

Long term regional sea level variability and total relative sea level rise in Tropical Pacific, Caribbean Sea, South China Sea and Indian Ocean : An overview

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Why REGIONAL and LONG TERM sea level change and variability?

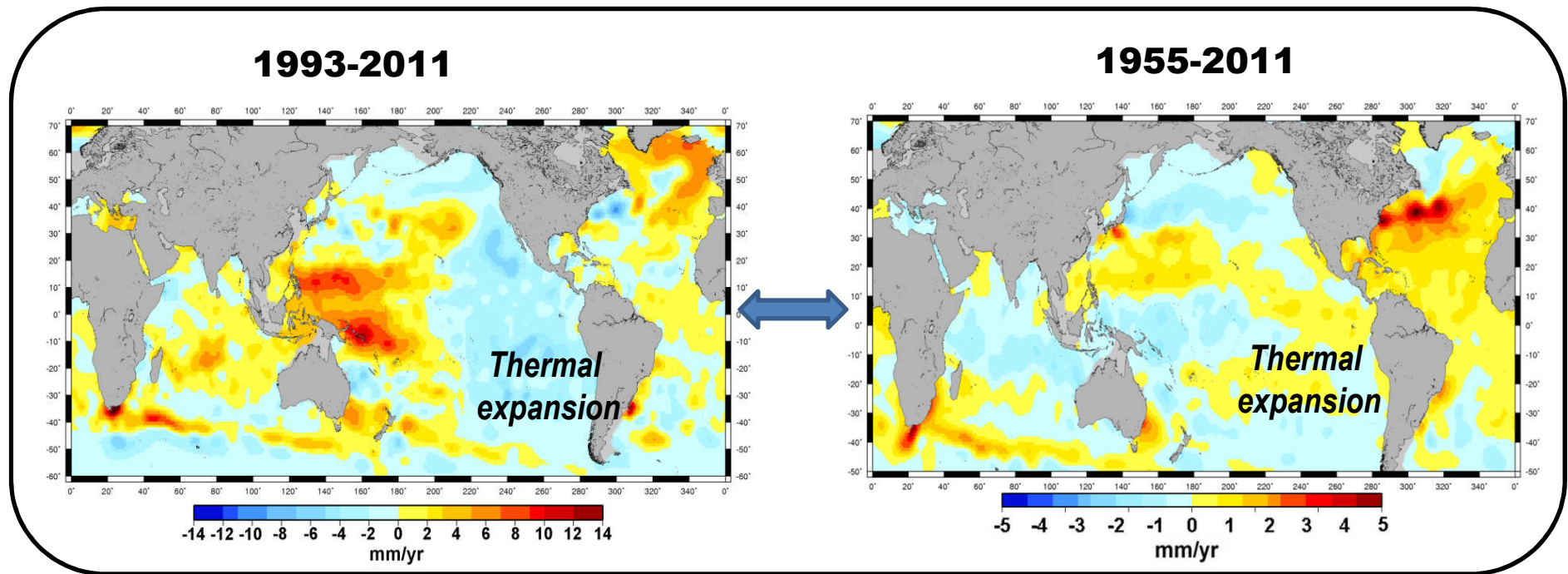
Sea level rise is not uniform. It is mostly due to non uniform thermal expansion..

Lombard et al. 2009

Kohl & Stammer 2008

Wunsch et al. 2007

Global mean trend removed



The regional variability oscillate in space and time in response to natural climatic modes (ENSO, NAO, ...)

Total local relative sea level rise

- ***2D Mean Reconstructed Sea Level (MRESL) Grid (1950-2010)***
- ***Observed altimetry (1993-2011)***
- ***Tide gauge records***

***climate-
related***

+

GPS and DORIS measures

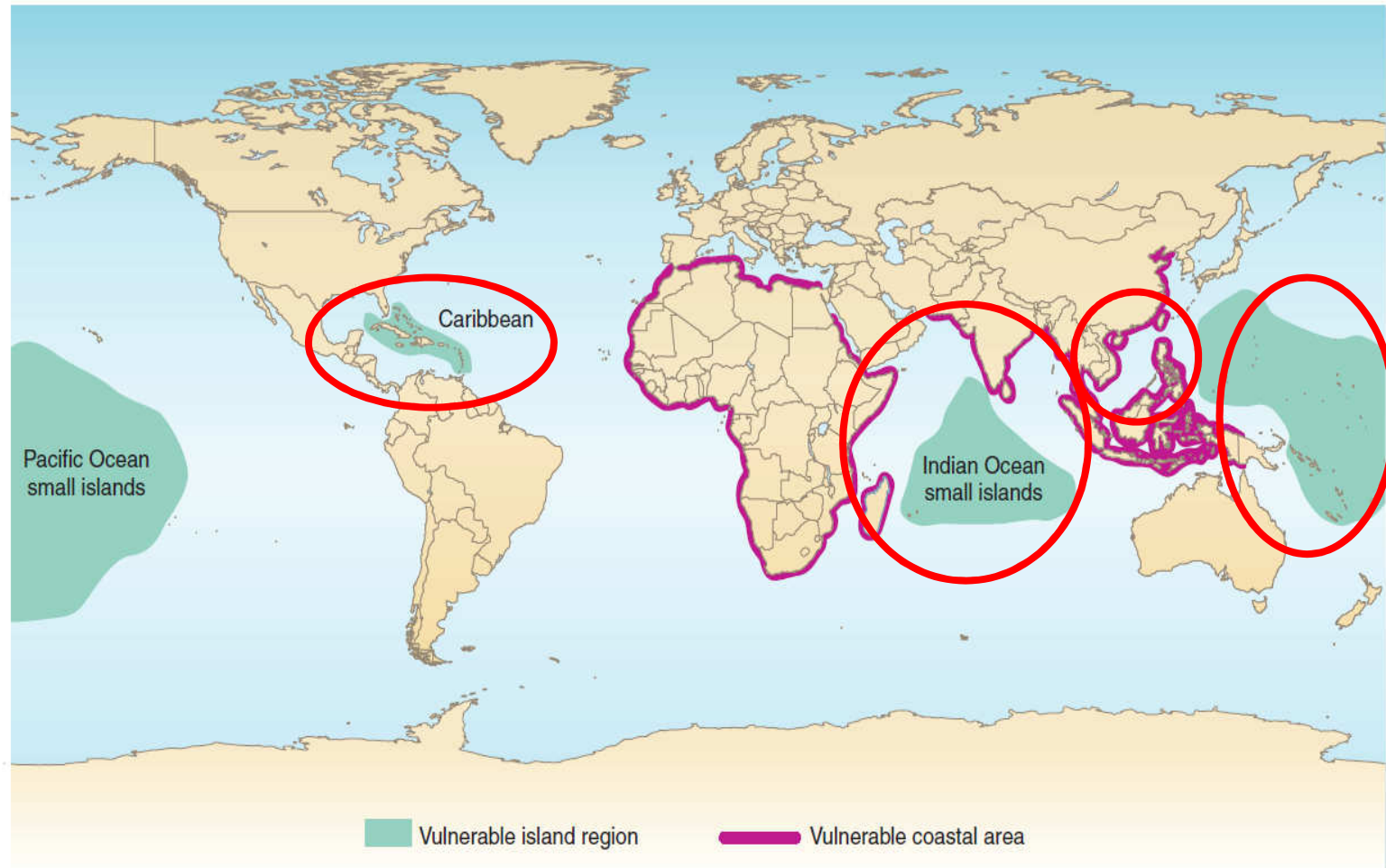
(ground water/

ice, volcanism, GIA)

Info on MRESL

Meyssignac et al., 2012

Regions vulnerable to changes in sea level



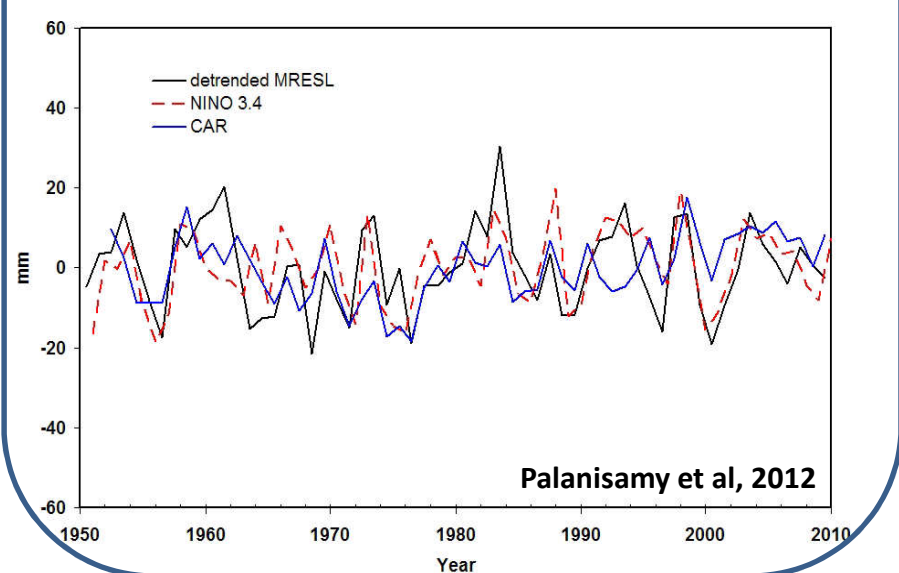
Nicholls and Cazenave 2010.

Climate-related sea level change 1950-2010

Caribbean Sea

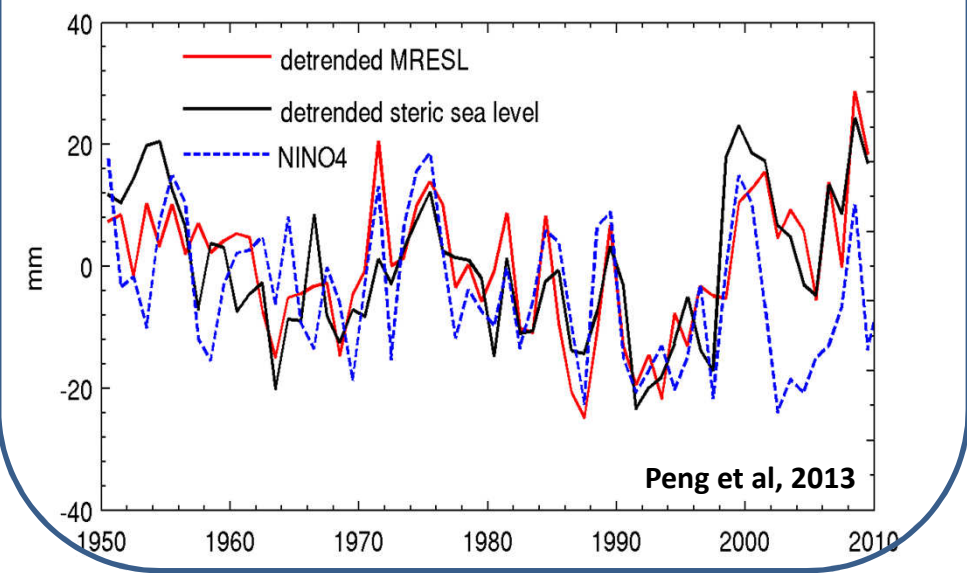
Trend = 1.8 0.5 mm/yr

Map showing precipitation trends (mm/year) in the Caribbean Sea region, ranging from -3 mm/yr to 5 mm/yr. The map includes latitude and longitude markers and labels for various locations: CABO SAN ANTONIO, GIBARA, NORTH SOUND, PORT ROYAL, PORT AU PRINCE, MAGUEYES, SAN JUAN, LIME TREE, MARIGOT, GUSTAVIA, PUERTO CORTES, POINTE-A-PITRE, FORT DE FRANCE, PORT OF SPAIN, PUERTO LIMON, CARTAGENA, and CRISTOBAL.



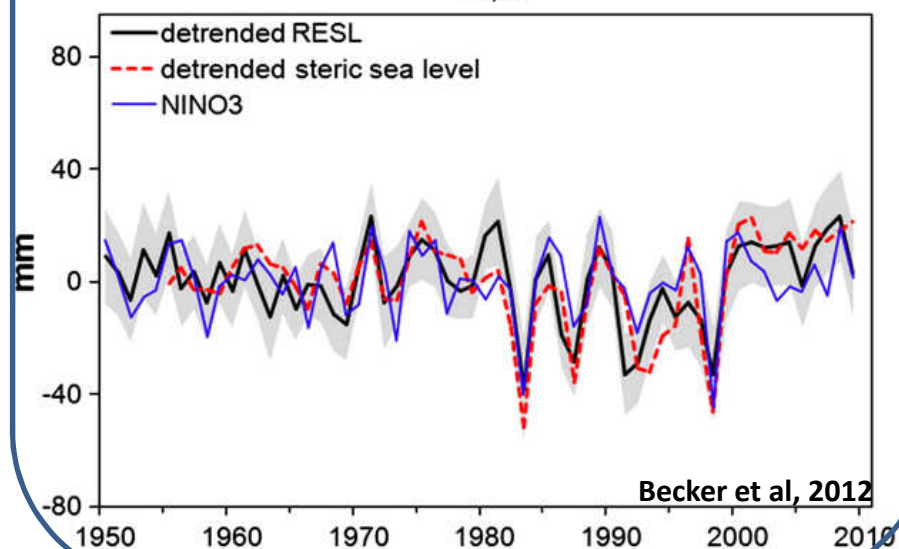
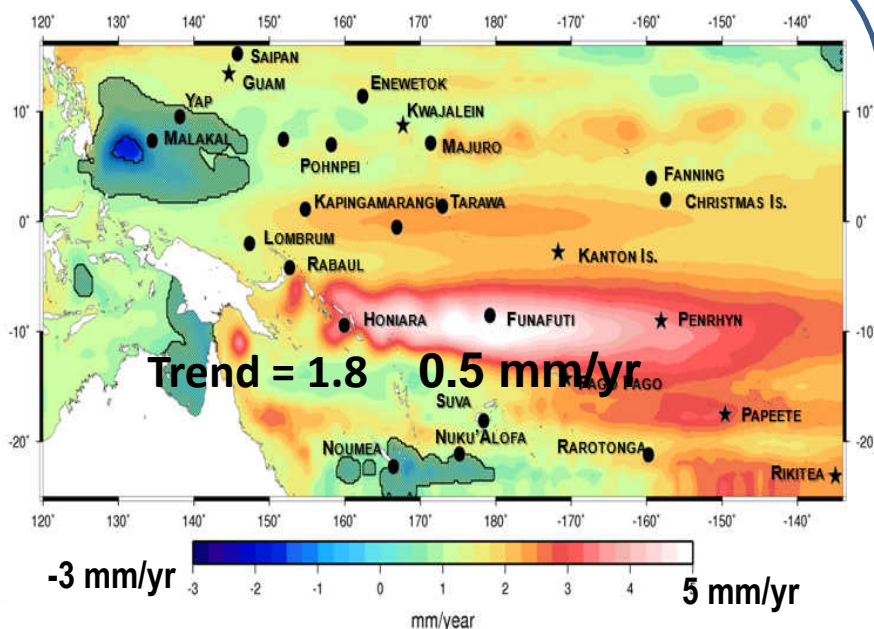
South China Sea

The map displays the South China Sea with latitude from 0° to 20°N and longitude from 105°E to 115°E. A color scale at the bottom indicates sea level rise trends in mm/yr, ranging from -0.5 (dark blue) to 3.0 (dark red). The trend values are generally higher in the northern part of the sea, reaching up to 3.0 mm/yr near Hainan Island, and lower in the southern part, around 0.5 mm/yr. Several locations are marked with black dots or triangles and labeled: HONDAU, HONGGU, DANANG, XI SHA, NAN SHA, KUDAT, KOTA KINABALU, LABUAN 2, JOHOR BAHRU, RAFFLES LIGHT HOUSE, GETING, CENDERING, TANJUNG GELANG, SHAN WEE, and TAI PO KAU. Three specific points are highlighted with blue circles and labels: HONGGU, HONNGU, and SHAPO. A large black star is located near SHAPO. The text "Trend = 1.8 0.5 mm/yr" is overlaid on the map.

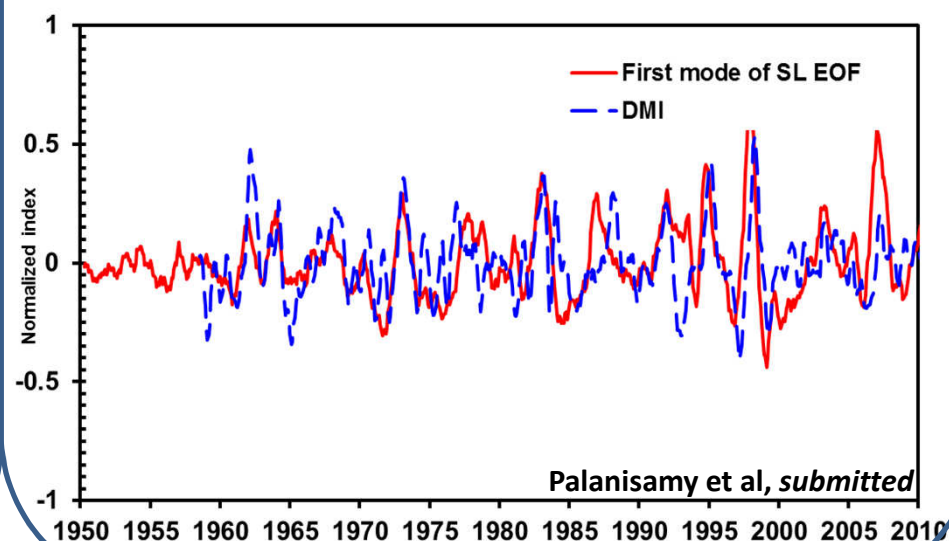
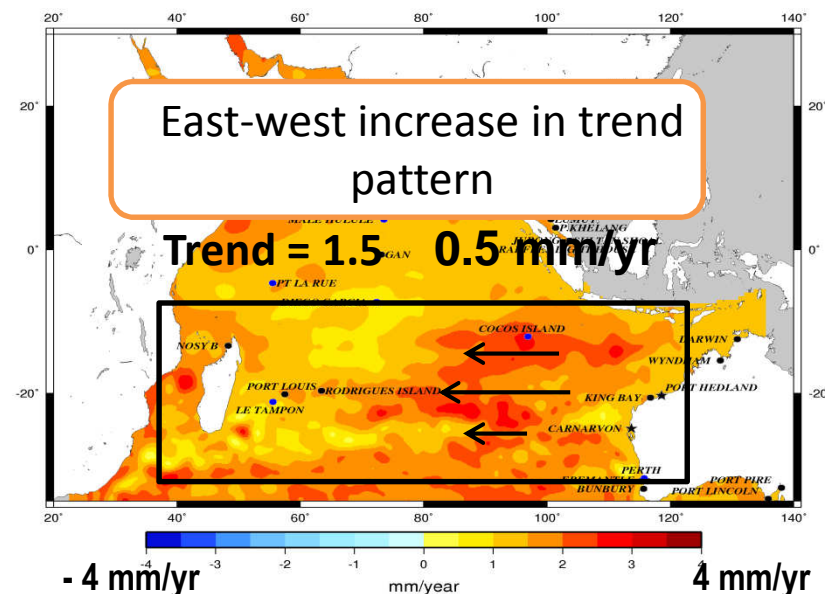


Climate-related sea level change 1950-2010

Tropical Pacific

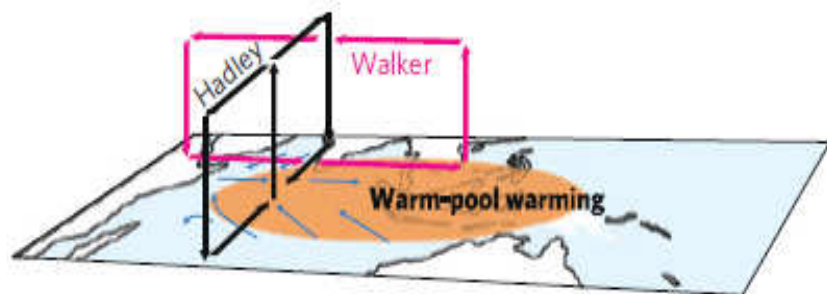
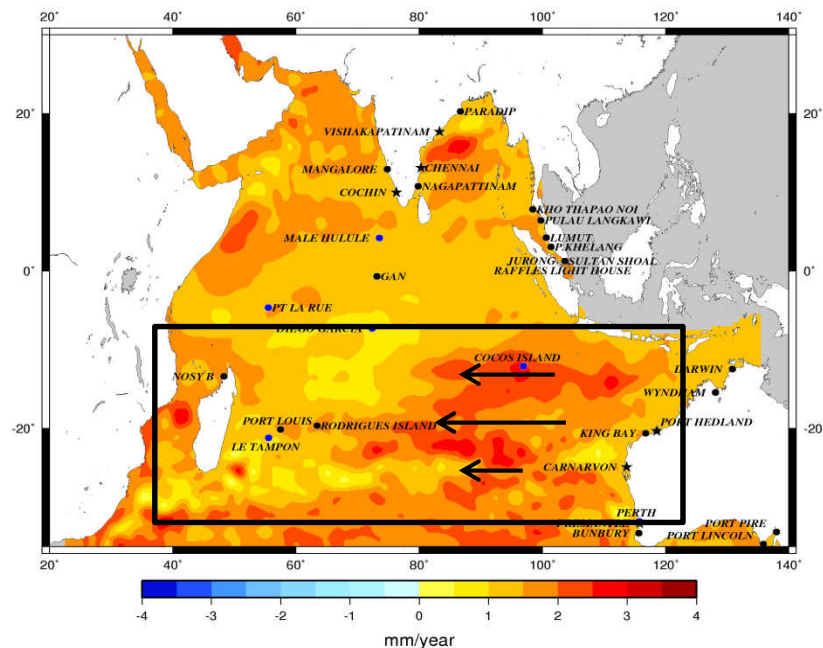


Indian Ocean

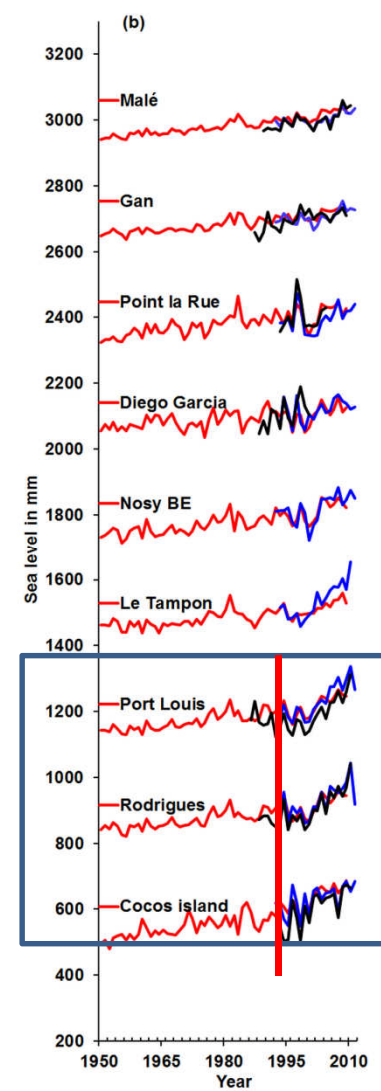
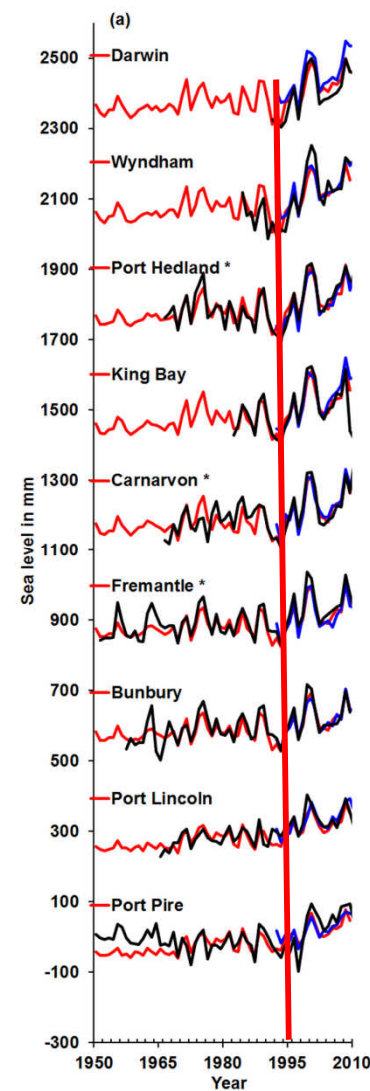


Climate-related sea level change 1950-2010

Indian Ocean



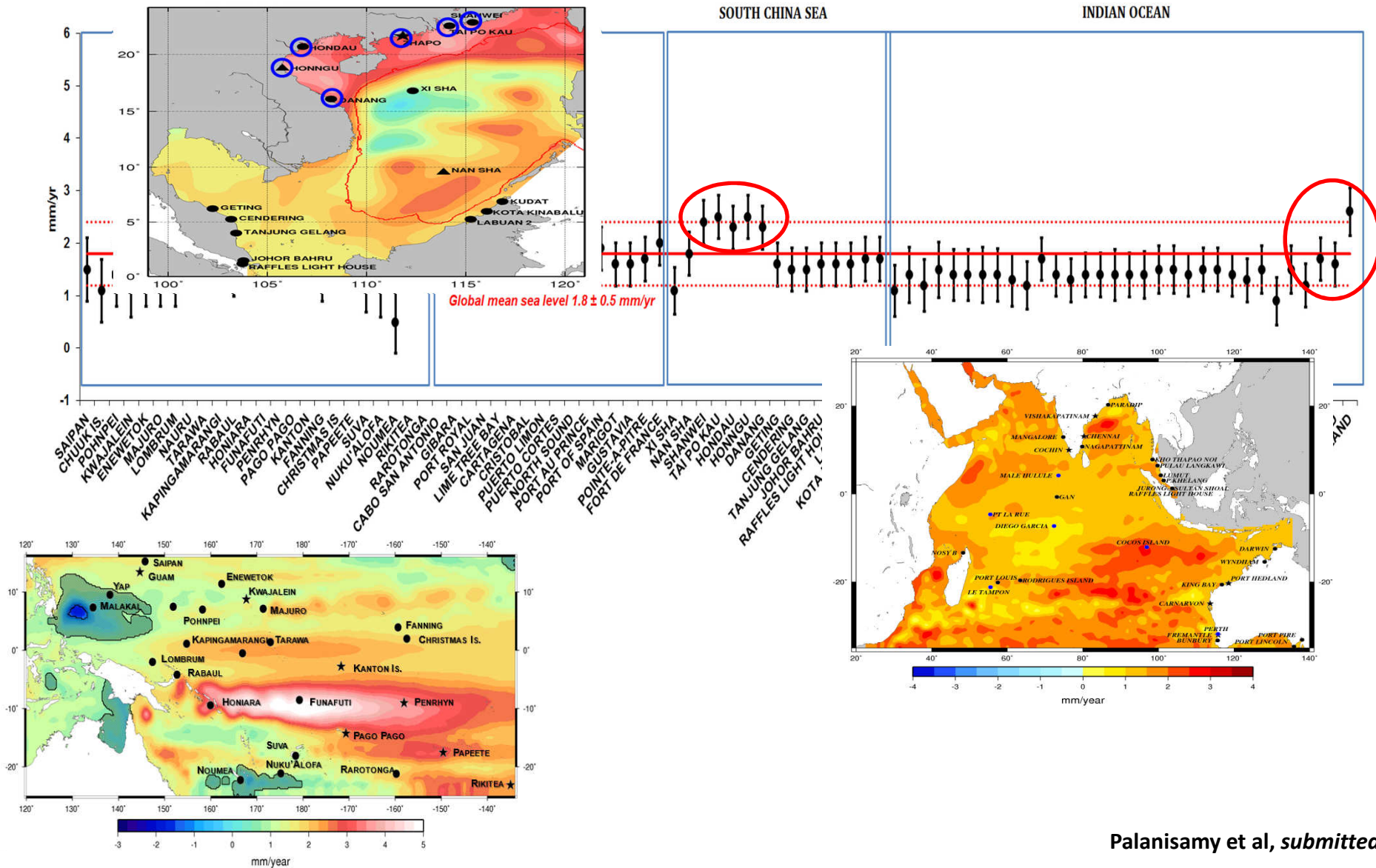
Han et al, 2010



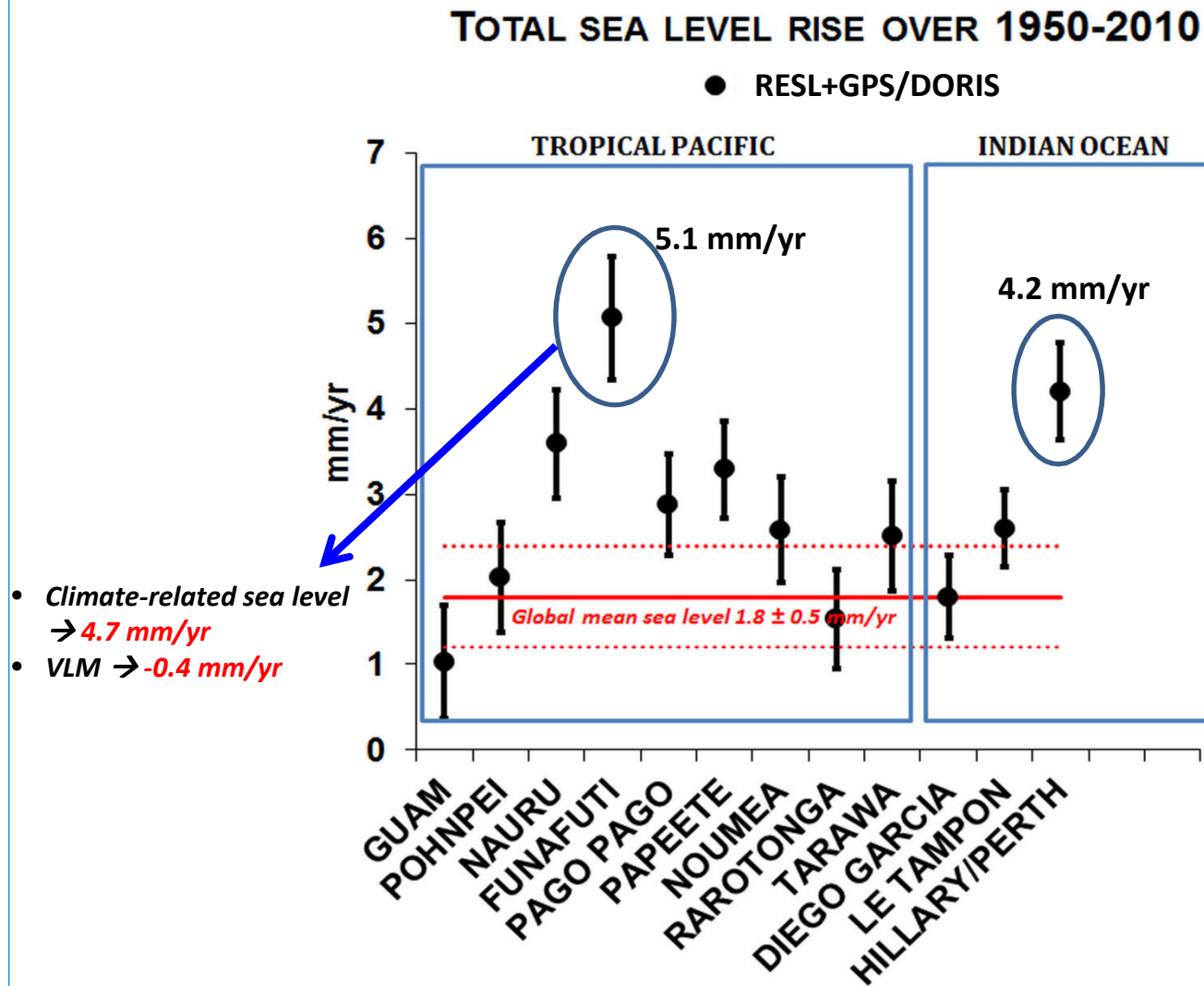
Palanisamy et al, submitted

Climate-related sea level change 1950-2010

CLIMATE-RELATED SEA LEVEL RISE 1950-2010

Palanisamy et al, *submitted*

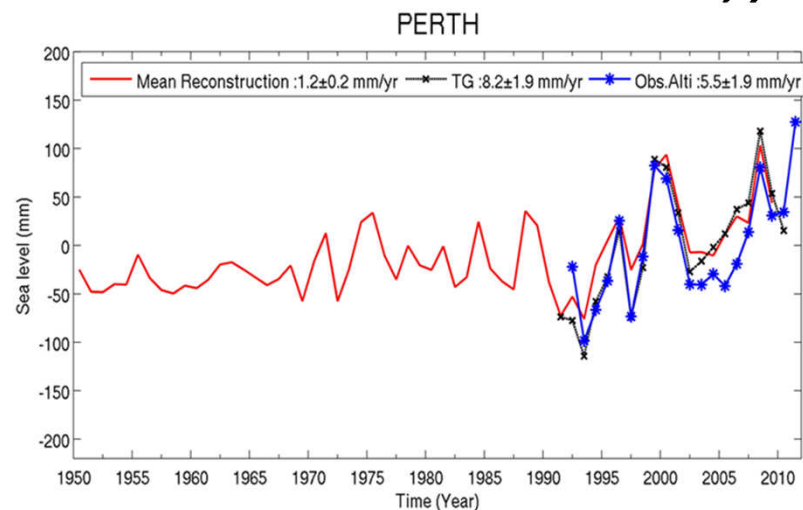
Total relative sea level change



Total relative sea level change

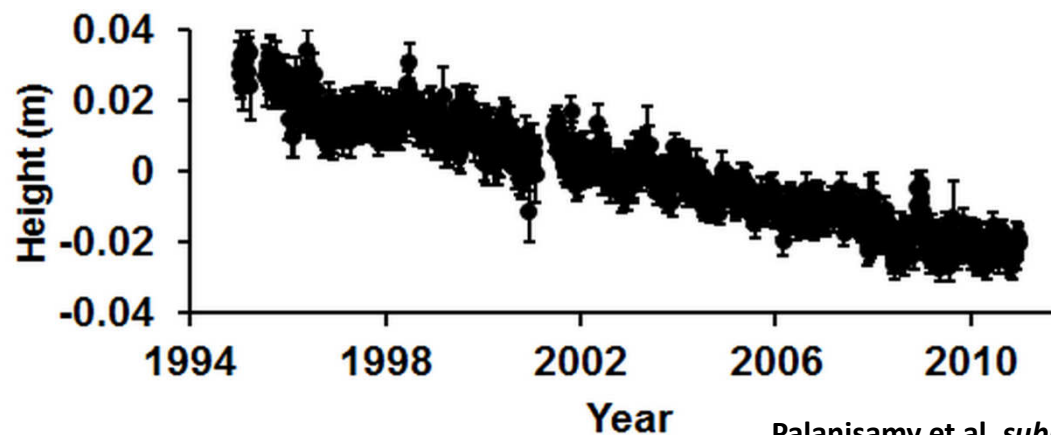


MRESL trend 1950 -2010 = **1.2mm/yr**



GPS VLM trend = **-2.98 mm/yr**

• **GPS-Perth**



Around 70% of total relative sea level rise contributed by subsidence!!

Subsidence in Perth due to excessive ground water extraction.. (Featherstone, 2013)

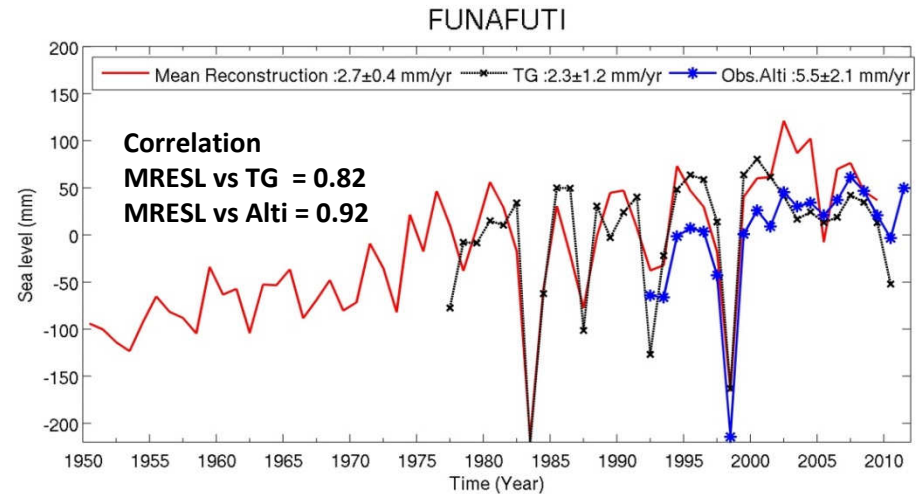
Conclusions & Perspectives

- *Sea level is rising but in order to determine the real impact of sea level rise on coastal and island zones, study on **regional variability** and **vertical land motion** becomes very important..*
 - *Need for more GPS/DORIS measures*
- *A new way to replace short term/erroneous/non-existent tide gauge records..*
 - *2D reconstructed sea level grids*
- *Improving the accuracy of sea level reconstruction grids*
 - *using more long, good quality tide gauges*
 - *with more spatial grids as input*
 - *regional reconstructions*

Synthetic tide gauge time-series

By product- Synthetic tide gauge time-series

- Validation of MRESL time series at individual tide gauge locations.



- develop MRESL time series at vulnerable locations with no/short/erroneous TGs.

