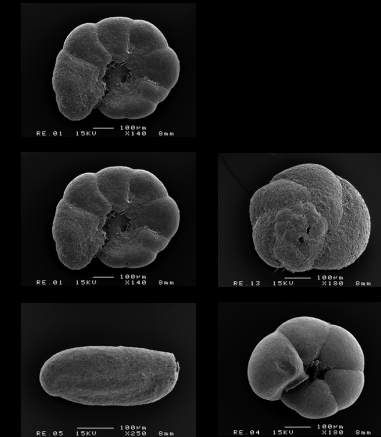
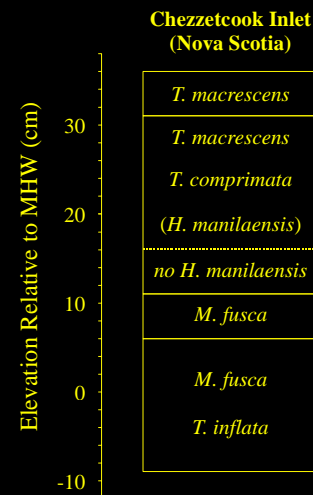


# Clues to future sea level rise: linking geological and instrumental records of change



Environmental Gradient



Robin Edwards  
School of Natural Sciences  
Trinity College Dublin  
Ireland



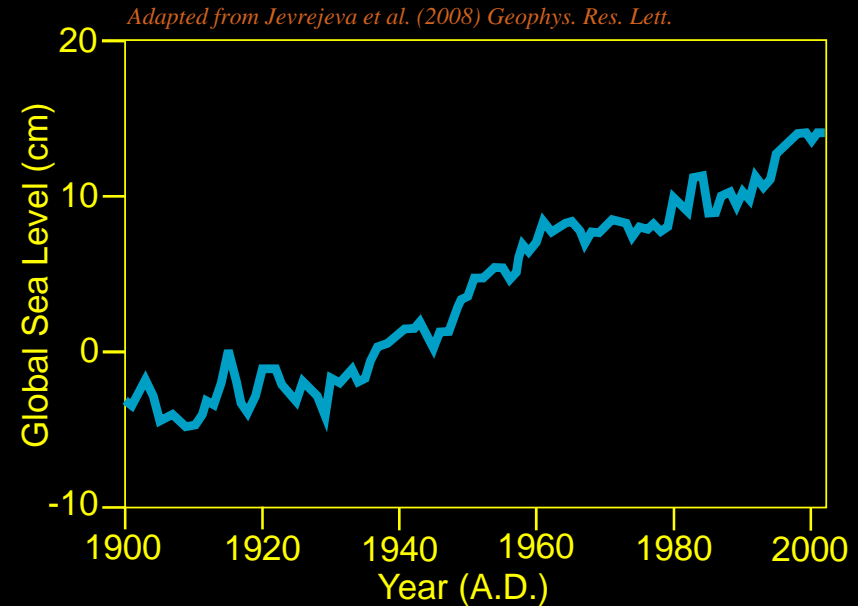
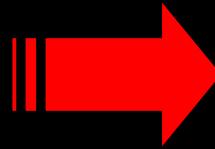
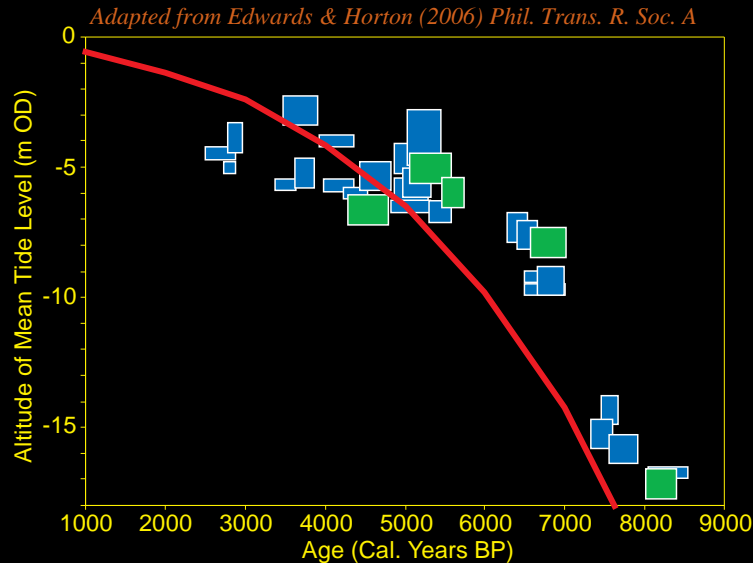
# Acknowledgements



# Why Geological Data?

- Context
  - Onset of accelerated sea level rise?
  - Significance of recently observed changes?
- Mechanisms of change
  - Past relationships / analogues
  - Data for model testing (e.g. hindcast temp. vs sea level)
- Limits of system response
  - Magnitude, rate, sensitivity etc

# Record Resolution



- Reduce age and altitude error terms
- Increase data coverage (sampling density)
- Microfossil-based transfer functions for tide level
- Composite chronologies

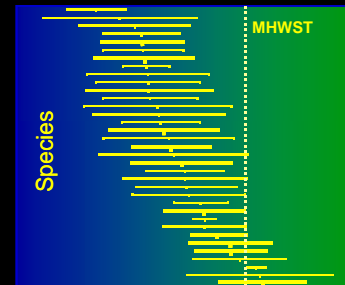
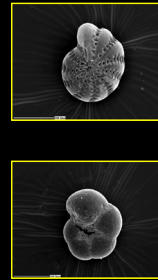
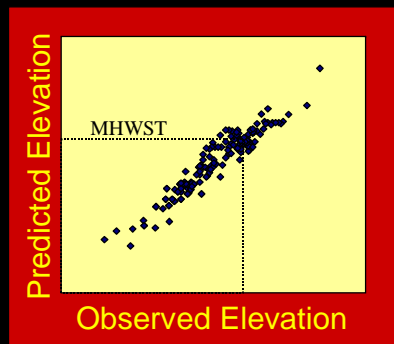
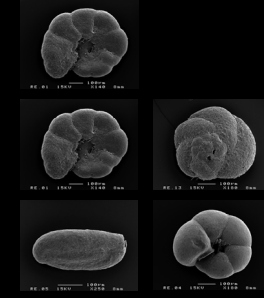
# Transfer function approach



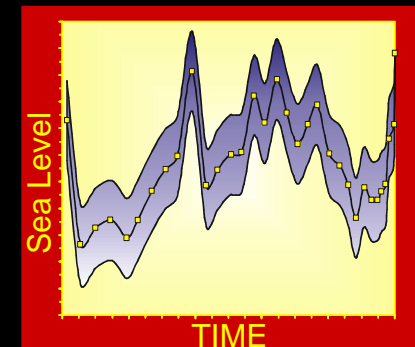
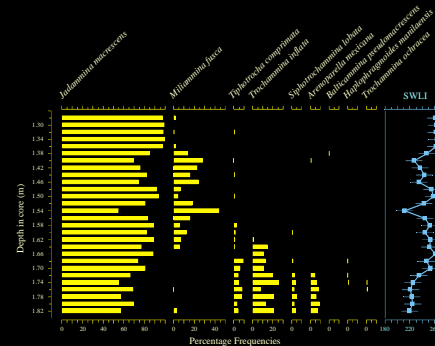
Chezetcook Inlet  
(Nova Scotia)

- T. macrescens*
- T. macrescens*
- T. comprimata*
- (*H. manilaensis*)
- no *H. manilaensis*
- M. fusca*
- M. fusca*
- T. inflata*

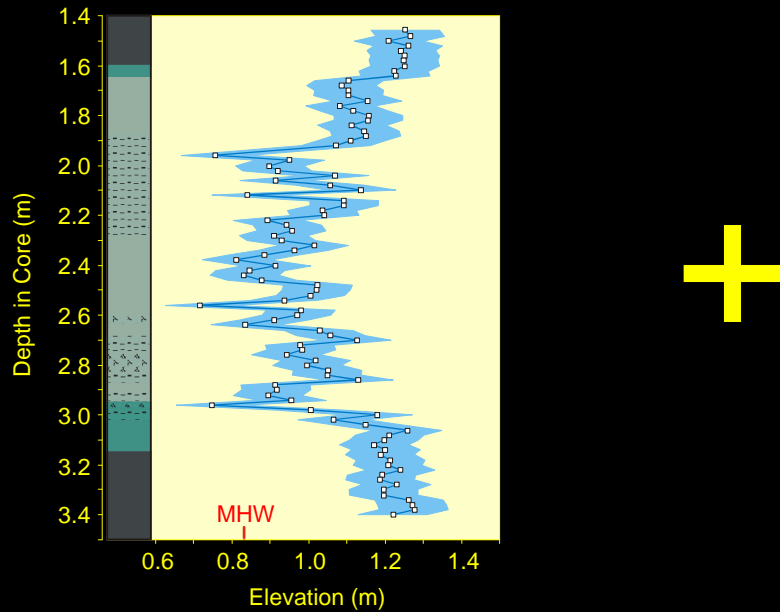
Elevation Relative to MHW (cm)



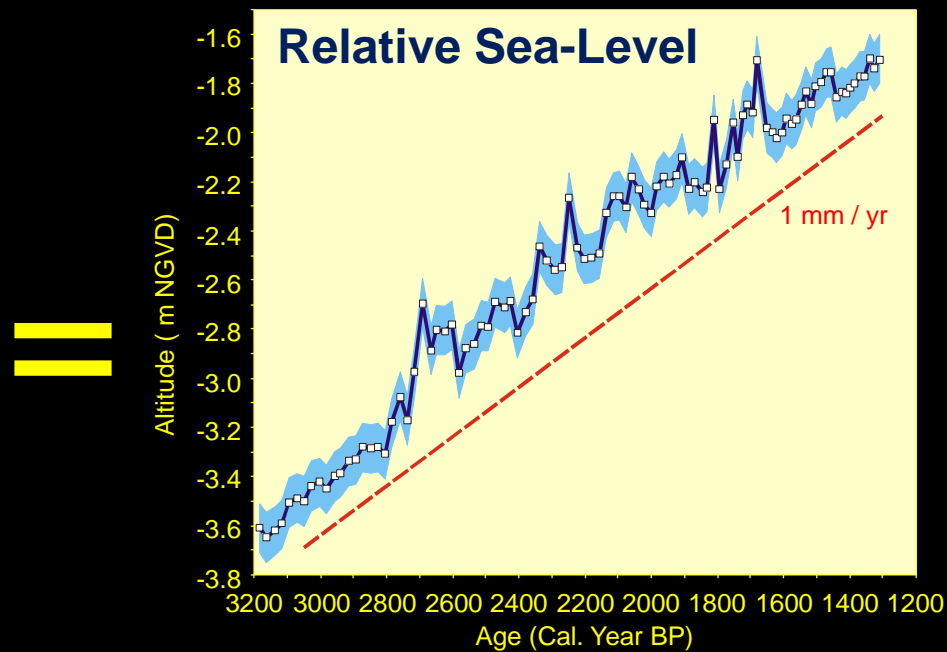
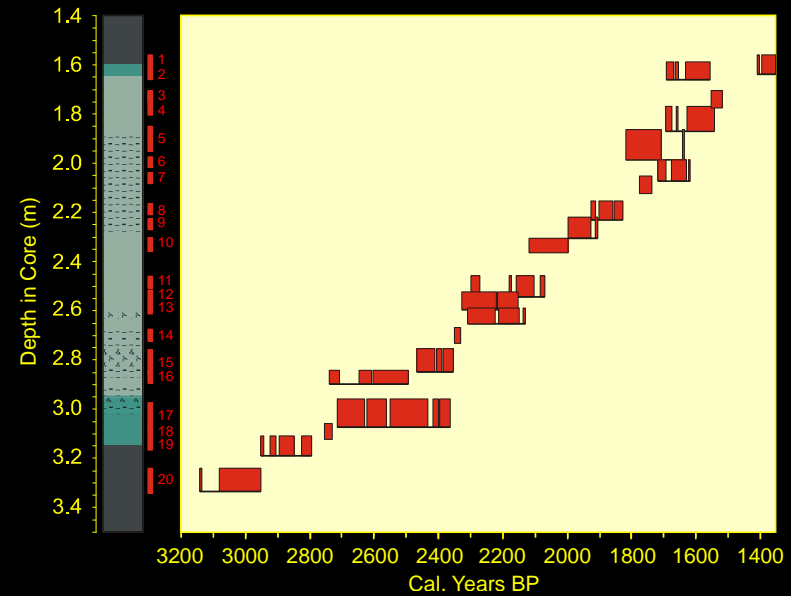
Water Depth



# Palaeommarsh-Surface Elevation

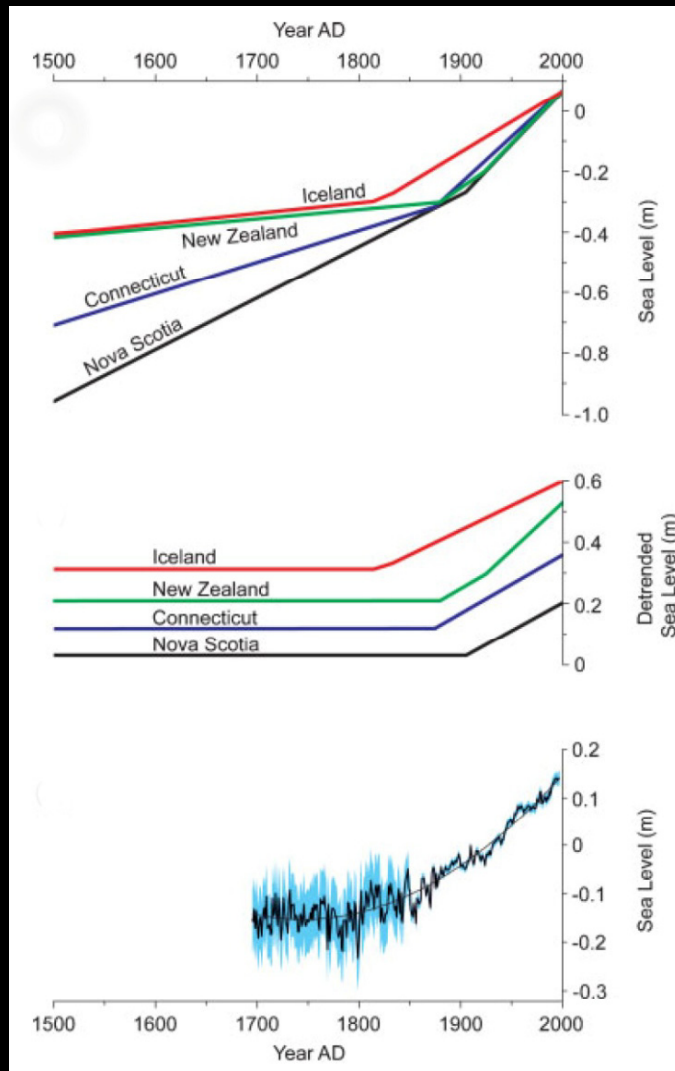


# Accumulation History



- Precision
  - Decimetre
  - Multi-decadal – century
- Detrend / correct
  - GIA
  - Compaction

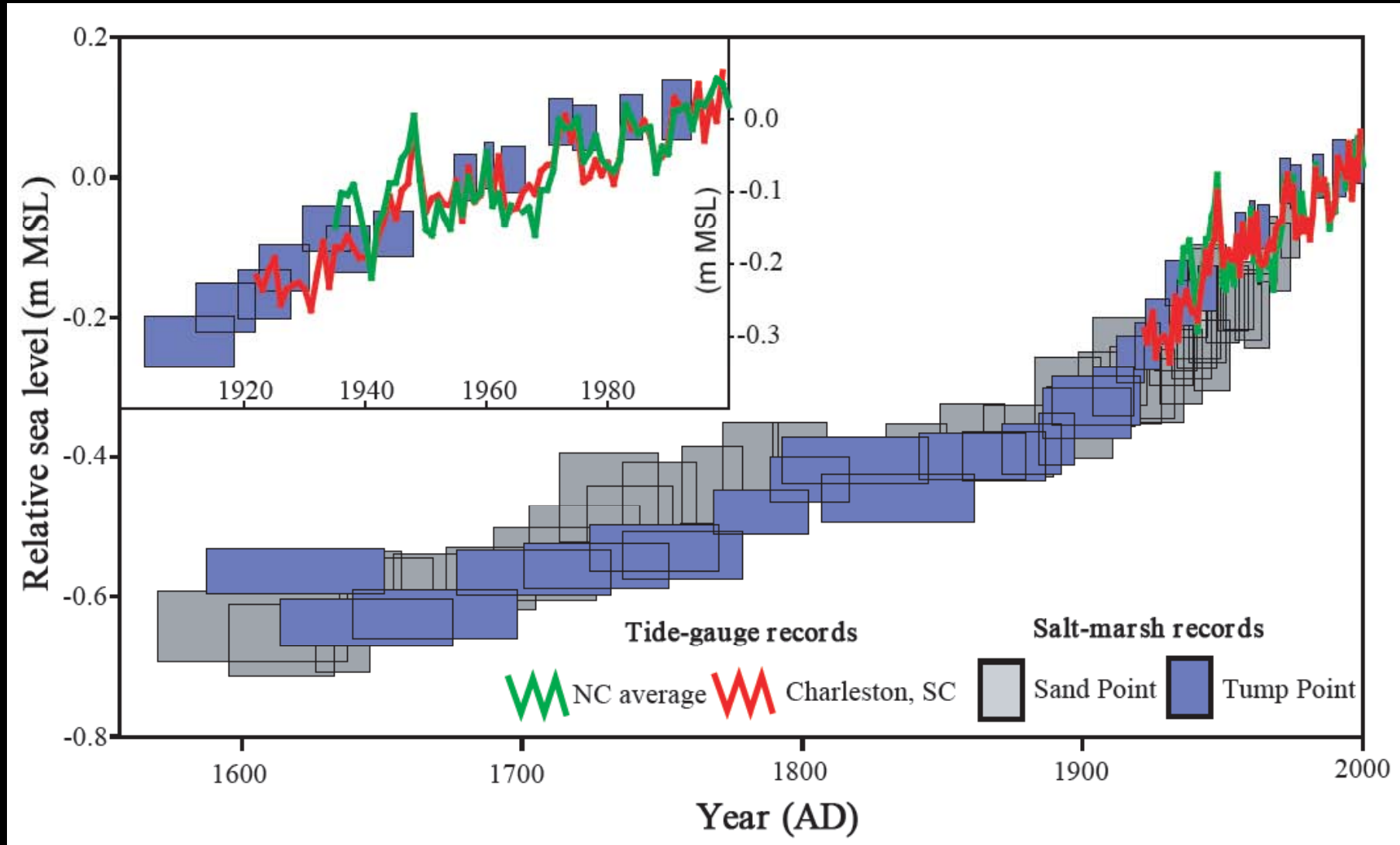
# Illustration: Accelerated Sea Level Rise

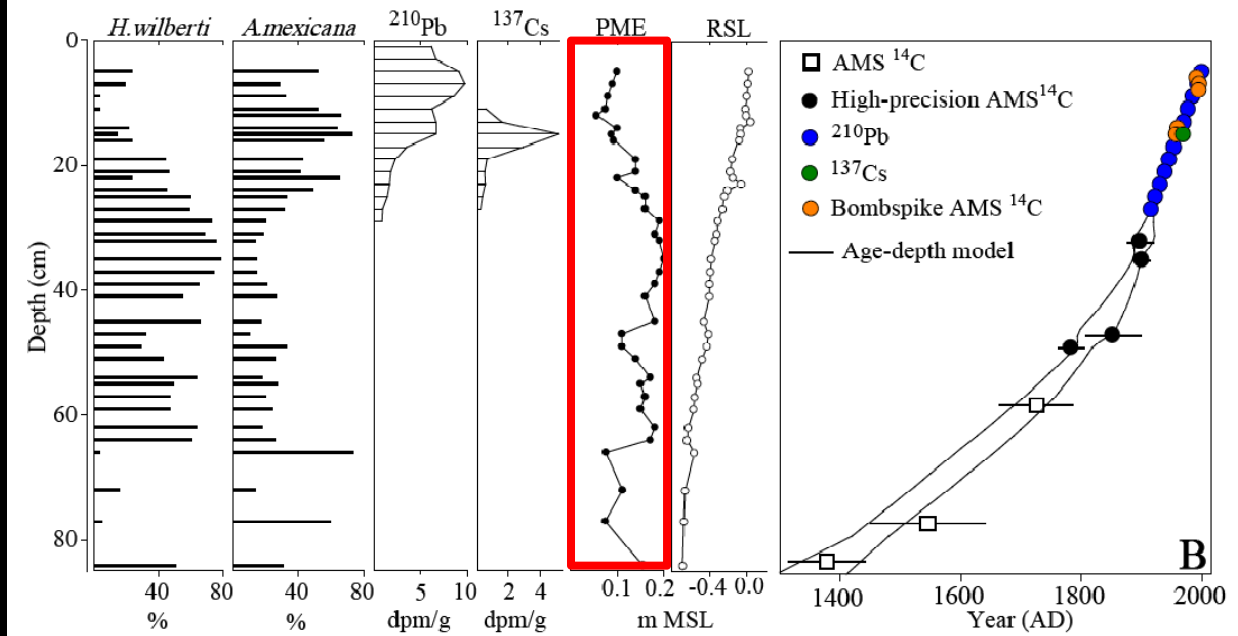
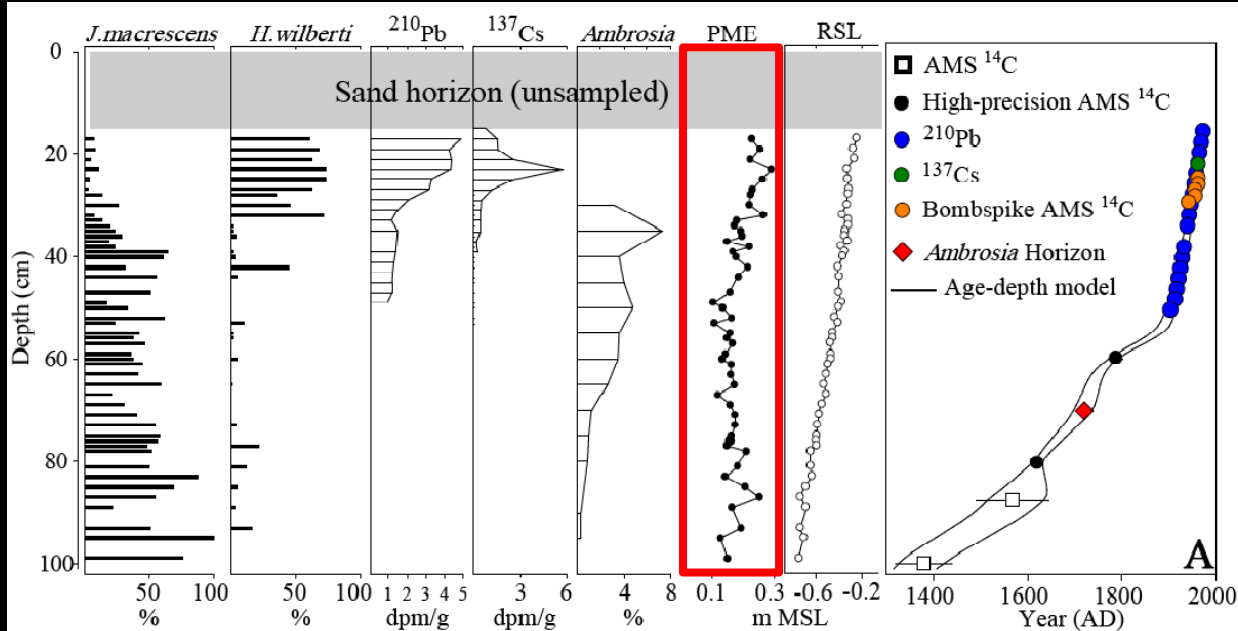


*Adapted from Gehrels (2009)*

- Geological evidence of pronounced rate change
- Spatially variable timing
  - Real? [mechanism/process]
  - Artefact? [dating limitations]
- Research objectives
  - Increase record precision
  - Expand data coverage
  - Test existing records (replication)

# Example: Kemp et al. (2009)



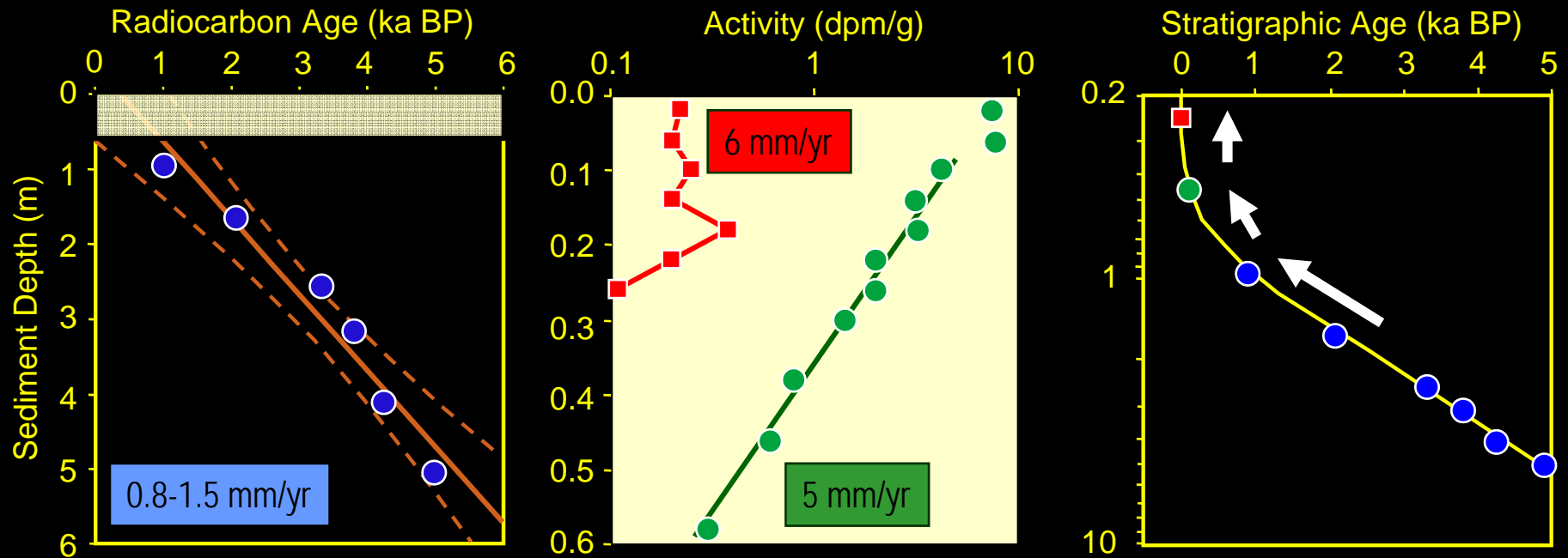


Limited PME Change  
(within error)



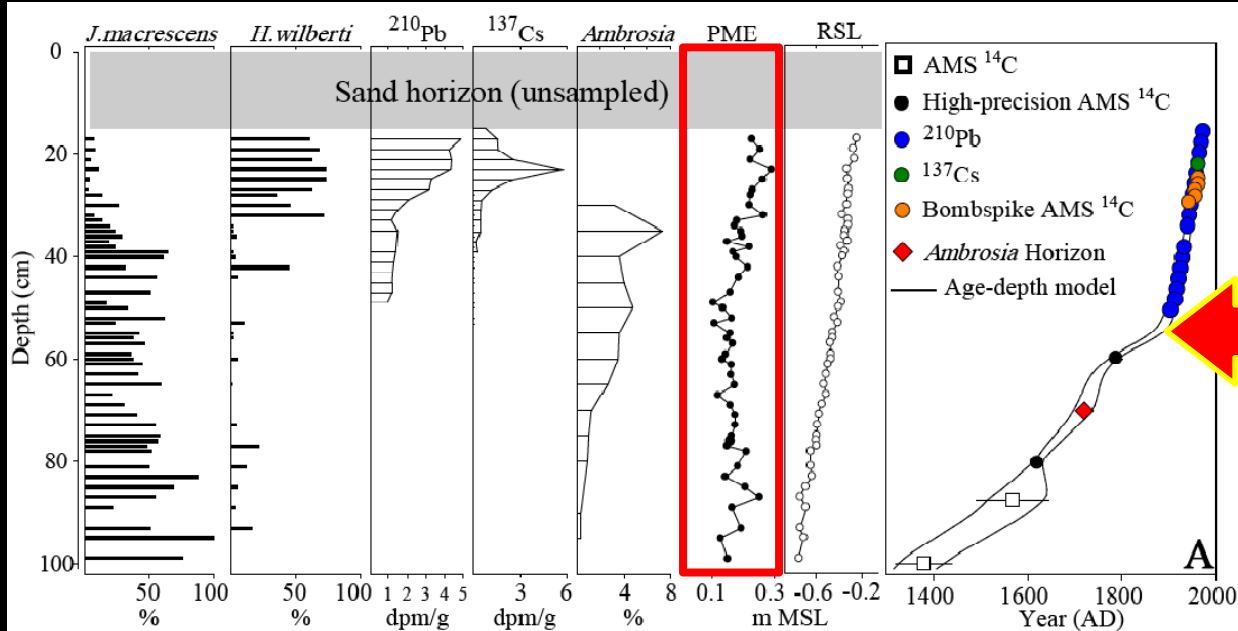
Accumulation driven  
RSL record

# Reliable Accumulation Histories



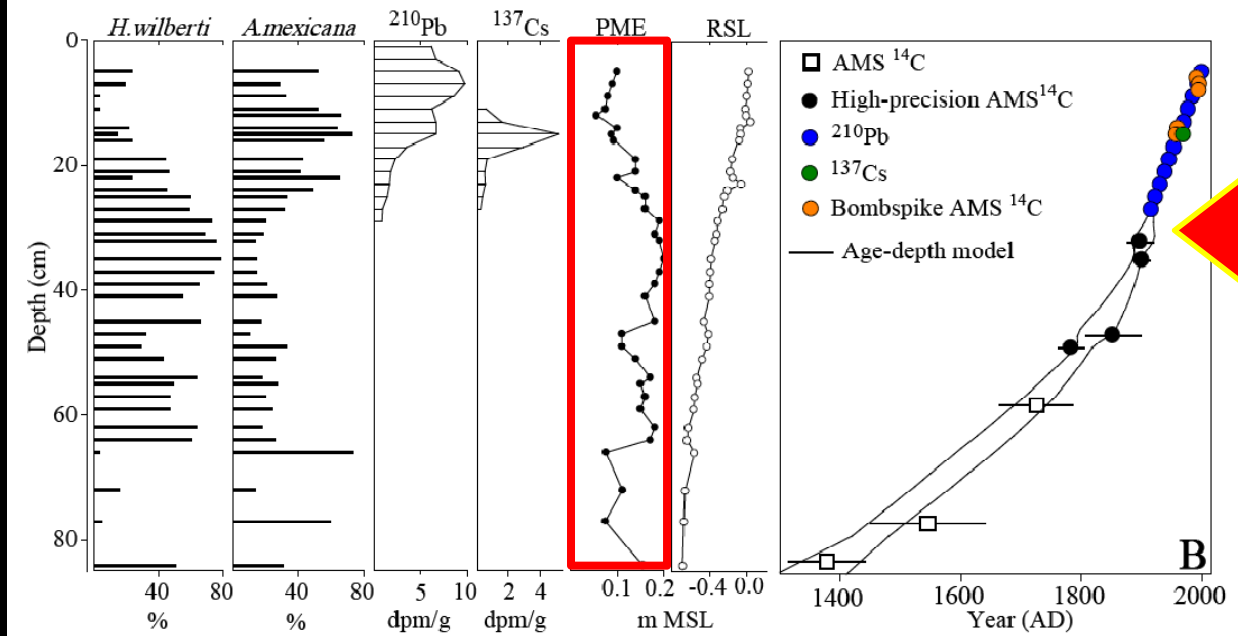
*Adapted from Sommerfield (2006) Continental Shelf Research*

- Stratigraphic completeness scales inversely with instantaneous deposition rate
  - Composite chronologies must be constructed with care
  - Caution where TFs show no change in elevation...



Chronology  
Weak Point

Limited PME Change  
(within error)

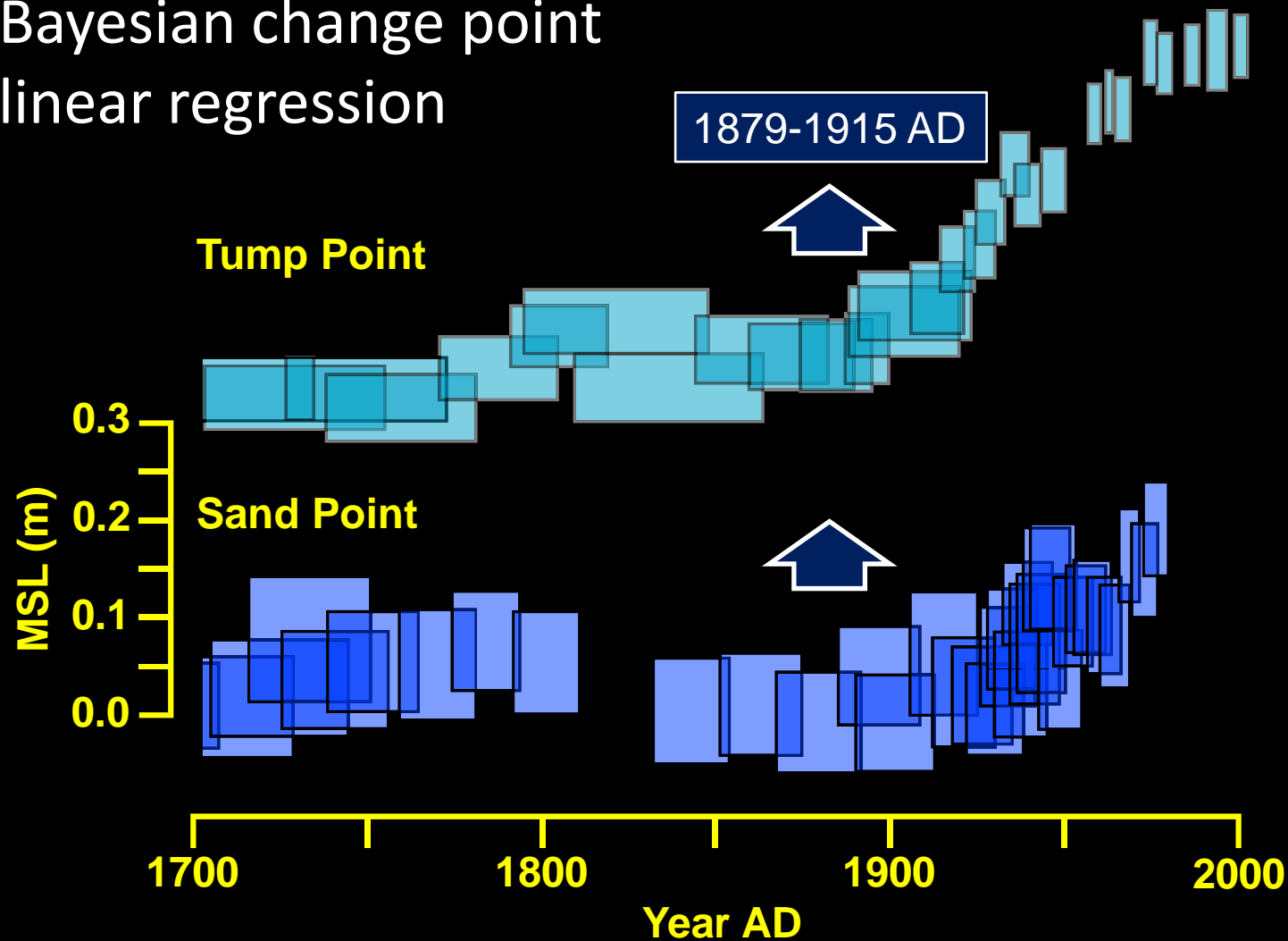


No Change

Accumulation driven  
RSL record

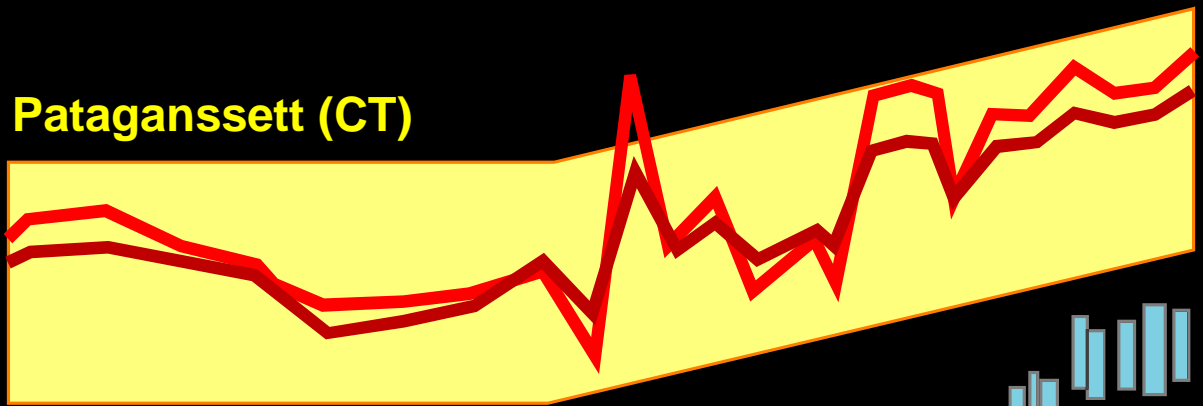
# Replicate Detrended Record

- Bayesian change point linear regression



Pataganssett (CT)

Lower rate  
Earlier onset?

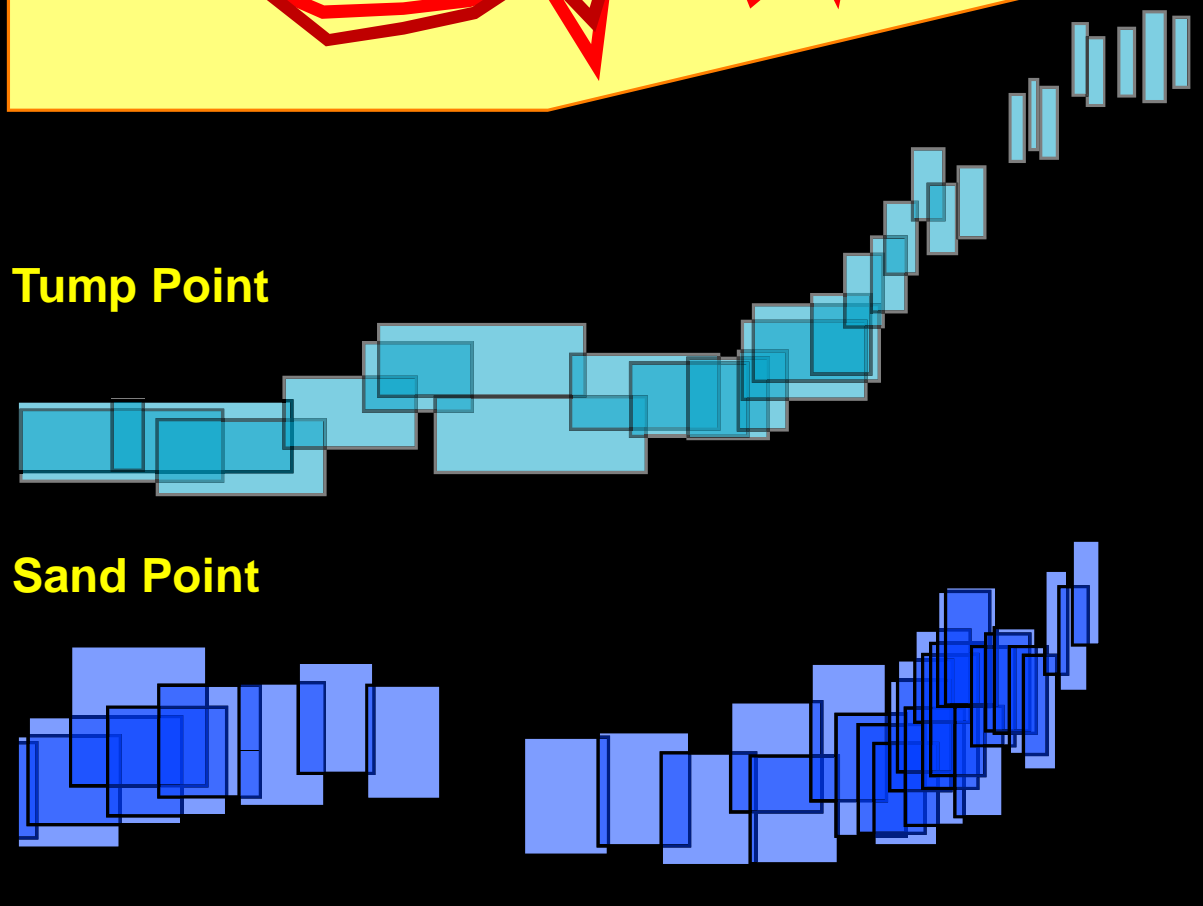


Tump Point

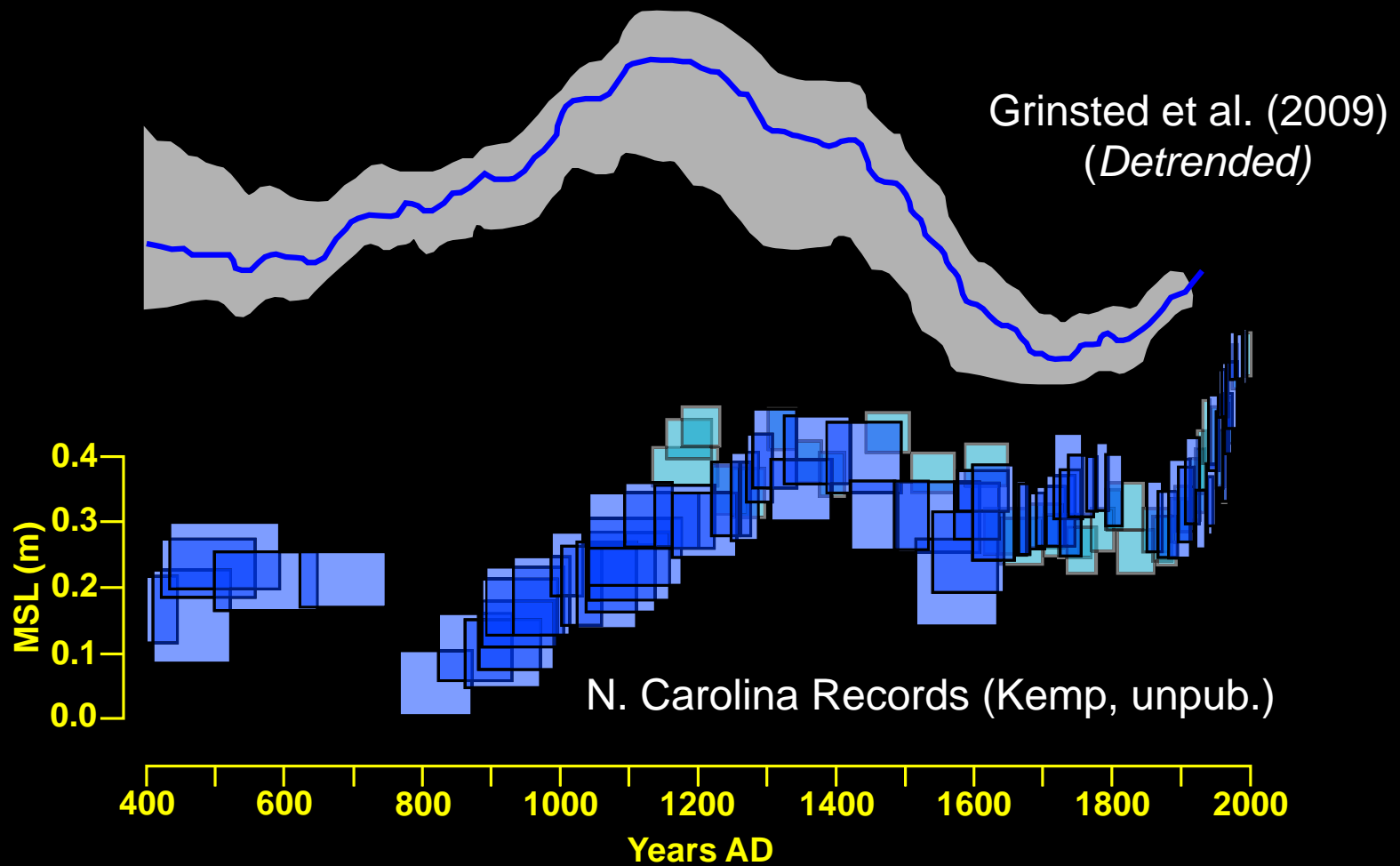
Sand Point

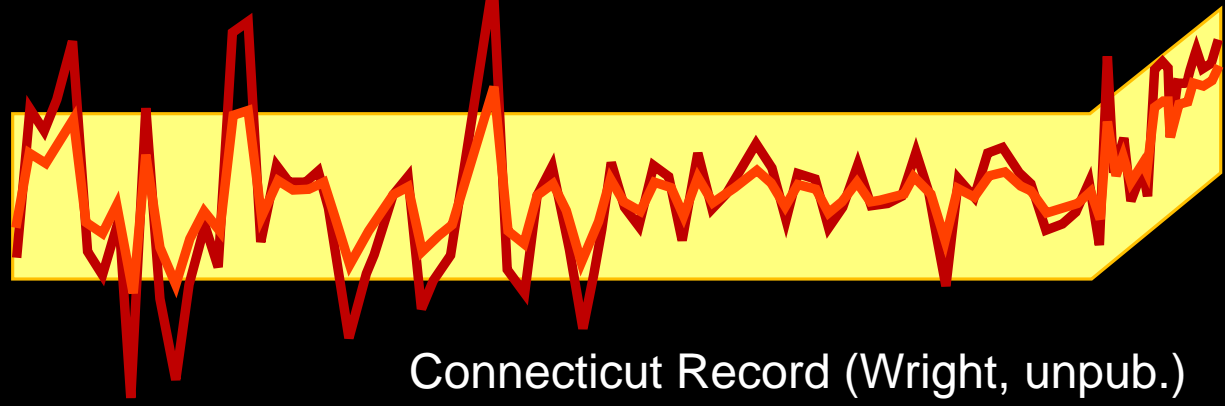
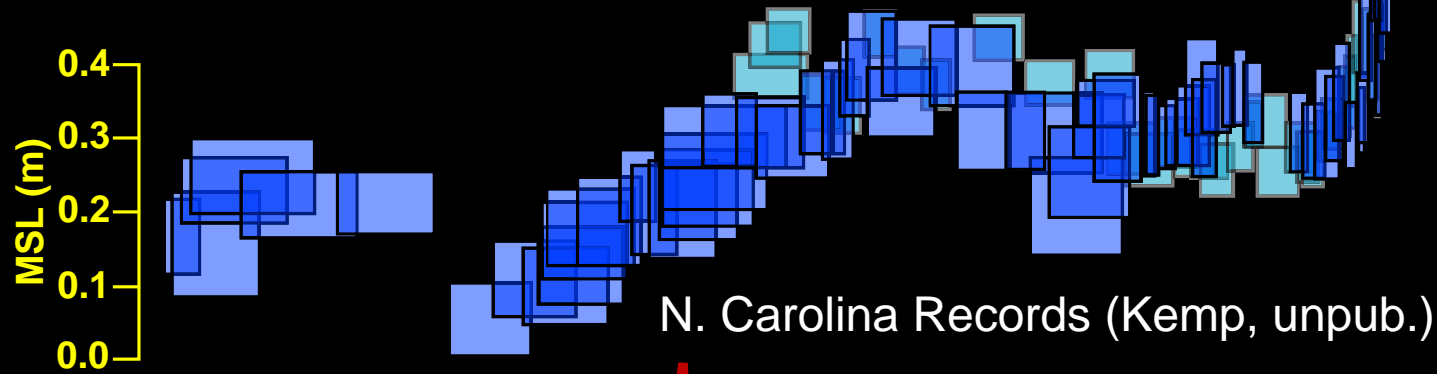
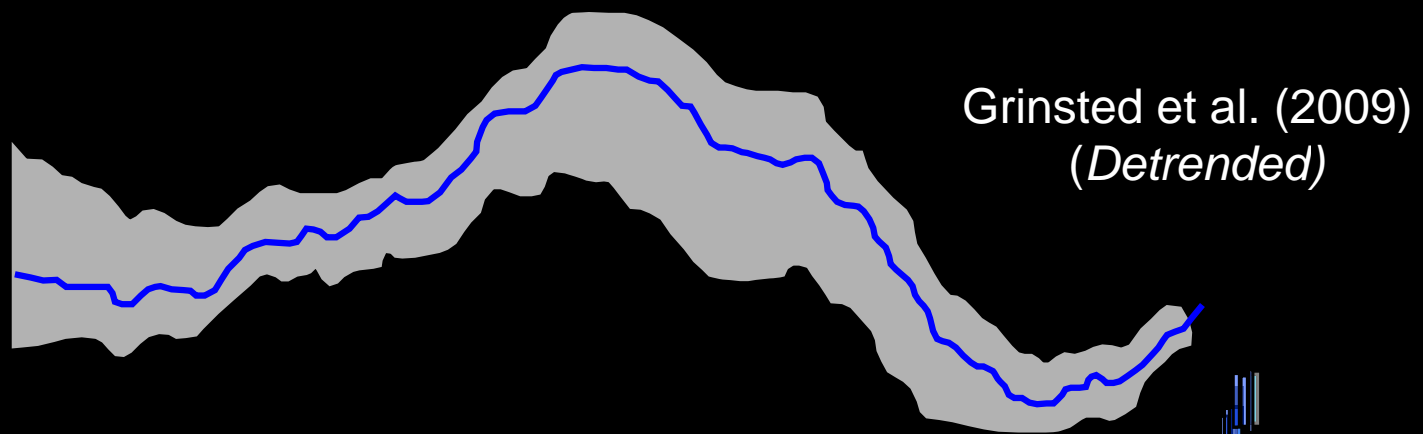
MSL (m)  
0.3  
0.2  
0.1  
0.0

1700 1800 1900 2000  
Year AD



# Illustration 2: Hindcast Validation





400 600 800 1000 1200 1400 1600 1800 2000  
Years AD

# Summary & Conclusions

- High resolution geological records now available
  - Context (e.g. timing/significance of change)
  - Mechanisms (spatial & temporal coverage)
- Model development & testing (two way process)
  - Field data for validation
  - Interpretation / understanding nature of geological record
- Research Directions
  - Expanded range of studies (location and duration)
  - Methodological testing and refinement
  - Cross-disciplinary collaboration