

Recent Climate Change Science

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Pacific Meteorological Desk Partnership

SPREP

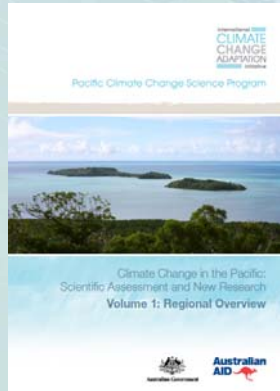


PACIFIC METEOROLOGICAL COUNCIL

The Pacific Meteorological Council (PMC) is a specialized subsidiary body of SPREP, established to facilitate and coordinate the scientific and technical programme and activities of the Regional Meteorological Services.



Recent Climate Change Science in the Pacific



Volume 2: Climate Change in the South Pacific: Scientific Assessment and new Research



Volume 1: Climate Change in the South Pacific: Country Reports



Brief

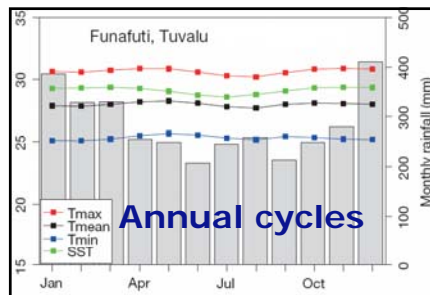
- Observed Changes
- Climate Change in a nut-shell
- Projected Changes



Observed changes

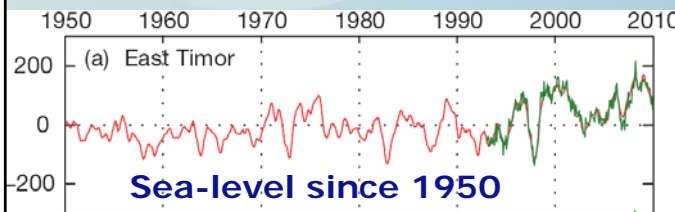
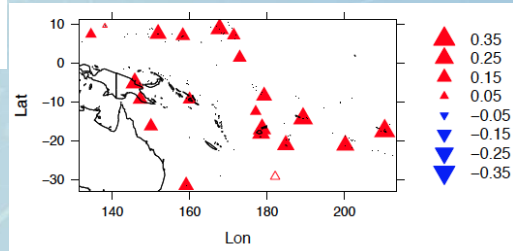


- CO₂ concentrations are now higher than they have been for hundreds of thousands of years.
- Humans primarily responsible for this increase.
- Research over past century clearly shows that higher greenhouse gas concentrations warm the planet.
- This is exactly what has been observed globally and over the Pacific.
- All Pacific island stations have warmed over the past 50 years, most in the range 0.4°-1.0°C.

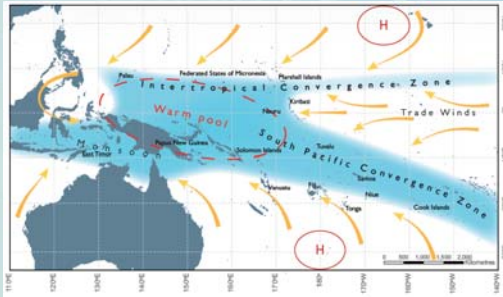


A very tiny snippet

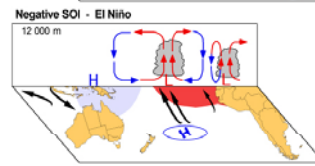
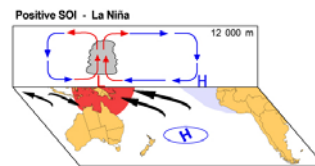
Air temperature trends
1961-2009 (°C/decade)



Some drivers of the Climate of the Pacific



THE WALKER CIRCULATION

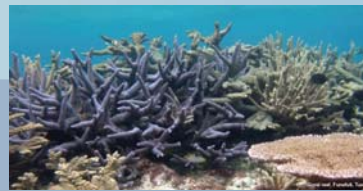


Sea temperatures: Warmer (red), Cooler (blue)
 Air pressure: Lower (L), Higher (H)
 Surface winds: (black arrows)



Observed Changes

- Global sea-level has risen by 1.7mm/yr since 1900 and twice this rate since 1993. Rise in the Pacific since 1993 is much larger than this in the west, much less in the east.
- The top 200m of the Pacific Ocean has warmed
- The Pacific Ocean has become more acidic



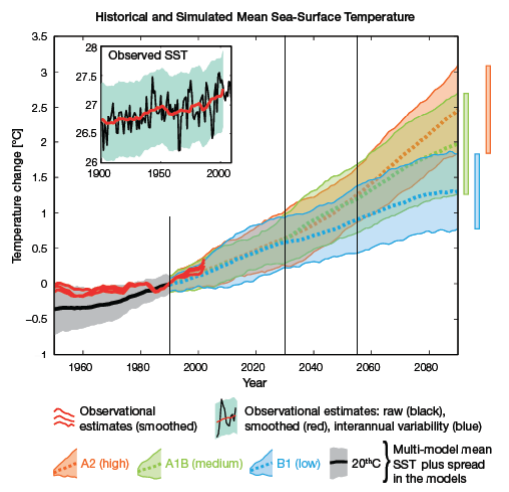
Climate Change in a nut-shell



- Pacific is getting hotter, sea-levels are rising, ocean acidification has occurred, equatorial winds have weakened. Further warming, acidification and sea-level rise appear inevitable.
- long-term trends occur with a great deal of naturally occurring variability linked to e.g. El Niño, but natural variability alone cannot explain past climate and will not wholly determine future climate.
- magnitude of future human-forced changes can be reduced if global emissions are reduced.



SST & Air Temperature Change in Samoa



- Surface air temperature and sea surface temperature are projected to continue to increase over the course of the 21st century. There is **very high confidence** in this direction of change because:
 - Warming is physically consistent with rising greenhouse gas concentrations.
- under the A2 (high) emissions scenario by 2090, temperature increases of greater than 2.5 °C are simulated by almost all models



Temperature Change in Samoa

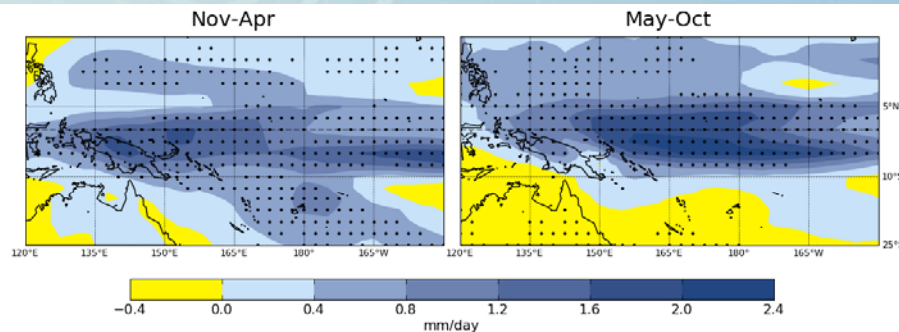
	2030 (°C)	2055 (°C)	2090 (°C)
Low emissions scenario	0.2–1.0	0.6–1.4	0.8–2.0
Medium emissions scenario	0.4–1.2	0.9–1.9	1.5–2.9
High emissions scenario	0.4–1.0	1.0–1.8	1.9–3.3

- The maximum temperature of Samoa has increased by about **0.22° C per decade**
- By 2030, under a high emissions scenario, this increase in temperature is projected to be in the range of **0.4–1.0° C**



Rainfall projections

Increases in annual mean rainfall over most of the region, especially along the equator, but small decreases during “dry season” (May-Oct) in some countries



A widespread increase in heavy rain days (20-50 mm)

Fiji's Rainfall Projections

What is the most likely direction of change?

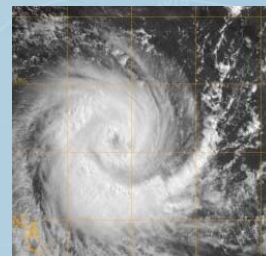


- Wet season rainfall is projected to increase (moderate confidence)
- Dry season rainfall is projected to decrease (moderate confidence)
- Annual mean rainfall is projected to increase (low confidence) *Rainfall over Fiji is strongly influenced by ENSO*
- The intensity and frequency of days of extreme rainfall are projected to increase (high confidence)
- Little change is projected in the incidence of drought (low confidence)



Tropical cyclones

- Tropical cyclone numbers projected to generally decline in the Pacific Ocean over the 21st century
- Many simulations with fine resolution models (downscaling) show an increase in the proportion of the most severe cyclones
- More research on this front needed



Sea level rise

- Sea-level rise in the Pacific region is likely to be similar to the global average
- By 2090:
 - 17-46 cm (B1)
 - 20-58 cm (A1B)
 - 21-60 cm (A2)
- Higher values possible:
Further study is needed to improve sea-level projections

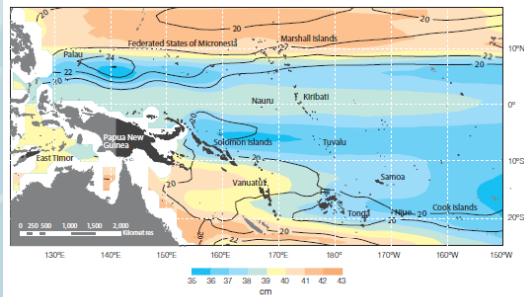
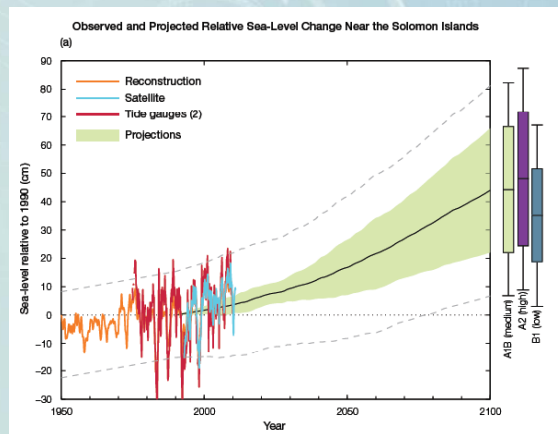


Figure 6.28: The sea-level projections (in cm) for the A1B (medium) emissions scenario in the PCCSP region for 2081-2100 relative to 1981-2000 are indicated by the shading, with the uncertainty indicated by the contours. The distribution of the projections of sea-level change are estimated by combining the global average sea-level projections, the dynamic ocean departure from the global average and the regional changes associated with the changing mass distribution in the cryosphere.



Sea Level Change near Solomon Islands

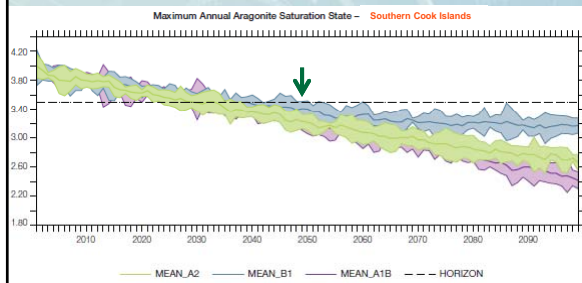


- Sea level near Solomon Islands has risen by about 8mm/yr since 1993 and will continue to rise throughout this century.

	2030 (cm)	2055 (cm)	2090 (cm)
Low emissions scenario	4-14	10-26	17-45
Medium emissions scenario	5-14	8-30	19-58
High emissions scenario	4-15	8-30	20-60



Ocean acidification



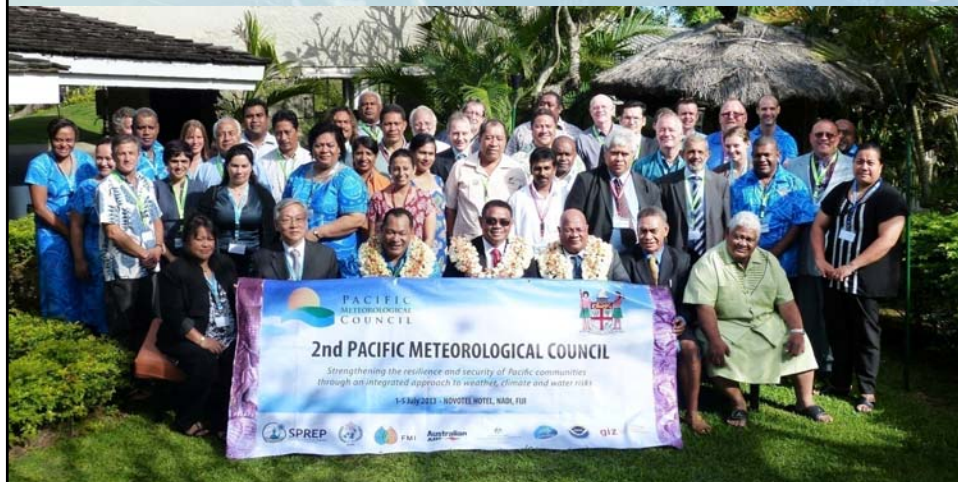
- Absorption of CO_2 causes ocean acidification and a decrease in aragonite saturation
- Aragonite values less than 3.5 result in stress for coral
- Values less than 3.5 reached by 2050 in much of the Pacific, and continue to decline
- Health of reef ecosystems is likely to be compounded by other stressors including coral bleaching, storm damage and fishing pressure



National Meteorological Services



National Meteorological Services



VINAKA

