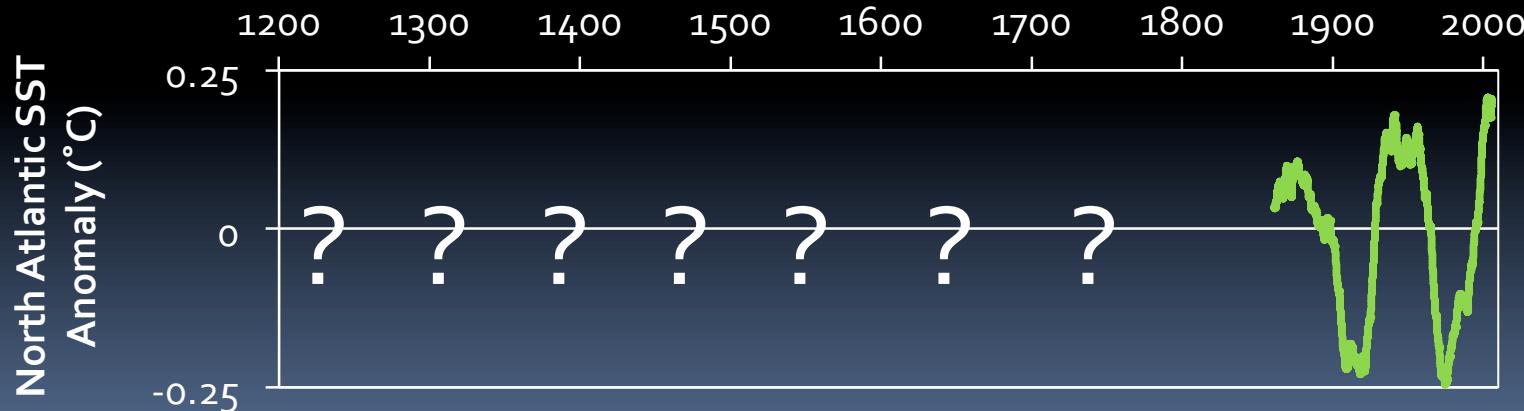


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A PALEOCLIMATE PERSPECTIVE ON ATLANTIC MULTIDEcadAL VARIABILITY

The View from the Tropics

K.Halimeda Kilbourne



AMO index, Enfield et al., 2001

Journal of Marine Systems Special Issue

Kilbourne, K.H., Alexander, M.A., J.A. Nye, A Paleoclimate Perspective on Atlantic Multidecadal Variability

Nye, J.A., A. Kenny, K.H. Kilbourne, K.S. Van Houtan, M. Stachura, M. Baker, R. Bell, E. Martino, and R. Wood. **Ecosystem effects of the Atlantic Multidecadal Oscillation.**

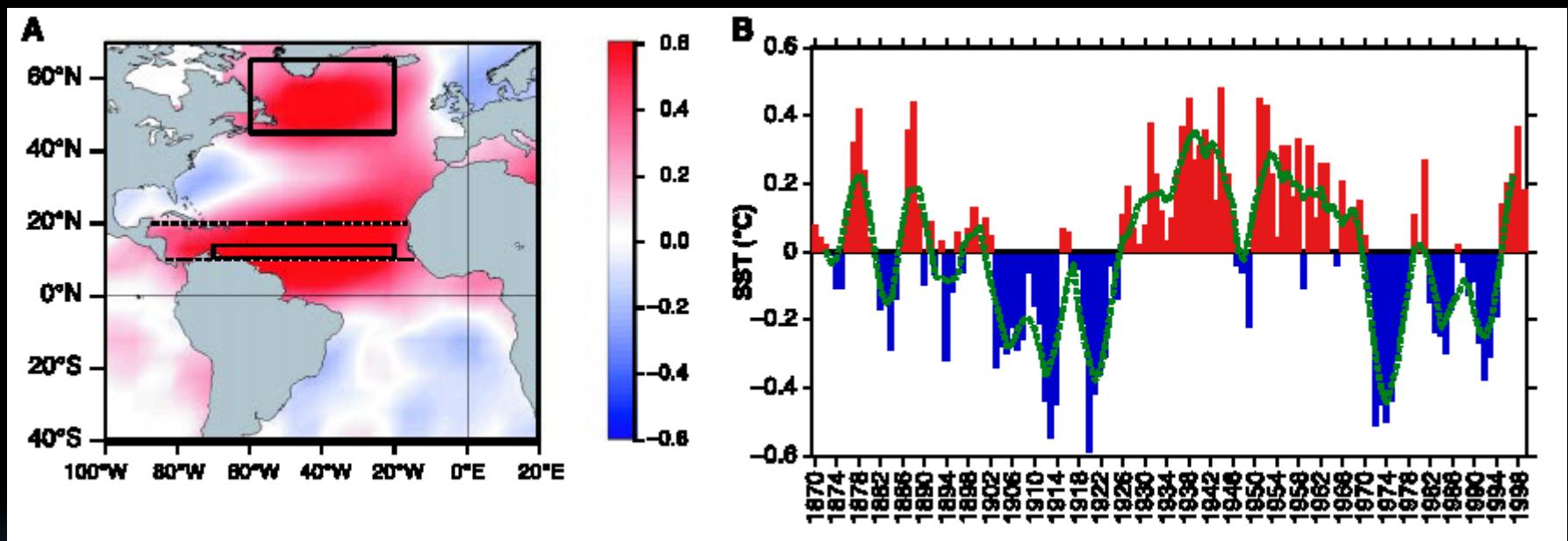
Alexander, M.A., K.H. Kilbourne, J.A. Nye, **Climate Variability During Warm and Cold Phases of the Atlantic Multidecadal Oscillation (AMO) 1871-2008**

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- Different definitions exist
- North Atlantic SST anomalies with multi-decadal scale variability



First rotated EOF of non-ENSO SST (linear trend removed)
 Goldenberg et al, 2001 *Science*

- Two centers of action
- Not all sites in the N. Atlantic equally appropriate for reconstructions

Need more
reconstructions of
AMV/AMO
HERE!

Multidecadal Atlantic SST Anomalies

Causes

Causes

Ocean Heat Content
(AMOC transport)

Multi-site
reconstructions
of AMV/AMO
(esp. tree-ring or
ice core based)

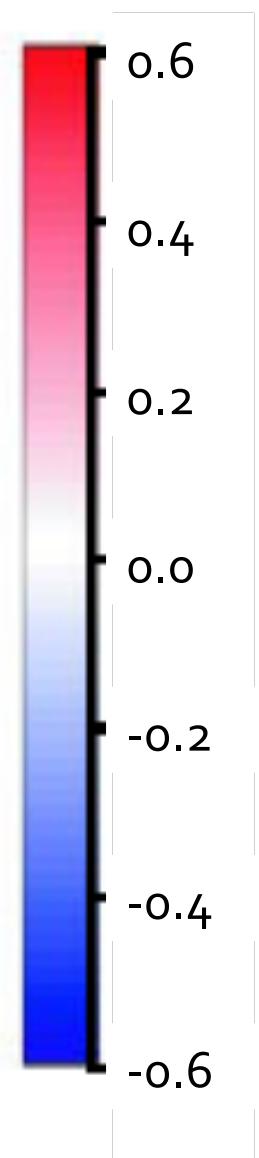
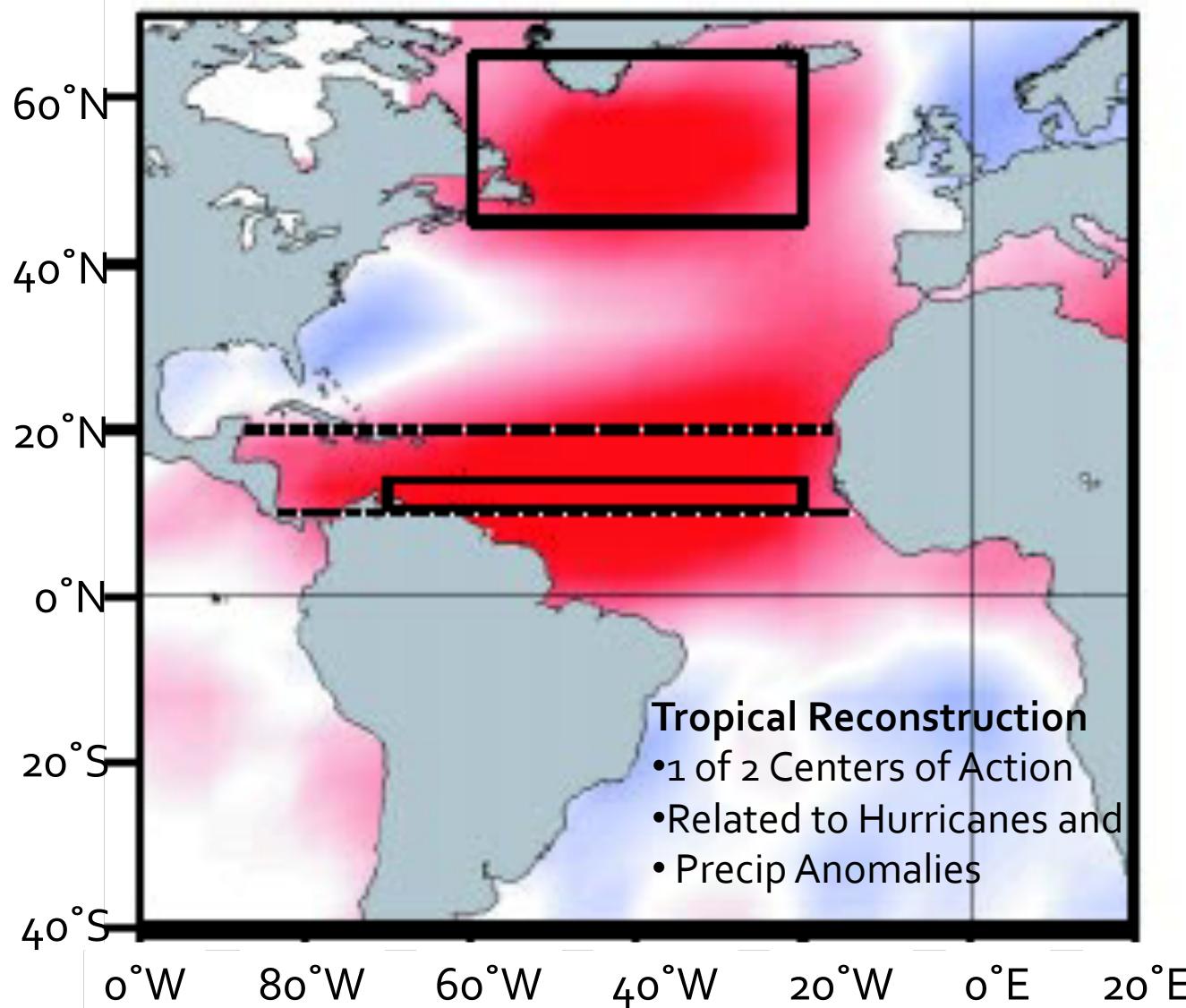
Climate System
Perturbations

Is there a concentration of variance at multidecadal bands in the climate of the Atlantic region above the expected red noise background?

- What variables are important to look at?
- What time-resolution do we need?
- What spatial distribution of data do we need?

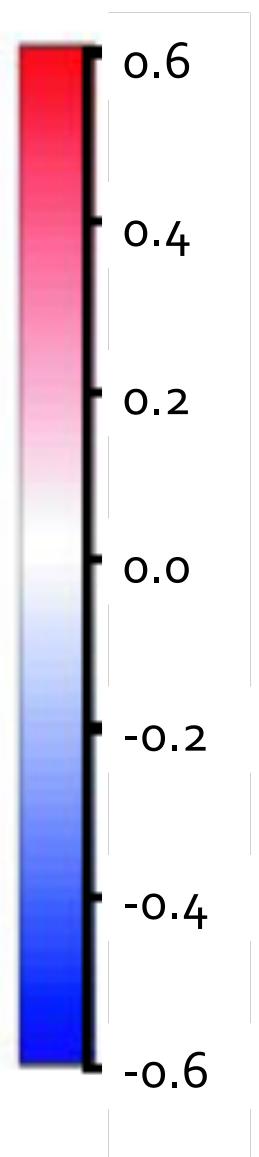
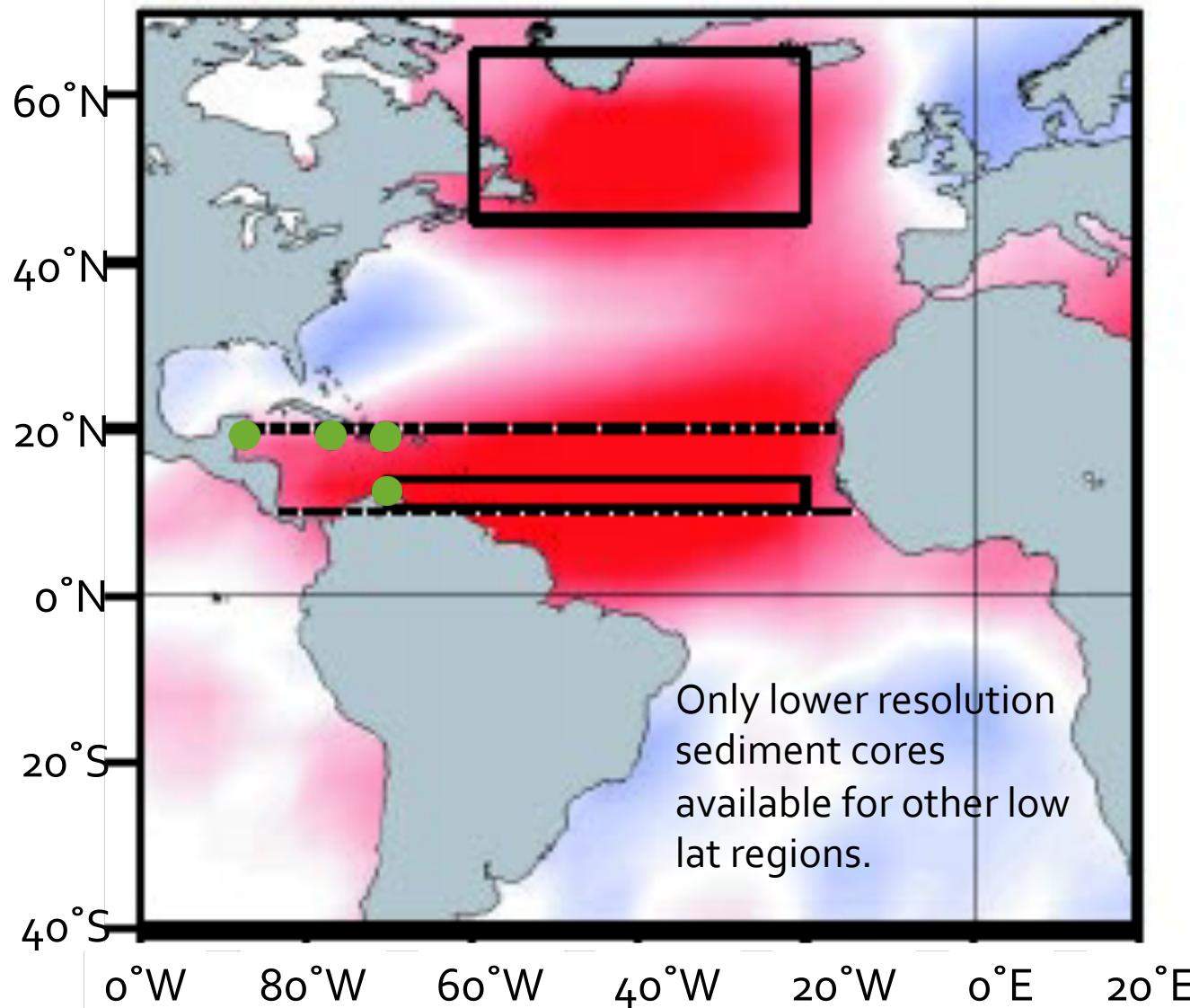
Summary of Paleo Lit (a la HK)

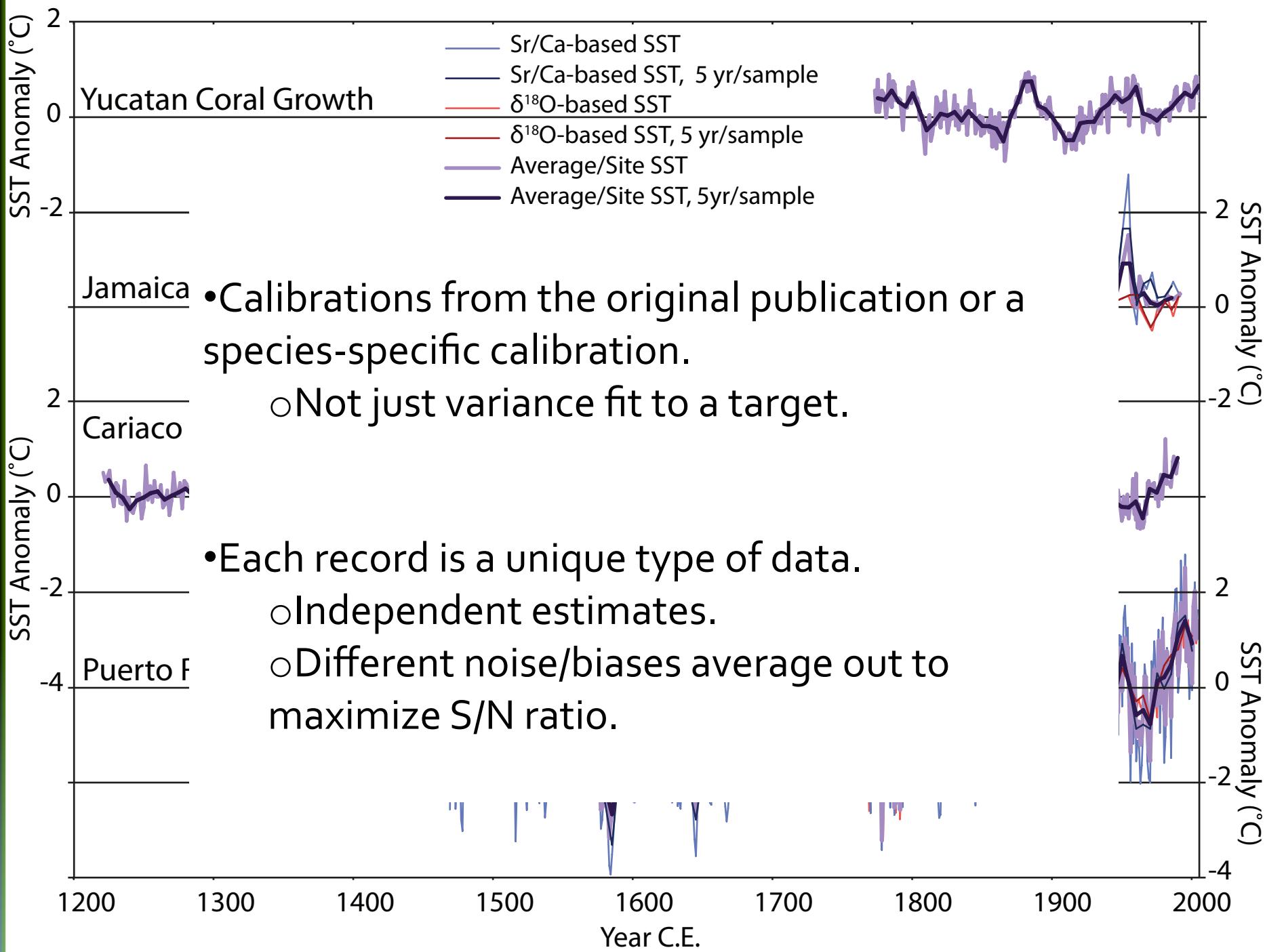
- Consensus view: significant multidecadal variability back to mid 1700s
- Prior to mid 1700's
 - Intermittent
 - Persistent
- Apples and Oranges
 - Local signals vs. regional
 - Different variables examined
- Recommendation: networks of SST records
only please

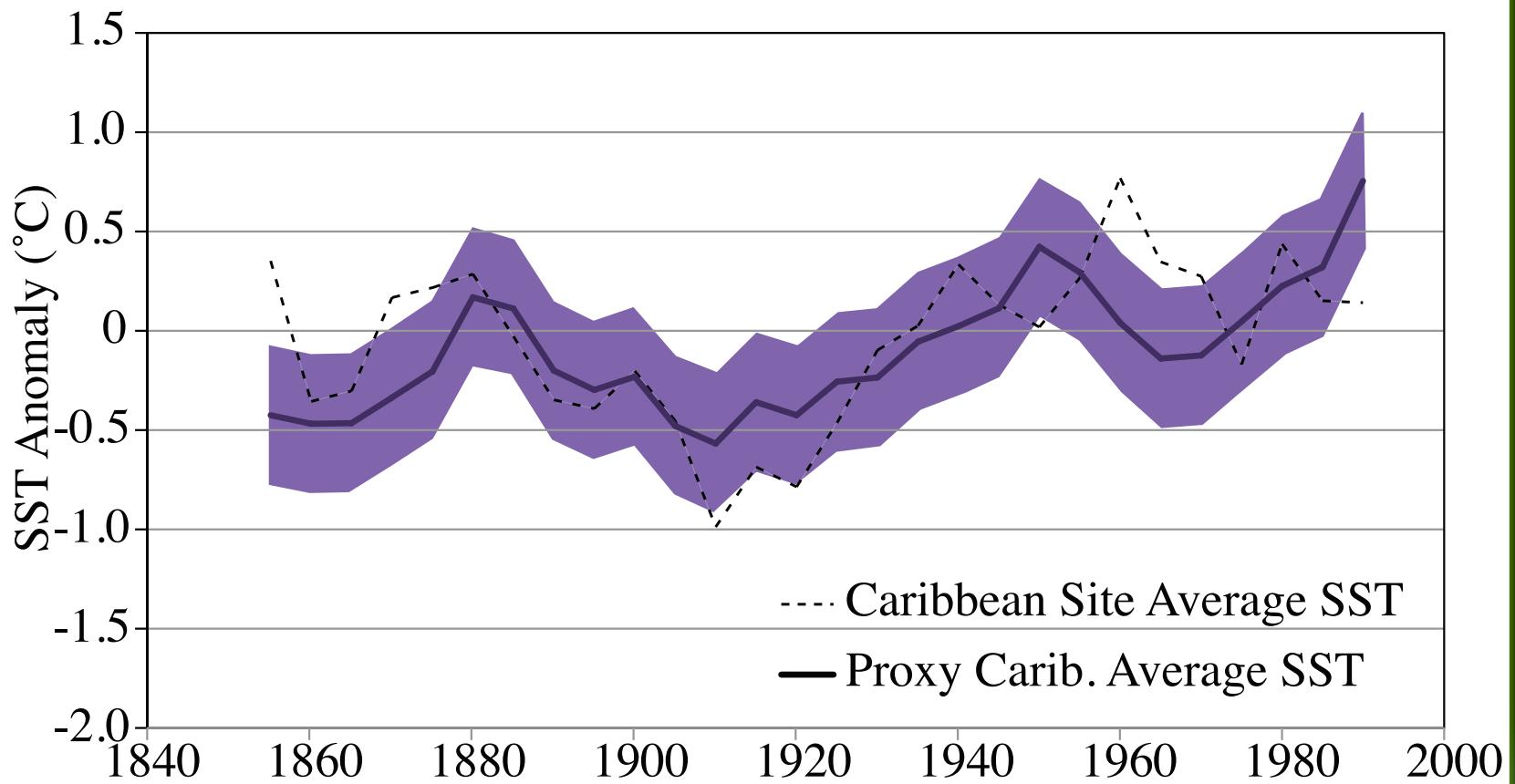


Data Selection Criteria

- Ocean temperature-sensitive paleoclimate proxy
 - Carbonate Sr/Ca, Mg/Ca
 - Carbonate $\delta^{18}\text{O}$
 - Coral growth rate
- < 5 years/sample on average
 - Heslop and Paul (2011)
- Location south of 22°N

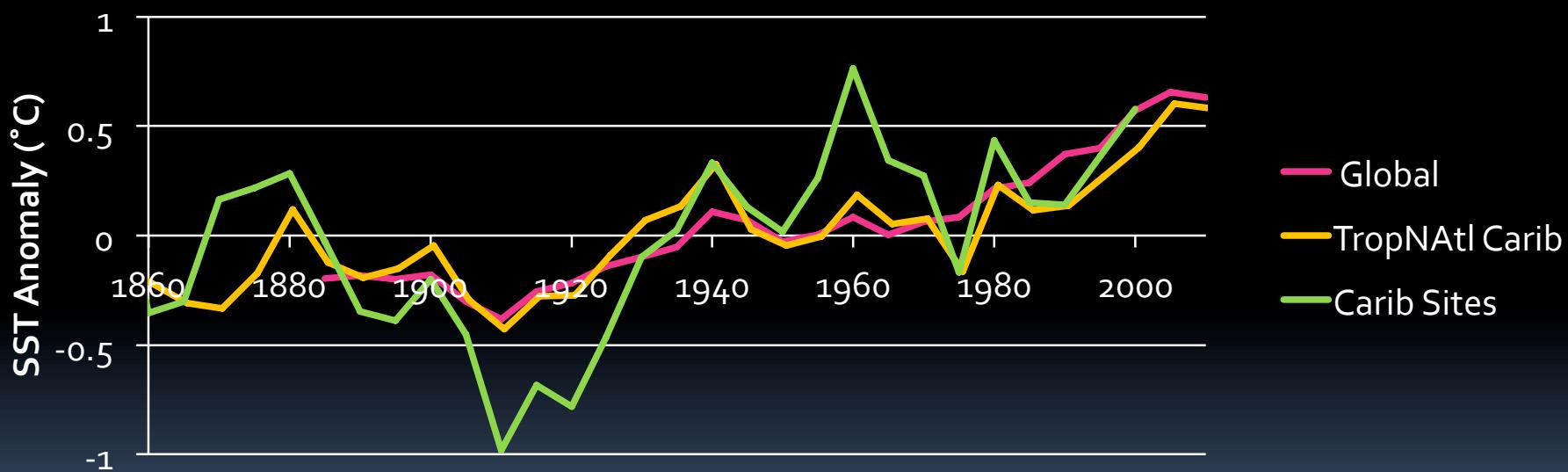


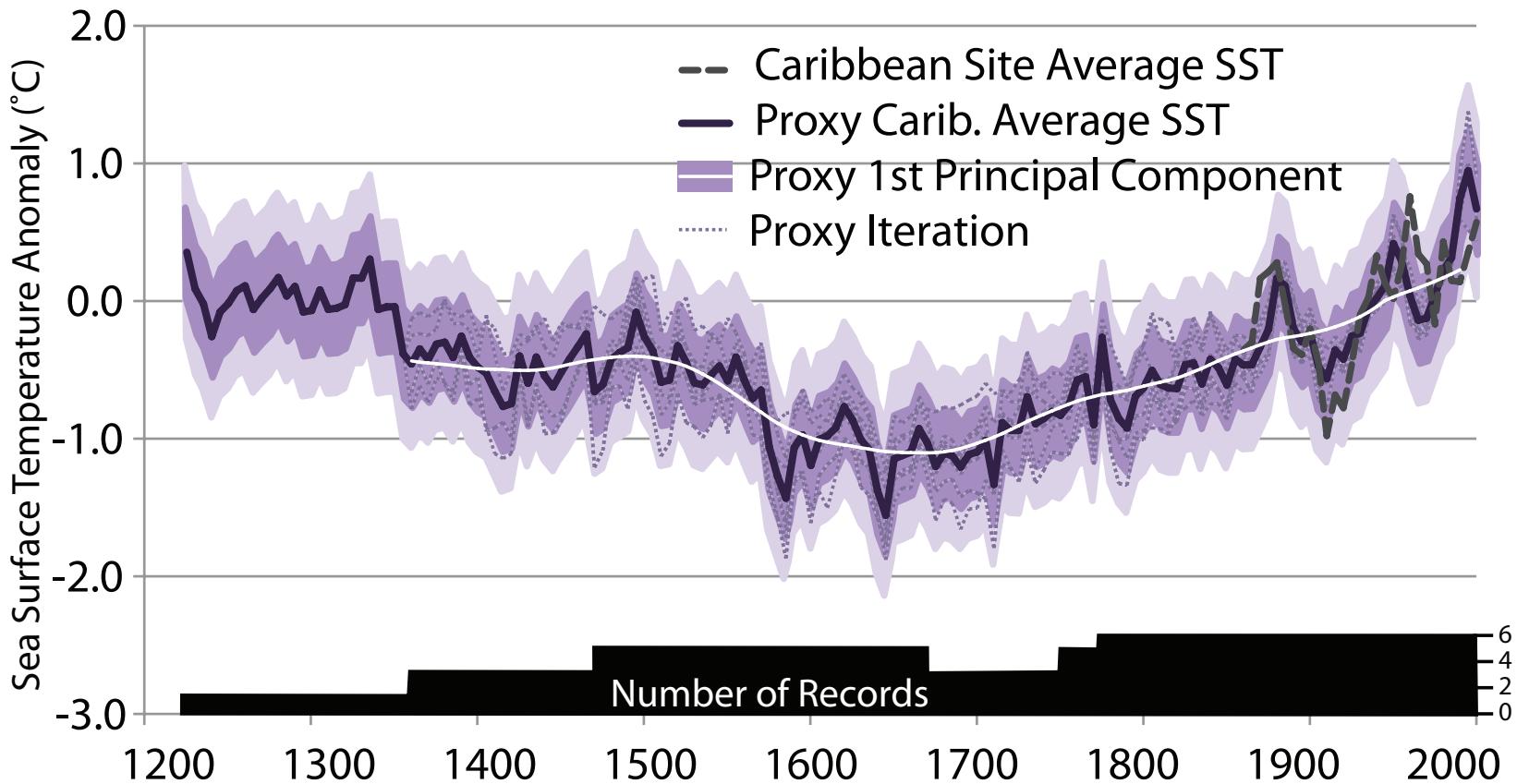




Proxy data from each site averaged to a regional compilation
Compared with ERSST from the grid boxes containing the sites
Standard error of reconstruction 0.34°C

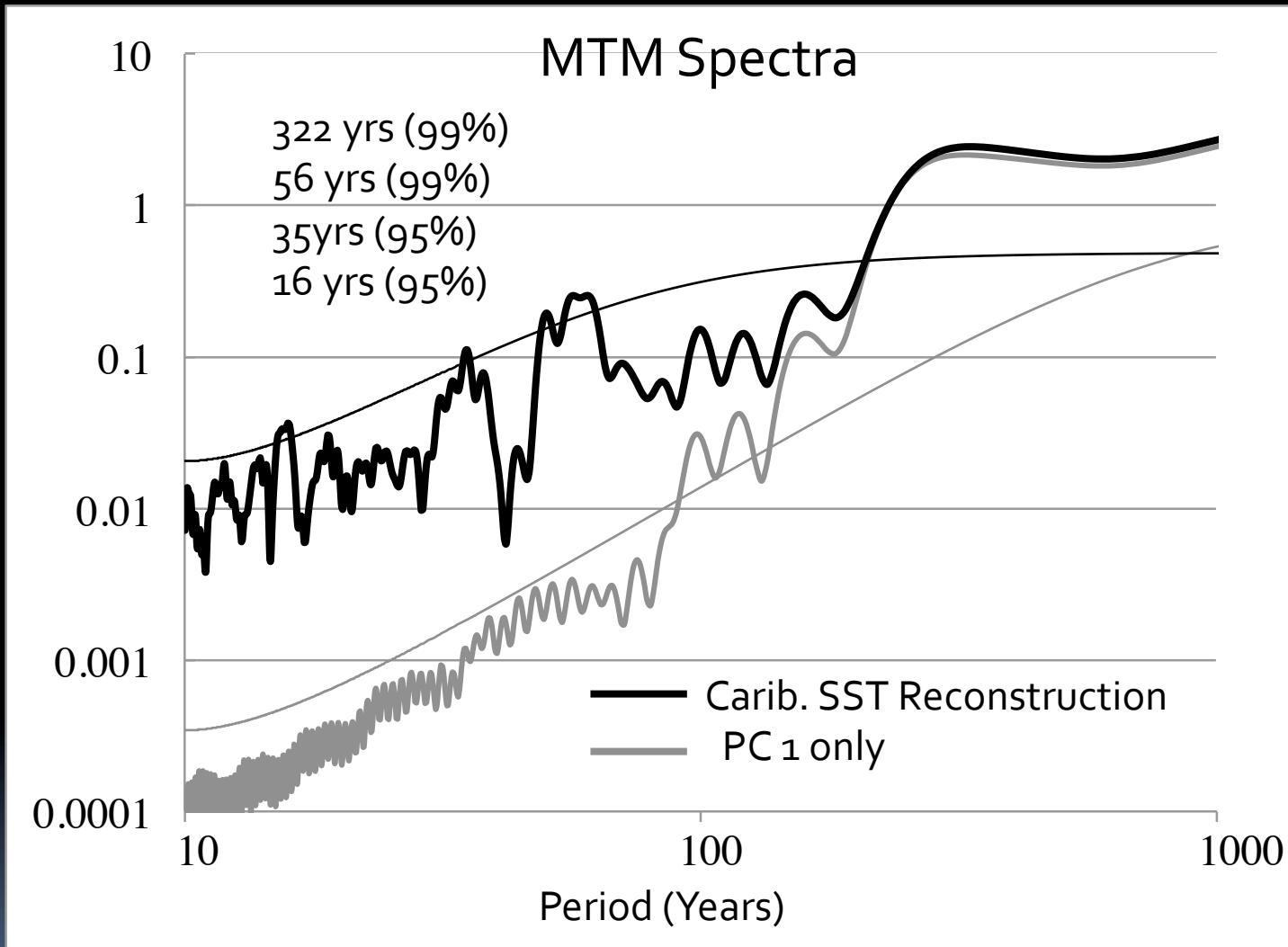
How does the regional data compare to tropical North Atlantic and global SST anomalies?



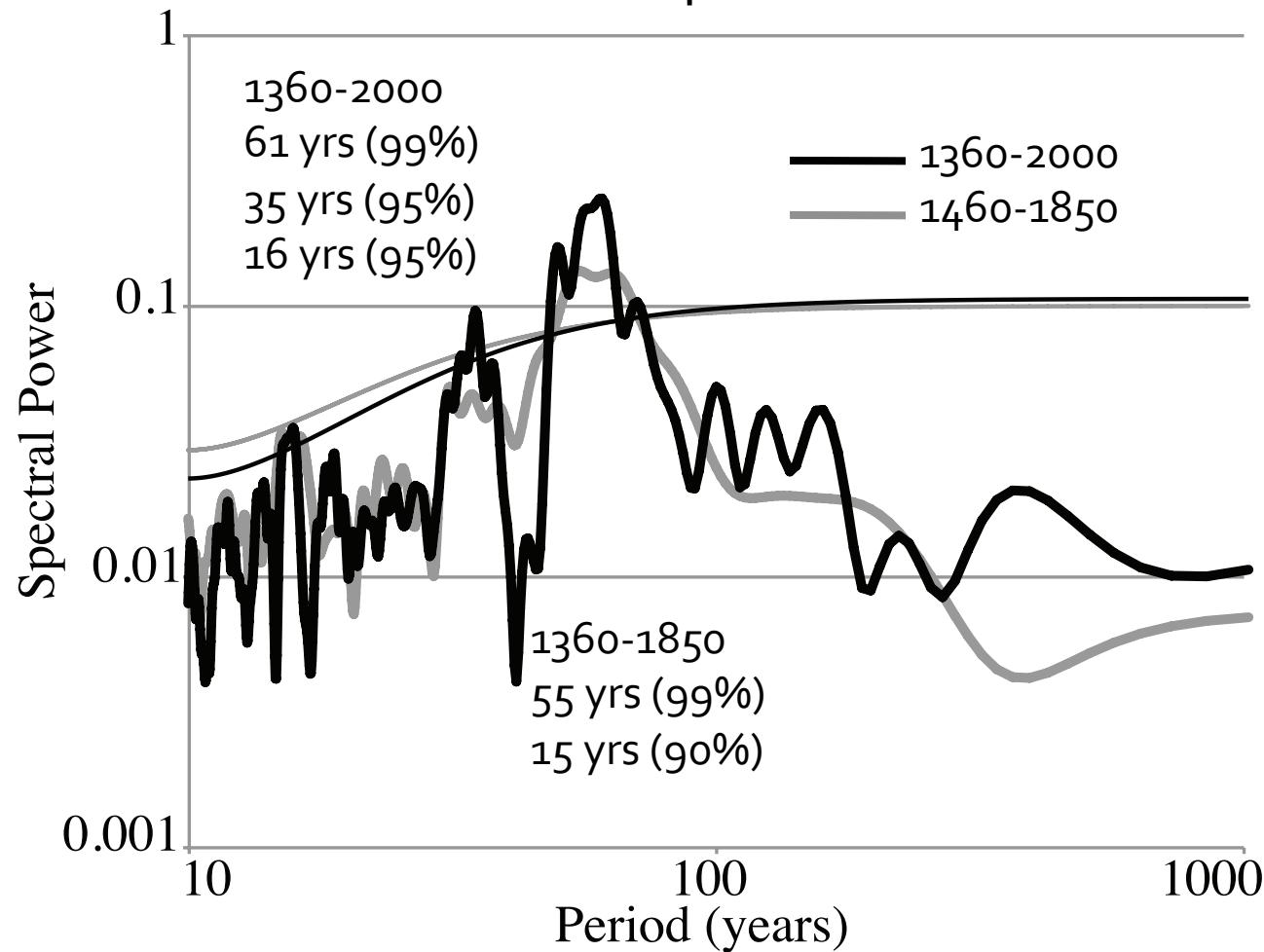


- Reconstruction iterated:
 1. Each site removed
 2. Each record removed
- Number of records varies through time 1-6
- Analysis on 1360-2000

- Error bars are regression standard error
- Singular spectral analysis 1st PC gives mean
- Multi-taper method spectral analysis
 - Good for spectral resolution of noisy data



MTM Spectra



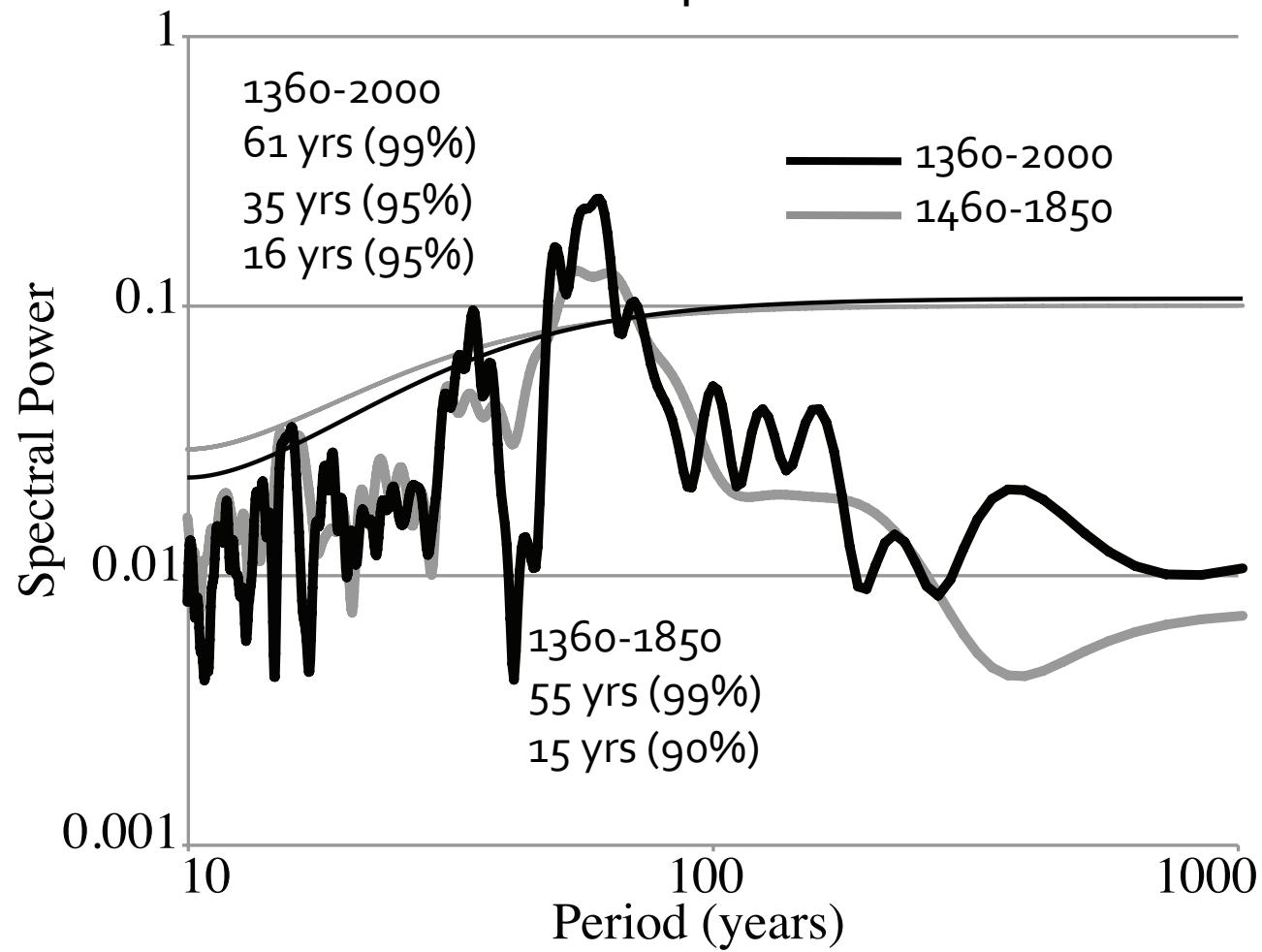
Another check on the significance
SSA analysis

Reconstructed the series with first 8 PCs

MTM spectral analysis

Results: same ~60 yr period peak

MTM Spectra



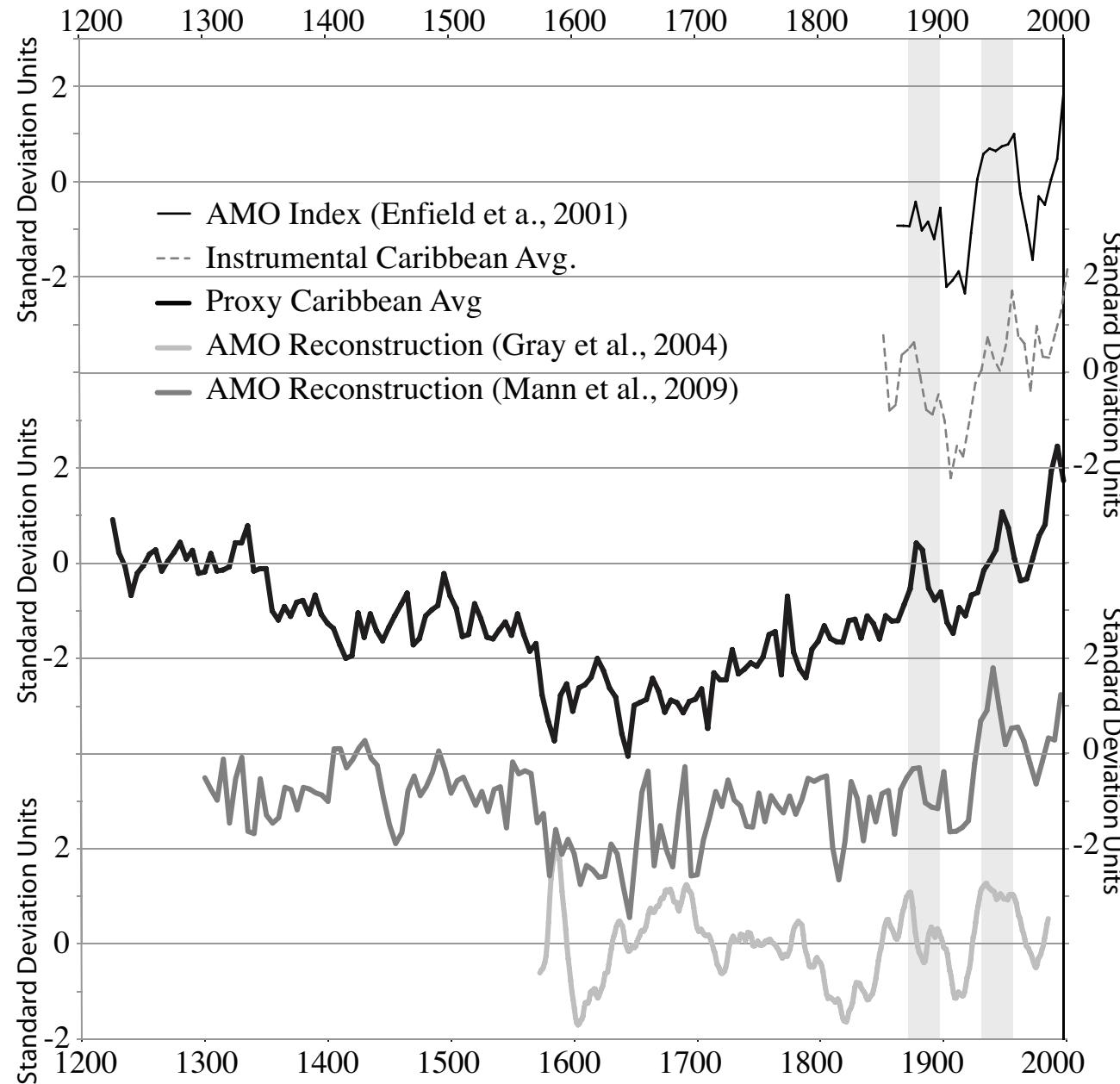
Significant multidecadal variability 1360-2000
Caribbean and possibly N. tropical Atlantic
Based on multiple proxies

Comparison With Other Multiproxy Reconstructions

Good coherence during instrumental period.

Little to no correlation in pre-instrumental times.

Need high latitude perspective on SST



Conclusions

- Need for East Atlantic and northern North Atlantic high resolution SST data
- Multidecadal scale variability persistent to 136°E in low latitude Atlantic
- Clear history of North Atlantic multidecadal variability still not available
(but we're getting closer)