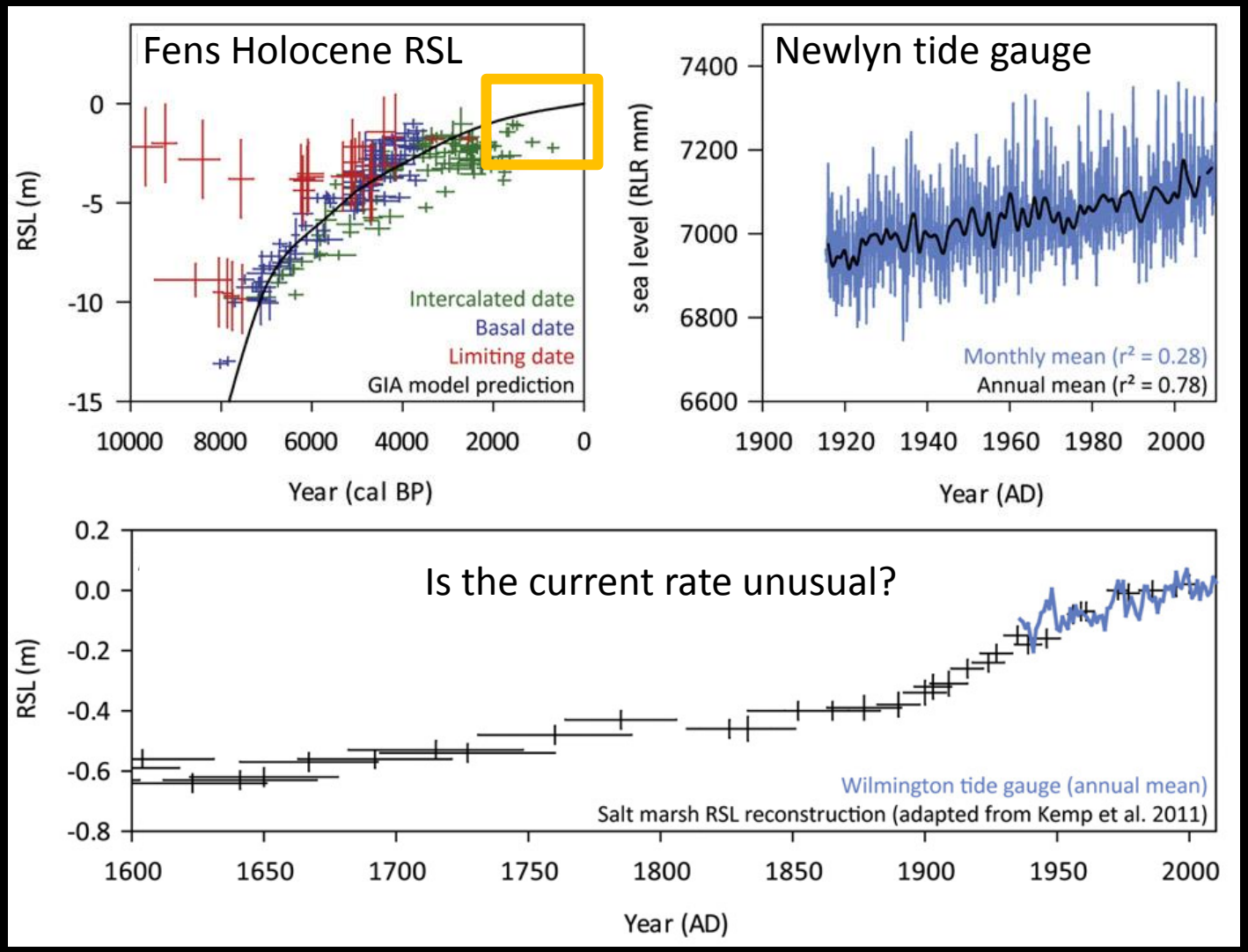
Salt marshes as late Holocene tide gauges

Natasha Barlow
Durham University

Antony Long, Roland Gehrels, Margot Saher

Note, unpublished salt marsh data has been removed from version given at the meeting

Linking palaeo and instrumental records

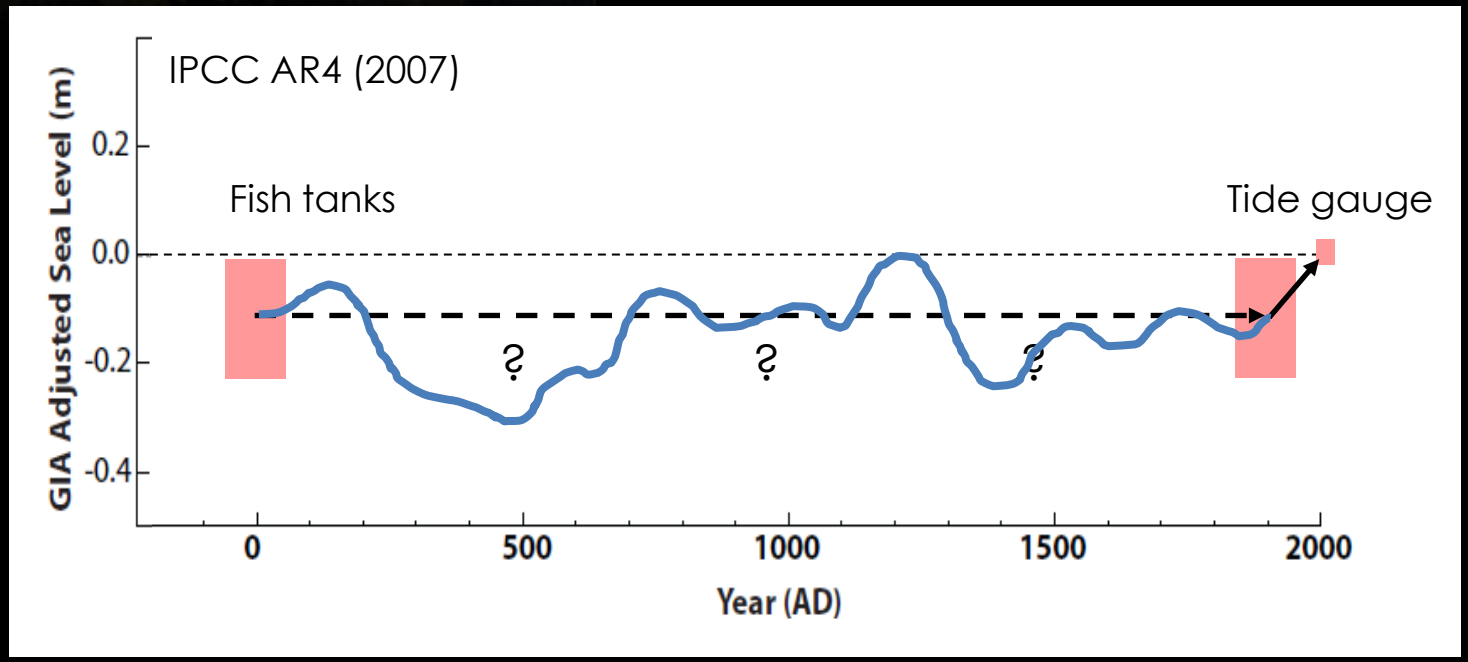


Adapted from Barlow et al. (2013)

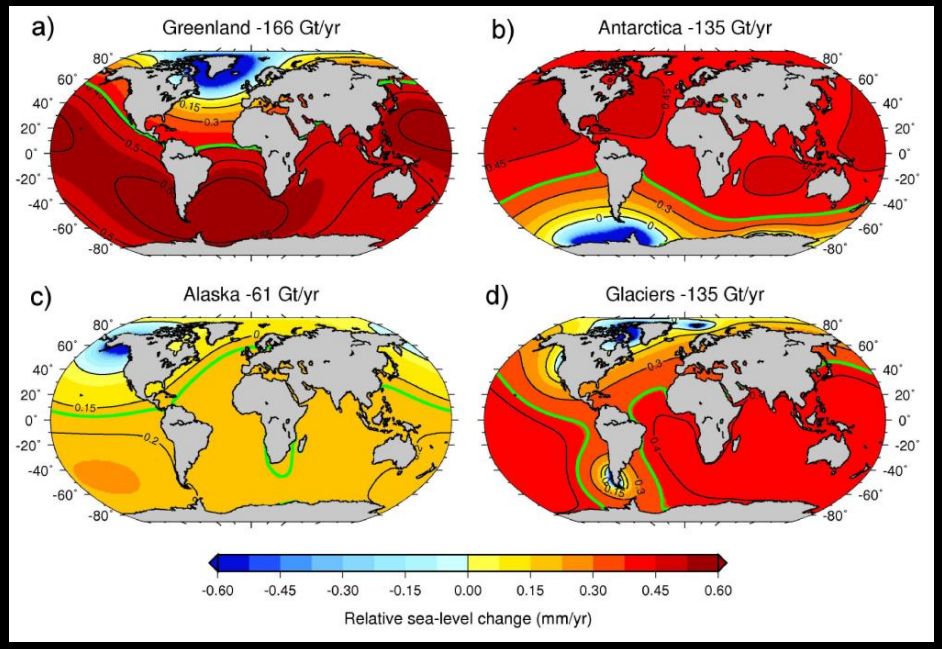
Late Holocene sea level

"When corrected…using geologically constrained model predictions, the change in eustatic sea-level since the Roman period is -0.13 ± 0.09 m"

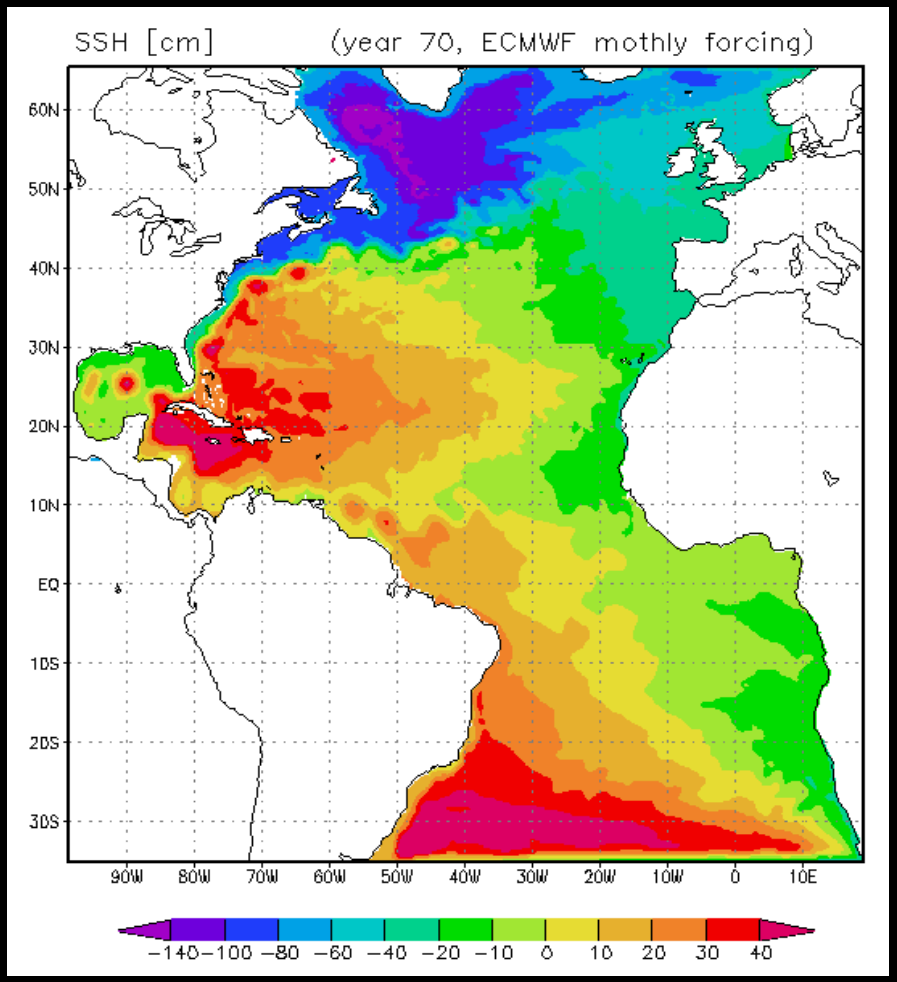
Lambeck et al. (2004)



Understanding spatial patterns of sea level



Bamber and Riva (2010)



Dynamic processes

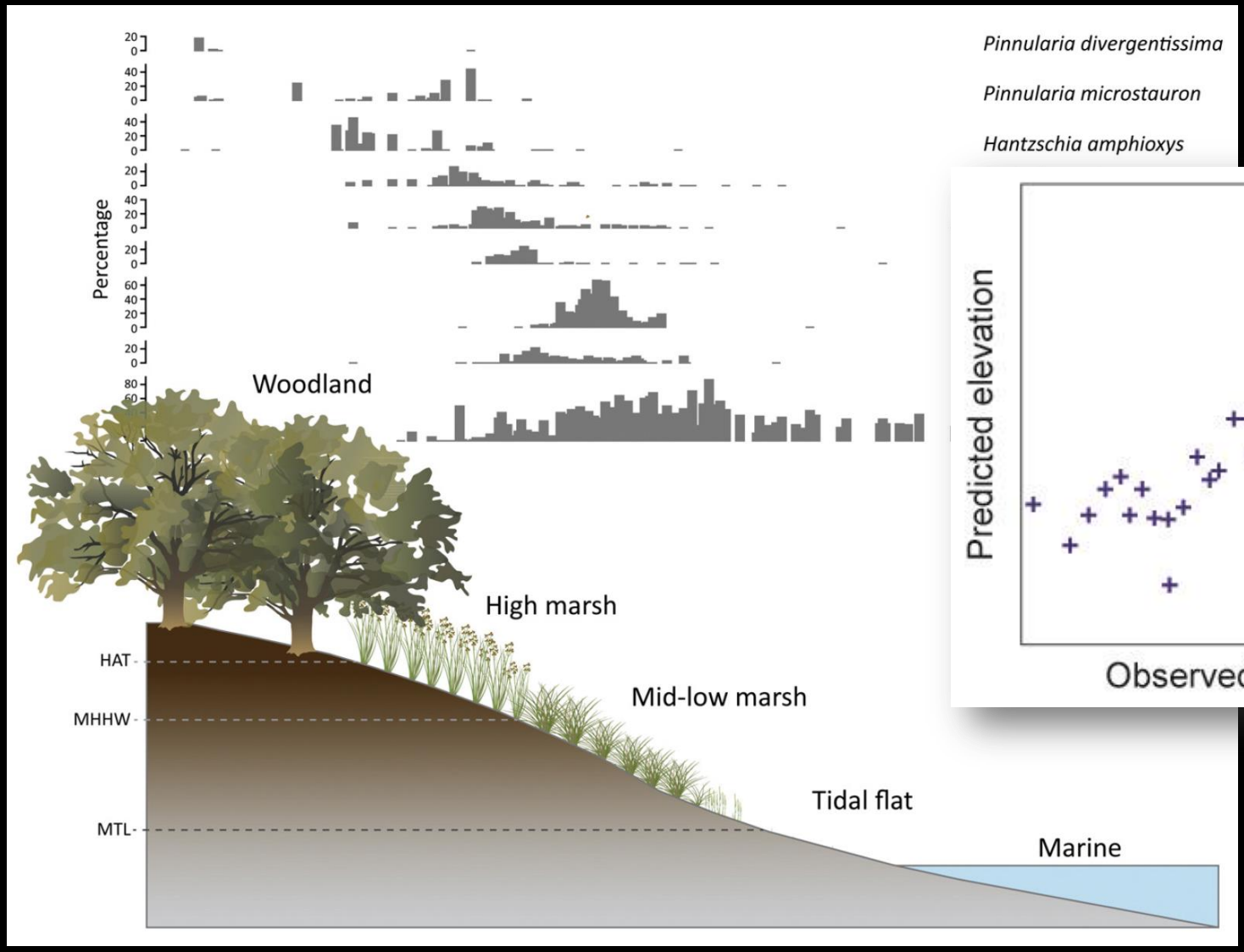

Viðarhólmi
Iceland
Saher et al. (in review)
Loch Laxford & Kyle of Tongue
North West Scotland
Newtown, Isle of Wight
Long et al. (in review)
Chezzetcook, Nova Scotia
Sanborn Cove, Maine
Barn Island, Connecticut
New Jersey; Kemp et al. (2013)
North Carolina; Kemp et al. (2011)
Florida
NASLV
North Atlantic
sea level
variability

Site selection is important

How do we develop geological tide gauge records?

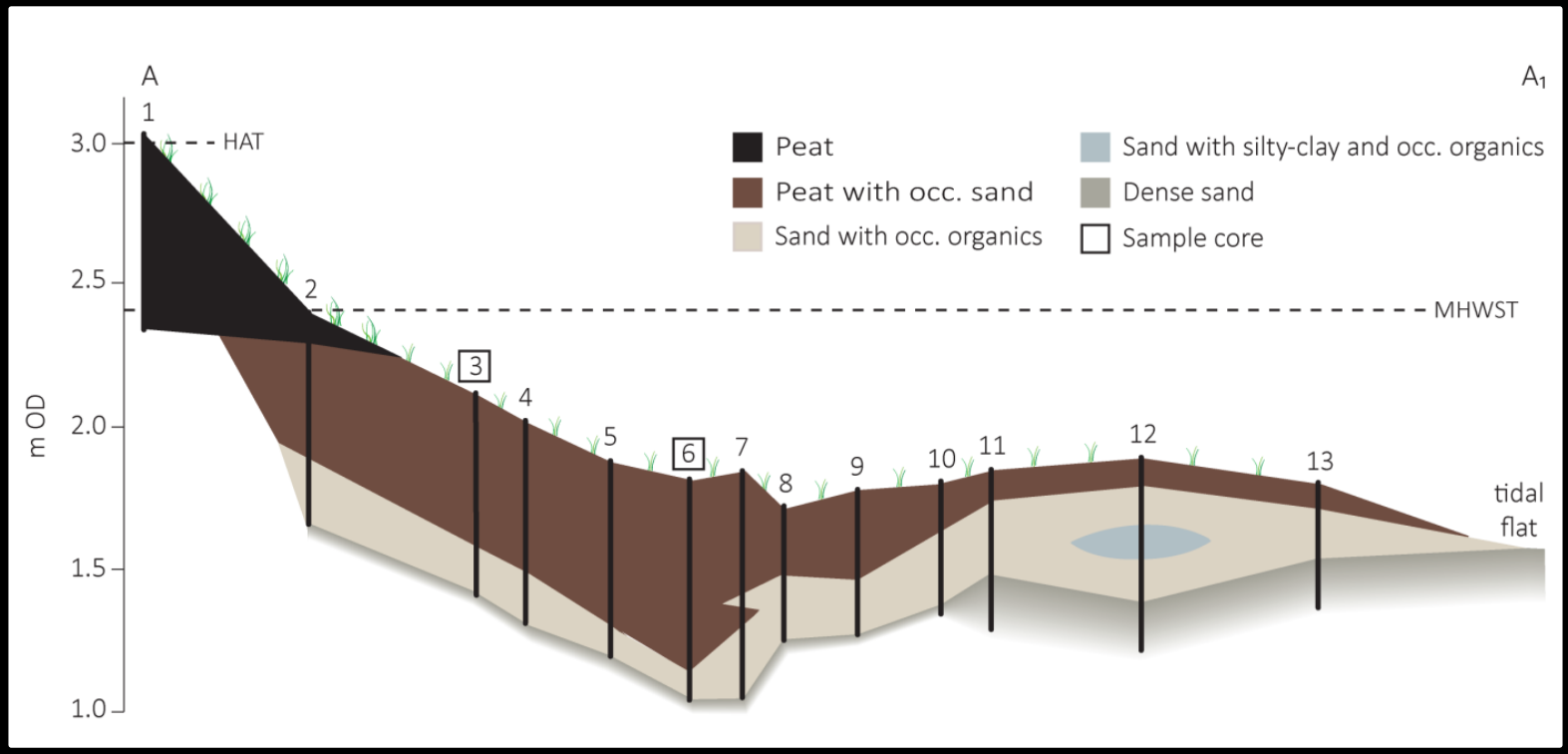
1. Understand the modern coastal environment
2. Construct a fossil archive
3. Quantitatively reconstruct past RSL change
4. Define the timing of any RSL change

Developing geological tide gauge records (1)

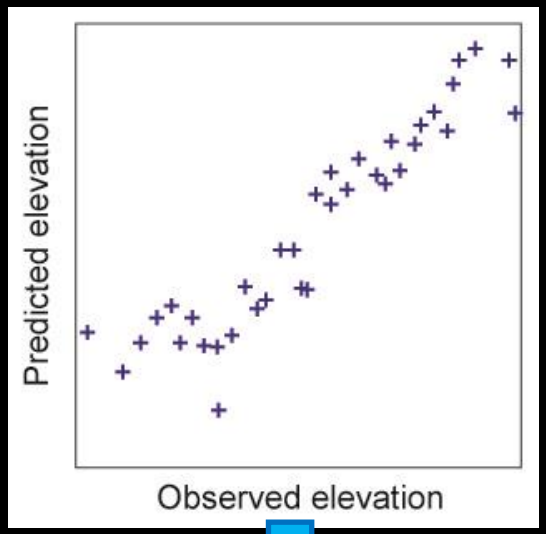


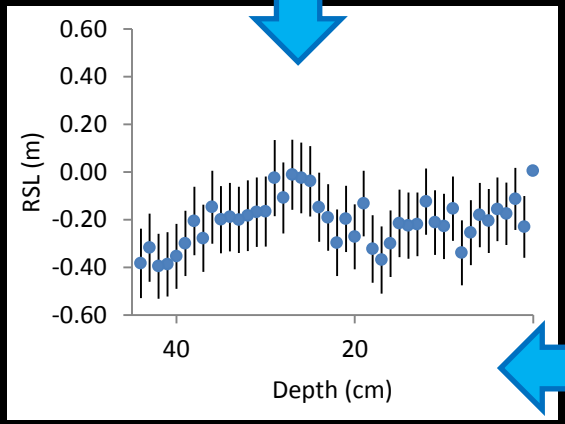
Barlow et al. (2013)

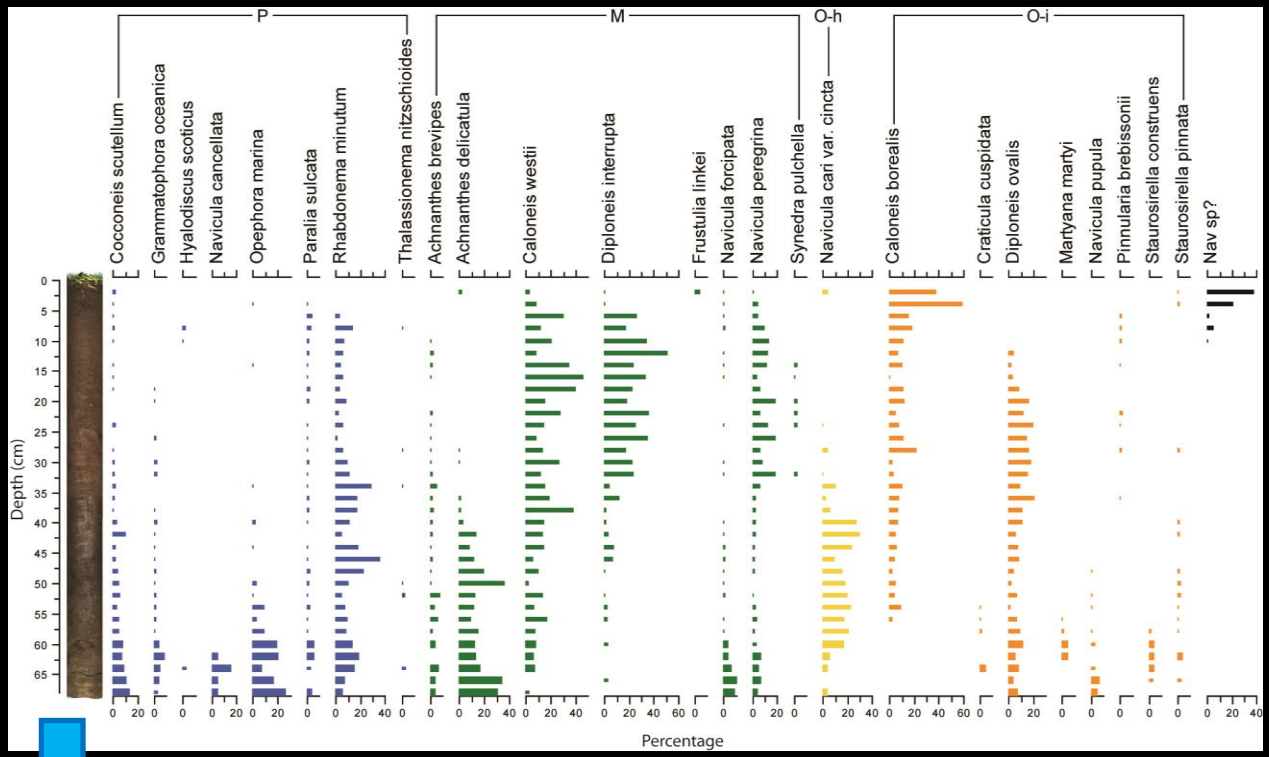
Developing geological tide gauge records (2)



Developing geological tide gauge records (3)

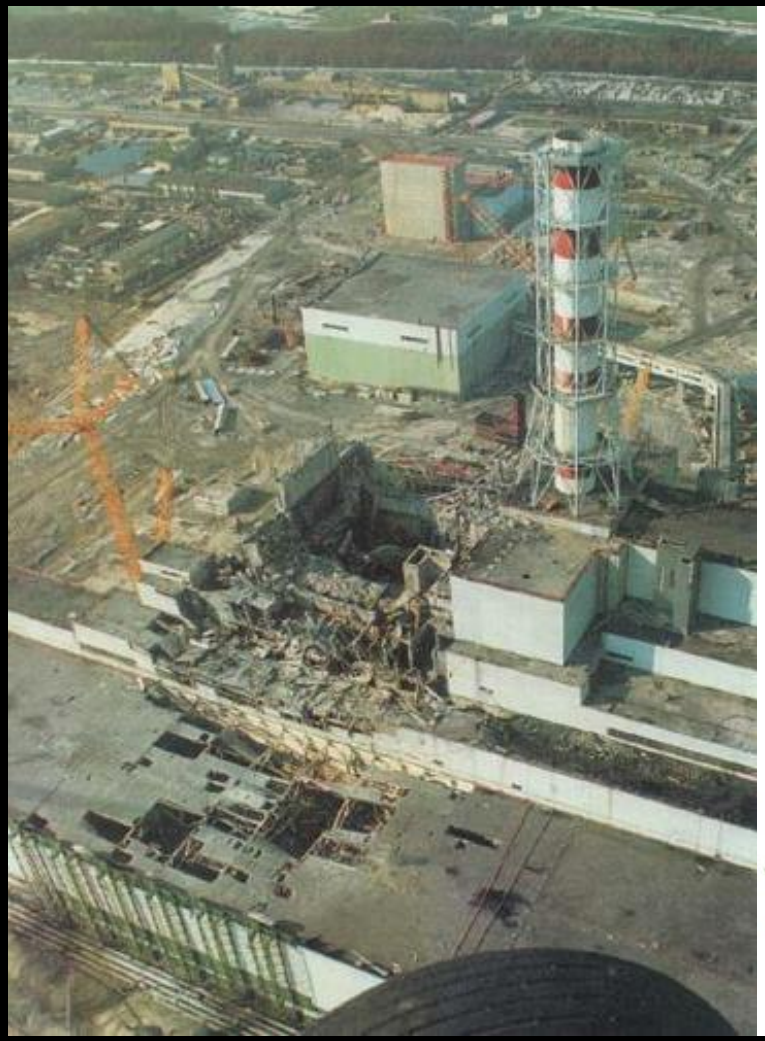


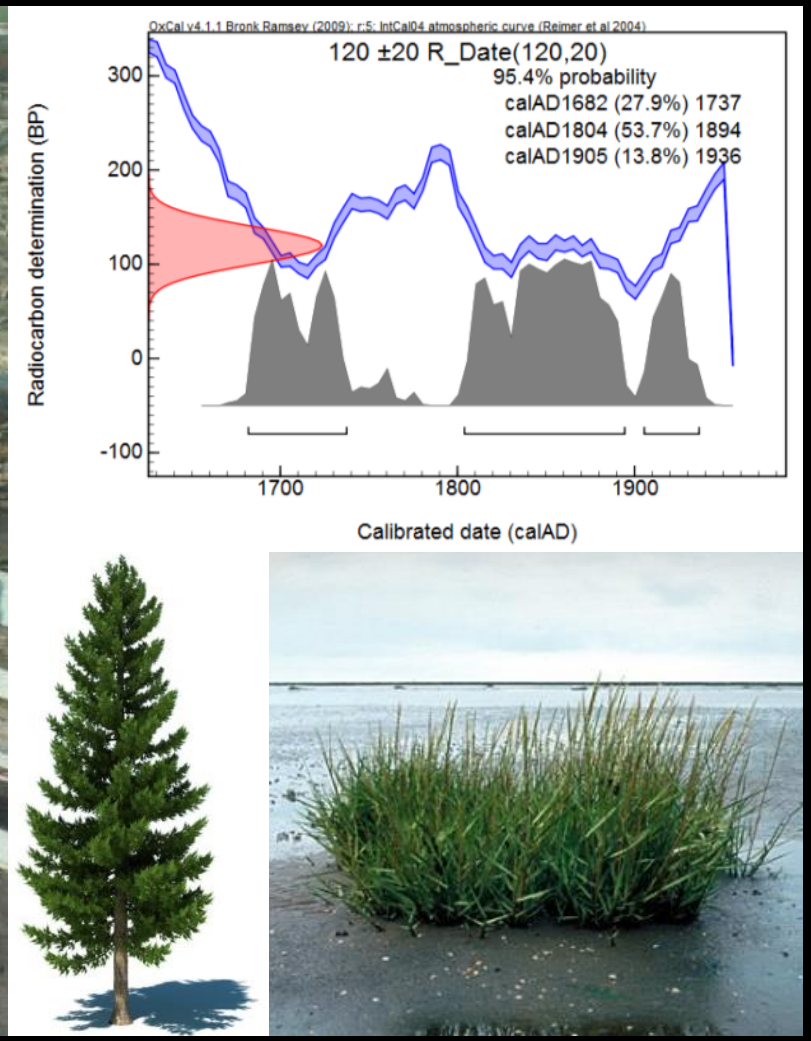




Calibrate fossil core with transfer function to produce RSL reconstruction

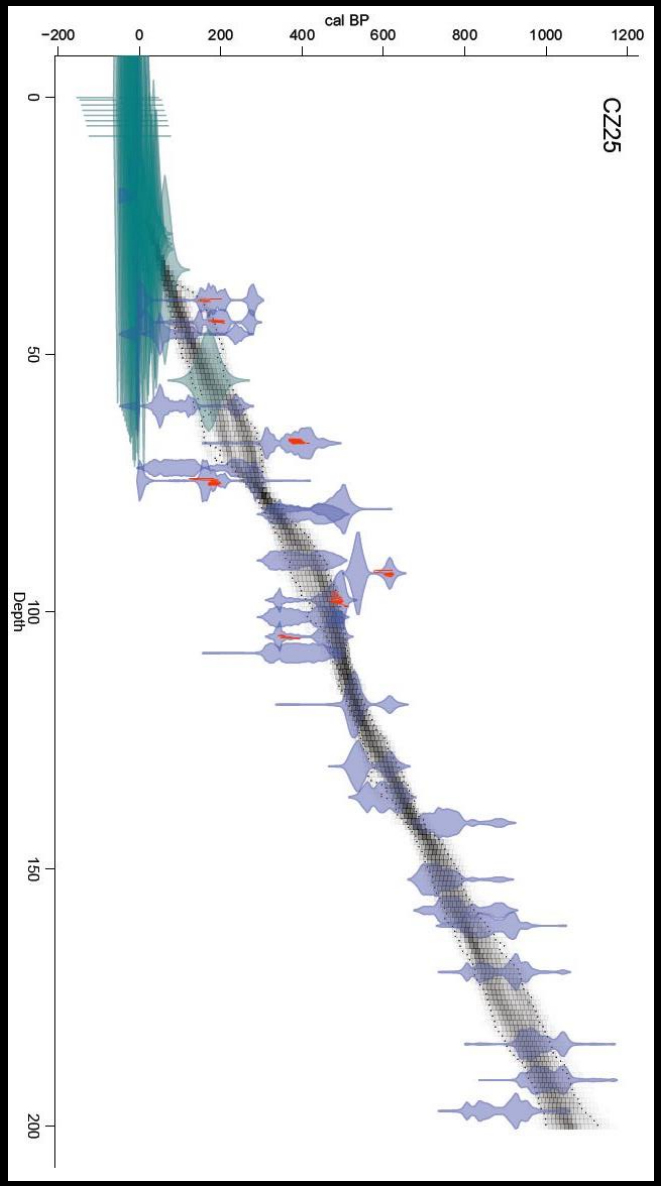
Developing geological tide gauge records (4)



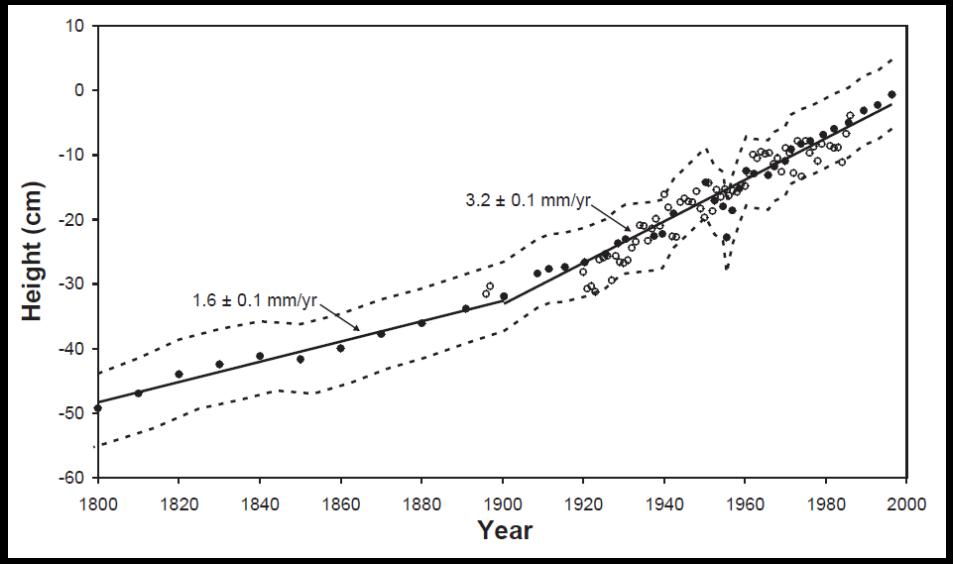


Developing geological tide gauge records (4)

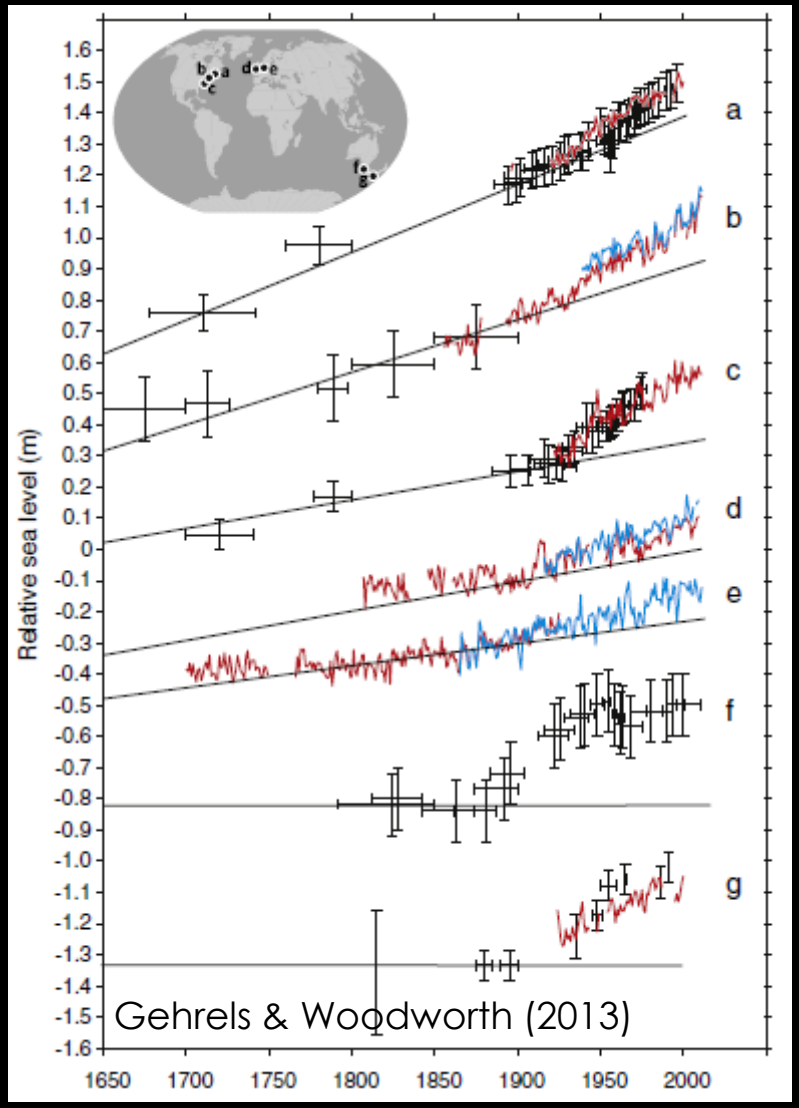
Developing geological tide gauge records (4)



Fit with instrumental tide gauge data



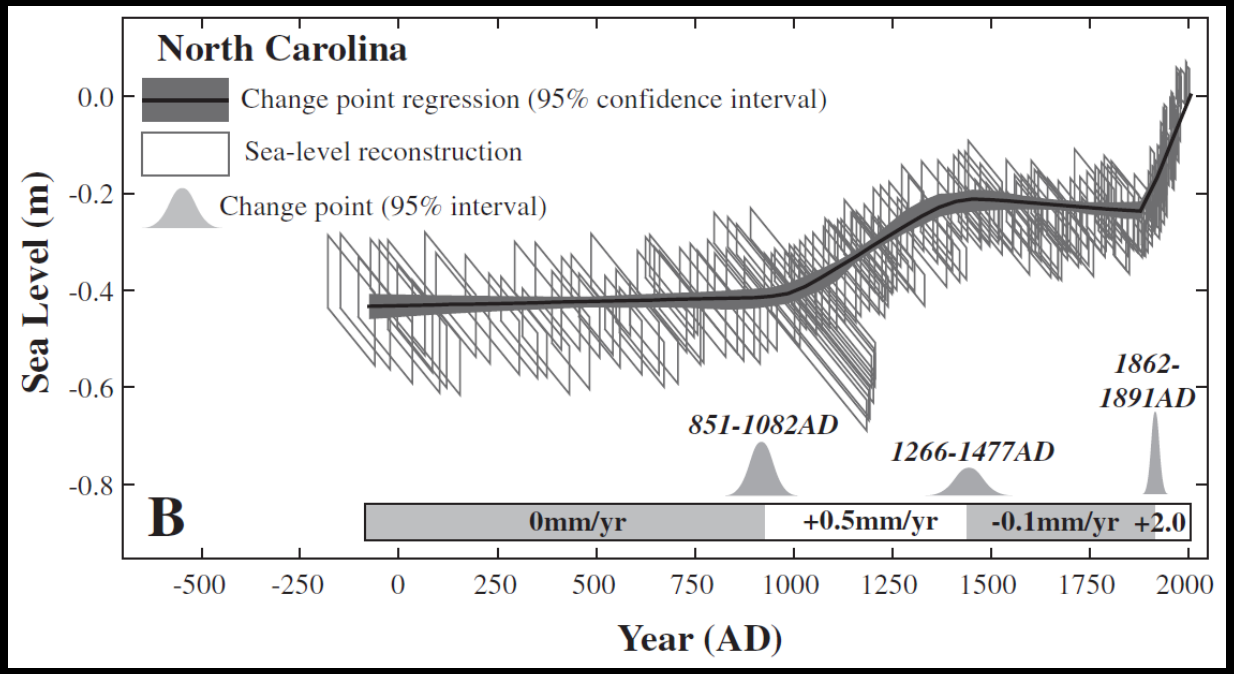
Gehrels et al. (2005)



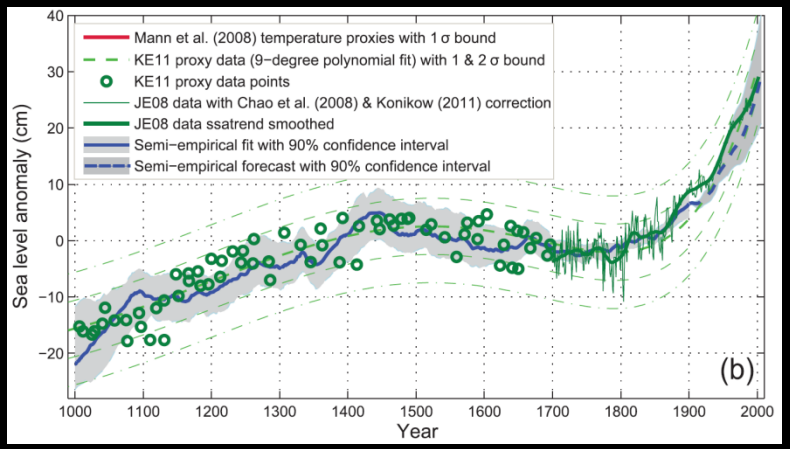
Gehrels & Woodworth (2013)

Highlights…

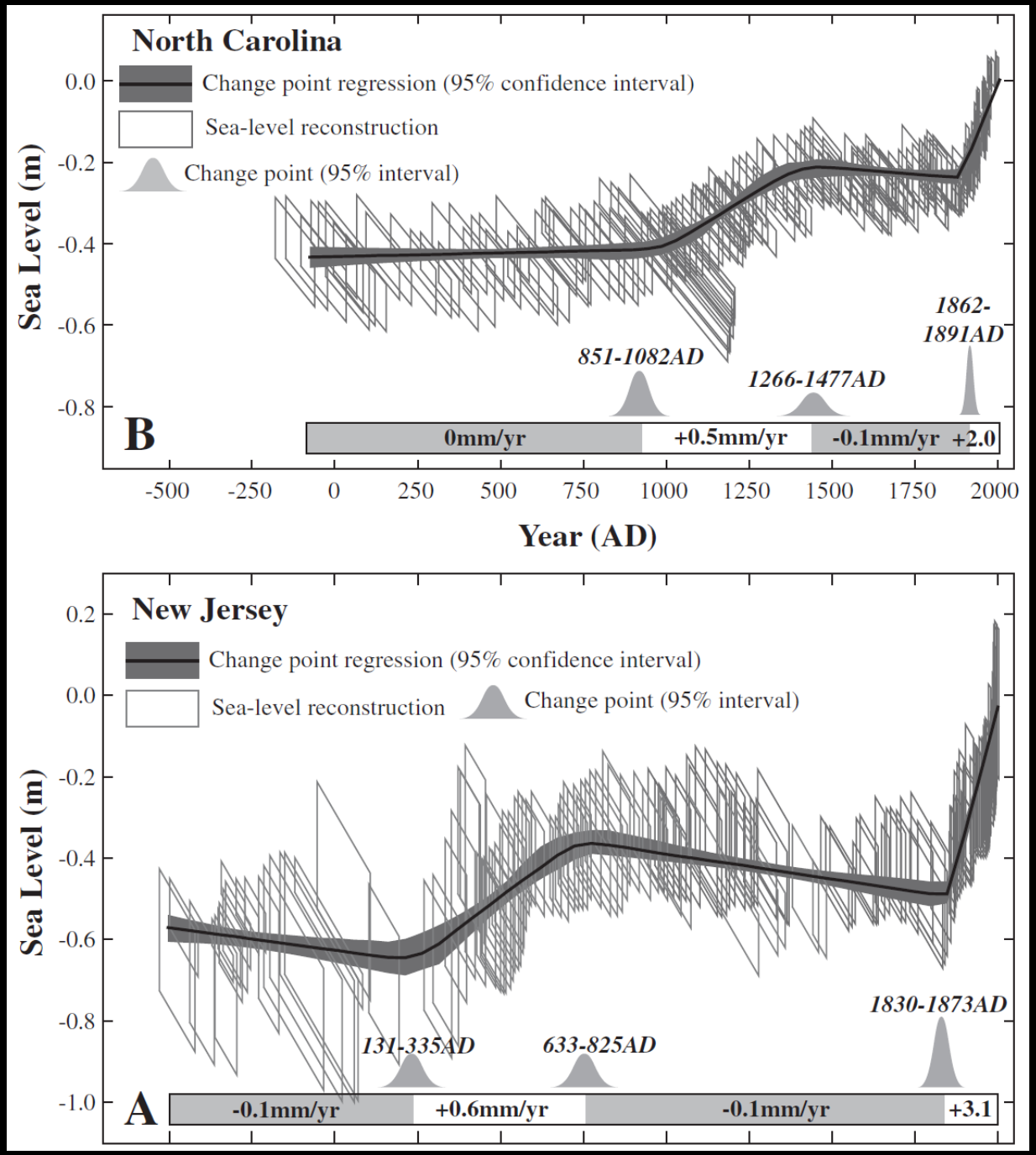
2000 years of North Atlantic sea-level change



Kemp et al. (2011)



Bittermann et al. (2013)



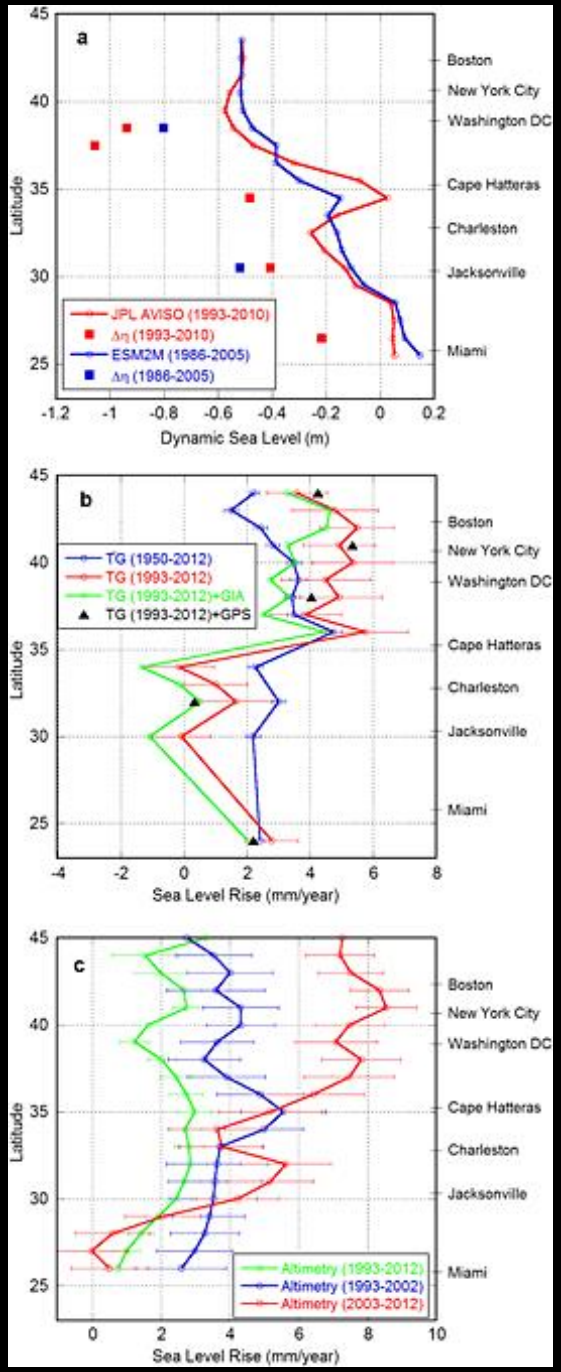
Kemp et al. (2013)

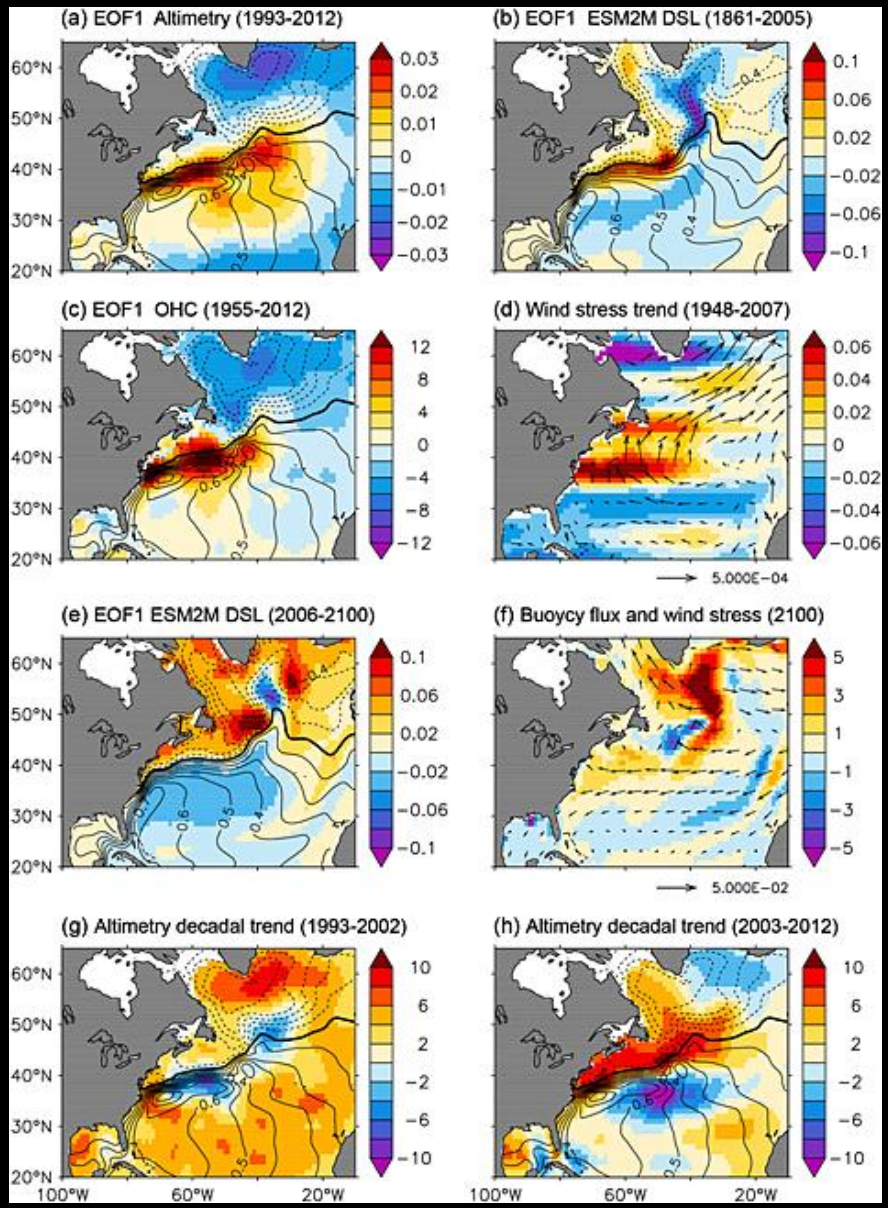
Unpublished salt marsh data removed.

Take home messages:

- Pattern of increasingly complex RSL south to north along the North American coast
- Contrasting sea level change between eastern and western North Atlantic margins (Long et al, in review)
- Icelandic sea level correlates with NAO (Saher et al, in review)

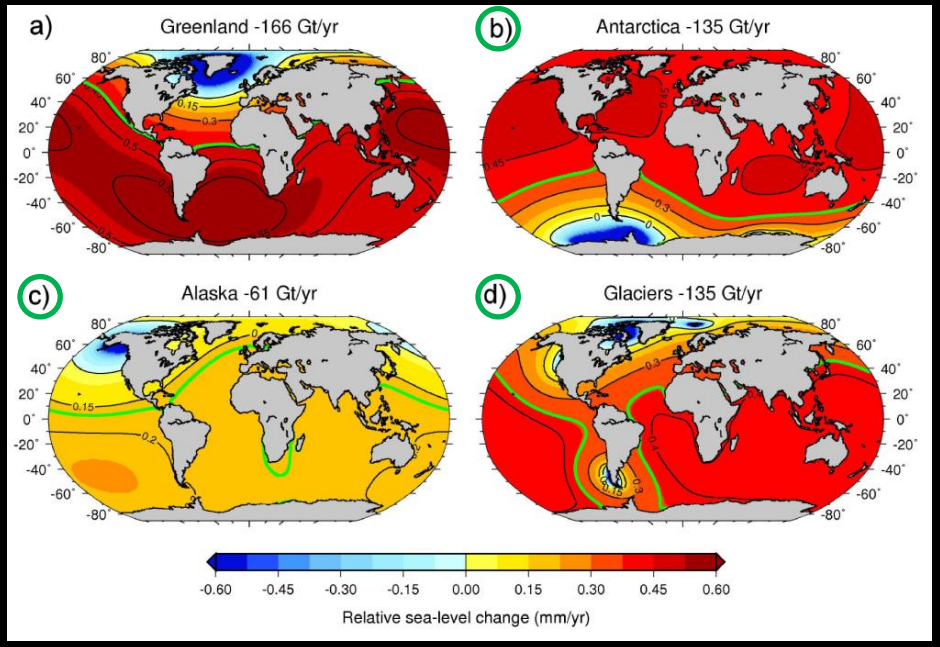
Spatial-temporal patterns



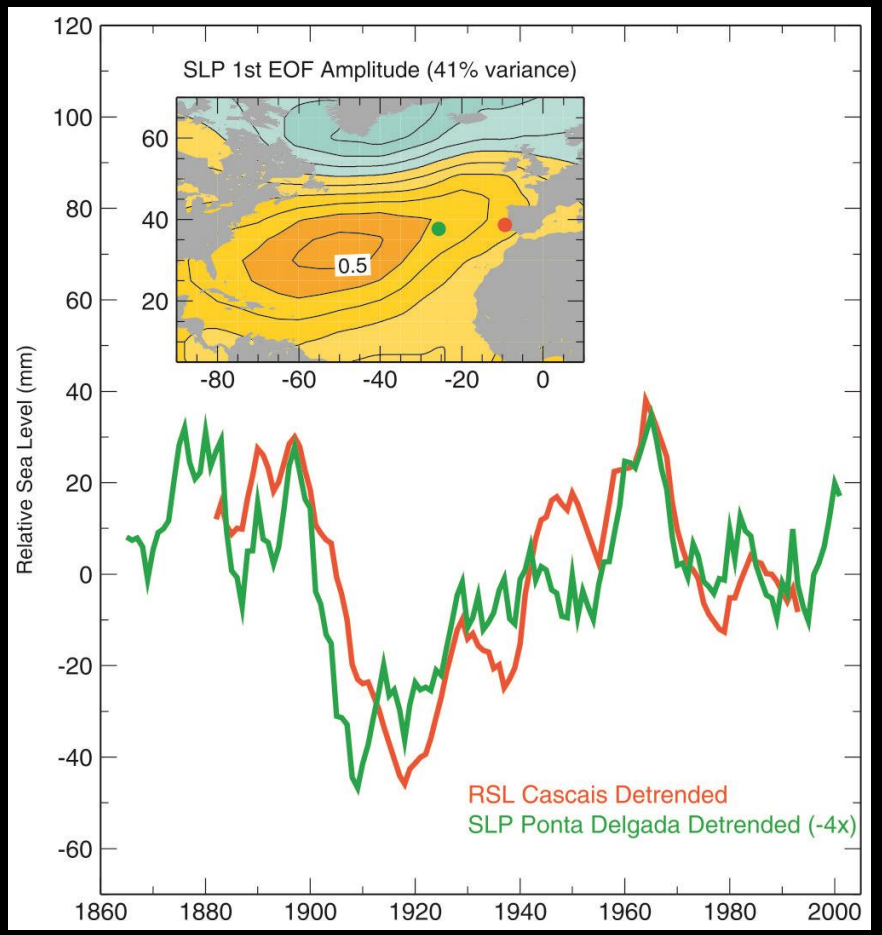


Yin & Goddard (in press)

Driving West-East patterns of sea level

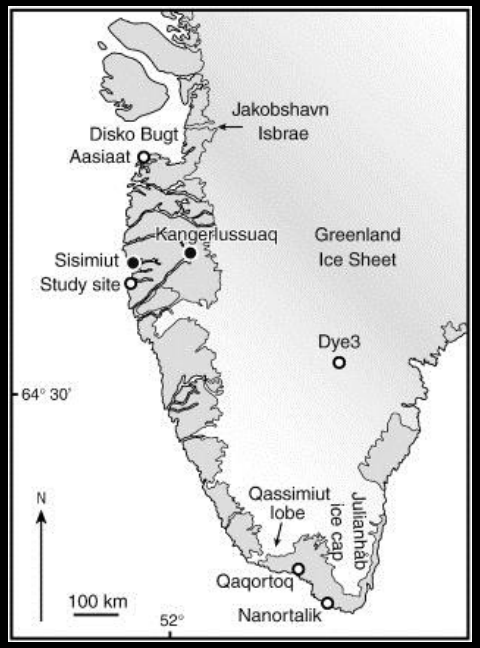


Mass balance fingerprint
Bamber and Riva (2010)

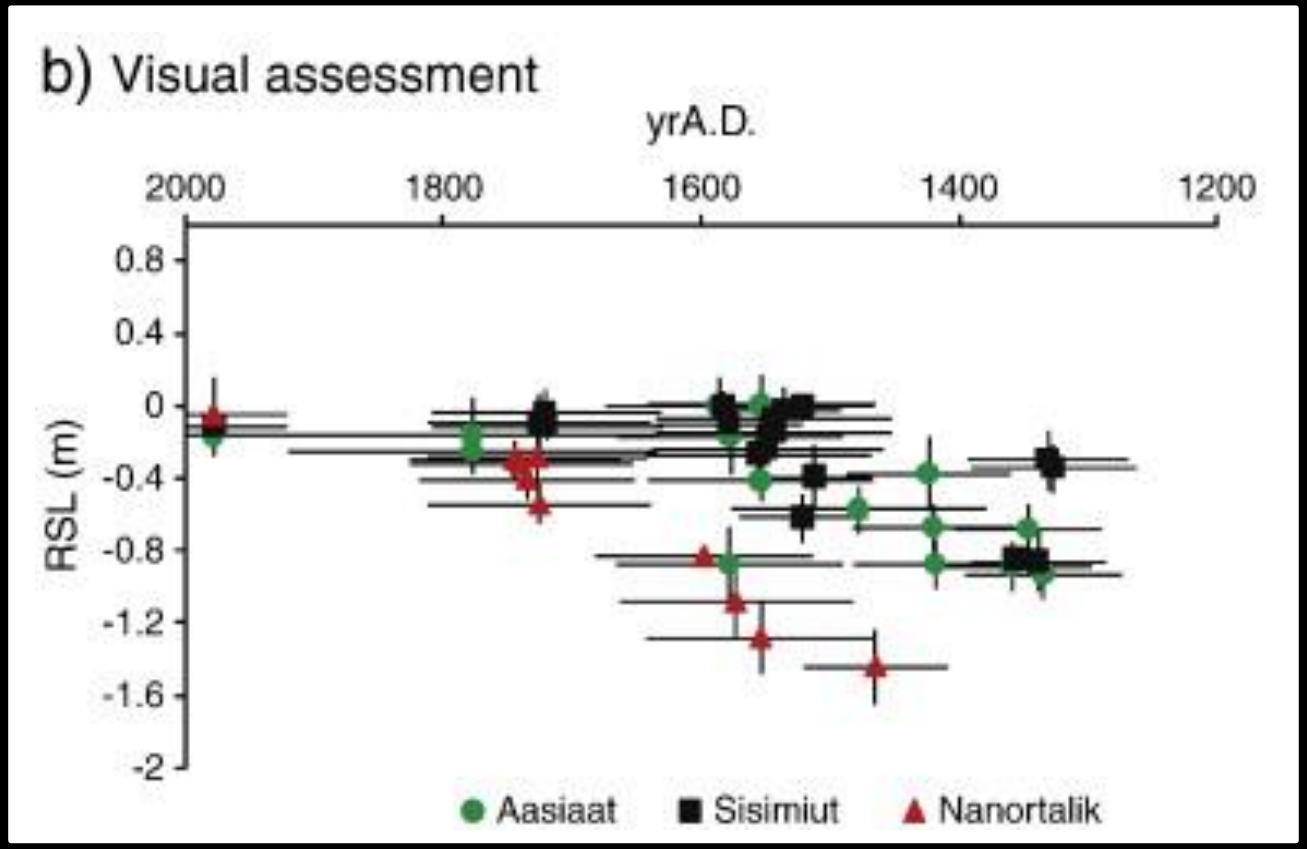


Gyre variations
Miller and Douglas (2007)

Near-field data:
mass balance change of Greenland



Long et al. (2012) EPSL



Where is next?

- Salt marshes are able to act as tide gauges and identify changes and trends in RSL, but the challenges of interpreting them are the same as interpreting instrumental records;
- We need additional proxy archives (e.g. Neoglacial mass balance data, ocean records) and for different communities to work together;
- Integrated understanding of ice-ocean-atmosphere interactions.