

# **COASTAL HAZARDS – A LONG-TERM VIEW OF THE SAFETY OF SMALL ISLAND COMMUNITIES IN THE SOUTH PACIFIC**

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# OVERVIEW

1. Sea level rise
2. Storms
3. Tsunamis
4. Planning for the Future

# SEA LEVEL RISE

## The Issues

### **(A) The sea level data are not completely consistent**

#### Tide Gauge Data

1900 - 2009, Global Av. Sea-level rise =  $1.7 \pm 0.2$  mm/yr

1961 – 2009, Global Av. Sea-level rise =  $1.9 \pm 0.4$  mm/yr

#### Satellite Altimeter Data

1993 – 2013, Global Av. Sea-Level Rise =  $3.2 \pm 0.4$  mm/yr  
but there is substantial regional variability.

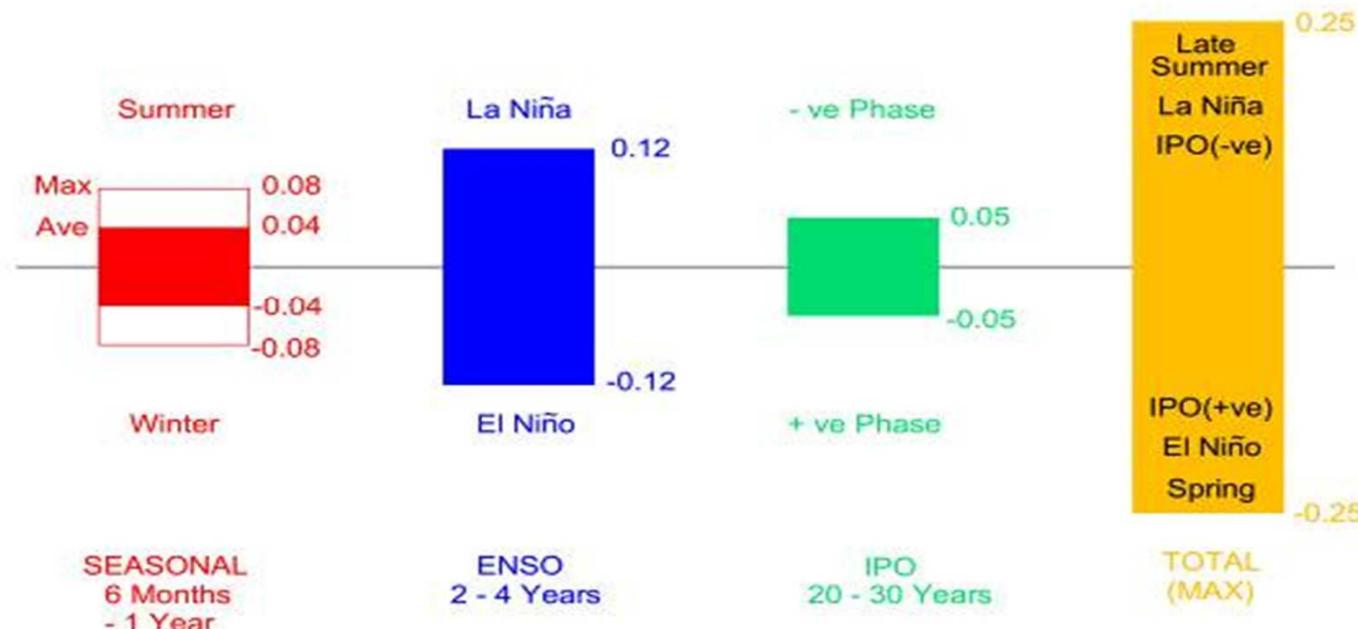
**THE TIDE GAUGE DATA SHOW NO EVIDENCE OF ANY  
RECENT ACCELERATION!**

# SEA LEVEL RISE

## The Issues

### (B) Long Term (Non-Tidal) Periodicities Must be Considered

1. Annual (Summer/Winter variations)
2. Inter-annual (ENSO) 2 – 4 yr. period
3. Inter-decadal (IPO) 20 – 30 yr. period
4. Longer periods 50 yr signal?



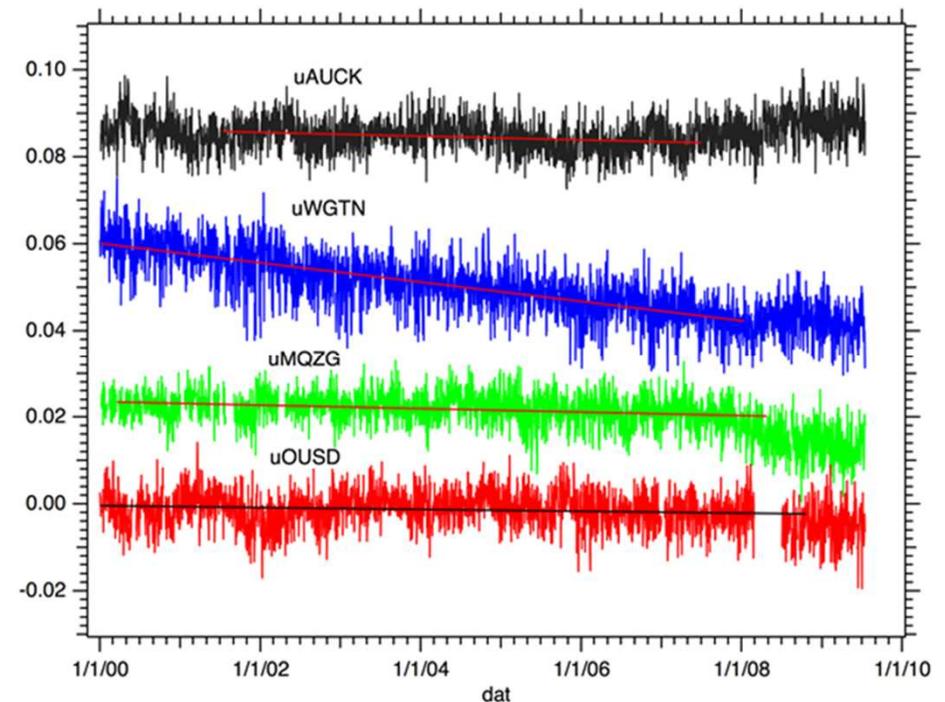
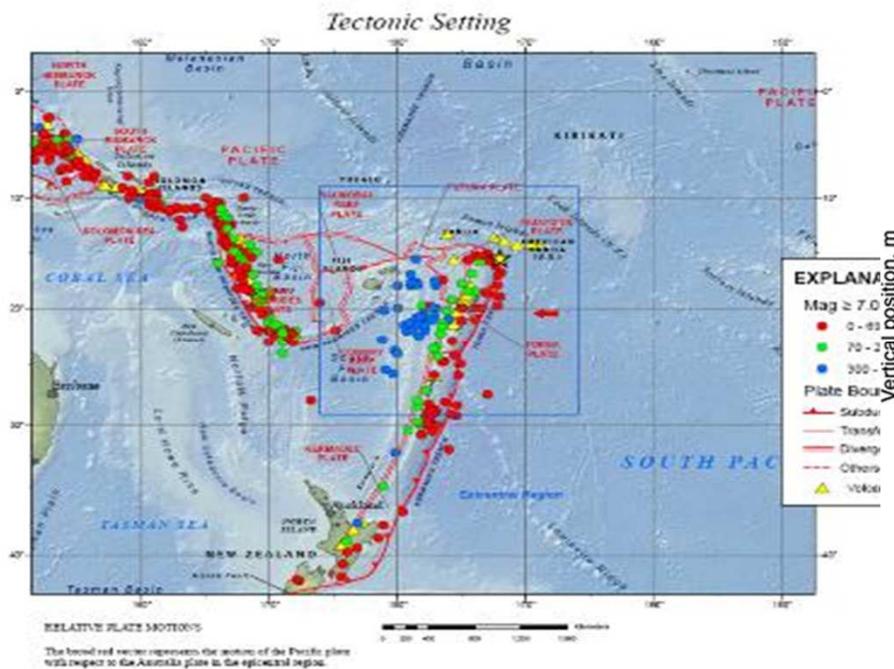
# SEA LEVEL RISE

## The Issues

### (C) Vertical tectonic motion must be determined

Many of the South Pacific Small Island Developing States are tectonically and seismically unstable.

### New Zealand GPS Data



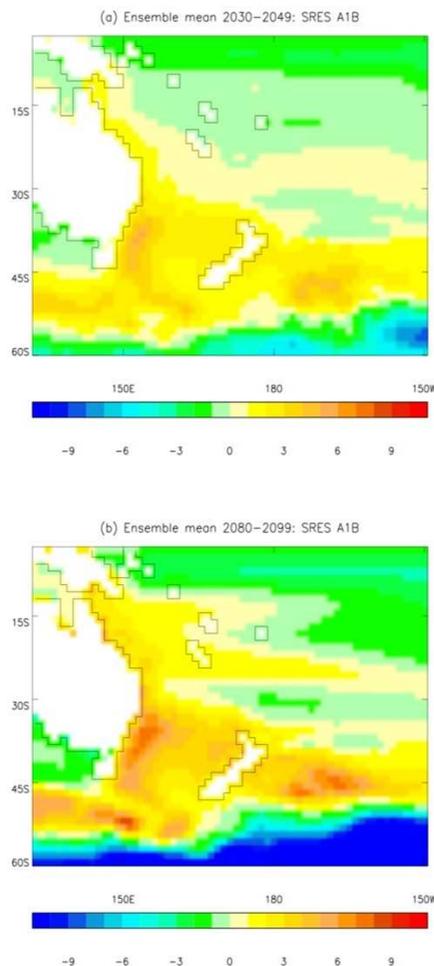
# SEA LEVEL RISE

## The Issues

**(D) Important to recognise the regional variability from the global mean.**

Driven by:

1. By wind and climate mode variations (Now).
2. Changes to Earth's gravitational field due to melting of polar ice sheets (Future).



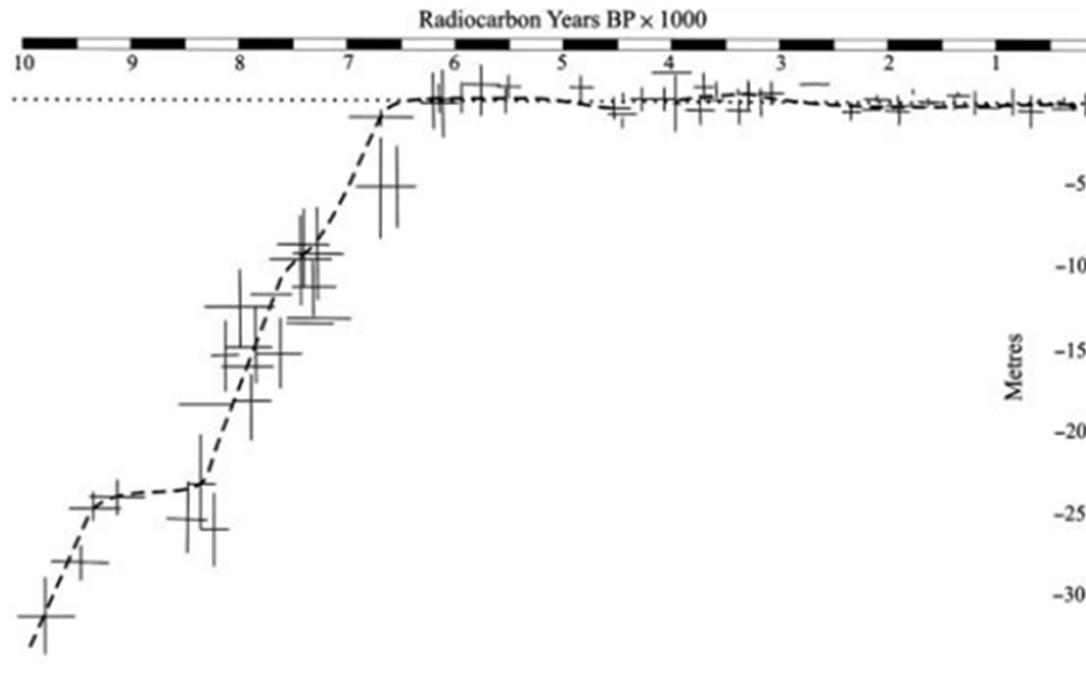
# SEA LEVEL RISE

## The Future?

The future is uncertain, BUT the past may help. About 4,000 yrs BP:

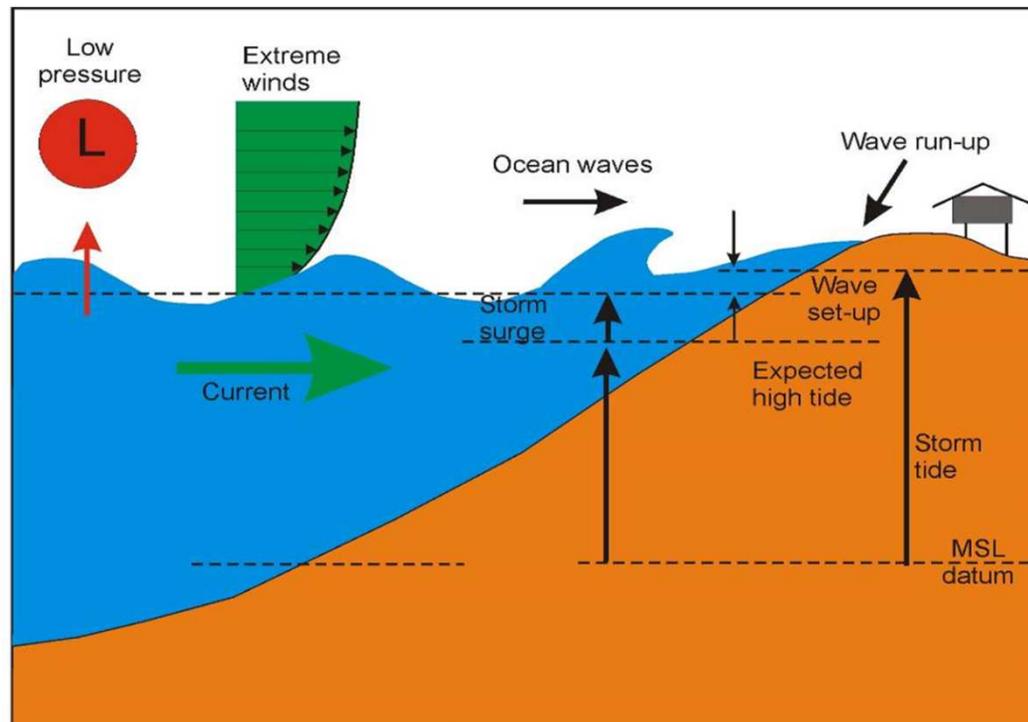
- temperatures +2° C higher than at present
- sea levels about 0.5 m higher than at present

Holocene Sea Levels in New Zealand

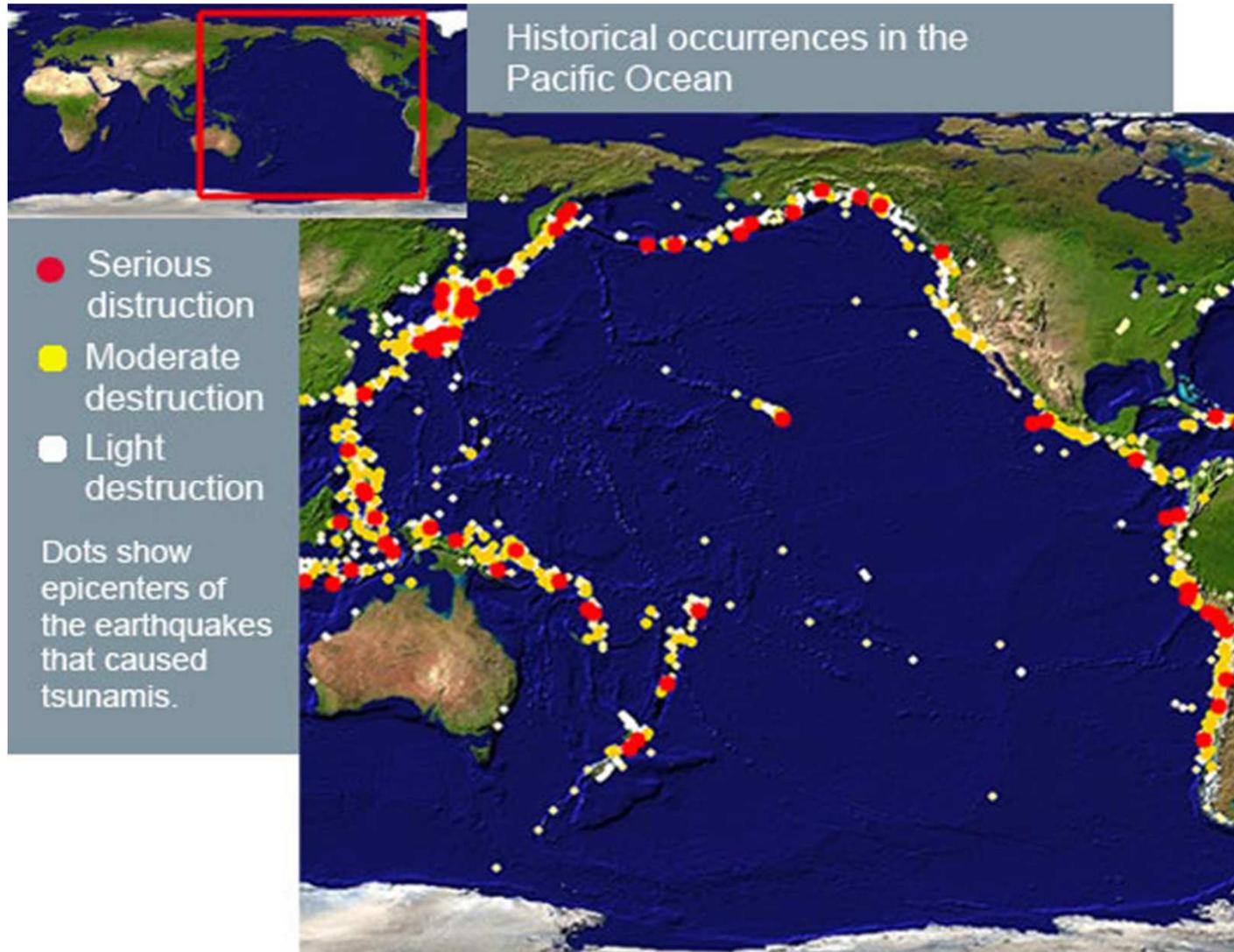


# STORMS

Some models suggest a 10 - 40 % increase in frequency of tropical cyclones by 2100. If this occurs, the South Pacific would see more monsoons & El Nino activity.



# Tsunami Risk



# TSUNAMI RISK

In the last 100 years:

- 12 tsunamis in the close Pacific region (Philippines to New Zealand) with wave heights higher than 5 m.

- 37 tsunamis around the Pacific “Ring of Fire” with wave heights higher than 5 m.



# WHAT ABOUT THE FUTURE?

**Sea level change** – a function of many variables, some understood well, some not understood. There will be very significant local variations. Globally, the science is not yet settled! **Use the mid-Holocene data as providing a useful extreme!!**

**Storms** – **Expect an increase of, say, 10 - 40%!**

**Tsunamis** – Completely unpredictable but potentially the most devastating risk. Be prepared - have an evacuation plan!!!

# CONCLUSIONS

1. Climate change science has tended to over-estimate future problems.
2. Well maintained (local) geodetic reference systems are essential to future monitoring efforts.
3. Important administrative data (e.g., land records) need back-up (for tsunami, storm and earthquake protection).
4. Systematic risk assessment (“what if”) scenarios is essential.