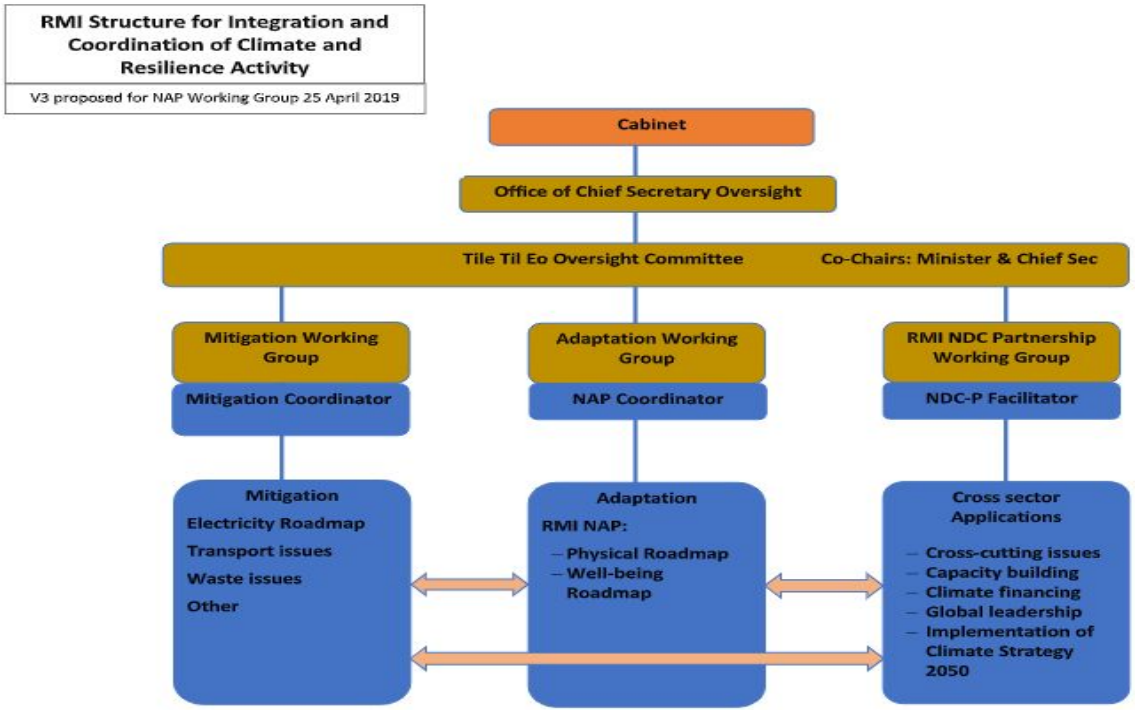
History and Development of the NAP process

- RMI NAP process commenced after the RMI's 2050 Climate Strategy publication in September 2018
- In February 2019 an ad hoc NAP Working Group was formed by the Chief Secretary
- In April 2019, an Internal Dialogue workshop was held with RMI stakeholders to introduce the NAP discussion to a wider group of stakeholders
    - Discussed RMI priority issues that needed to be addressed within the 2025-2030 time period
- The need for NAP Coordinator identified to keep issues focused on
    - Timeliness of delivery, coordination with TTEC Structure, etc.

RMI NAP Outline & Relation to Health

- The RMI NAP is an all inclusive plan that includes many cross sectors of the RMI, Health being one of them.
- Outcome 5 of the NAP lists: “Vulnerabilities to climate change impacts understood in the context of practical adaptation planning and decision making”
- And on some of the activities within the 5th outcome includes understanding outer islands and urban center vulnerabilities within the context of:
    - habitation/demographic, Health and education, Livelihood activity, Land and coastline, Infrastructure and Economic survey

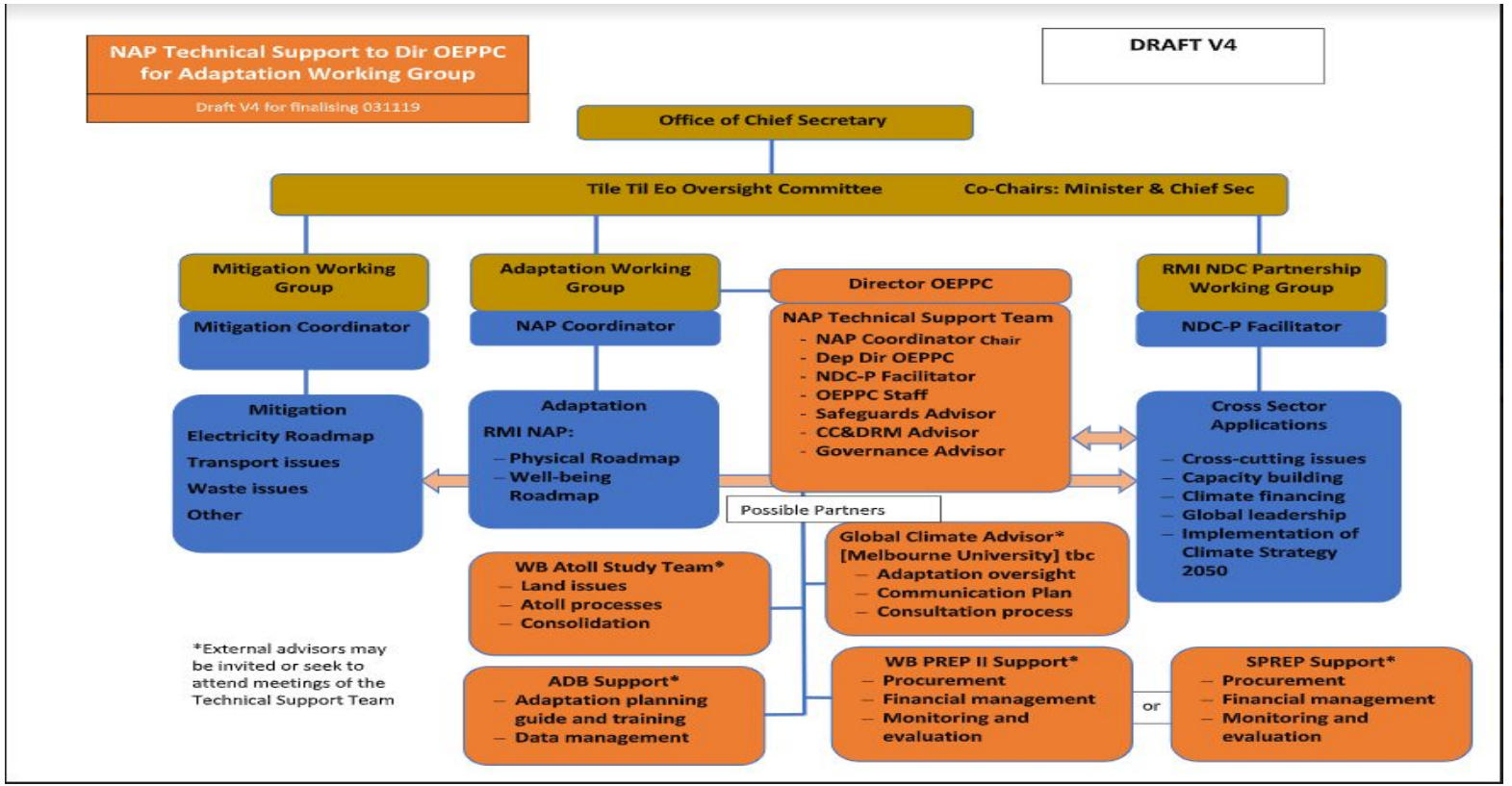
Tile Til Eo (TTEC) Structure



Adaptation WG:

1. EPA
2. MoTCI
3. MoWIU
4. MoCIA
5. MIMRA
6. WSO
7. CMAC
8. IOM
9. MICS
10. MWG
11. NDC-P
12. CC Envoys

NAP Technical Support Structure



Funding Opportunities

- Multiple agencies have offered support to help develop the RMI NAP:
  - GCF: $3 Mil
  - ADB : $300-500 K
  - PREP II: $1.5 Mil
  - Peace-Building Fund: $ 1 Mil
  - World Bank Atoll Study: technical support for adaptation options
  - Melbourne University: technical support for adaptation expert advice/ develop Communications and Consultation Plans
- Some of these opportunities are being actively pursued in parallel with GCF funding and decision will be made on which to go forward towards the end of November 2019.

TTEC decision

- RMI's goal was to establish a NAP within a year's time
- The two offers on the table were to either get a NAP within a 3 year timeframe with the GCF funds or 1.5 years with PREP II.
- We asked our TTEC members to decide on which funding mechanisms that works better and the PREP II restructuring money took the leading votes
- PREP II funding should kick off by July 2020 all while our technical team and Adaptation Working Group are all working on internal content for the NAP document.

Key Milestones

- December 2019: Policy Paper on RMI Adaptation Policy- outlining issues to be addressed to enable the implementation of the NAP
- April 2020: Communications Plan and Consultations Processes- a report on the methodology of communications and consultations
- September 2020: NAP Summary - a summary of the key issues for the NAP as understood at that time
- September 2021: NAP document for consideration by Cabinet - noting activities not completely defined will be included for the implementation.

National Climate Change and Health Dialogue
January 30 – 31, 2020
ICC Building

Management of the RMI Response to Climate Change and Disaster Risk
TILE TIL EO COMMITTEE

The **Purpose** of the TTEC is to provide oversight of the Republic of Marshall Islands (RMI) response to climate change and to the reduction of climate and disaster risk for the well-being of the people of RMI. For this purpose it will receive reports, provide direction to agencies and make recommendations to Cabinet through the Chief Secretary on climate change policy, resilience to climate and disaster risk and reporting against global climate change and disaster reduction conventions.

The **Scope** of its oversight is through accountable agencies and includes:

- mitigation of emissions and related energy, transportation and waste planning and implementation
- adaptation to climate change and disaster risk planning and implementation – including the National Adaptation Plan with a focus on the *well-being* of the Marshallese people
- receiving Assessments and Special Reports from IPCC and analyzing and responding to their impact on RMI
- development and monitoring of integrated policy for climate change and disaster risk
- coordinate of technical and political dialogue and message both internal and to the global discussion

Working Groups of the TTEC

The TTEC is comprised of three main Working Groups:

1) Working Groups for Mitigation Working Group
2) Adaptation Working Group
3) RMI NDC-Partnership Working Group

Additional Working Groups or Task Forces may be established for specific purposes as agreed by TTEC

The Functions of the Mitigation Working Group are to include:

- Implementation of Electricity Roadmap according to priorities and funding including through the EU-EDF11 budget sector programme and other energy related projects funded by development partners
- Maintenance of the National Energy Policy & Action Plan with review for a successor policy for post 2020

The functions of the Adaptation Working Group are to include:

- Development and preparation of RMI's NAP to identify vulnerabilities to climate change, options for adaptation activity and a national plan of action
- Facilitate awareness of adaptation issues through the Marshall Islands
- Facilitate and promote adaptation measures through all sectors of RMI

The functions of the RMI NDC Partnership Working Group are to include:

- Represent the interest of the Global NDC Partnership (and any funding source) on the Mitigation and Adaptation Working Groups
- Provide/develop integrated cross-cutting services to the Mitigation and Adaptation Working Groups including:
    - Women's issues and gender
    - Human rights
    - Vulnerable groups
    - Youth and children
    - Health services
    - Education services
    - Outer island engagement
    - Capacity building
    - Climate financing and financial services
    - Global leadership

Climate change already has negative health effects and undermines the“right to health” cited in the Paris Agreement. Climate change undermines the social and environmental determinants of health, including people’s access to clean air, safe drinking-water, sufficient food and secure shelter. It is affecting health particularly in the poorest, most vulnerable communities such as small-island developing States (SIDS) and least developed countries, thus widening health inequities.

Climate Change and Health in RMI

-

Findings from WHO Need Assessment Mission in November 2019

By:

Nasir Hassan, Ko Eunyoung and Saori Kitabatake

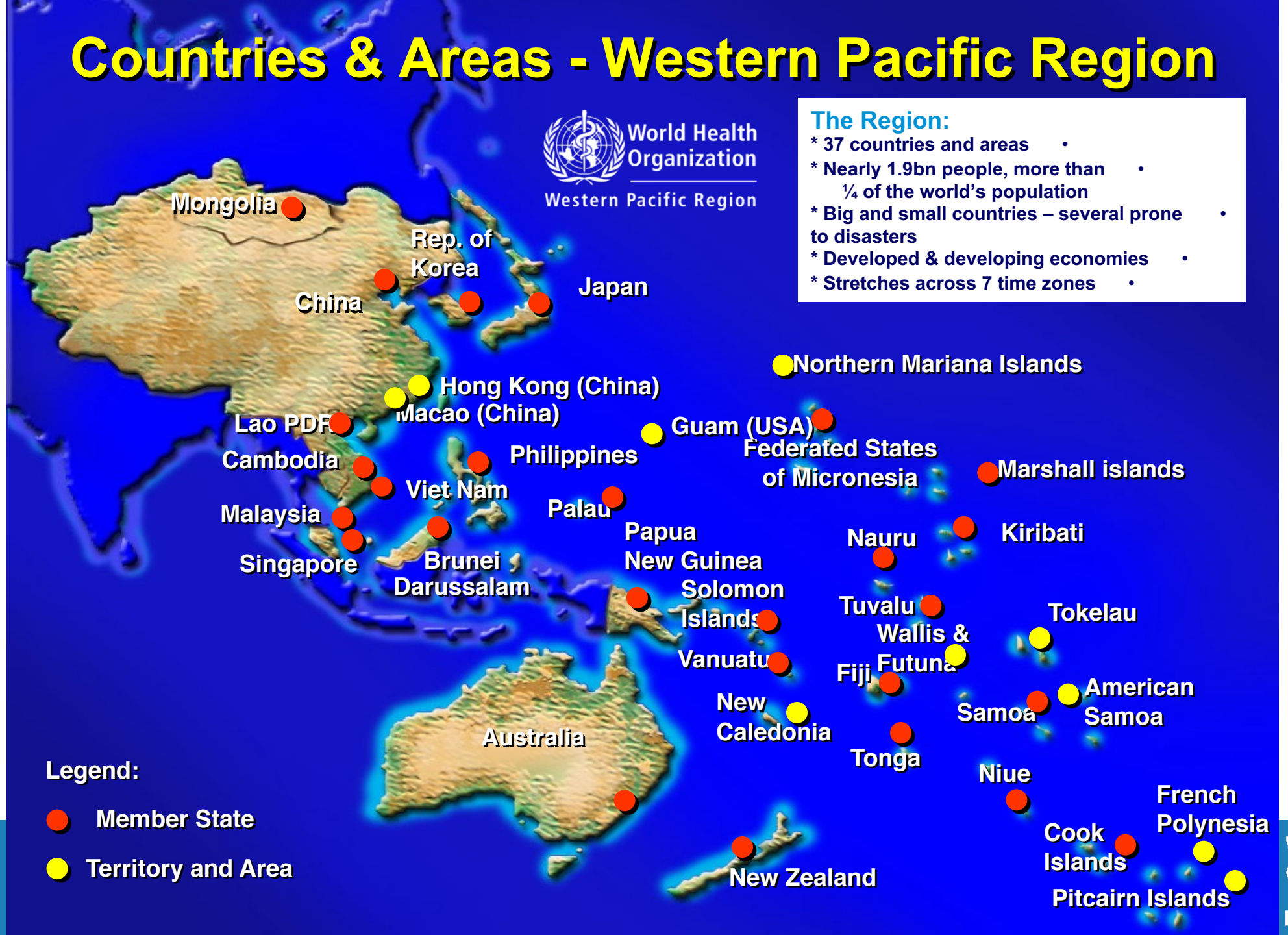
Further information:

hassanm@who.int

Overview

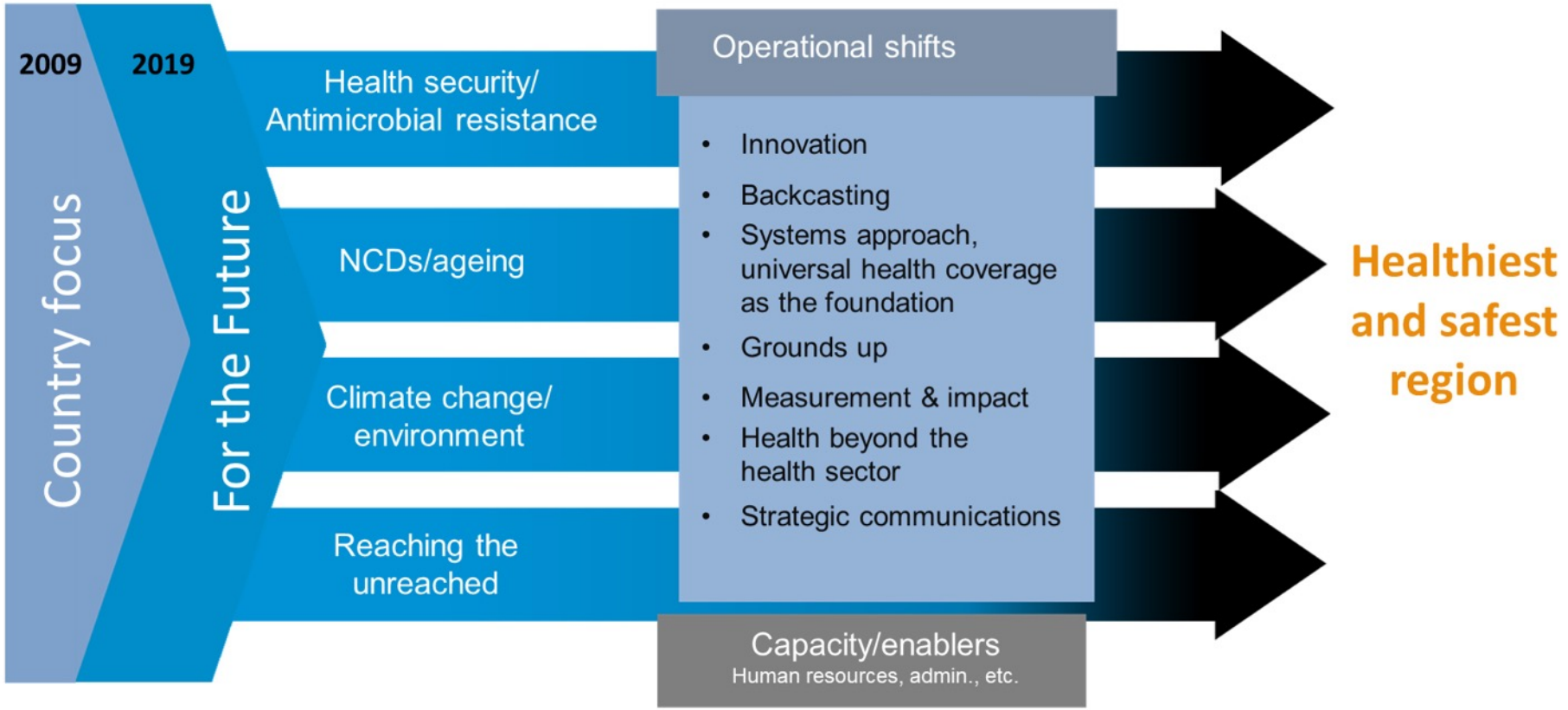
- WHO's work in climate change and health
- Findings from November 2019 consultations
  - Recommendations
- Moving forward

Countries & Areas - Western Pacific Region



World Health Organization
Pacific Region

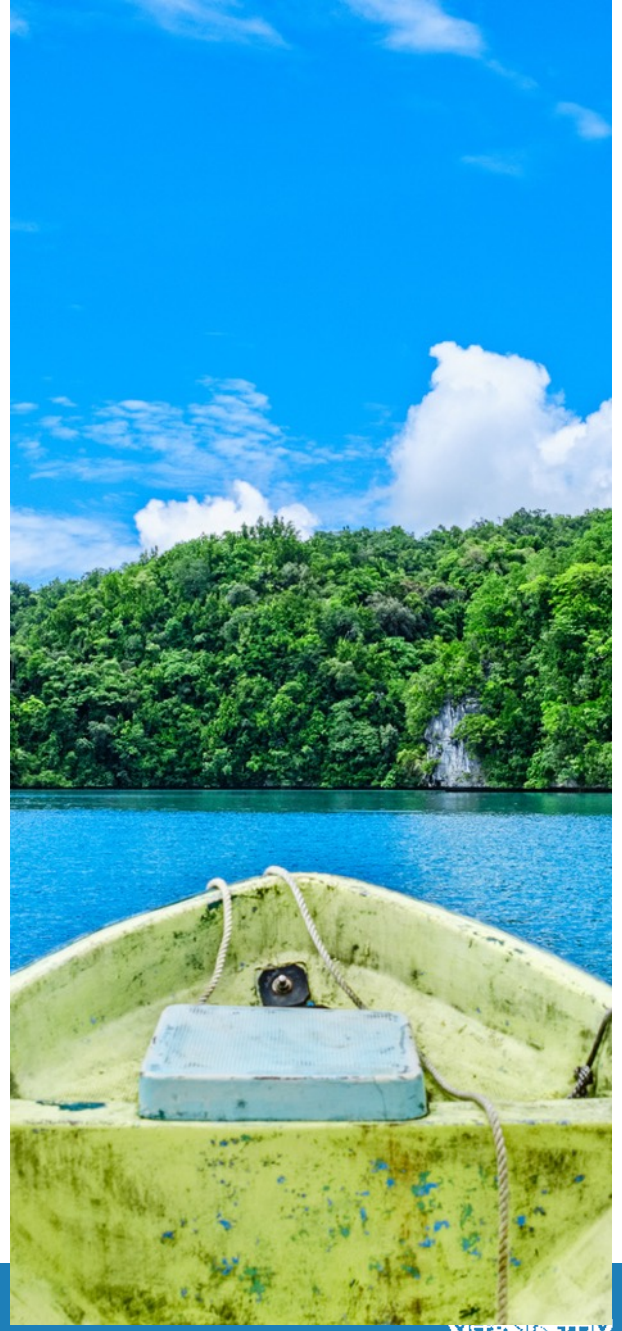
For the Future: The safest and healthiest region



WHO work in the Pacific

Currently working with Member States to:

1. **Tackle NCDs in the Pacific and improve health through the lifecourse**
2. **Strengthen Pacific health systems**
3. **Strengthen health security**
4. **Combat communicable diseases**
5. **Protect the health of Pacific people from the impacts of climate change and environmental hazards**

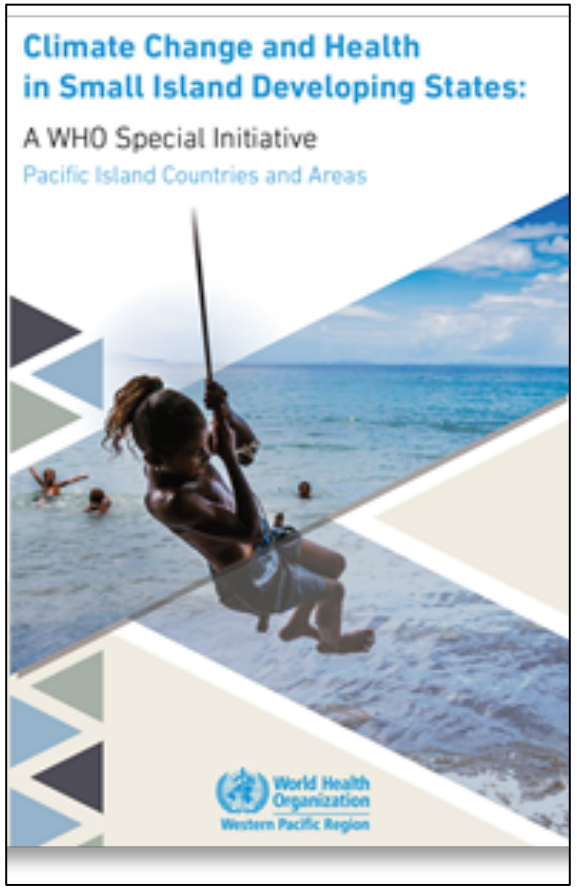


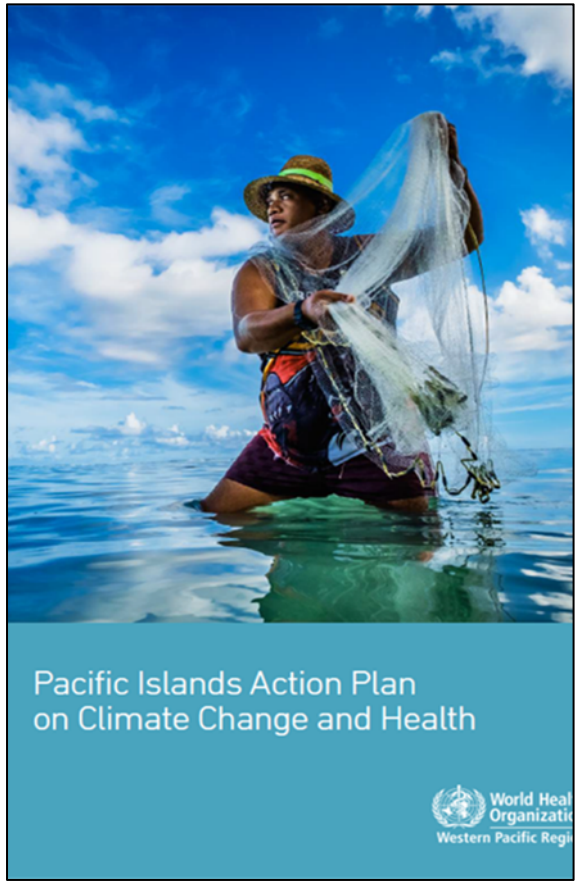
WHO 4 Areas of Focus- Climate Change and Environment (CCE)

WHO's work on CCE in the Pacific

SIDS Initiative

Building climate-resilient health systems in all the SIDS by 2030





WHO Mission to RMI

- Mission - Nov 11-15, 2019 by WHO Consultant (Dr Natasha Kuruppu)
- Mission objectives:
  - *to assess the needs of health sector in building climate resilient health systems*
- Mission activities:
  - *receive feedback and insights from key stakeholders on country priorities for climate change and health, including barriers and opportunities;*
  - *scope and build evidence to establish baseline, contextualize proposed activities,*
  - *identify gaps in data or information, as well as needed resources, potential timetable, target areas, relevant documents, and potential co-financing opportunities*

Organizations in RMI WHO Met and Consulted:

Ministry of Health	Marshall Islands Conservation Society (MICS)
Majuro Water & Sewer Company	National Energy Office
Majuro Energy Company	Majuro Atoll Local Government
Ministry of Works, Infrastructures and Utilities (MoWIU)	Environmental Protection Authority (EPA)
Economy Policy, Planning and Statistical Office (EPPSO)	Asian Development Bank
International Organization for Migration (IOM)	177 Health Care Program
Office of Environmental Planning and Policy Coordination (OEPPC)	Marshall Islands Council of Non-Governmental Organizations (MICNGOs)
Ministry of Natural Resources and Commerce	Ministry of Finance
National Disaster Management Office (NDMO)	Independent consultant & researcher Dr Riyad Mukadam
University of the South Pacific	

What we were asking ?

- What are the top 3 critical health challenges in RMI and who is the most vulnerable?
- How do you believe climate change will affect these challenges?
- What new initiative are needed/planned to address these climate change related challenges?
- What are the other key ministries/organizations you collaborate with?

Findings:
Key emerging theme - health challenges and needs

- Recurring outbreaks of climate-sensitive diseases
  - Dengue outbreaks
  - Challenge to maintain normal routine activities
- Lack of human resources across many sectors
  - lack of personnel dedicated to climate change in the MoH
- Challenge to maintain basic infrastructure needs in healthcare facilities, especially in the outer islands (e.g. non-functioning radios, solar panels, cold-chain)
  - Assessment of climate vulnerabilities in healthcare facilities is needed
- Limited awareness of health impacts of climate change in key-health determining sectors
  - Opportunity to promote health-co benefits and enhance climate actions of health determining sectors

Findings:

- There are existing climate change projects that have health implications in RMI
  - the Global Climate Change Alliance Plus – Scaling up Pacific Adaptation (GCCA+ SUPA) funded by EU and implemented by SPC, SPREP and USP

- There are ongoing activities in areas of climate change and health
  - Updating National Climate Change and Health Action Plan

Green Climate Fund- Readiness objectives

Objective 1: capacity building for climate finance coordination

Objective 2: strategies for climate finance implementation

Objective 3: strengthened adaptation planning for investment

Objective 4: paradigm-shifting pipeline development

Objective 5: knowledge sharing and learning

Health Sectors Needs in RMI (potential supports from donors)

1. Establish a baseline to produce evidence-based solutions
   - Vulnerability and adaptation assessments of outer islands healthcare facilities to climate change and vulnerability

2. Capacity building for leadership and governance
   - Support the establishment of a designated full-time climate change technical officer position within the MoH, to mainstream climate change into all health programmes.

Health Sectors Needs in RMI (potential supports from donors) – Cont.

3. Strengthening health and climate early warning surveillance systems;
   - strengthen integrated risk monitoring, which is the use of early detection tools and epidemiological surveillance used in conjunction with technologies for surveillance of environmental determinants of health

4. Mental health and climate change impacts
   - Establish a baseline understanding of the linkage to climate change;
   - identify gaps and support mechanisms needed to strengthen psychosocial wellbeing of communities.

5. Sustainable business models for Indigenous and traditional medicines and therapies
   - Identify the climate change impact on traditional herbal plants, biodiversity and indigenous knowledge and what actions are required to build resilience of these practices

Recommendations

- For the Ministry of Health:
  - Continued engagement with NDA and staff at OEPPC to understand the direction and opportunities for Readiness funds and further discuss the needs of building climate resilience in the health sector to safeguard the health of Marshallese population.
  - Identify which key activities for Readiness and larger GCF funding Ministry of Health would want to take forward and identify appropriate modality
    - Activities should have strong climate rationales.
  - Identify funding opportunities from other donor to mobilize resources to the health sector for adaptation planning and implementation of activities to build climate-resilience
  - Identify areas of collaboration with existing climate change-related projects and initiatives and promote cross-sectors coordination, including civil society and communities

Moving forward

- Informal Working Group to discuss implementation of priority actions of the Pacific Islands Action Plan on Climate Change and Health (2019-2023)
    - March 25 -26, 2020 Nadi, Fiji

- Western Pacific Regional Platform on Climate Change and Environment
    - To be developed in 2020
    - A space for knowledge-sharing and innovative ideas

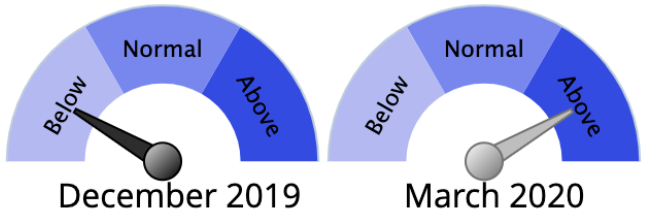
Kommol tata!

Questions?

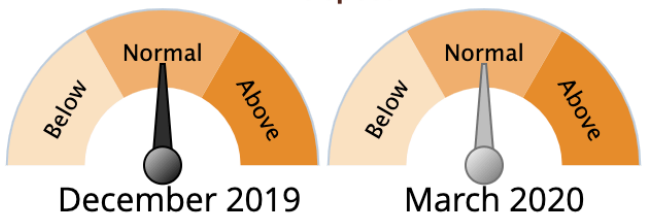
Examples of existing climate services products for the Pacific Islands region/RMI

This quarter (updated monthly)

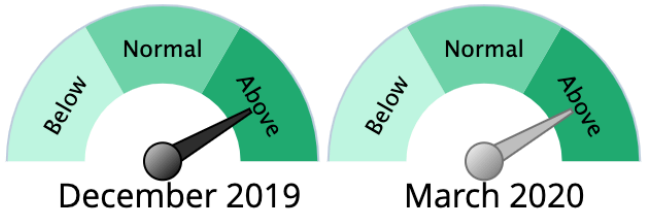
Rainfall



Wind speed



Sea level (not including waves or tides)



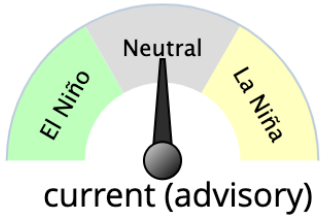
For more detail on the above information see the Marshall Islands Climate Outlook and the Pacific ENSO Applications Center (PEAC) bulletin.

Daily information on inundations is available for Kwajelein and Majuro. For daily information on storms and inundations, stay tuned to radio or the 'chatty beetle.'

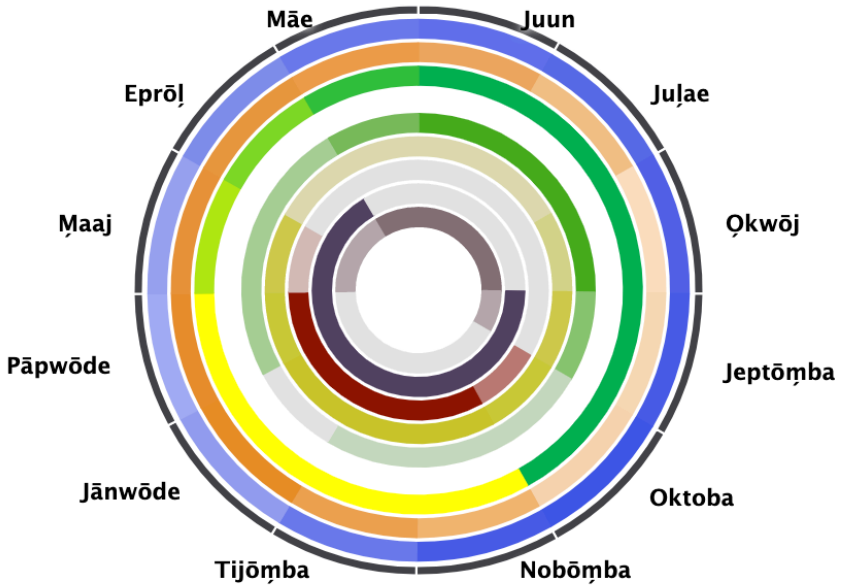
This year (updated monthly)

(Normal Conditions)

Updated 9 January 2020



- What is the El Niño/La Niña pattern?
- Learn about the Marshallese traditional agroforestry calendar.



SOLOMON ISLANDS
MALACLIM EARLY ACTION RAINFALL WATCH
July 2019

This bulletin is produced using the MalaClim Model which is based on October to December monthly rainfall to provide Early Warning System for Malaria transmission risk on the North Guadalcanal for the period January to June.

Coming Up:

- *Normal or average Malaria transmission risk is predicted for North Guadalcanal for the period—January to June 2019.*
- *ENSO Outlook is at INACTIVE Status. That means ENSO status is likely to be Neutral in the coming months.*
- *Below normal rainfall is predicted for North Guadalcanal region for the period—August to October 2019.*

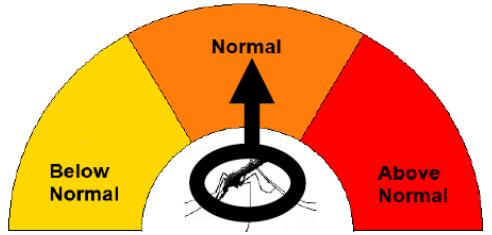
Malaria Rainfall WATCH Update

Northern Guadalcanal Malaria Early Warning System **OCTOBER—DECEMBER** 2018 Rainfall Thresholds (mm) for Honiara.	LOWER	UPPER
	370	540

Total rainfall received for the period ***October to December* 2018** was **513.9 mm.** This falls between low (**370mm**) and upper (**540mm**) thresholds hence, the forecast for the period is consistent with the observed.

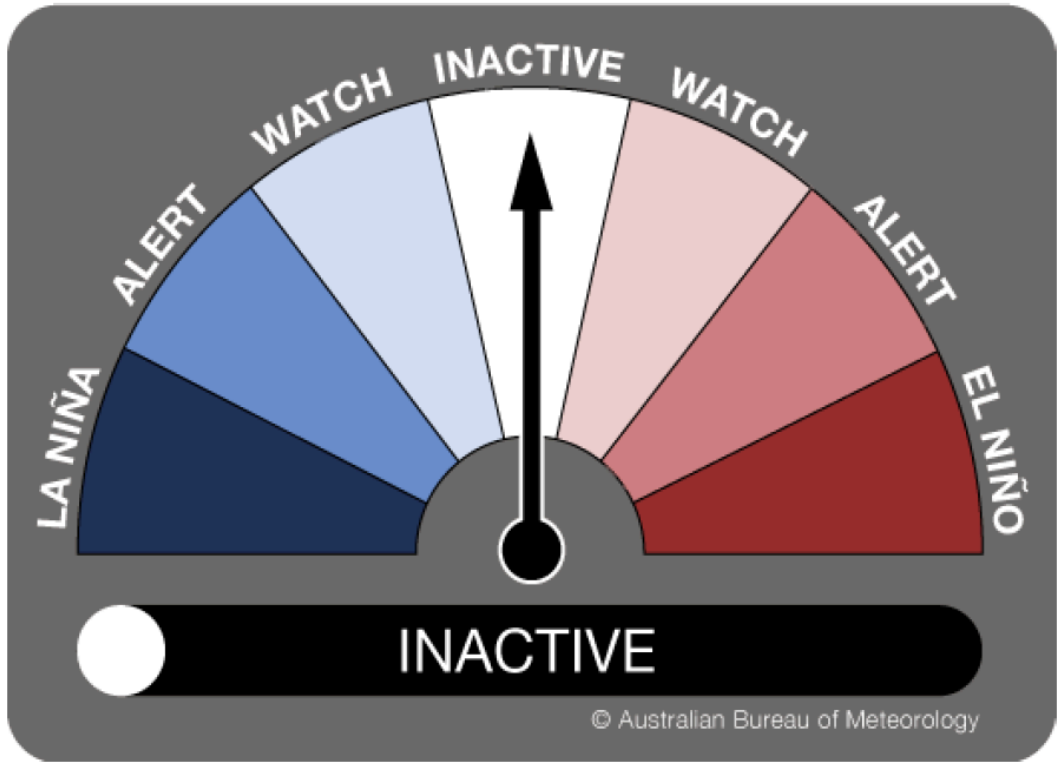
HONIARA RAINFALL UPDATES				
Year	**Oct**	**Nov**	**Dec**	**Total**
2017	67.1	205.3	363.0	**635.4**
2018	55.2	61.5	397.2	**513.9**

*"That means the Malaria transmission risk for the Northern Guadalcanal region for the period **January—June 2019** is expected to be NORMAL or at average and the number of malaria cases is likely to be around **4122** cases."*



MALARIA RISK INDEX

El Nino Southern Oscillation (ENSO) Update



Source—Bureau of Meteorology (BOM), Australia, 9th July 2019.

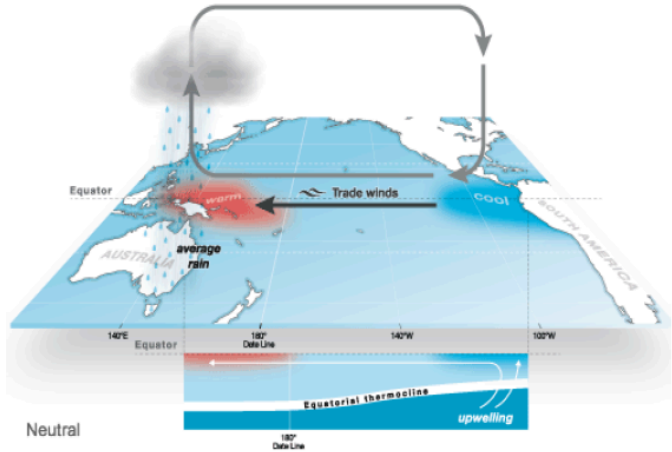
EL NINO—*Associates with Below Normal Rainfall.*

NEUTRAL—*Associates with Normal Rainfall.*

LA NINA—*Associates with Above Normal Rainfall.*

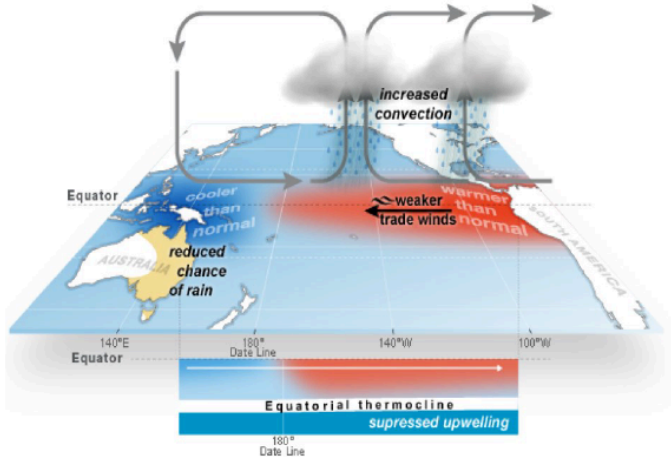
Current status:

The El Niño Southern Oscillation (ENSO) is still at Neutral status.



Outlook:

The ENSO outlook is at **INACTIVE status**, meaning ENSO is neutral and there is no clear indications that an El Nino or La Nina event will develop in the coming months.



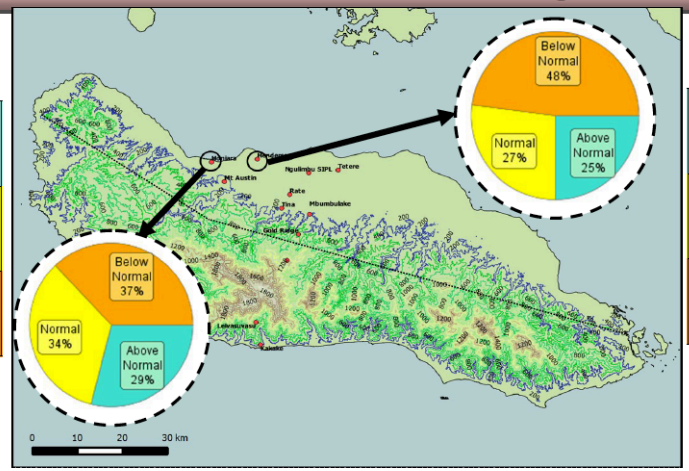
El Niño–Southern Oscillation (ENSO): **El Niño**

Northern Guadalcanal Rainfall Prediction—August to October 2019

HONIARA

Above Normal	*Rainfall Greater than*	***359.0 mm***
Normal	*Rainfall Between*	***259.9 and 359.0 mm***
Below normal	*Rainfall Less than*	***259.9 mm***

Below normal rainfall is predicted for Honiara for the period—August to October 2019.



HENDERSON

Above Normal	*Rainfall Greater than*	***319.6 mm***
Normal	*Rainfall Between*	***247.0 and 319.6 mm***
Below normal	*Rainfall Less than*	***247.0 mm***

Below normal rainfall is predicted for Henderson for period—August to October 2019.

Below normal rainfall is most likely predicted for the northern Guadalcanal for the period—August to October 2019.

Observed Rainfall—April to June 2019

STATIONS	TOTAL Rainfall (mm)	Forecasted Rainfall (mm)	Forecast Verification	33% Rainfall (mm)	66% Rainfall (mm)	Median Rainfall (mm)
Henderson	376.1	Below Normal	Consistent	303.3	370.7	341.7
Honiara	388.5	Below Normal	Consistent	337.3	469.7	376.0

Below Normal rainfall was predicted for both Honiara and Henderson for the period—April to June 2019.

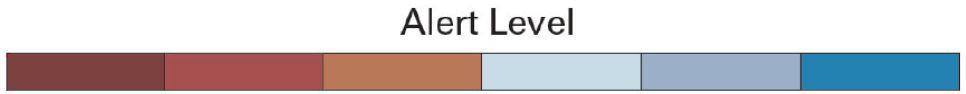
Observed data shows that the forecasts for the two stations are consistent.

Malaria case Verification—January to June 2018

Malaria cases for the period—January to June 2018 was predicted for below normal with an expected total of less than ***3261*** cases. The rainfall observed for the period—October to December 2017 was **635.4mm**, which is more than the **upper 540mm** threshold indicating that there is consistency in **observed rainfall** and **expected number of malaria cases**.

On a similar note, total number of malaria cases (data) received from the Vector Born Disease Control Program is ***840*** for Northern Guadalcanal during the malaria season (January to June 2018). The result was consistent to its forecast (**below normal** malaria transmissions) which is significantly less than the forecasted ***3261 cases***.

Red Cross Seasonal Rainfall Watch



◀ Increasing chance of drier 3 months Increasing chance of wetter 3 months ▶

Alert Level	Divisions with Below Normal Rainfall favoured in the coming 3 months	Alert Level	Divisions with Above Normal Rainfall favoured in the coming 3 months
	Samoa		Solomon Is. (Western Region)
	Cook Islands (Southern) Vanuatu (Southern)		Cook Islands (Northern), Solomon Is. (Central and Eastern Regions)
			Tuvalu

ACTION Level	Divisions/ Regions	Recommended actions (predetermined by IFRC office)
LOW ACTION	Samoa	** Ensure normal preparedness activities are done, and also: – Use IFRC low rainfall/drought check list for preparedness activities or use your own adapted one – Check that you have sufficient emergency response stocks; for example, do you have enough water storage containers like jerry cans and buckets, and are these are available to all areas that you are committed to serve – Check that your reverse osmosis/ desalination plants are functional, that you have spare parts (refer to comment in footnote)[2] and that there are enough qualified staff/volunteers to operate – Regularly monitor climate and weather updates from Met Service

Ready–Set–Go Framework

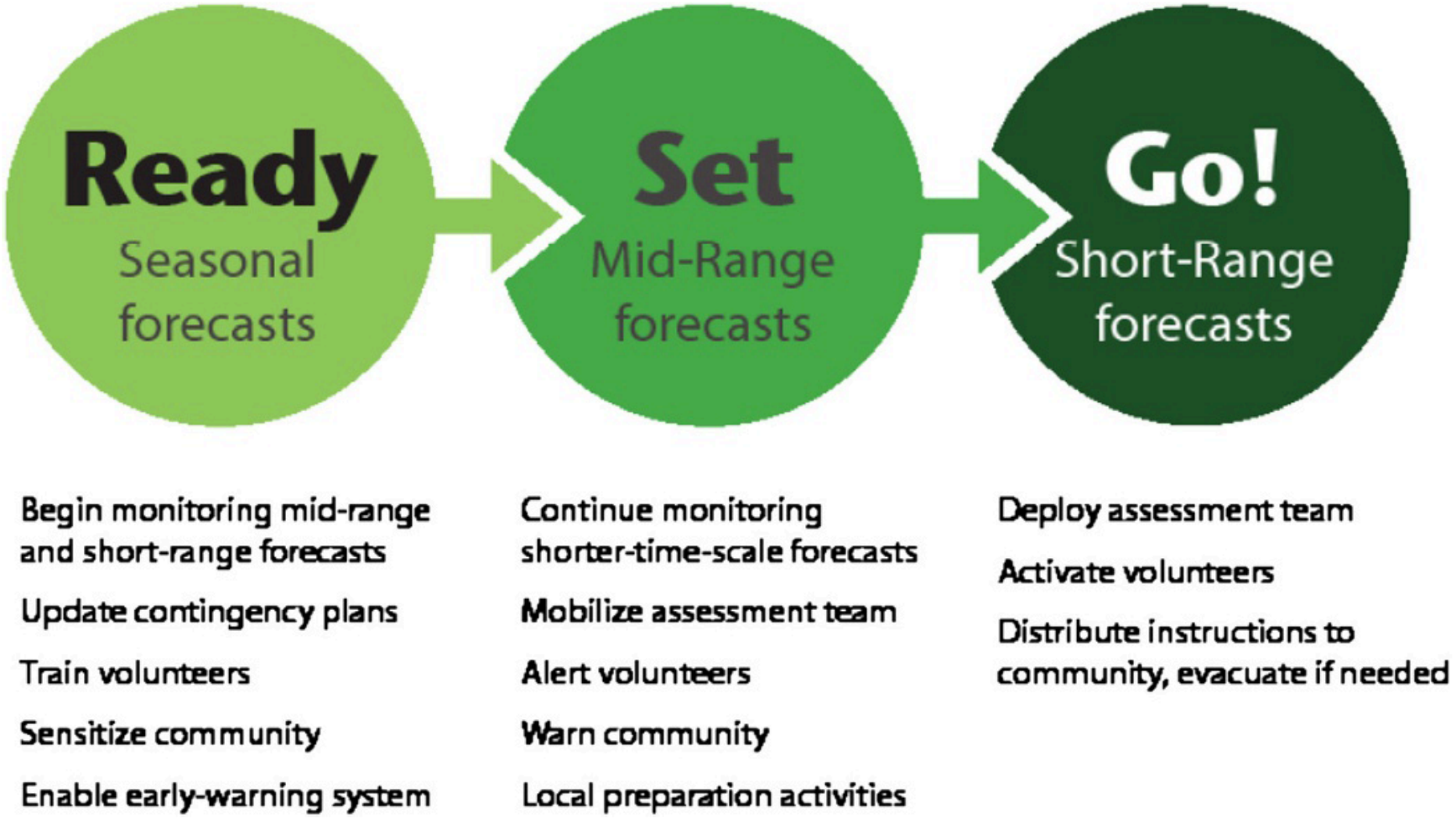


Figure 4 Ready-set-go!. Example schematic for ready-set-go! framing. (Source: M.Daly).