Pacific Perspectives

Sea Level Rise Impacts

Professor Elisabeth Holland
Norway Pacific Chair in Oceans
And Climate Change

Land Ice Working Group Meeting
NCAR, Boulder, CO
11 February, 2020
State of the Pacific: Rising Seas

Regional Mean Sea Level Trends (Jan-1993 to May-2017)
Min = -0.5 mm/yr; Max = 7.2 mm/yr; Mean = 3.5 mm/yr

Data Type: Observations (DUACS DT-2018)
Credit: E.U. Copernicus Marine Service Information / Copernicus Climate Change Service (mm/year)
The estimated multiplication factor (shown at tide gauge locations by colored dots), by which the frequency of flooding events of a given height increases with mean sea level (MSL) rise of 0.5 m (b) using regional projections of MSL for the RCP4.5 scenario, shown in Figure 13.19a.
Community Resilience: Where are we?

Human Security Index:
100 villages Caukadrove Province, Vanua Levu
(1-5 scale, 3= good)

84% of the villages are in danger zone
14% of the villages are ranked poor
Primary concerns: coastal health & security of place
SPECIAL REPORT 1.5 –

Every half degree (0.5°C) matters. Every Year matters. Every Action matters.

The time for action is now.
The Ocean and Cryosphere in a Changing Climate

This Summary for Policymakers was formally approved at the Second Joint Session of Working Groups I and II of the IPCC and accepted by the 51st Session of the IPCC, Principality of Monaco, 24th September 2019

Summary for Policymakers
Sea Level Rise
- Sea level rise will continue beyond 2100.
- Could be limited to around 1m in 2300 under low emissions.
- Up to 5.4m in 2300 for high emissions.
- Adaptation will be necessary, with low emission scenarios giving the best chance of adaptation success.
(a) Schematic effect of regional sea level rise on projected extreme sea level events (not to scale)

- Historical Centennial extreme sea-level Events (HCEs) become more common due to sea level rise
- Mean sea level rise
- Recent past
- Future

(b) Year when HCEs are projected to recur once per year on average

- RCP8.5
- RCP2.6

(c) Difference between RCP8.5 and RCP2.6

The difference map shows locations where the HCE becomes annual at least 10 years later under RCP2.6 than under RCP8.5.
(d) Impacts and risks to ocean ecosystems from climate change

Global mean sea surface temperature (SST) change relative to pre-industrial levels (°C)

- Warm water corals
- Kelp forests
- Seagrass meadows
- Epipelagic
- Rocky shores
- Salt marshes
- Cold water corals
- Estuaries
- Sandy beaches
- Mangrove forests
- Abyssal plains

Level of added impacts/risks

- **Very high**
  - Purple: Very high probability of severe impacts/risks and the presence of significant irreversibility or the persistence of climate-related hazards, combined with persistence of climate-related hazards, combined with limited ability to adapt due to the nature of the hazard or impacts/risks.

- **High**
  - Red: Significant and widespread impacts/risks.

- **Moderate**
  - Yellow: Impacts/risks are detectable and attributable to climate change with at least medium confidence.

- Undetectable
  - White: Impacts/risks are undetectable.

Confidence level for transition

- ••••• = Very high
- ••• = High
- •• = Medium
- • = Low
- | = Transition range

**see figure caption for definition**
Sea level rise risk and responses

The term response is used here instead of adaptation because some responses, such as retreat, may or may not be considered to be adaptation.

(a) Risk in 2100 under different sea level rise and response scenarios

Risk for illustrative geographies based on mean sea level changes (medium confidence)

Levels of risk:
- Purple: Very high probability of severe impacts/risks and the presence of significant irreversibility or the persistence of climate-related hazards, combined with limited ability to adapt due to the nature of the hazard or impacts/risks.
- Red: Significant and widespread impacts/risks.
- Yellow: Impacts/risks are detectable and attributable to climate change with at least medium confidence.
- White: Impacts/risks are undetectable.

Relative contribution of response options to risk reduction (per geography):
- Green = In situ responses
- Beige = Planned relocation
Increasing Complexities of Ocean Governance

What happens when our EEZ is at risk?
Pacific Messages –
Every island matters.
Every cm (sea level rise) matters.
Every body matters.
Every voice matters

The time for action is now.
Sustainable Development Goals

17 Goals
169 Targets
by 2030
“The ocean was given to us by our ancestors to manage so that we could pass it on to our children and future generations. It is our common responsibility and moral obligation for our children”.

Foua Toloa, Minister, Tokelau, Commissioner, Global Ocean Commission

• Vinaka vakalevu
• Fa'afetai tele lava
• Malo au’pita
• Tank iu
• Meral ma Sulang
• Ko rab’a
• Obrigado
• Tank yiu tumas
• Tenkyu tru
• Fakafetai lasi
• Kommol tata
• Meitaki Ma’ata
• Tubewa
• Fakaaue lahi
Sail in Pacific Languages

Cook Islands CK - Takie
FSM FM - Terag
Fiji FJ – Laca/ Soko
Kiribati KI – Te Borau
Niue NU -La
Palau PW - Yars
PNG PG - Sel
RMI MH - Wojla
Samoa WS - Folau
Tokelau TK – Fakatele / Folau
Tonga TO Leae (Folau / Faila)
Tuvalu TV - Fakatele
We have created an Atlas for the Pacific Ocean States that delivers ocean data to address the needs of decision makers and to meet climate directives. It responds directly to Fiji’s requests at the 2017 United Nations Ocean Conference for the Sustainable Development Goals (SDGs) i.e. for life below water) and in the 2017 COP23 conference for SDG13 (on climate action).

The Pacific Island States are particularly vulnerable to the changing marine environment. They face unprecedented threats to the 3 pillars of sustainable development: economy, environment, and society.

Ocean heat content (OHC) impacts on climate and biodiversity. It is a measure of the ocean heat content and is important to understand climate change impacts. Tropical regions are especially vulnerable to the impacts of ocean warming.

Sea surface temperatures are rising throughout the Pacific Ocean around the islands. This temperature rise has significant impacts on marine life, tourism, and human health.

Thermocline depth and ocean circulation patterns affect marine ecosystems. Changes in these patterns can have significant impacts on marine biodiversity.

Chlorophyll-a levels are decreasing in the Pacific Ocean around the islands, affecting phytoplankton and marine life. This decrease is likely due to increased ocean temperatures and associated changes in ocean circulation patterns.

The Copernicus Marine Atlas for the Pacific Island States shows sustained and decreasing sea-surface warming, sea-level rise, and a decrease in the marine food chain (phytoplankton).
IPCC Special Report on Global Warming of 1.5°C