Pacific Islands Health Officer's Association

CAPT Barry Choy

NOAA Liaison US PACOM

September 5, 2018

Barry.Choy@noaa.gov
Ph. 808-477-7529

Overview

- The NOAA's organization and mission
- Climate: Past, present, and future?
- Impacts on human health

National Oceanic and Atmospheric Administration

NOAA's Mission: Science, Service, and Stewardship

To understand and predict changes in climate, weather, oceans, and coasts,

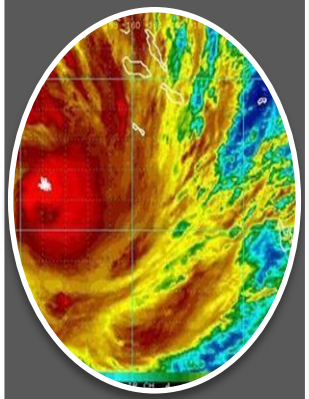
To share that knowledge and information with others

To conserve and manage coastal and marine ecosystems and resources

NOAA Line Offices

National Weather Service (NWS)

Oceanic and Atmospheric Research (OAR)



National Environmental Satellite Data & Information Service (NESDIS)

National Ocean Service (NOS)

National Marine Fisheries Service (NMFS)

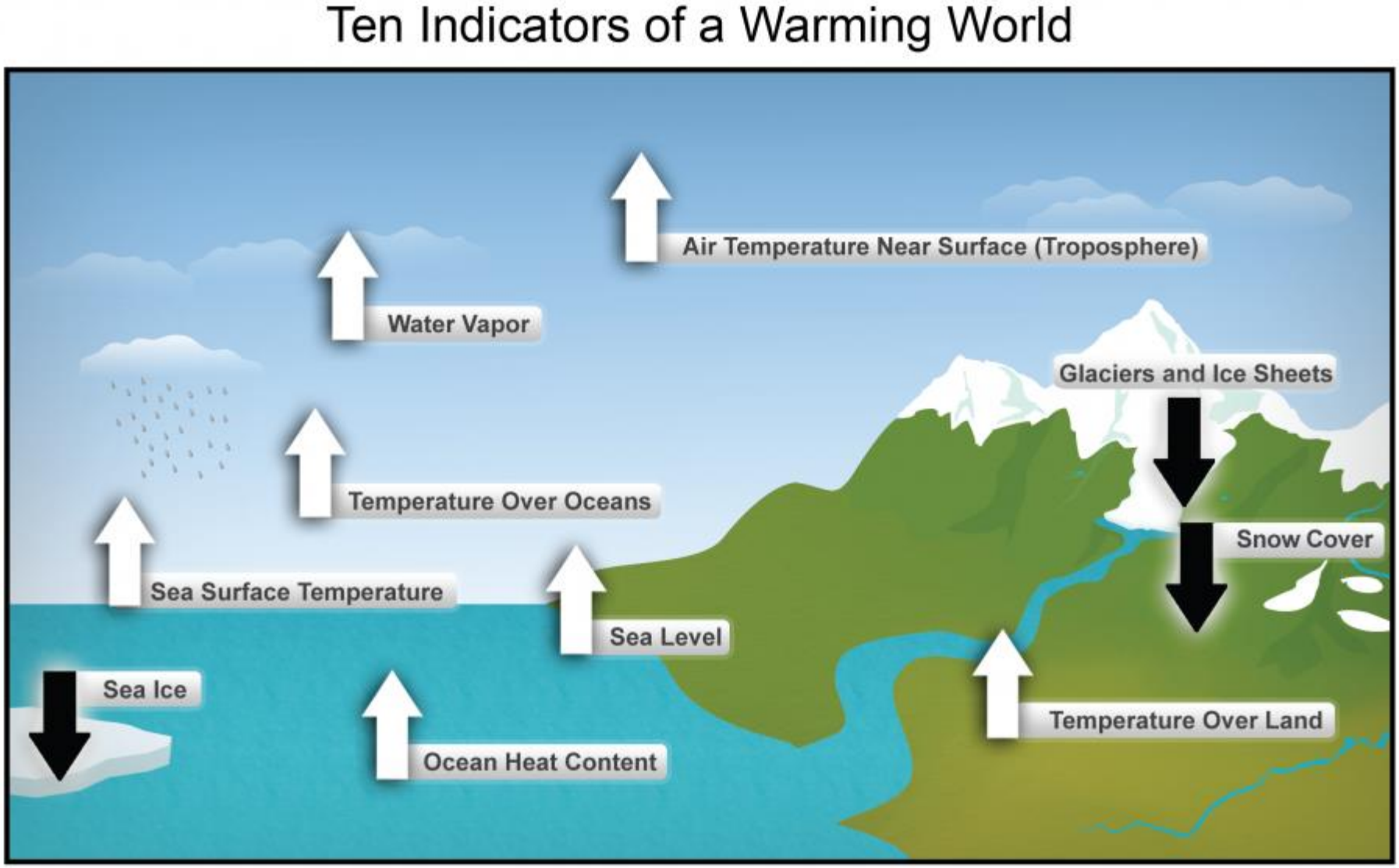
Office of Marine and Aviation Operations (OMAO)

SCIENCE

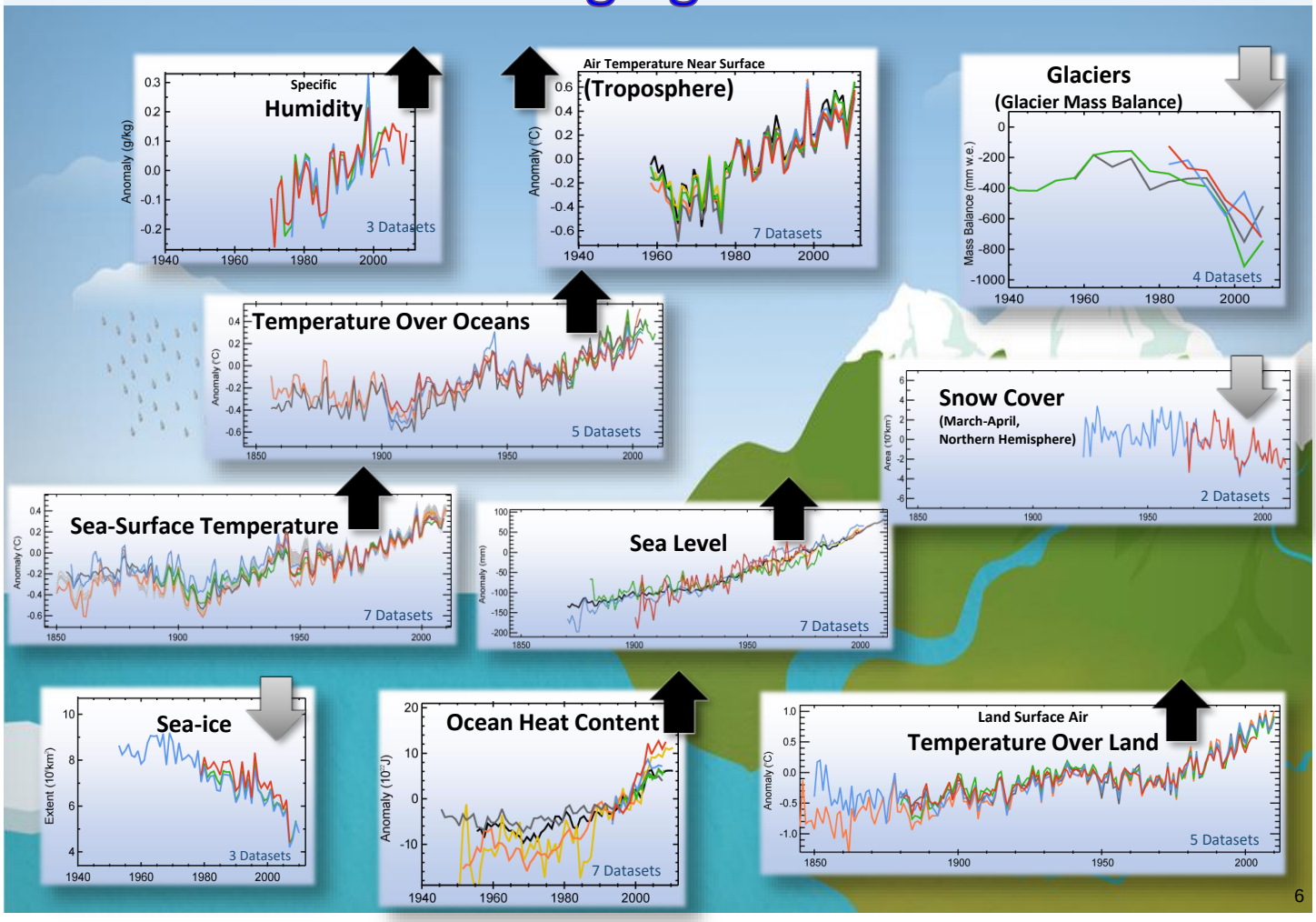
SERVICE

STEWARDSHIP

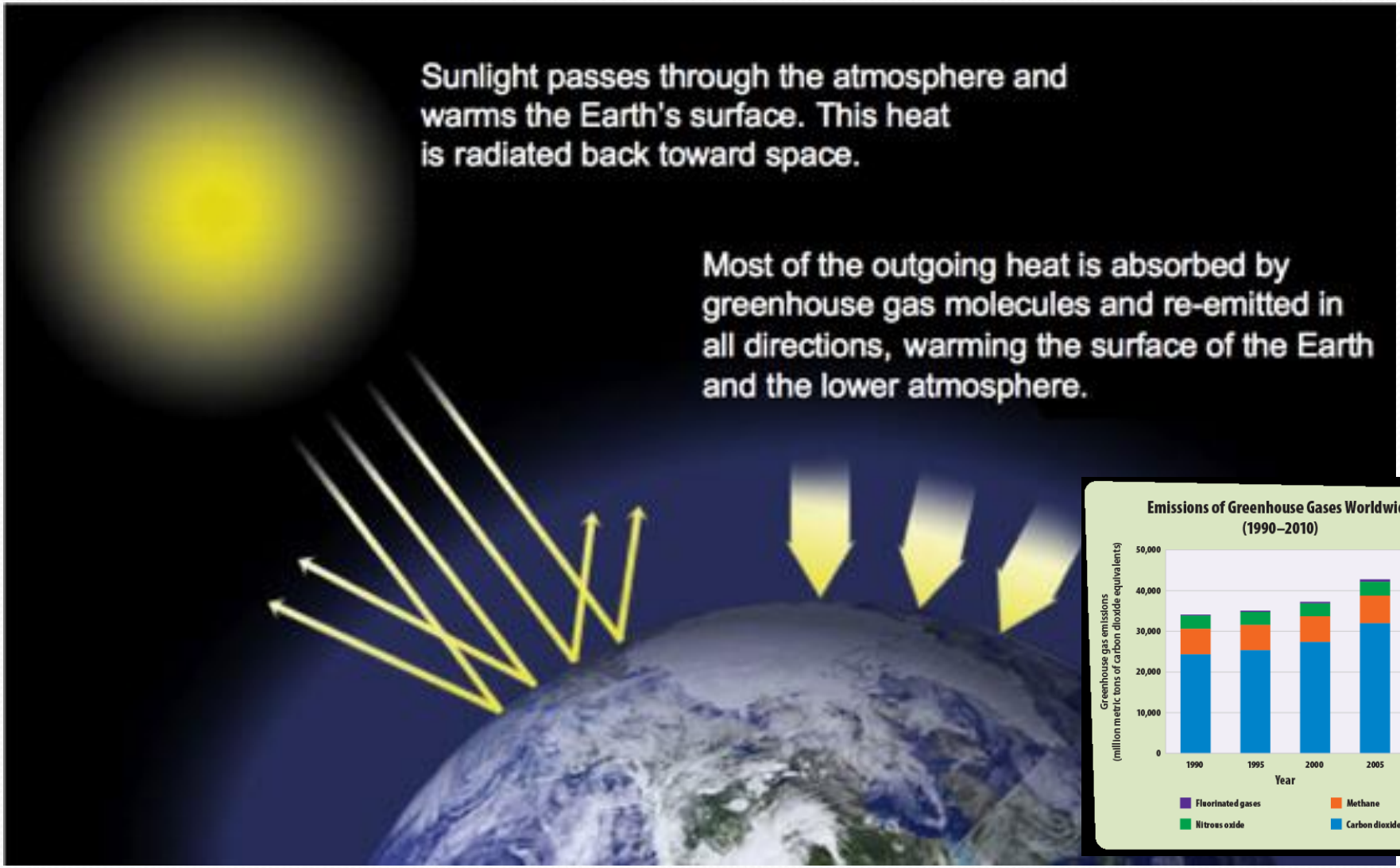
Is this planet warming?



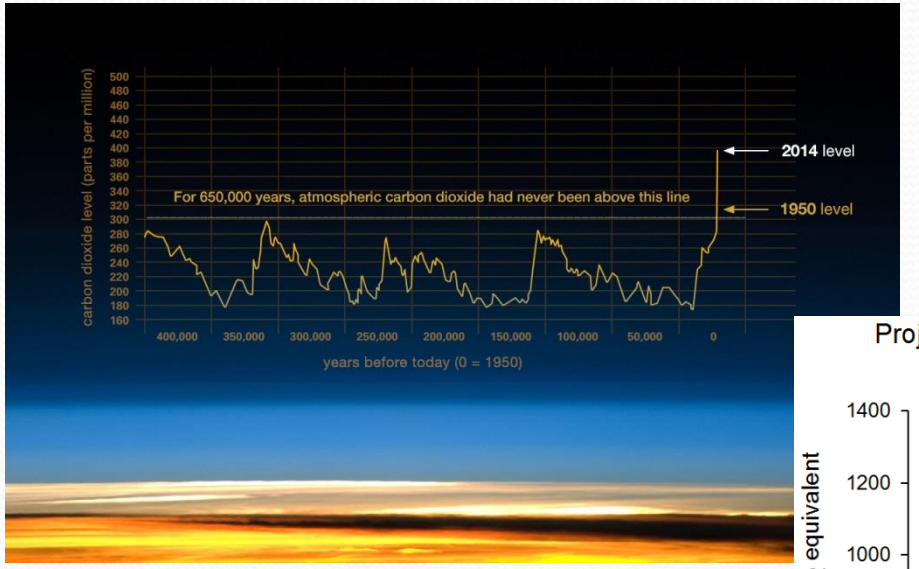
Is the climate changing ? -Observed Trends

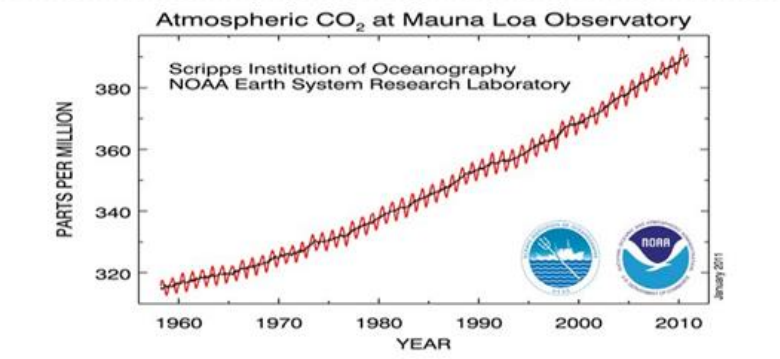


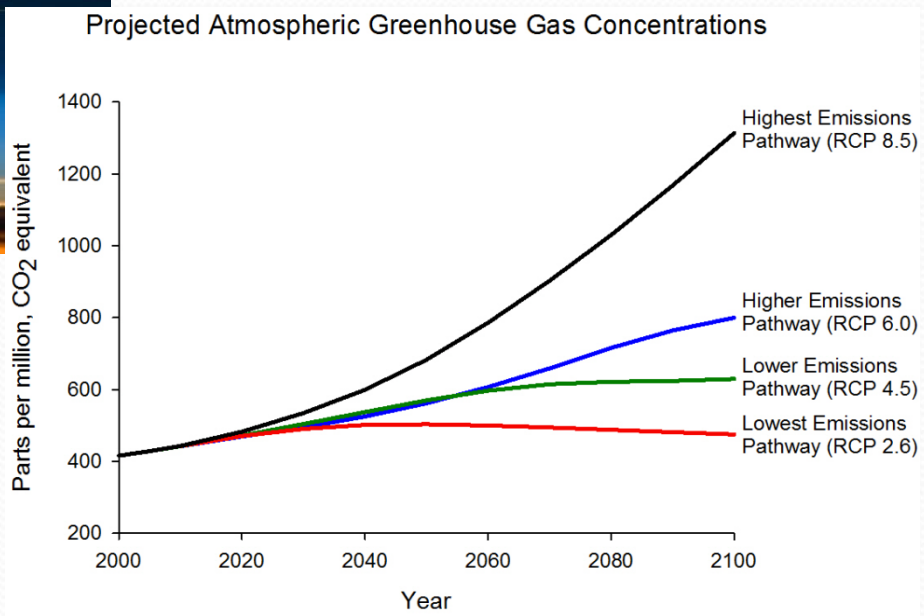
Greenhouse


Sunlight passes through the atmosphere and warms the Earth's surface. This heat is radiated back toward space.
Most of the outgoing heat is absorbed by greenhouse gas molecules and re-emitted in all directions, warming the surface of the Earth and the lower atmosphere.
Emissions of Greenhouse Gases Worldwide (1990–2010)
Greenhouse gas emissions (million metric tons of carbon dioxide equivalents)
50,000
40,000
30,000
20,000
10,000
0
1990
1995
2000
2005
2010
Year
Fluorinated gases
Methane
Nitrous oxide
Carbon dioxide

Carbon dioxide



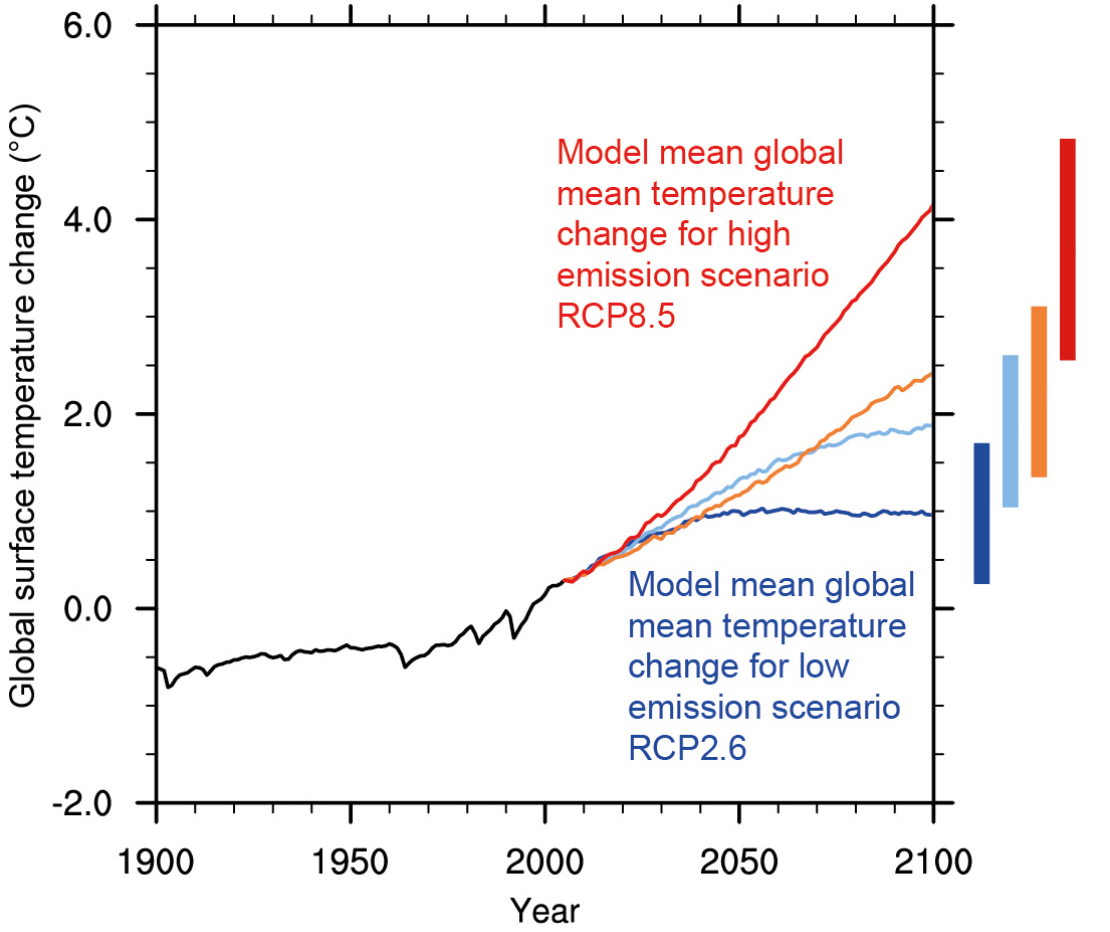




Parameter	Currently	2050	2100
Atmospheric CO2	400 ppm	550 ppm	650 ppm

Confidence level H M L

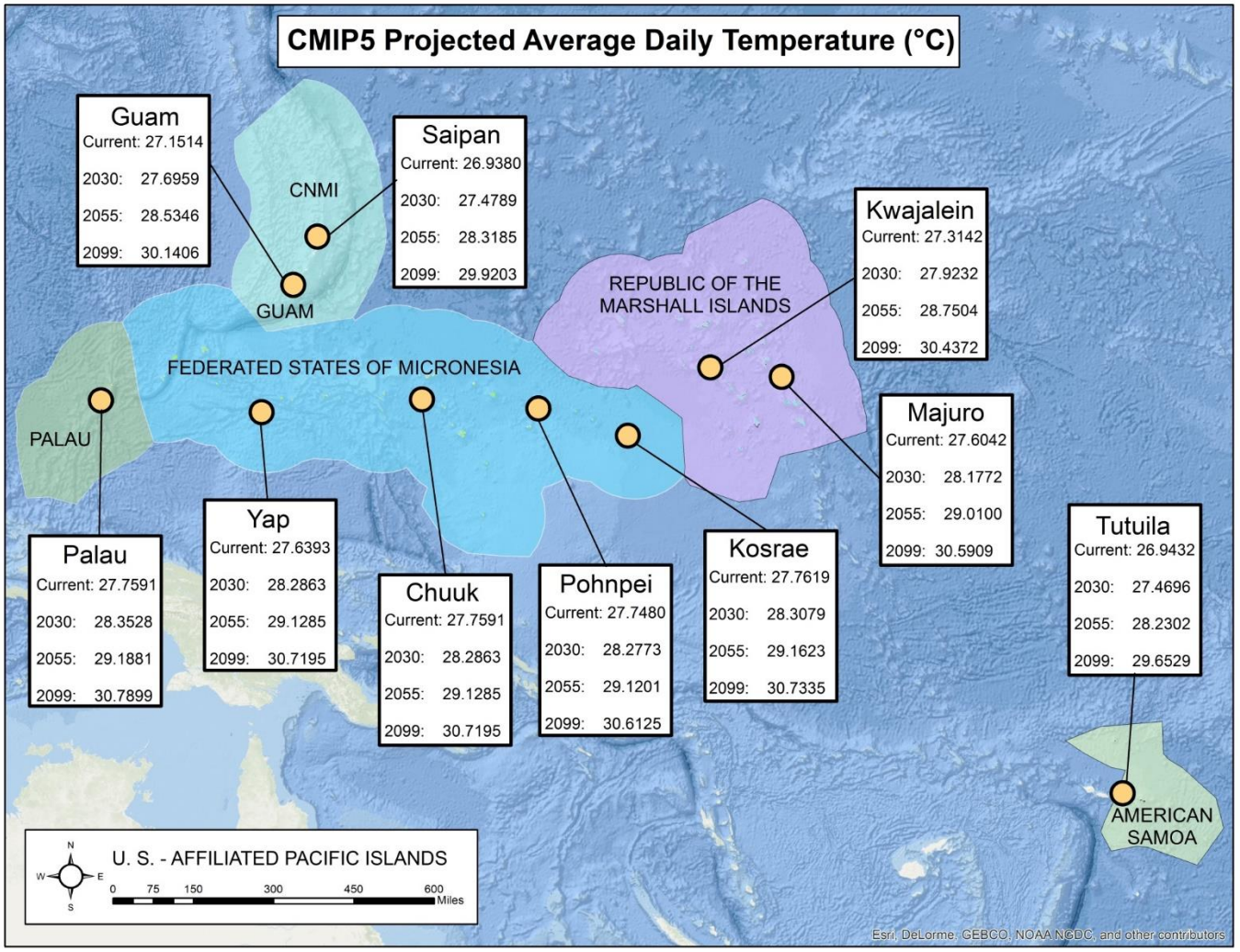
Global temperature



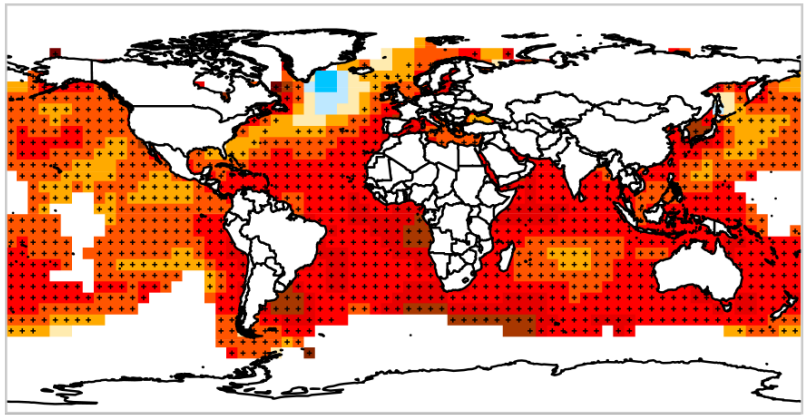
- Increased variability (extremes)
  - Rainfall
  - Droughts
  - Heat waves
- Air pollution
- Melting
  - Glacial
  - Sea ice
  - Permafrost
- Snow cover

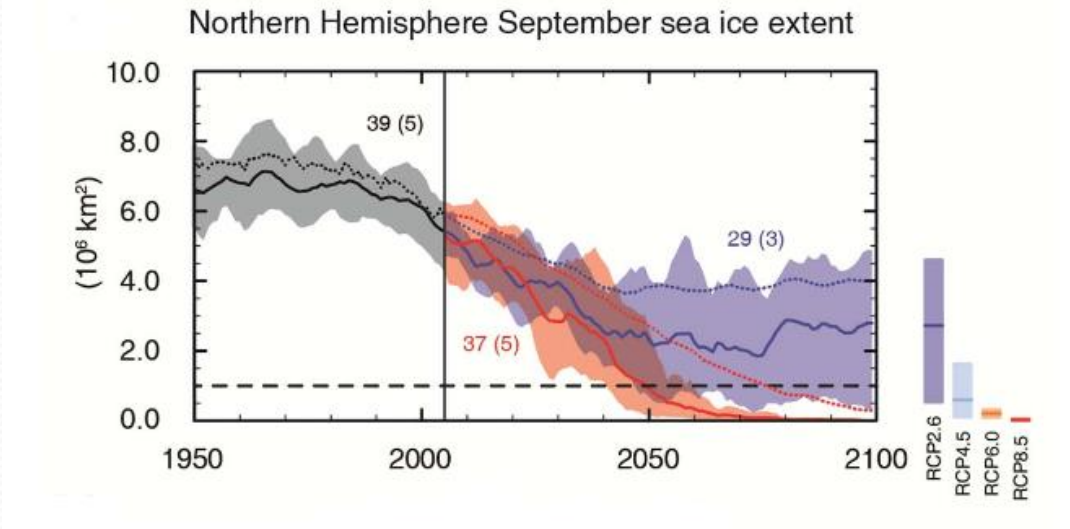
Parameter	Currently	2050	2100
Temperature	--------	+1.0°C	+2.5°C

http://www.ipcc.ch/reprt/ar5/wg1/


CMIP5 Projected Average Daily Temperature (°C)
Guam
Current: 27.1514
2030: 27.6959
2055: 28.5346
2099: 30.1406
Saipan
Current: 26.9380
2030: 27.4789
2055: 28.3185
2099: 29.9203
CNMI
GUAM
REPUBLIC OF THE MARSHALL ISLANDS
Kwajalein
Current: 27.3142
2030: 27.9232
2055: 28.7504
2099: 30.4372
FEDERATED STATES OF MICRONESIA
PALAU
Majuro
Current: 27.6042
2030: 28.1772
2055: 29.0100
2099: 30.5909
Palau
Current: 27.7591
2030: 28.3528
2055: 29.1881
2099: 30.7899
Yap
Current: 27.6393
2030: 28.2863
2055: 29.1285
2099: 30.7195
Chuuk
Current: 27.7591
2030: 28.2863
2055: 29.1285
2099: 30.7195
Pohnpei
Current: 27.7480
2030: 28.2773
2055: 29.1201
2099: 30.6125
Kosrae
Current: 27.7619
2030: 28.3079
2055: 29.1623
2099: 30.7335
Tutuila
Current: 26.9432
2030: 27.4696
2055: 28.2302
2099: 29.6529
AMERICAN SAMOA
U. S. - AFFILIATED PACIFIC ISLANDS
N
W
E
S
0 75 150 300 450 600
Miles
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

Sea surface T and ocean heat content



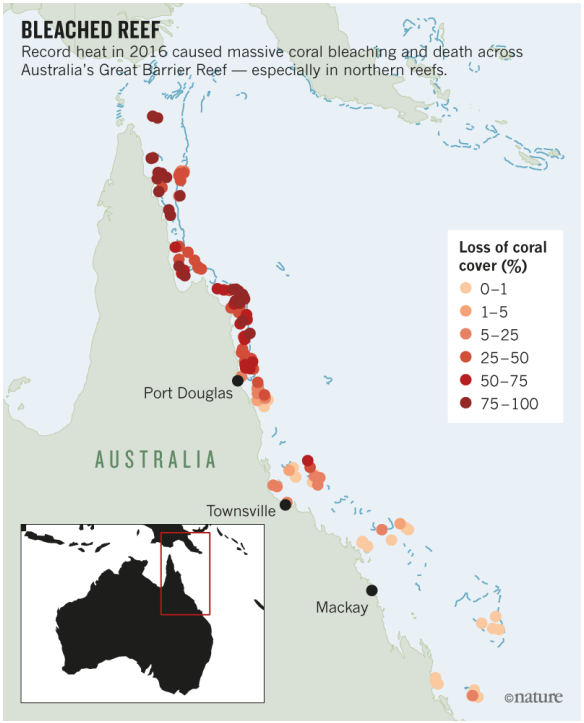


http://www.ipcc.ch/reprt/ar5/wg1/

- Impacts on ENSO
  - Stronger TCs
  - Fewer TCs
  - Storm frequency and intensity changes
- Reduced arctic sea ice
- Distribution of living marine resources
  - Tunas

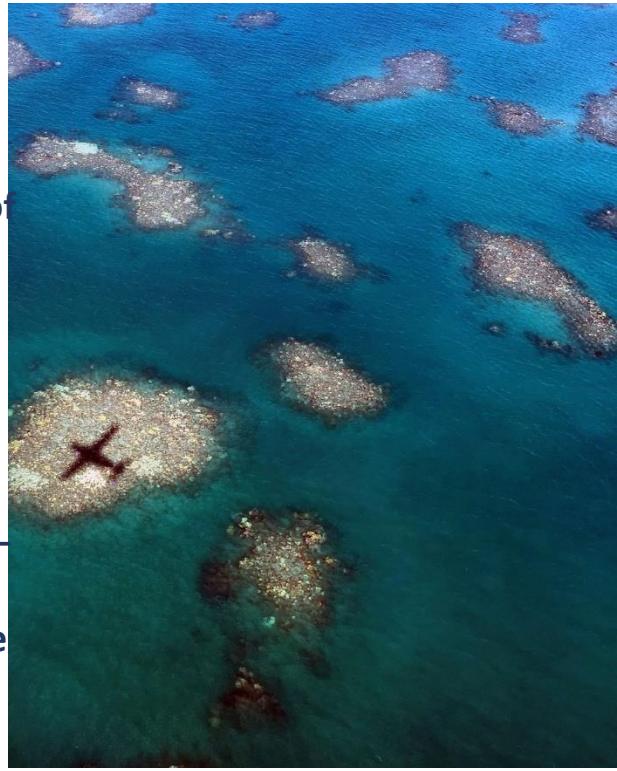
In 2015-2017, the Great Barrier Reef experienced its worst bleaching event on record

Bleaching during the 2015-2016 El Niño was severe and, for the first time, continued into the non-El Niño year of 2017

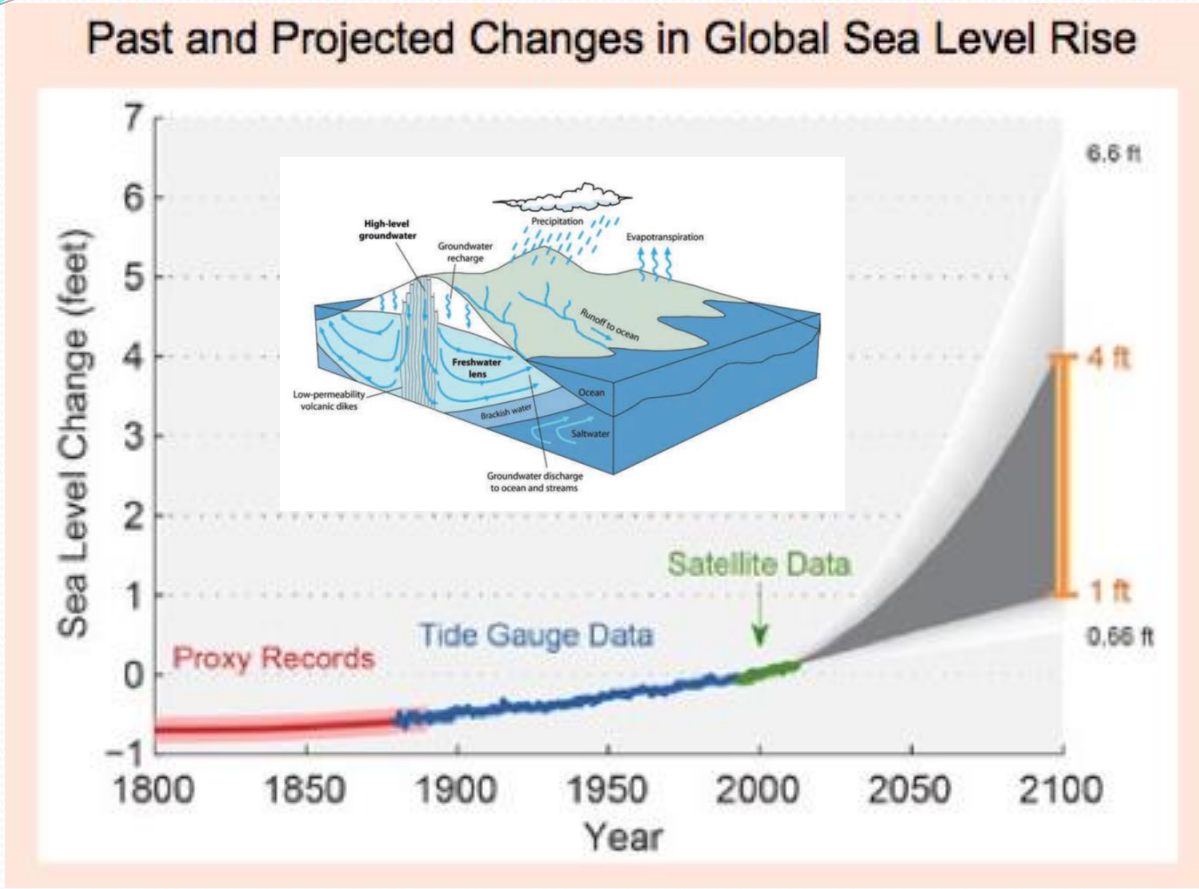


High ocean temperatures killed roughly 30% of the Great Barrier Reef corals in 2016 alone

"the interval between recurrent bouts of coral bleaching is too short for a full recovery…tropical sea surface temperatures are warmer now during current La Niña conditions than they were during El Niño events three decades ago…….coral bleaching is occurring more frequently in all El Niño–Southern Oscillation phases, increasing the likelihood of annual bleaching in the coming decades." (Hughes et al., 2018, Science)



Sea level



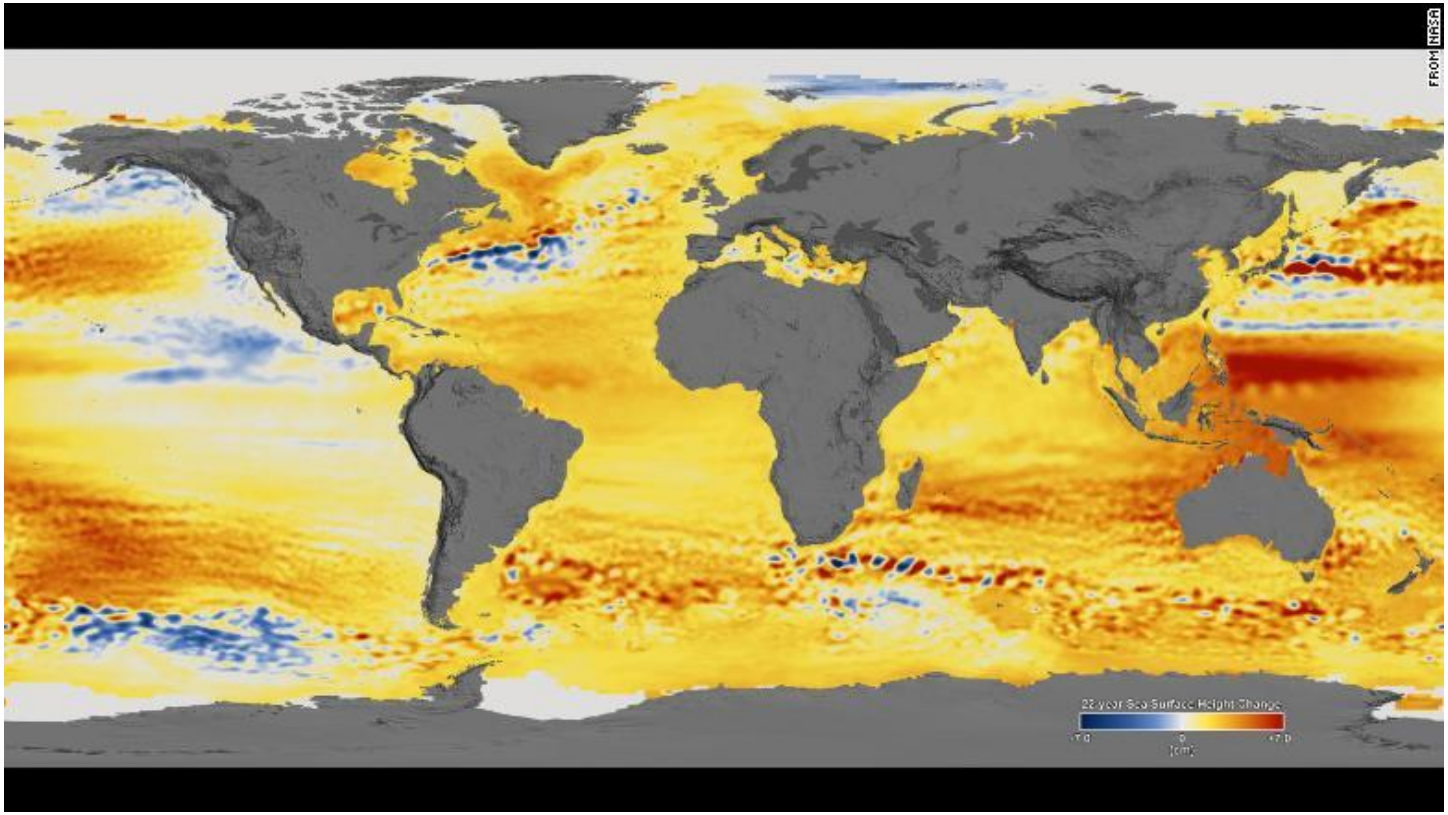
- Salt water intrusion
  - Potable water
  - Irrigation
- Coastal inundation
  - Storm surge
  - King tides
  - High surf
- Flood inundation
  - Tidal
  - Tsunami

Parameter	Currently	2050	2100
Sea level (MLLW)	--------	+0.3 m (~1.1 ft)	+1 m (+3.3 ft)

Two factors can cause sea level to rise:

1. thermal expansion of warmer ocean water
2. additional water added to the oceans from melting land ice (glaciers and ice sheets);

(sea ice is shrinking but that doesn't add to sea level rise)



Changes in sea level observed between 1992 and 2014. Orange/red colors represent higher sea levels, while blue colors show where sea levels are lower.

Why are concerned about Greenland and Antarctica!
(Tetiaroa, highest point above sea level: 6 feet)

Combined with sea level rise, storm waves will increase the frequency of over-wash events

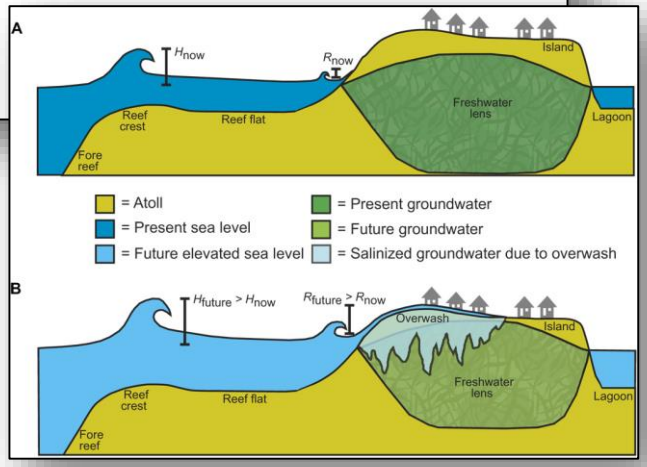
RESEARCH ARTICLE | OCEANOGRAPHY

Most atolls will be uninhabitable by the mid-21st century because of sea-level rise exacerbating wave-driven flooding

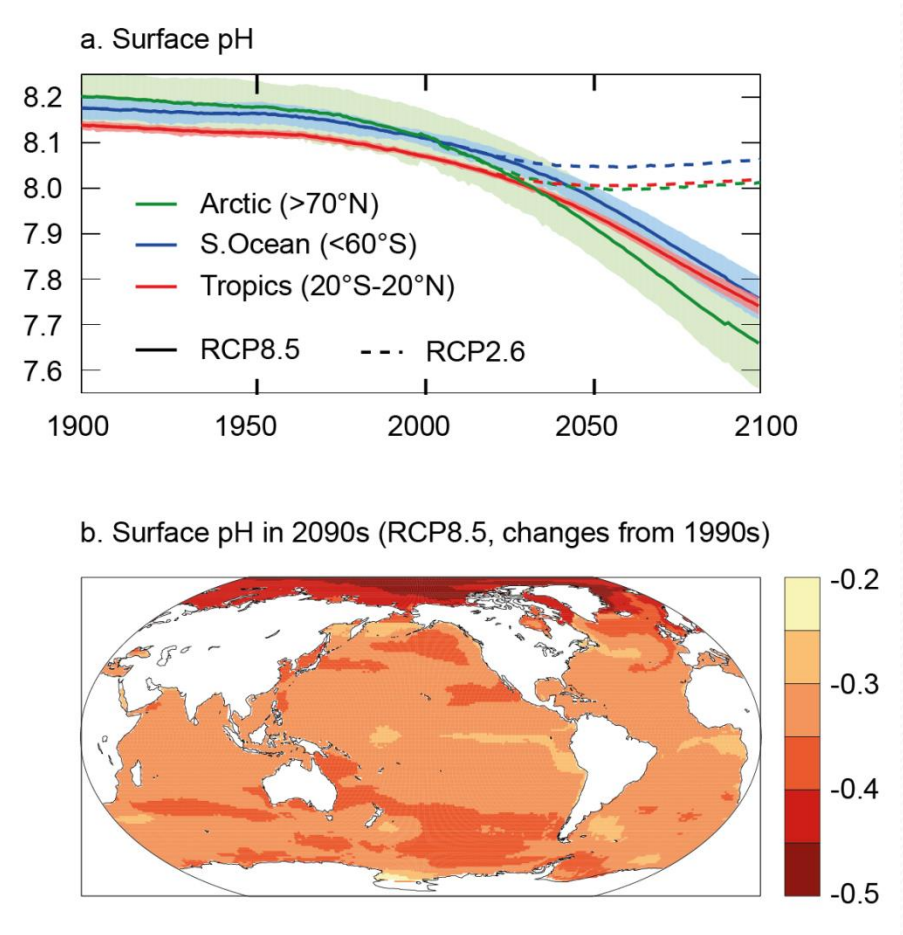
Curt D. Storlazzi[1,*], Stephen B. Gingerich[2], Ap van Dongeren[3], Olivia M. Cheriton[1], Peter W. Swarzenski[4], Ellen Quataert[3], Cl…

+ See all authors and affiliations

Science Advances 25 Apr 2018:
Vol. 4, no. 4, eaap9741
DOI: 10.1126/sciadv.aap9741

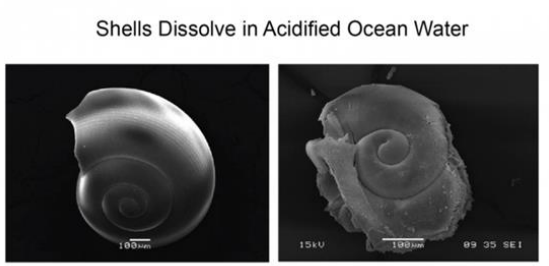


Ocean acidification

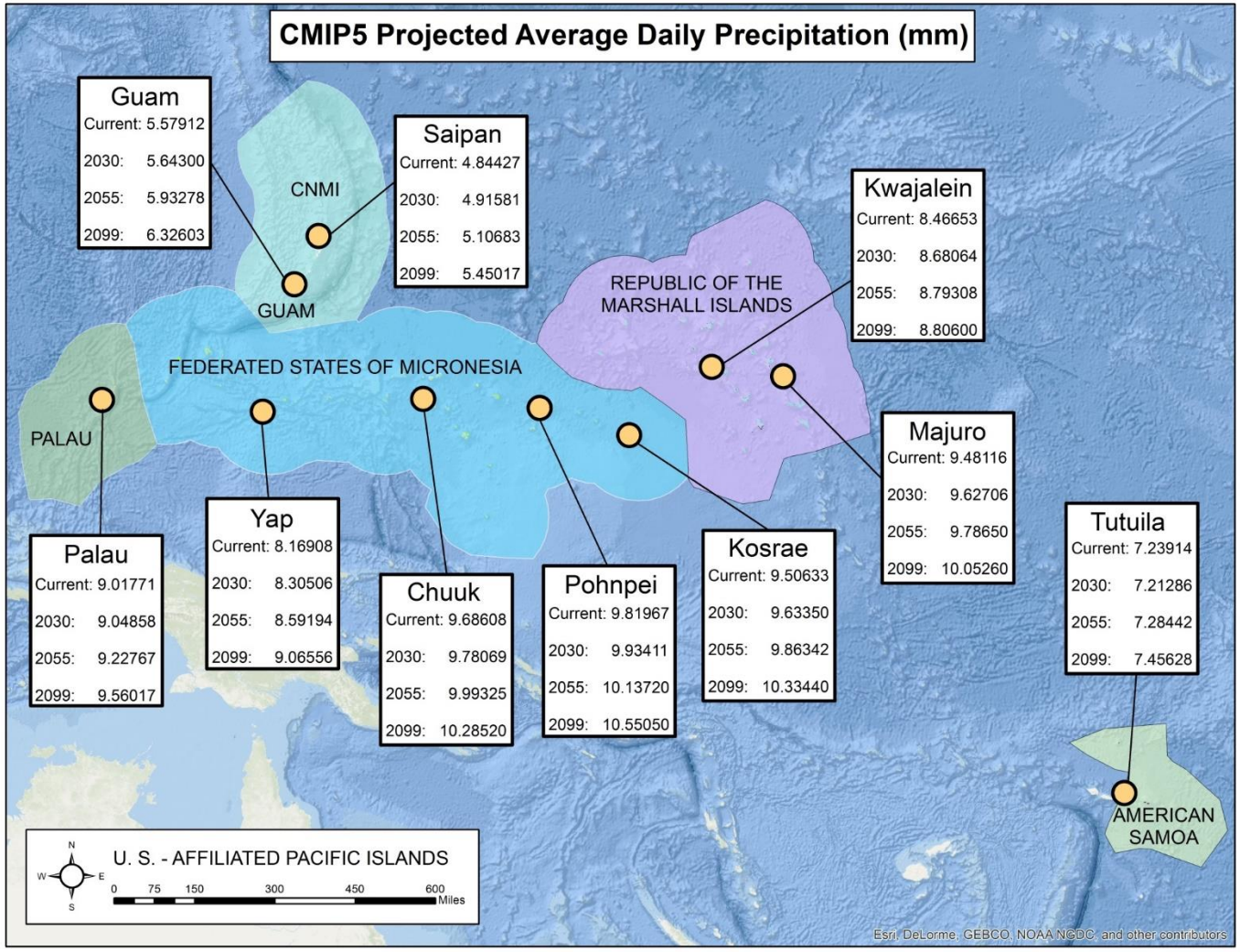


- Reduced Aragonite saturation
  - Reduced calcifying
  - Zooplankton
  - Coral reefs
  - Crustaceans
  - Bivalves

- Ecosystem impacts
  - Reduced biodiversity

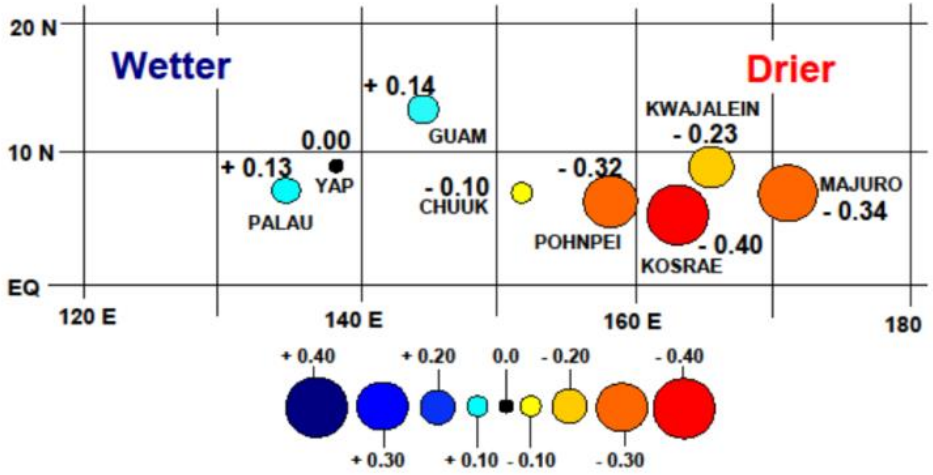


Parameter	Currently	2050	2100
pH	8.0	7.9	7.7


CMIP5 Projected Average Daily Precipitation (mm)
Guam
Current: 5.57912
2030: 5.64300
2055: 5.93278
2099: 6.32603
Saipan
Current: 4.84427
2030: 4.91581
2055: 5.10683
2099: 5.45017
CNMI
GUAM
REPUBLIC OF THE MARSHALL ISLANDS
Kwajalein
Current: 8.46653
2030: 8.68064
2055: 8.79308
2099: 8.80600
FEDERATED STATES OF MICRONESIA
PALAU
Majuro
Current: 9.48116
2030: 9.62706
2055: 9.78650
2099: 10.05260
Palau
Current: 9.01771
2030: 9.04858
2055: 9.22767
2099: 9.56017
Yap
Current: 8.16908
2030: 8.30506
2055: 8.59194
2099: 9.06556
Chuuk
Current: 9.68608
2030: 9.78069
2055: 9.99325
2099: 10.28520
Pohnpei
Current: 9.81967
2030: 9.93411
2055: 10.13720
2099: 10.55050
Kosrae
Current: 9.50633
2030: 9.63350
2055: 9.86342
2099: 10.33440
Tutuila
Current: 7.23914
2030: 7.21286
2055: 7.28442
2099: 7.45628
AMERICAN SAMOA
N
W
E
S
U. S. - AFFILIATED PACIFIC ISLANDS
0 75 150 300 450 600
Miles
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

Precipitation & Drought Patterns are Changing

From 1950-2010, islands in east Micronesia are getting significantly drier (annual avg. -15%), while those in the west have gotten slightly wetter.



Modified and updated from Guard & Lander

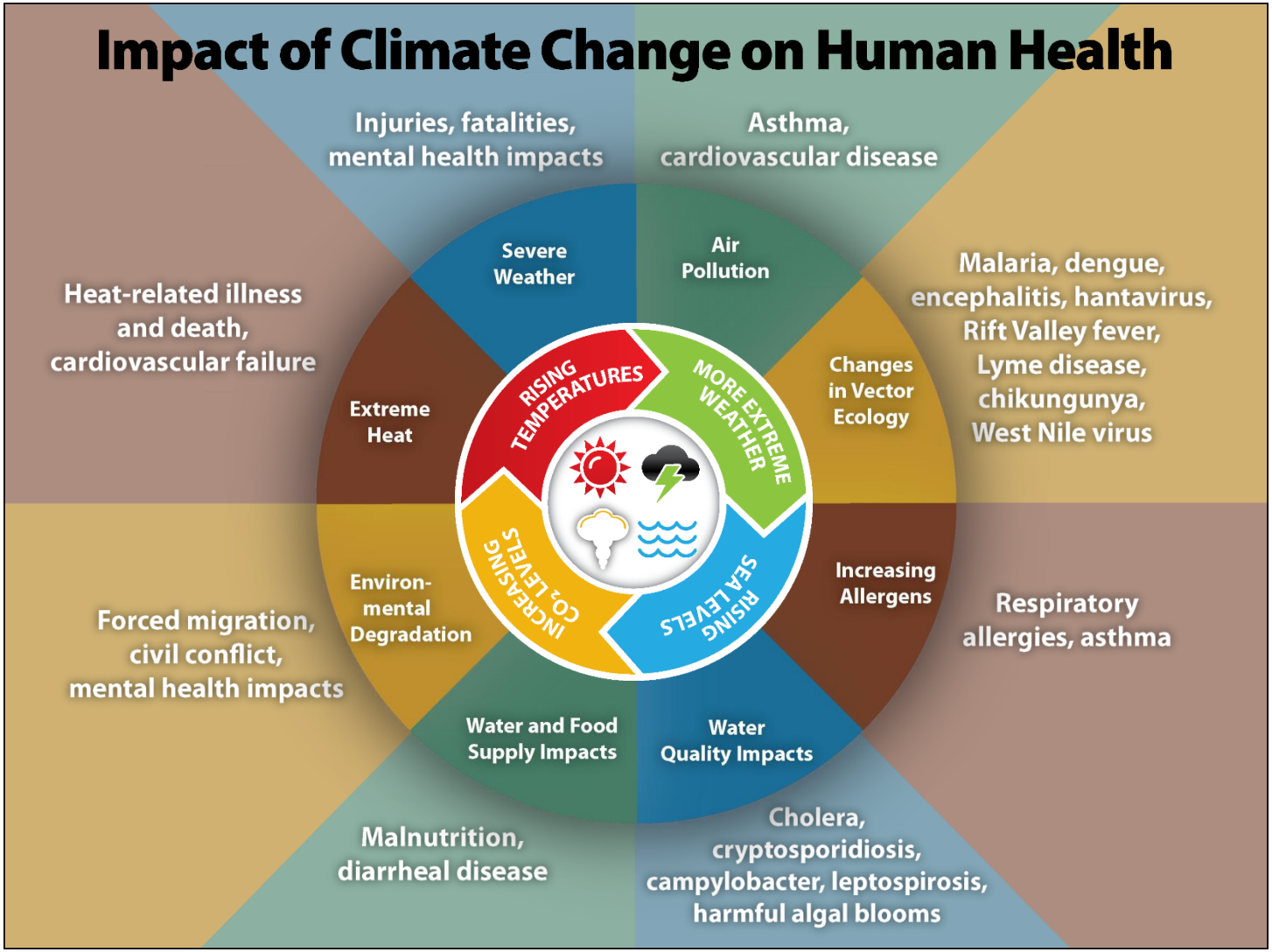
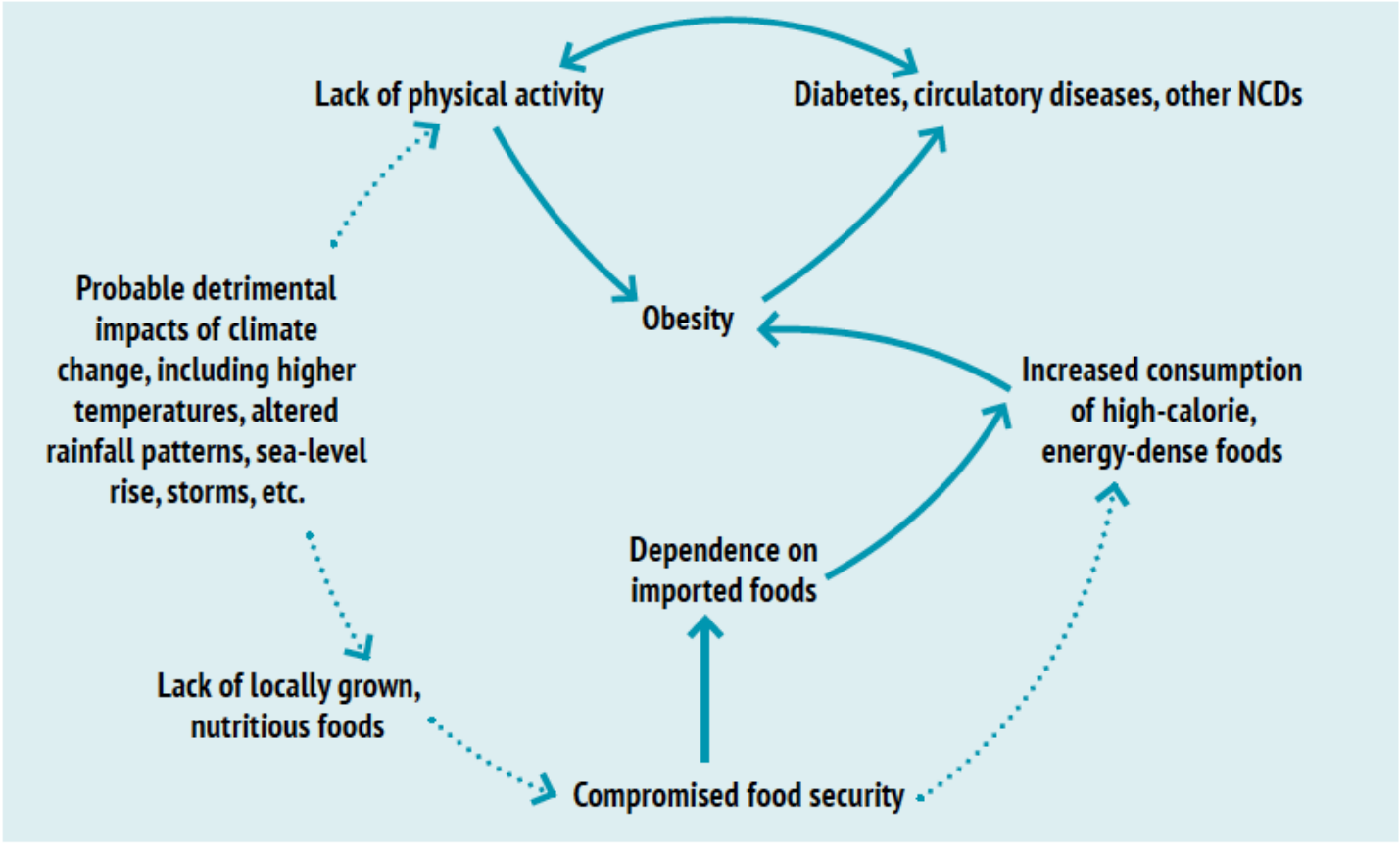

Impact of Climate Change on Human Health
Injuries, fatalities, mental health impacts
Asthma, cardiovascular disease
Heat-related illness and death, cardiovascular failure
Malaria, dengue, encephalitis, hantavirus, Rift Valley fever, Lyme disease, chikungunya, West Nile virus
Forced migration, civil conflict, mental health impacts
Respiratory allergies, asthma
Malnutrition, diarrheal disease
Cholera, cryptosporidiosis, campylobacter, leptospirosis, harmful algal blooms
Severe Weather
Air Pollution
Extreme Heat
Changes in Vector Ecology
Environ-mental Degradation
Increasing Allergens
Water and Food Supply Impacts
Water Quality Impacts
RISING TEMPERATURES
MORE EXTREME WEATHER
INCREASING CO2 LEVELS
RISING SEA LEVELS

Figure 15. Conceptual model summarizing the pathways between climate change and NCDs (dotted arrows represent hypothetical links)



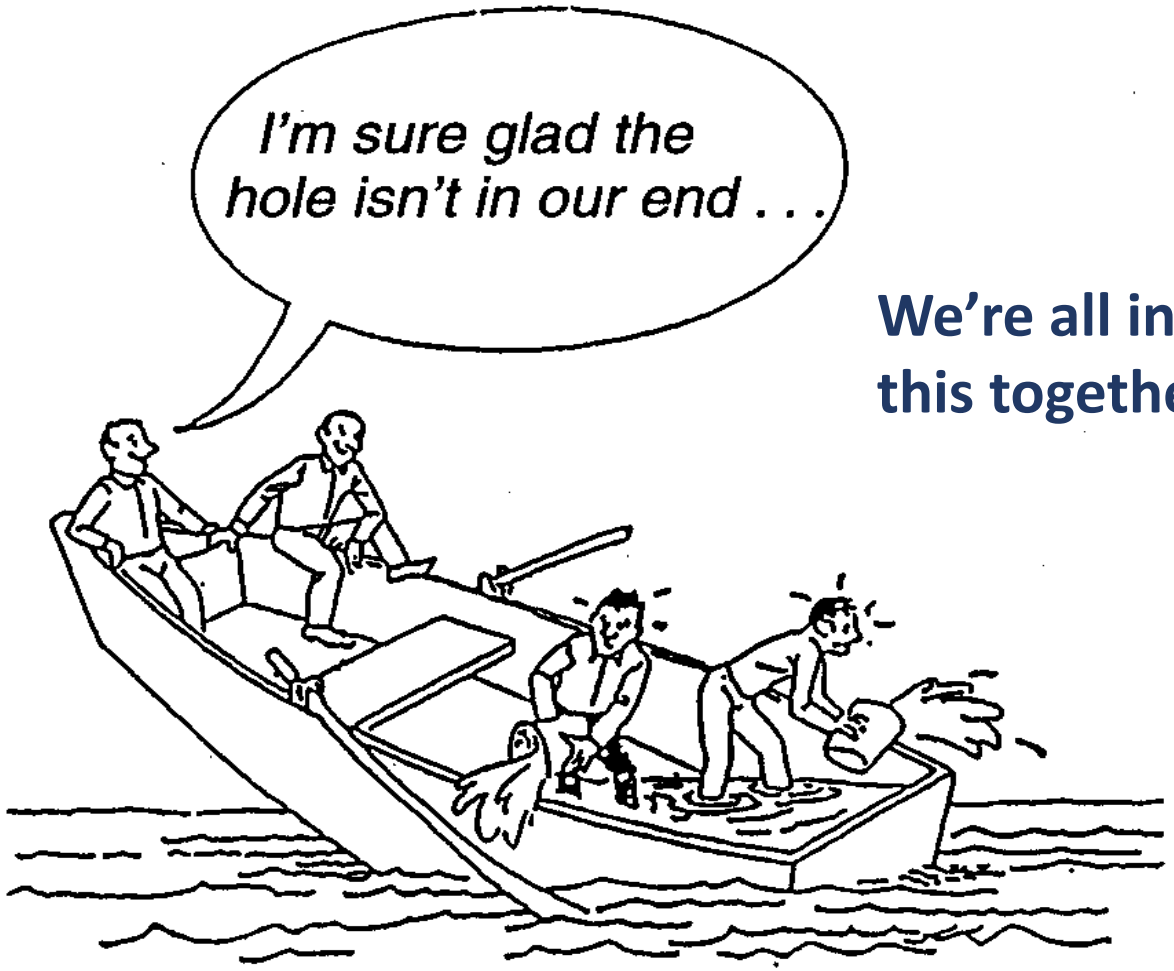
Some of the highest incidence and prevalence rates of NCDs globally, particularly diabetes and certain types of cancers

Increasing health impacts due to environmental vulnerabilities – e.g. increased rainfall resulting in ideal breeding grounds for mosquito-borne outbreaks; persistent drought conditions resulting in consumption of poor quality/contaminated water sources

Source: WHO 2015 Human Health and Climate Change in Pacific Islands

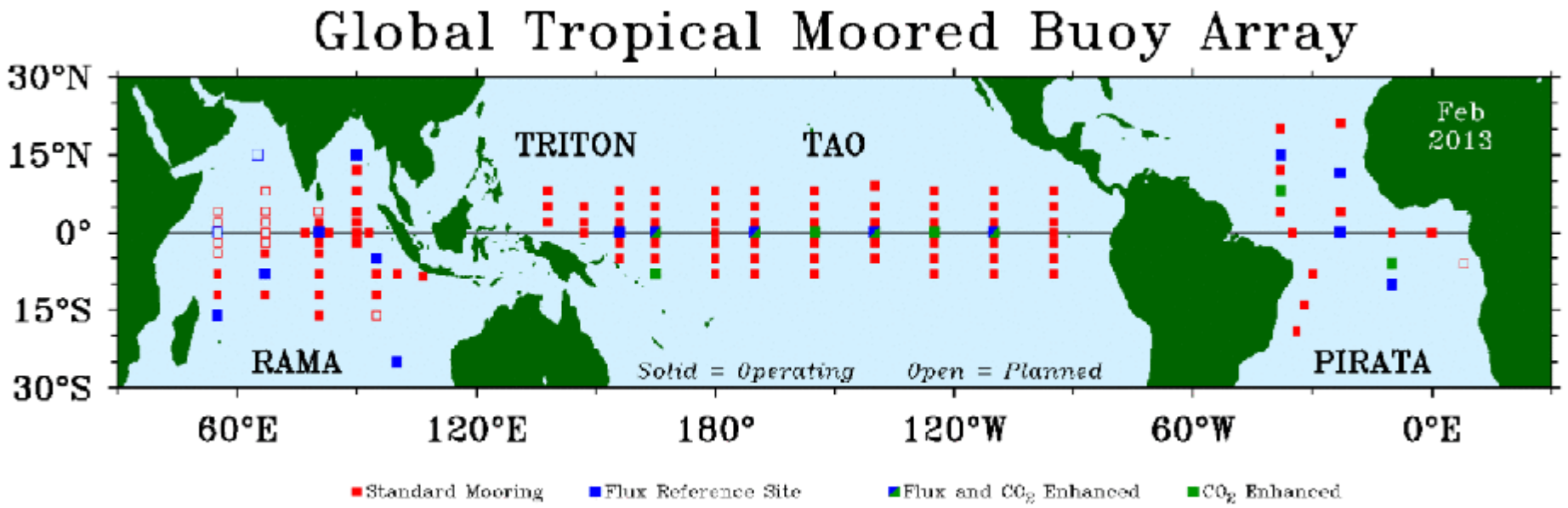
Summary

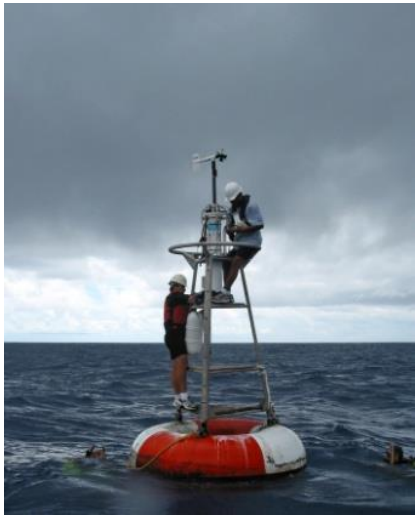
- Climate extremes, variability and changes are affecting the Pacific Islands and their populations through rising temperatures, changing precipitation, and a growing number of extreme weather and climate events: droughts, floods, storm surge, and sea level rise.
- Pacific Island countries are globally ranked among the most vulnerable to climate.
- Vector and water borne diseases that may be affected by climate, Pacific Islands populations experience very high rates of non-communicable diseases, including obesity, diabetes, and hypertension
- **There is a need to develop a collaborative agenda to build resilient communities and health systems in the Pacific Islands that considers the health risks of climate change, in the context of limited resources, the inherent isolation of islands, and demographic and socioeconomic challenges underscores.**



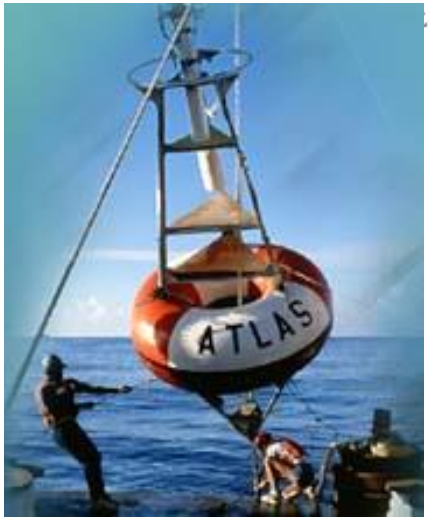
We're all in this together

Climate


Global Tropical Moored Buoy Array
30°N
15°N
0°
15°S
30°S
TRITON
TAO
Feb
2013
RAMA
PIRATA
Solid = Operating
Open = Planned
60°E
120°E
180°
120°W
60°W
0°E
Standard Mooring
Flux Reference Site
Flux and CO_2 Enhanced
CO_2 Enhanced




NOAA


ATLAS