Pacific Perspectives

Sea Level Rise Impacts

Professor Elisabeth Holland
Norway Pacific Chair in Oceans
And Climate Change

Land Ice Working Group Meeting
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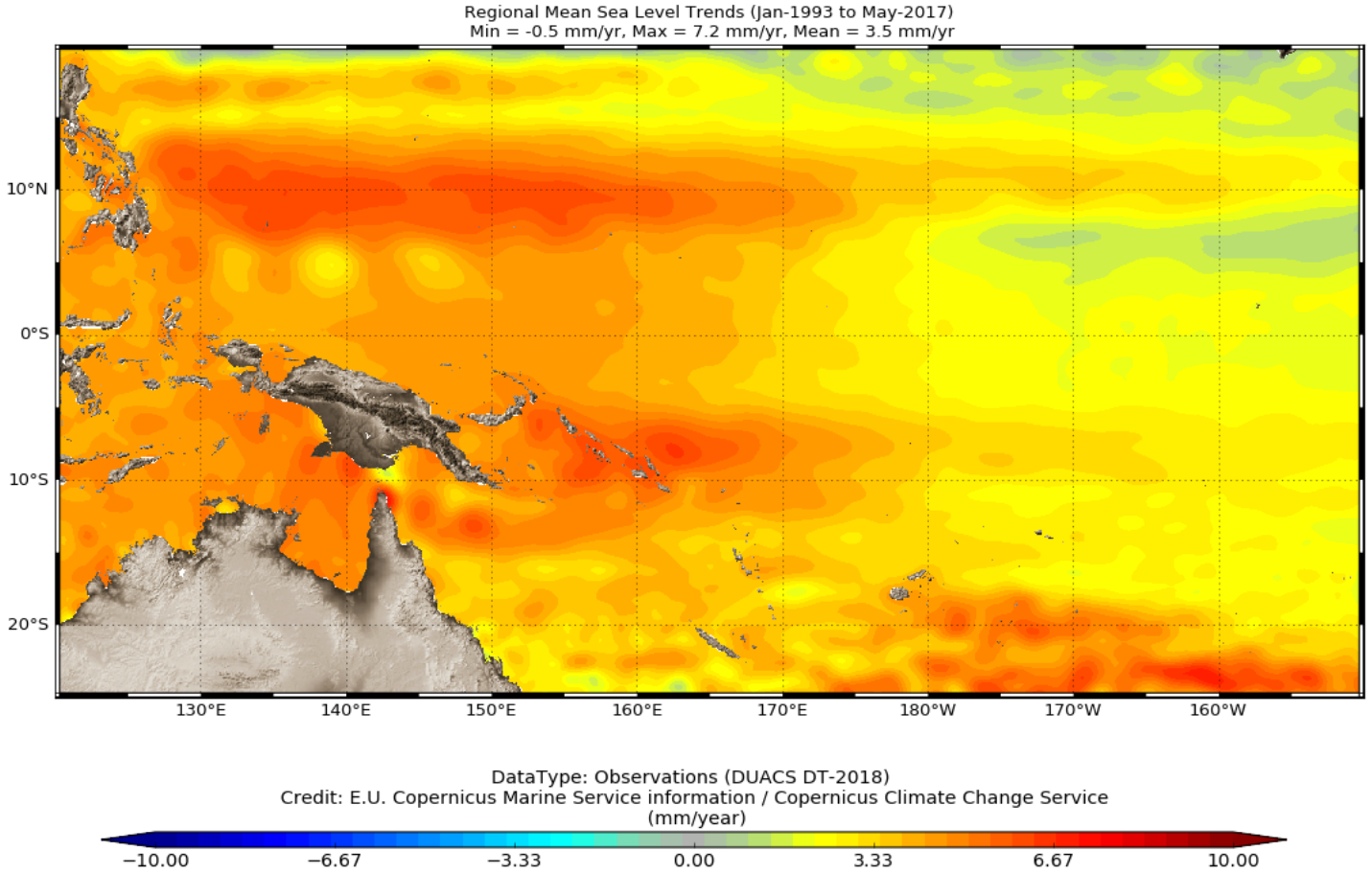
Northern Marianas (US)
Guam (US)
REPUBLIC OF MARSHALL ISLANDS
Kwajalei
Ratak Chain
Johnston (US)
YAP
Colonia
CHUUK
Weno
POHNPEI
Kolonia
PALIKIR
KOROR
PALAU
FEDERATED STATES OF MICRONESIA
KOSRAE
Kosrae
Ralik Chain
MAJURO
Palmyra (US)
Northern Line Islands
Kiritimati
Howland & Baker (US)
NAURU
YAREN
TARAWA
Banaba
KIRIBATI
GILBERT ISLANDS
KIRIBATI
PHOENIX ISLANDS
Kanton
Jarvis (US)
KIRIBATI
LINE ISLANDS
Southern Line Islands
Admiralty Islands
Wewak
Bismark Archipalago
PAPUA NEW GUINEA
New Ireland
Rabaul
New Britain
Bougainville
Choiseul
Santa Isabel
Lae
PORT MORESBY
EAST TIMOR
(TIMOR LESTE)
SOLOMON ISLANDS
New Georgia
HONIARA
Guadalcanal
Malaita
D'Entrecasteaux Islands
Louisiade Archipelago
Makira
Santa Cruz Islands
TUVALU
FUNAFUTI
Tokelau (NZ)
SAMOA
APIA
Savaii
Upolu
Wallis & Futuna (FR)
Rotuma
Torres Islands
Banks Islands
Espiritu Santo
Malekula
Efate
PORT VILA
VANUATU
Erromango
Tanna
Yasawa Group
Viti Levu
Nadi
SUVA
FIJI
Vanua Levu
Lau Group
Vava'u Group
Ha'apai Group
Tongatapu Group
NUKU'ALOFA
TONGA
NIUE
ALOFI
Tutuila
American Samoa (US)
COOK ISLANDS
Northern Cook Islands
Southern Cook Islands
RAROTONGA
New Caledonia (FR)
French Polynesia (FR)
Norfolk (AUST)
Lord Howe (AUST)
Kermadec Islands (NZ)
Brisbane
Sydney
CANBERRA
Adelaide
Melbourne
Hobart
TASMANIA
North Island
Auckland
WELLINGTON
Christchurch
South Island
Chatham Islands (NZ)
GCCA
Global Climate Change Alliance
EUROPEAN UNION

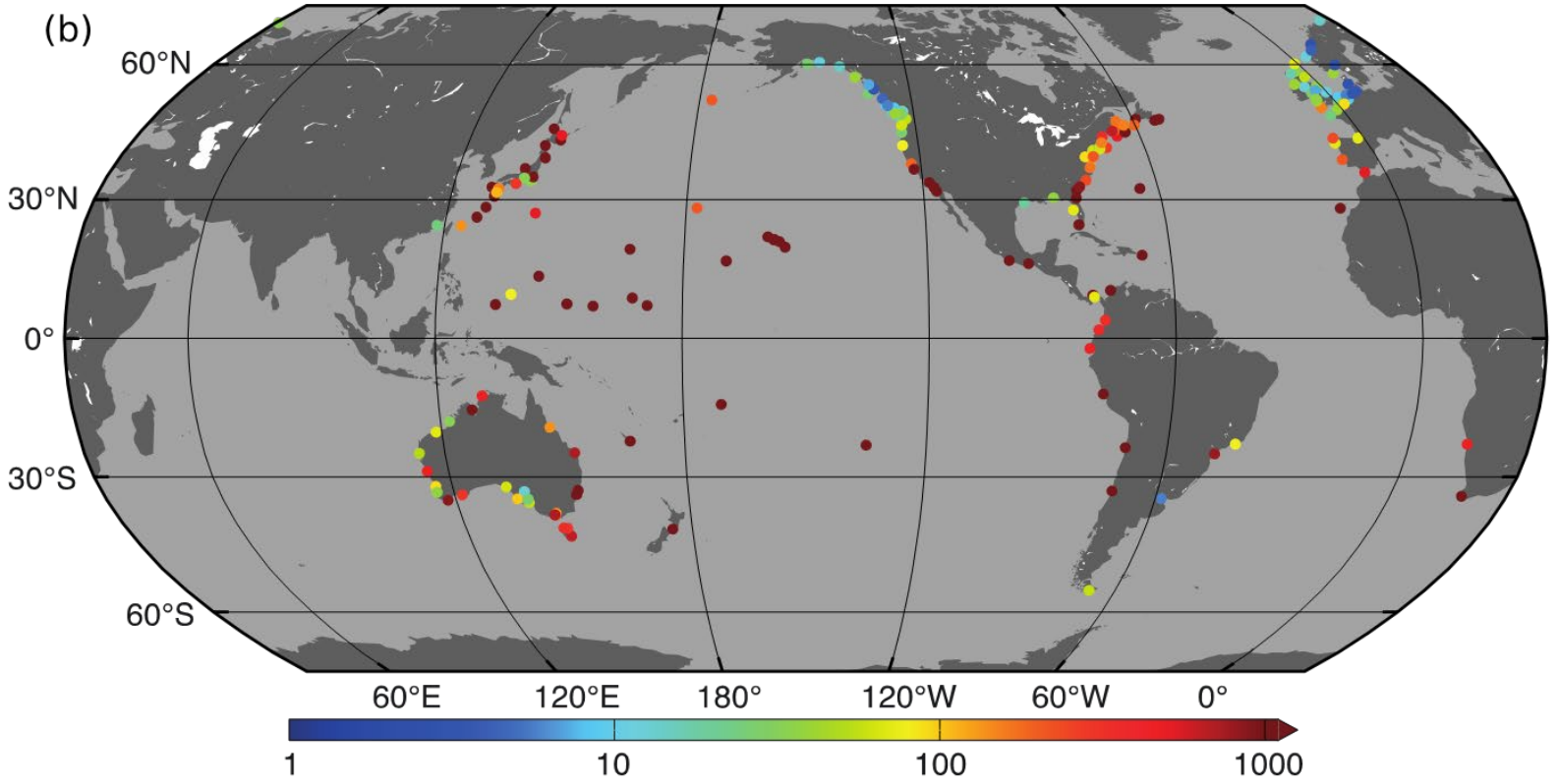
State of the Pacific: Rising Seas

USP
PACIFIC CENTRE FOR ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

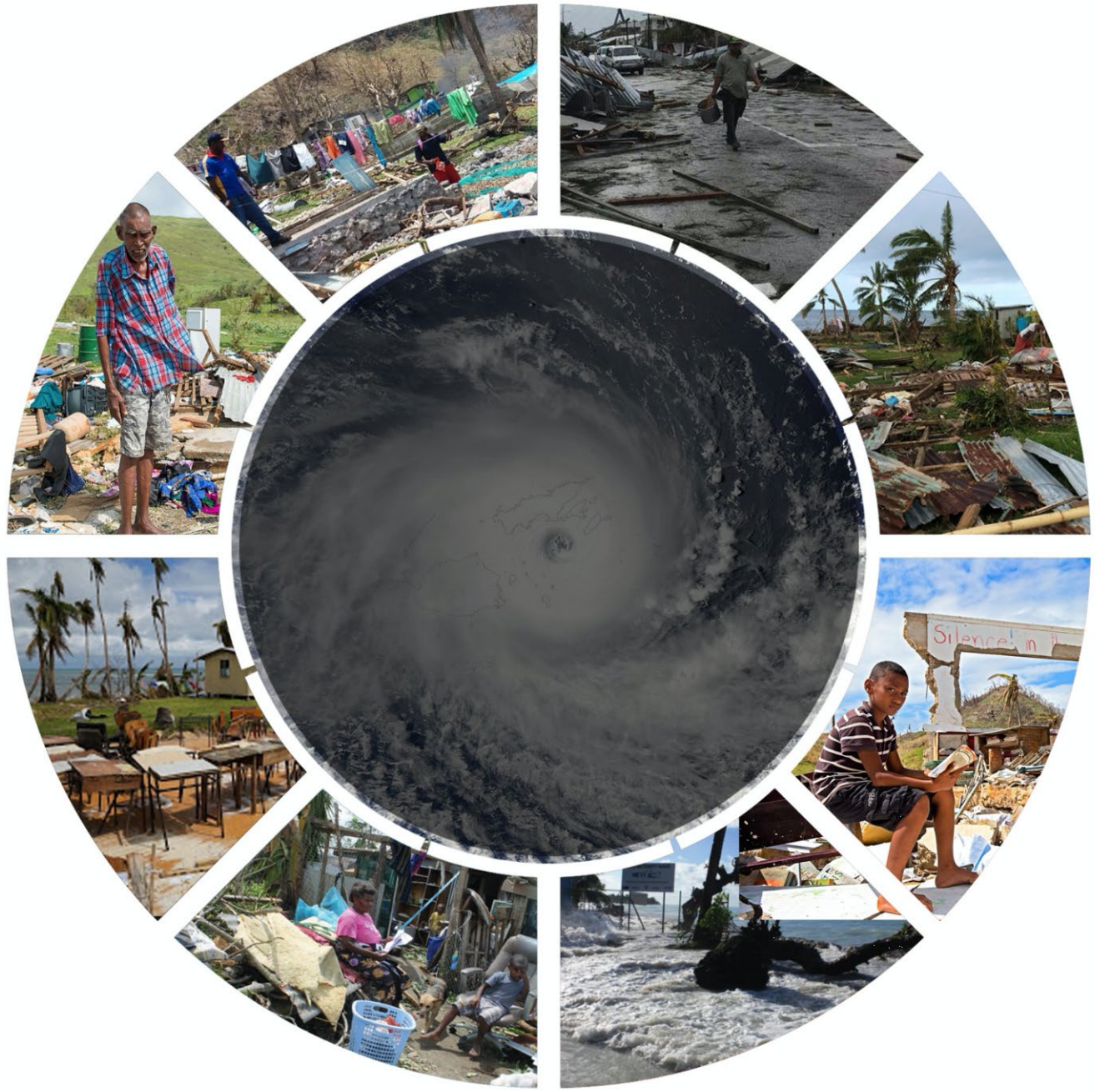


Climate Change: Rising Seas & Storm Surge

USP
PACIFIC CENTRE FOR ENVIRONMENT AND SUSTAINABLE DEVELOPMENT



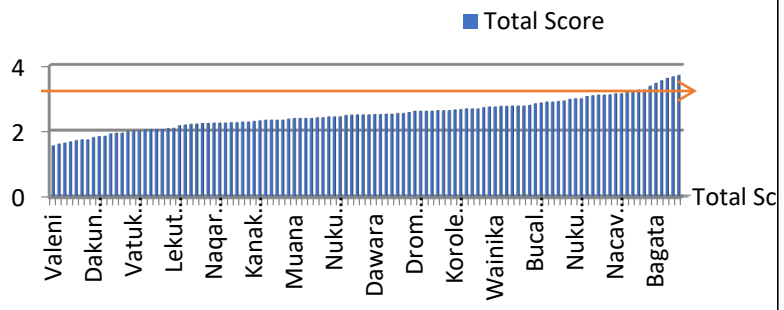
.25 | The estimated multiplication factor (shown at tide gauge locations by colored dots), by which the frequency of flooding events of a given height incre
level (MSL) rise of 0.5 m (b) using regional projections of MSL for the RCP4.5 scenario, shown in Figure13.19a.



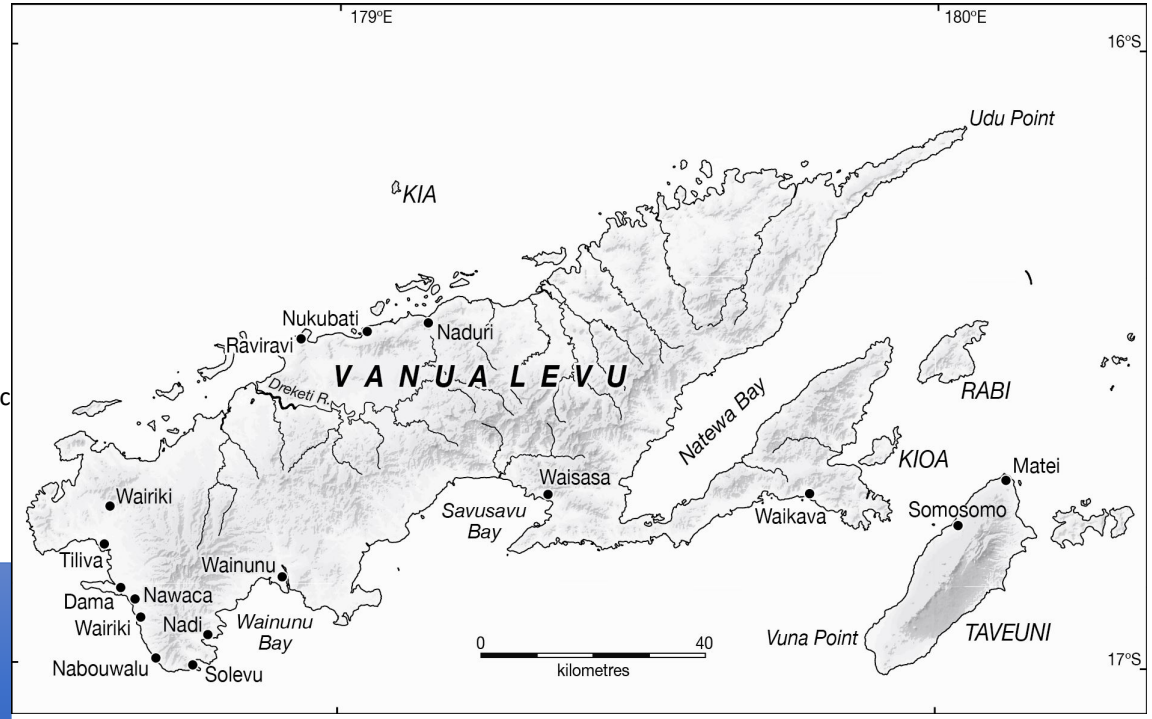
Community Resilience: Where are we?

PACIFIC CENTRE FOR ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

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.

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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 51th Session of the IPCC, Principality of Monaco, 24th September 2019

Summary for Policymakers

WG I × WG II

WMO UNEP

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INTERGOVERNMENTAL PANEL ON climate change

WG I × WG II

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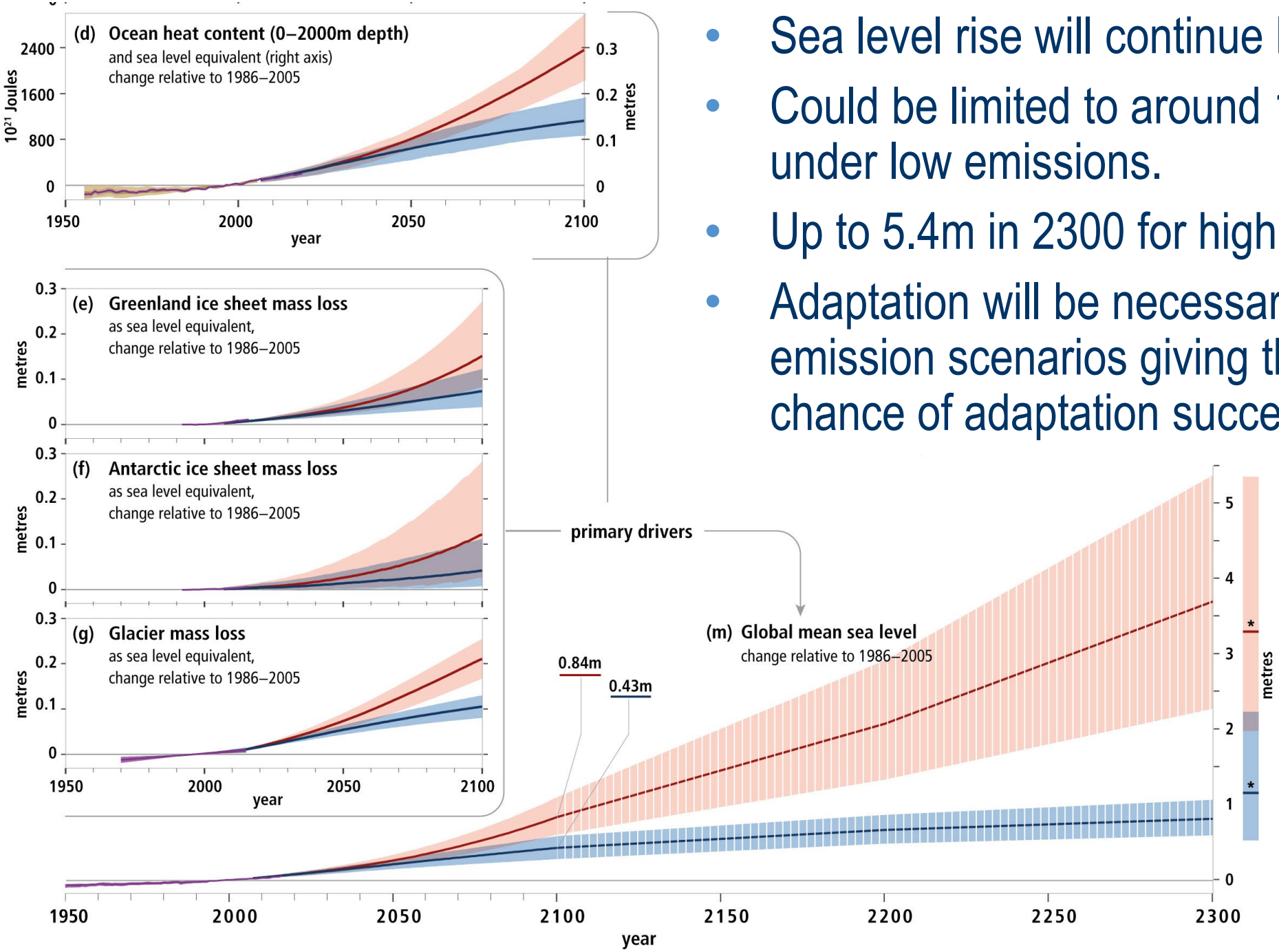
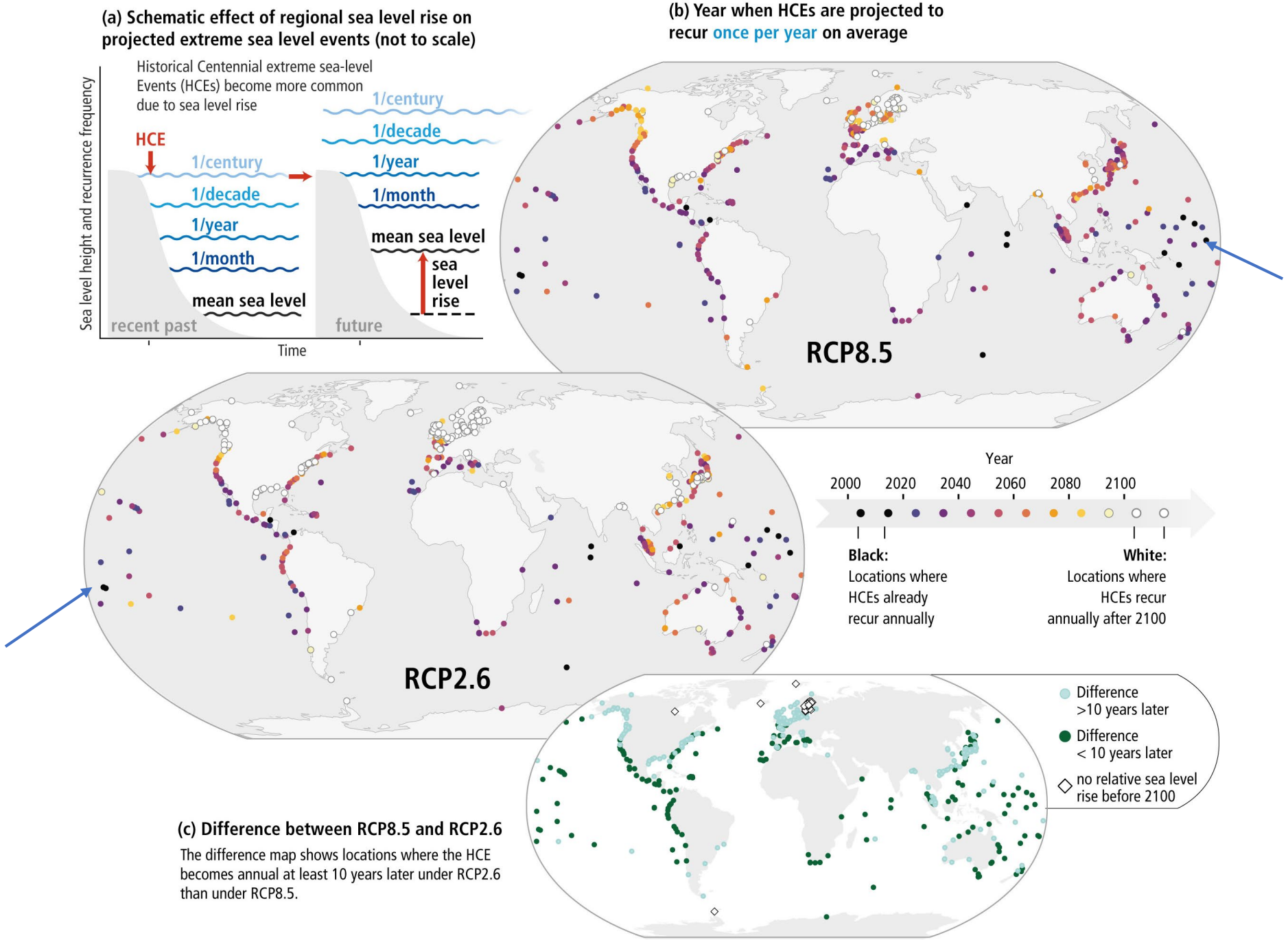
Sea Level Rise

Photo: Glenn R. Specht

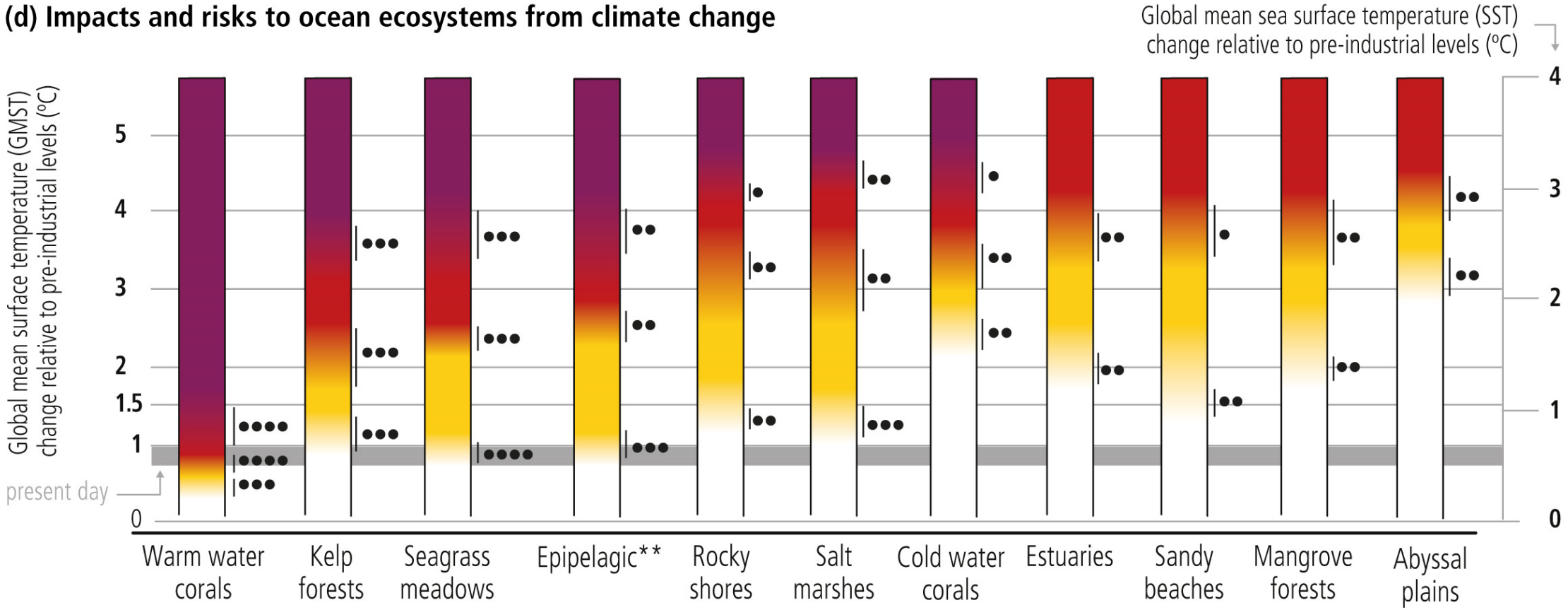
- Sea level rise will continue beyond 2100.
- Could be limited to around 1m in 2300 under low emissions.
- Up to 5.4m in 2300 for high emissions.
- Adaptation will be necessary, with low emission scenarios giving the best chance of adaptation success.




(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
Sea level height and recurrence frequency
HCE
1/century
1/decade
1/year
1/month
mean sea level
recent past
future
Time
1/century
1/decade
1/year
1/month
mean sea level
sea level rise
(b) Year when HCEs are projected to recur once per year on average
RCP8.5
RCP2.6
Year
2000
2020
2040
2060
2080
2100
Black:
Locations where HCEs already recur annually
White:
Locations where HCEs recur annually after 2100
Difference >10 years later
Difference < 10 years later
no relative sea level rise before 2100
(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.


Ocean and
Marine Life
Photo: Mr. JK

(d) Impacts and risks to ocean ecosystems from climate change



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

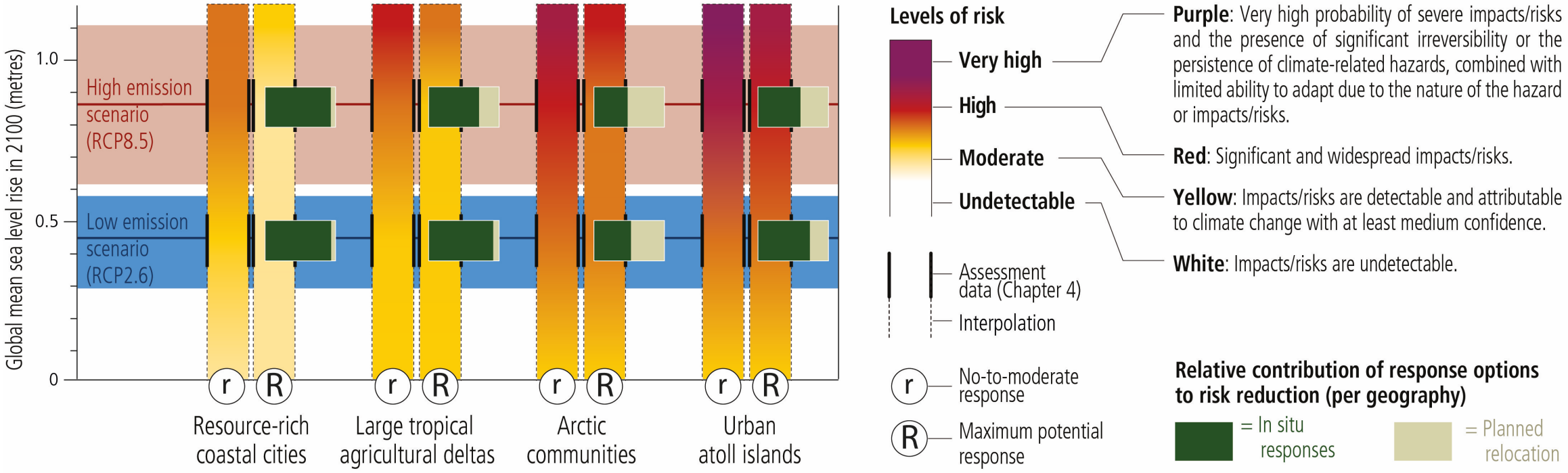
**see figure caption for definition

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)*



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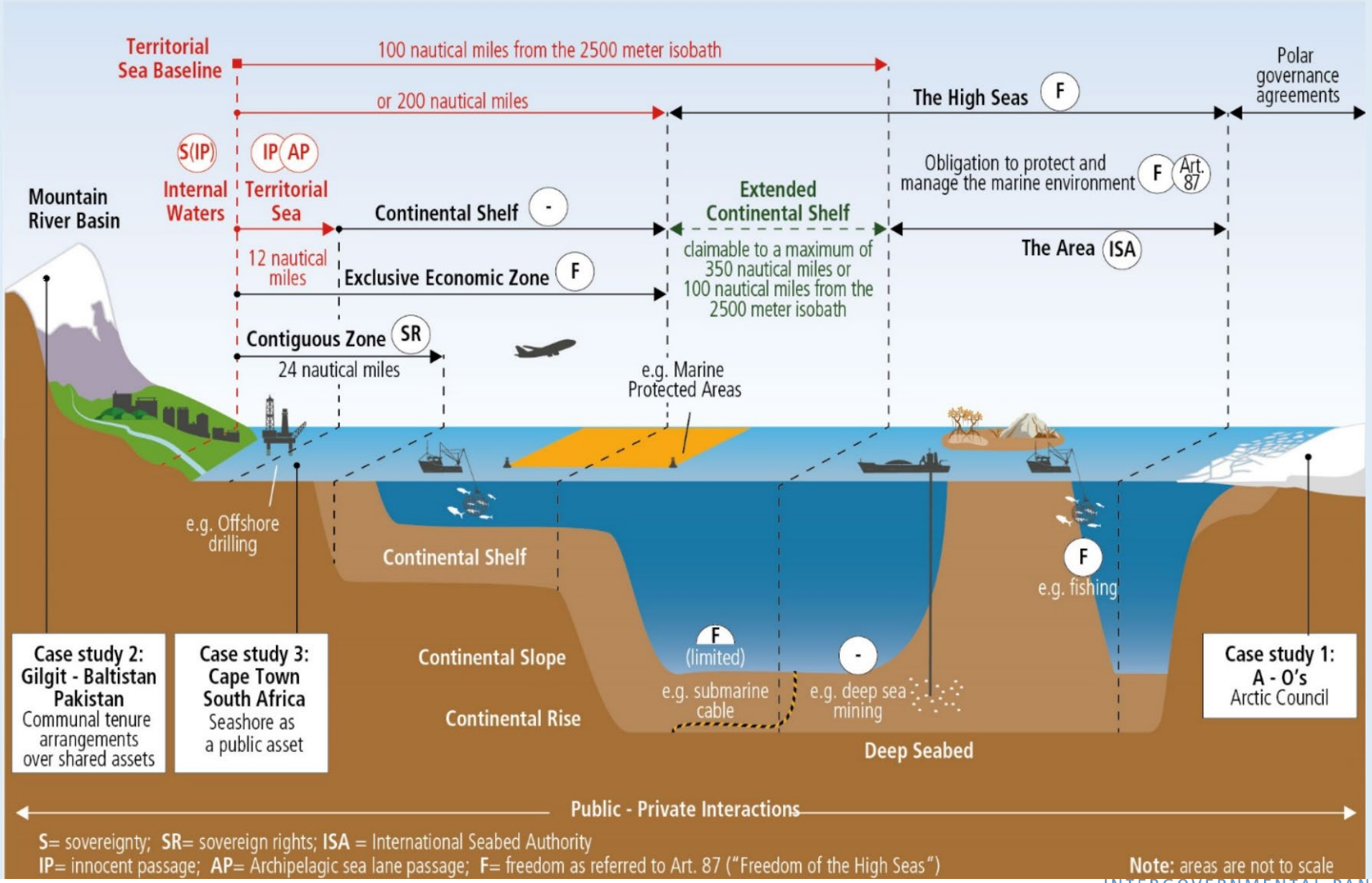
CB3.2). The complexities of governance arrangements in the ocean, coasts and cryosphere (Figure CB3.1), and the interactions and emergence of relationships between different governance actors in multiple configurations across various spatial scales (Figure CB3.2) are illustrated below.



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.

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"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, Comissioner, Global Ocean Commission

https://www.change.org/p/ban-ki-moon-help-secure-a-living-ocean-food-and-prosperity-propose-a-new-agreement-for-high-seas-protection-2

Pictures: www.asiapacific.anu.edu.au

- *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*

Weaving the Laea for Oceania:

Pacific Assessment of
Our Changing Climate and Ocean

USP

PACIFIC CENTRE FOR
ENVIRONMENT AND
SUSTAINABLE DEVELOPMENT

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

COPERNICUS MARINE ATLAS FOR THE PACIFIC OCEAN STATES

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 Oceans Conference for the Sustainable Development Goal (SDG)14 (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.**

Did you know?

In addition to the threats caused by ocean warming, sea level rise and the decrease in phytoplankton, the Pacific Island States lie in a path where many devastating storms pass.

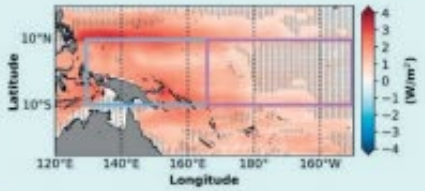
Hurricanes / typhoons / cyclones extract heat from the surface and sub-surface of the ocean, which acts as a source of energy making them stronger and last longer. Sea surface temperature and ocean heat content are important variables for forecasting and understanding these storms and other weather events.

OCEAN HEAT CONTENT (OHC)

Units: Watts/m²
Trend from 1993 to 2017 / 0-700 m

Temperatures are rising in the surface and deeper waters of the Pacific Ocean around the islands

		Western Pacific Islands	Central Pacific Islands
Pacific Islands Total area	**+1.2** ±0.7	**+1.9** ±1.5	**+0.8** ±0.7



Ocean Heat Content (OHC) includes water temperatures at the surface and beneath the ocean surface. It is used to track changes in sea level, stratification, ocean currents, as well as in marine ecosystems. The ocean is a major heat source for global atmospheric circulation and has important implications for regional and global climates, including severe events. With rising ocean temperatures, marine ecosystems are also damaged. Many species suffer or die off, putting economies and food security at risk.

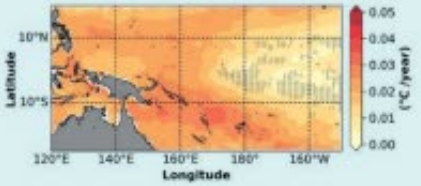
Figure: Upper ocean heat content (0-700 metres) in Watts per square metre (W/m²) trend from 1993-2017.
In this section: the entire figure domain represents "Pacific Islands total area"*; the blue box represents "Western Pacific Islands" and the purple represents "Central Pacific Islands."**

SEA SURFACE TEMPERATURE (SST)

Units: °C/year
Trend from 1993 to 2017

Sea surface temperatures are rising throughout the Pacific Ocean around the islands

		Western Pacific Islands	Central Pacific Islands
Pacific Islands Total area	**+0.02** ±0.1	**+0.02** ±0.01	**+0.01** ±0.02



Sea surface temperature is used to assess climate change impacts and is essential for weather and extreme event prediction (such as cyclones). It is also used to assess ecosystem health. For example, warming can lead to coral reef damage (coral bleaching) and biodiversity loss, putting coastal protection, economies and food security at risk.

Figure: Sea surface temperature trend from 1993-2017 in degrees Celsius per year (°C/year). Black dots indicate areas where data is sparse and there is less confidence.

THERMOSTERIC SEA LEVEL

The sea level is rising throughout the Pacific Ocean around the islands

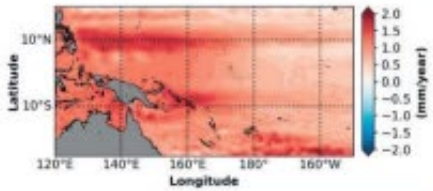
The sea level is rising mainly due to melting ice and thermal expansion (water expands when heated, a phenomena referred to as thermosteric sea level rise). About 40% of contemporary global sea level rise can be attributed to ocean thermal expansion. At a regional level, the thermosteric effect can dominate the sea level change in the area.

The Pacific Ocean is warming significantly and this goes hand-in-hand with the sea level rise in the region.

SEA LEVEL

Units: mm/year
Trend from 1993 to 2017

		Western Pacific Islands	Central Pacific Islands
Pacific Islands Total area	**+3.5** ±2.5	**+4.8** ±2.5	**+2.8** ±2.5



Sea level is an important variable to inform climate adaptation and coastal planning. Sea level rise can seriously affect human populations in coastal regions and natural environments on land as well as marine ecosystems.

Figure: Sea level trend in millimetres per year (mm/year) from 1993-2017

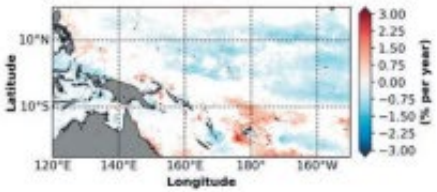
*As defined by the EU Cotonou agreement and served by the EU's ACP secretariat.
**To explore the dynamics inside and outside the Western Pacific Warm Pool, the domain was further subdivided.

CHLOROPHYLL-a (Chl-a)

Units: % / year
Trend from 1997 to 2017

Overall decrease in phytoplankton in the Pacific Ocean around the islands

		Western Pacific Islands	Central Pacific Islands
Pacific Islands Total area	**−0.4** ±0.001	**−0.4** ±0.02	**−0.7** ±0.001

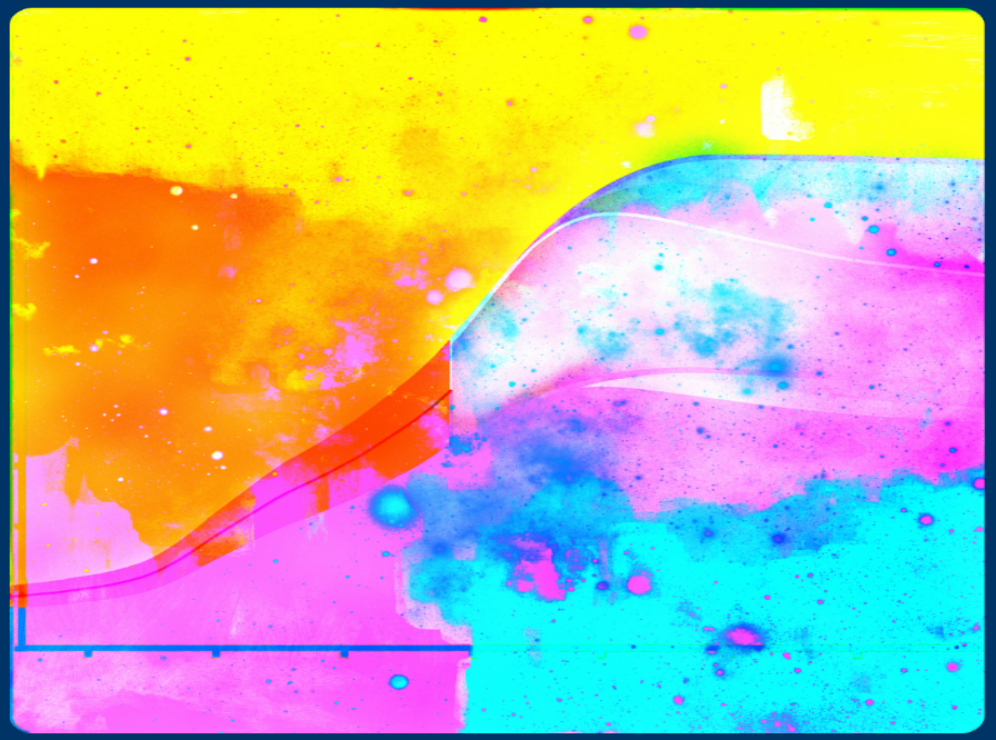


Nearly all ocean life depends on phytoplankton health. Chlorophyll-a is used as a proxy to monitor phytoplankton, which is the base of the marine food web. Nearly half of all the production of organic matter on Earth takes place in the ocean. Phytoplankton photosynthesis contributes to more than half of the oxygen content in the Earth's atmosphere and it consumes an enormous amount of carbon. Changes in phytoplankton populations can impact ecosystems and biogeochemical cycling, which in turn impacts economies and food availability.

Figure: Chl-a trend from September 1997- December 2017 as percentage per year.

The Copernicus Marine Atlas for the Pacific Island States shows sustained and drastic ocean warming, sea level rise, and a decrease in the base of the marine food chain (phytoplankton).

UNEP



IPCC Special Report on Global Warming of 1.5°C

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