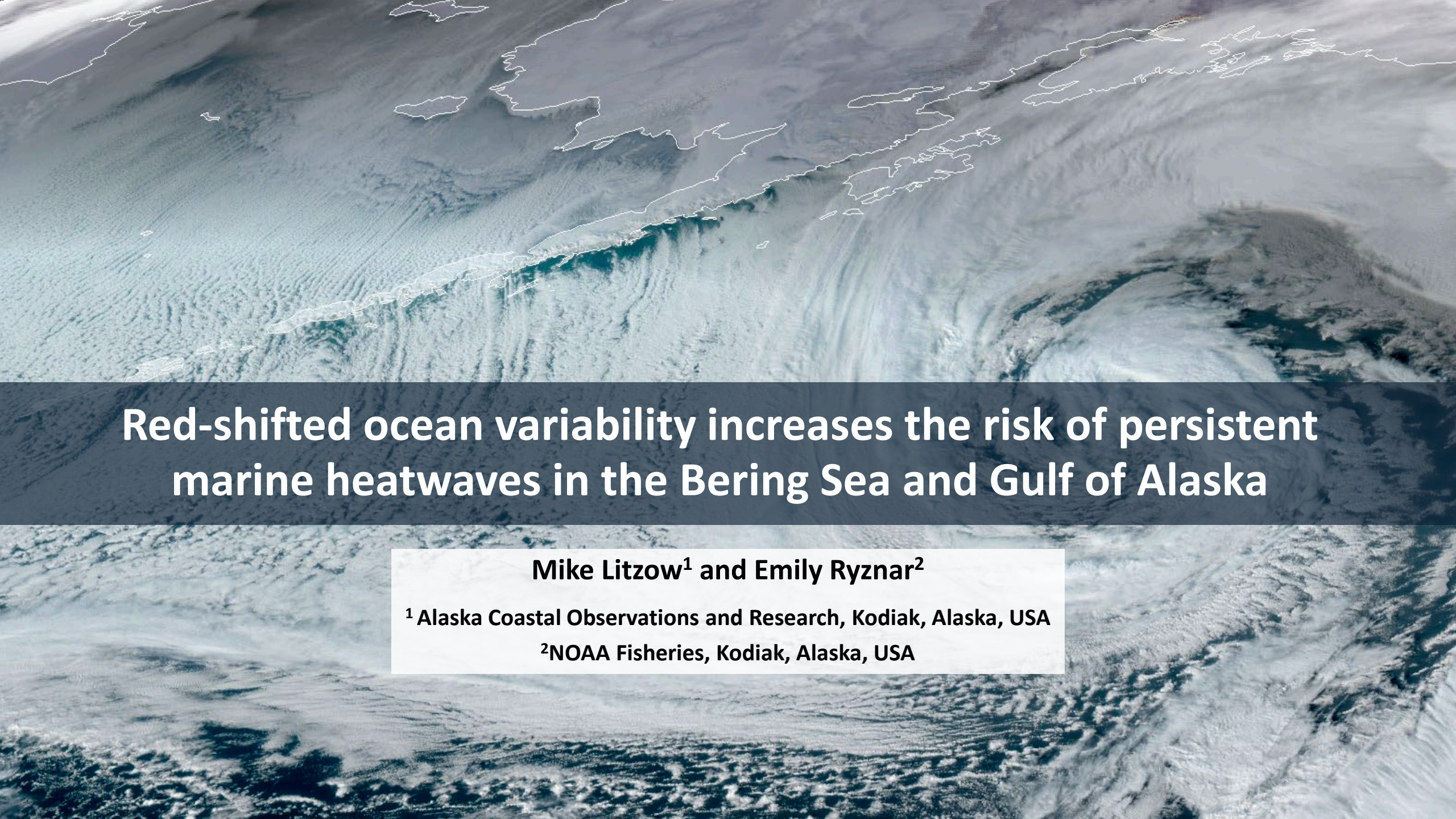


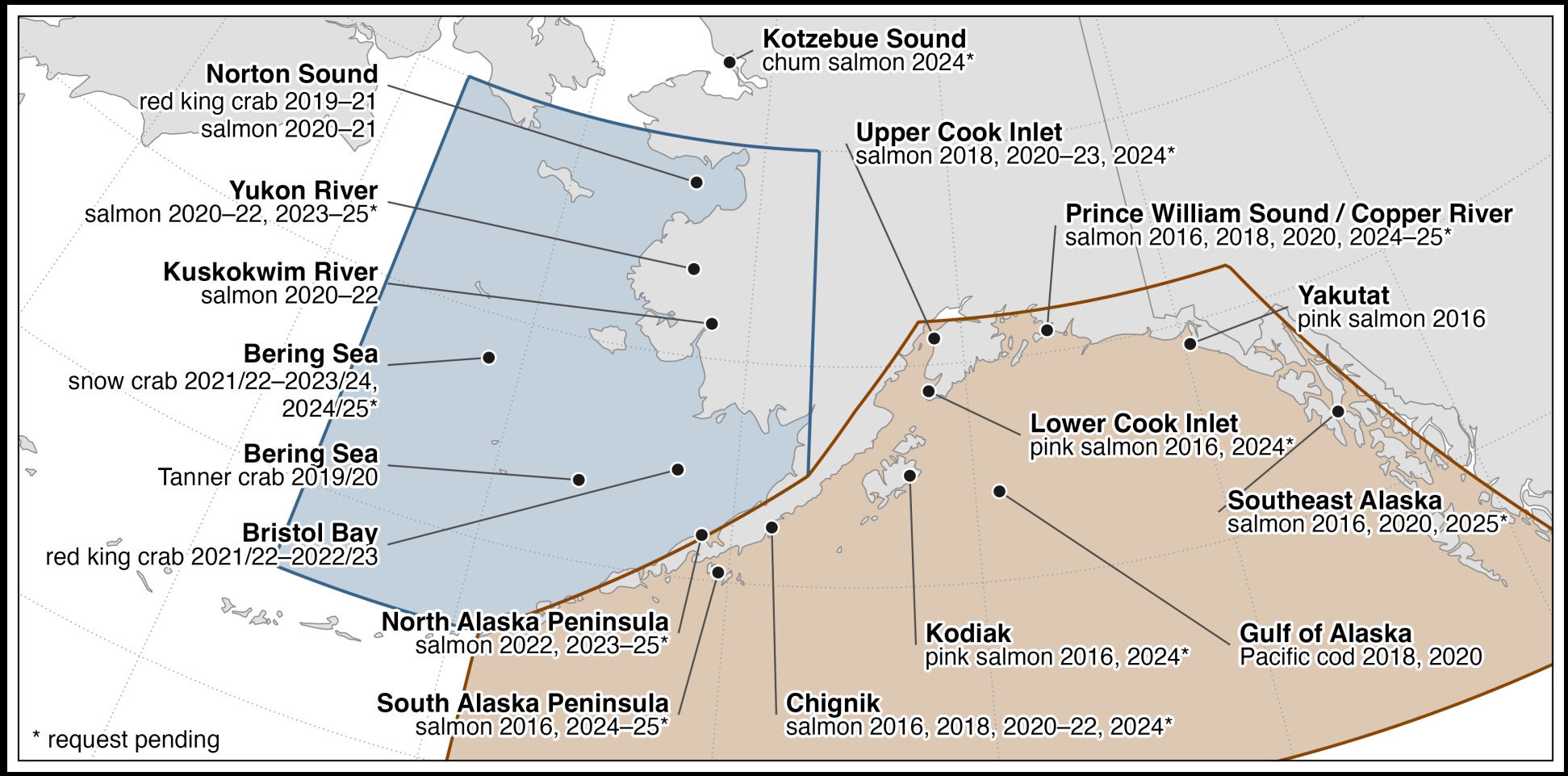
Red-shifted ocean variability increases the risk of persistent marine heatwaves in the Bering Sea and Gulf of Alaska

Mike Litzow[1] and Emily Ryznar[2]

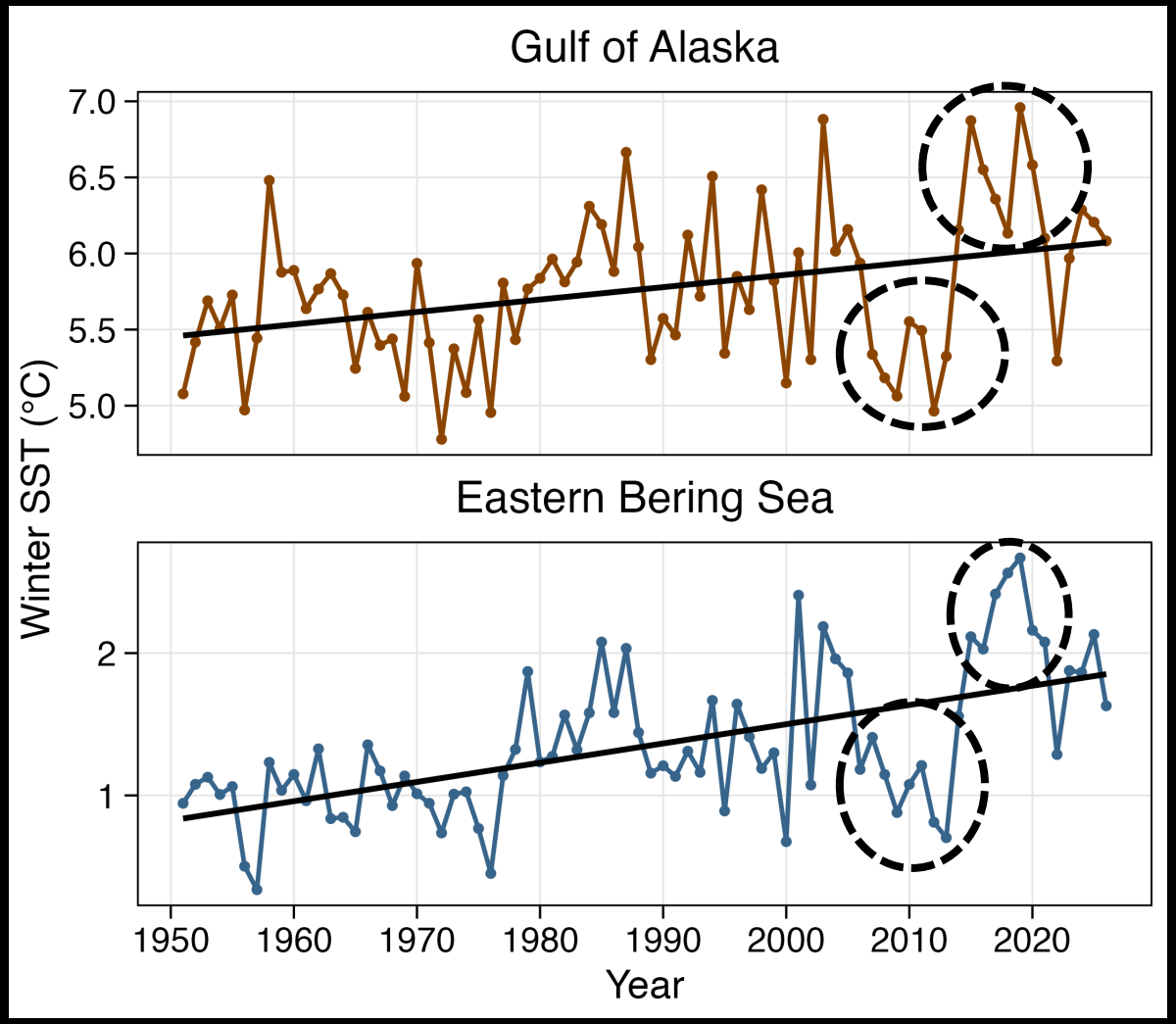
[1] Alaska Coastal Observations and Research, Kodiak, Alaska, USA

[2]NOAA Fisheries, Kodiak, Alaska, USA

Alaskan fisheries economic disasters, 2016-2025



Winter sea surface temperature, 1951-2026



Papers invoking temperature “stanzas” in the GOA/EBS

Research Article

Phytoplankton communities respond to environmental shifts in the eastern Bering Sea: Low abundances of *Calanus* copepods correlate with larger but potentially adverse phytoplankton taxa during warm stanzas

Jeanette C. Gann, David G. Kimmel, Franz J. Mueter, Michael W. Lomas, Lisa B. Eisner, Sarah L. Mincks

Reproductive potential of red king crab (*Paralithodes camtschaticus*) across warm and cold stanzas in Bristol Bay in

Time-series of direct primary production and phytoplankton biomass in the southeastern Bering Sea: responses to cold and warm stanzas

Michael

ICES Journal of Marine Science

ICES Journal of Marine Science (2020), 77(3), 953–963. doi:10.1093/icesjms/fsz180

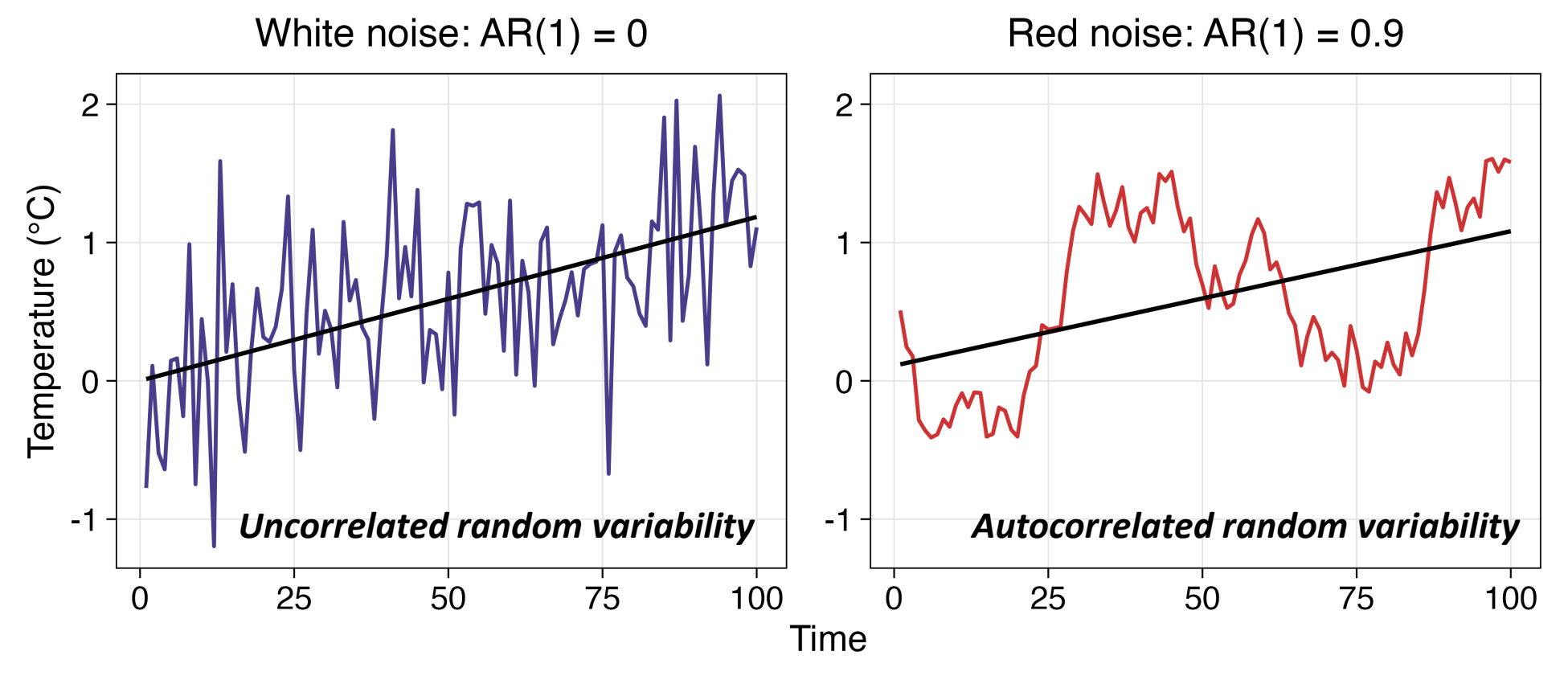
Original Article

Contrasting the variability in spatial distribution of two juvenile flatfishes in relation to thermal stanzas in the eastern Bering Sea

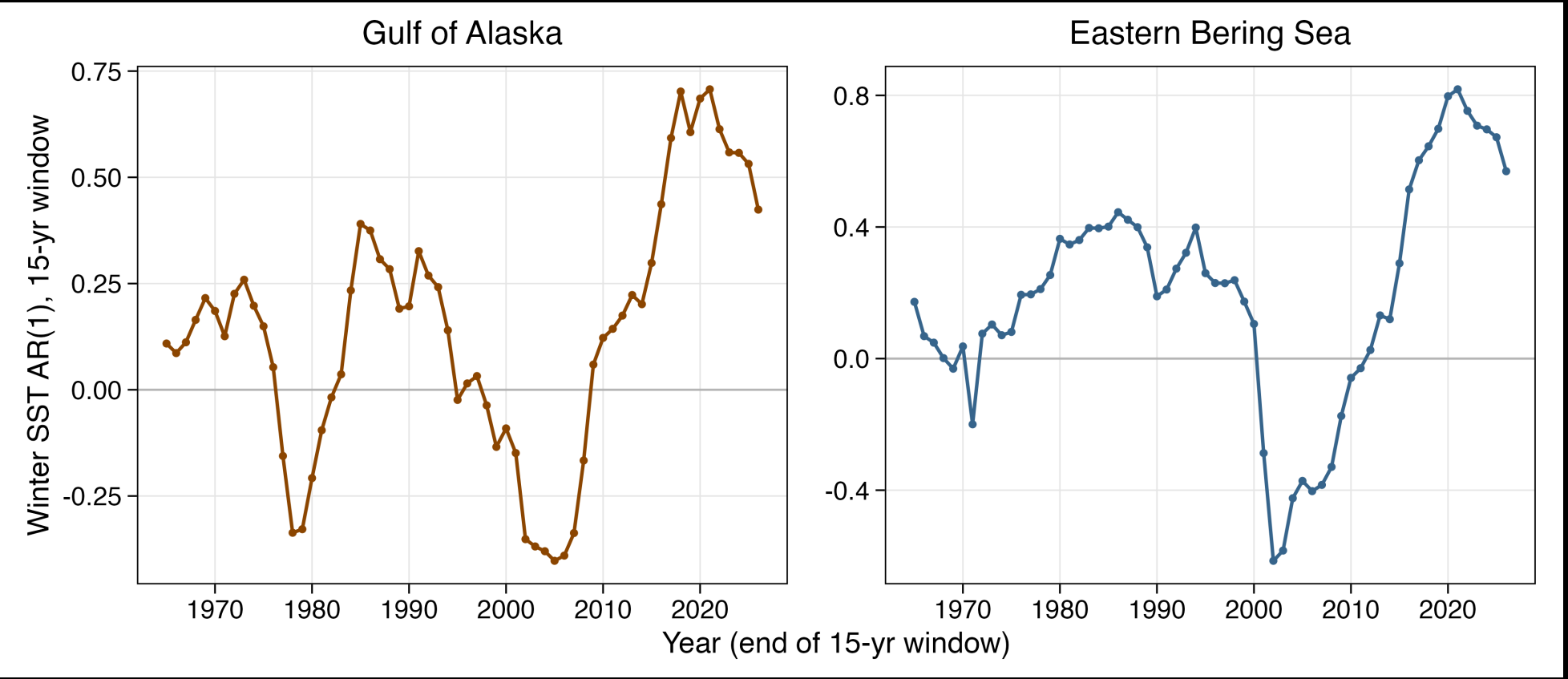
Cynthia Yeung * and Daniel W. Cooper

Alaska Fisheries Science Center, NOAA Fisheries, 7600 Sand Point Way NE, Seattle, WA 98115, USA

“Stanzas” = red noise (autocorrelated random variability)

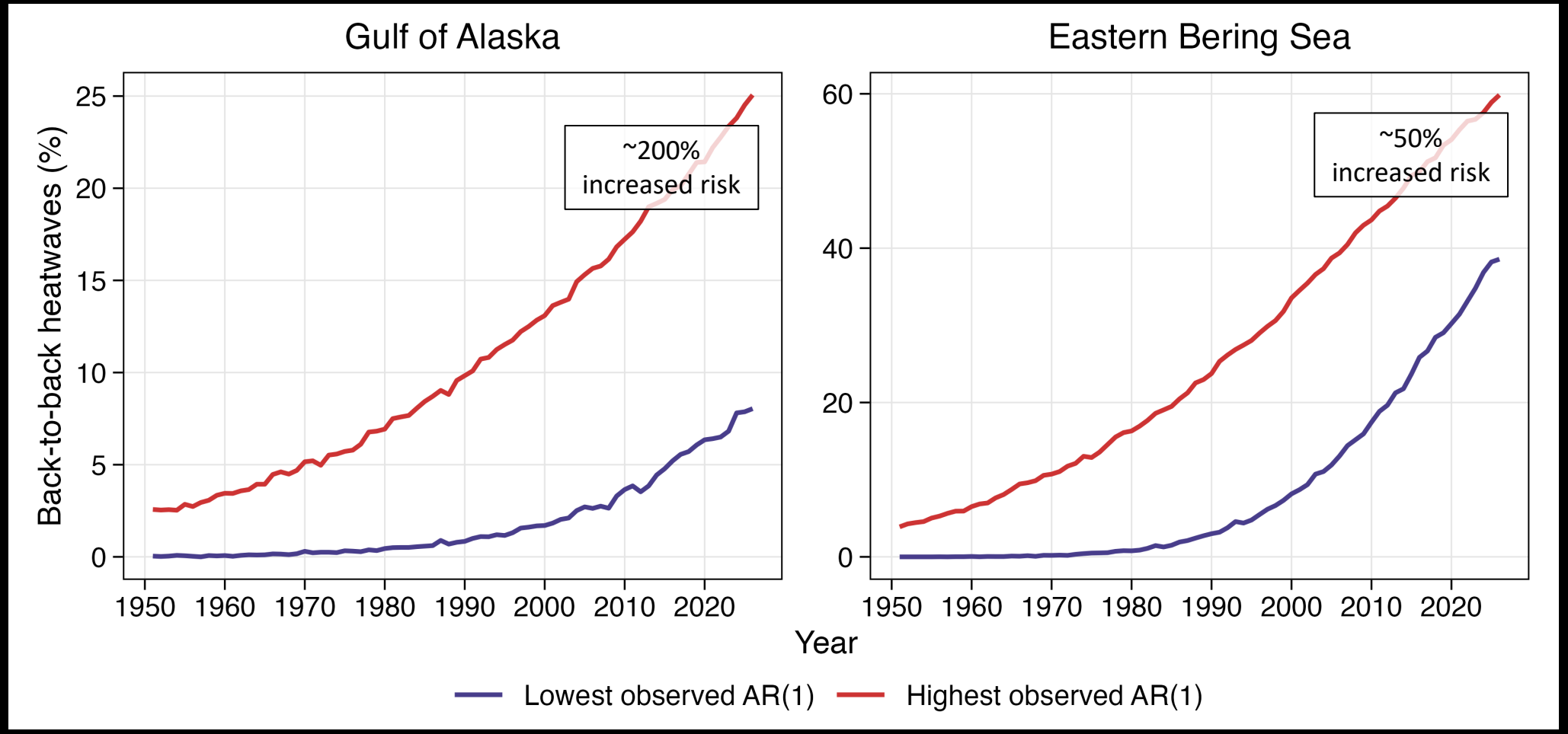


SST variability has red-shifted in recent decades



1. What are the implications for extreme event risk?
2. Why is the regional climate reddening?

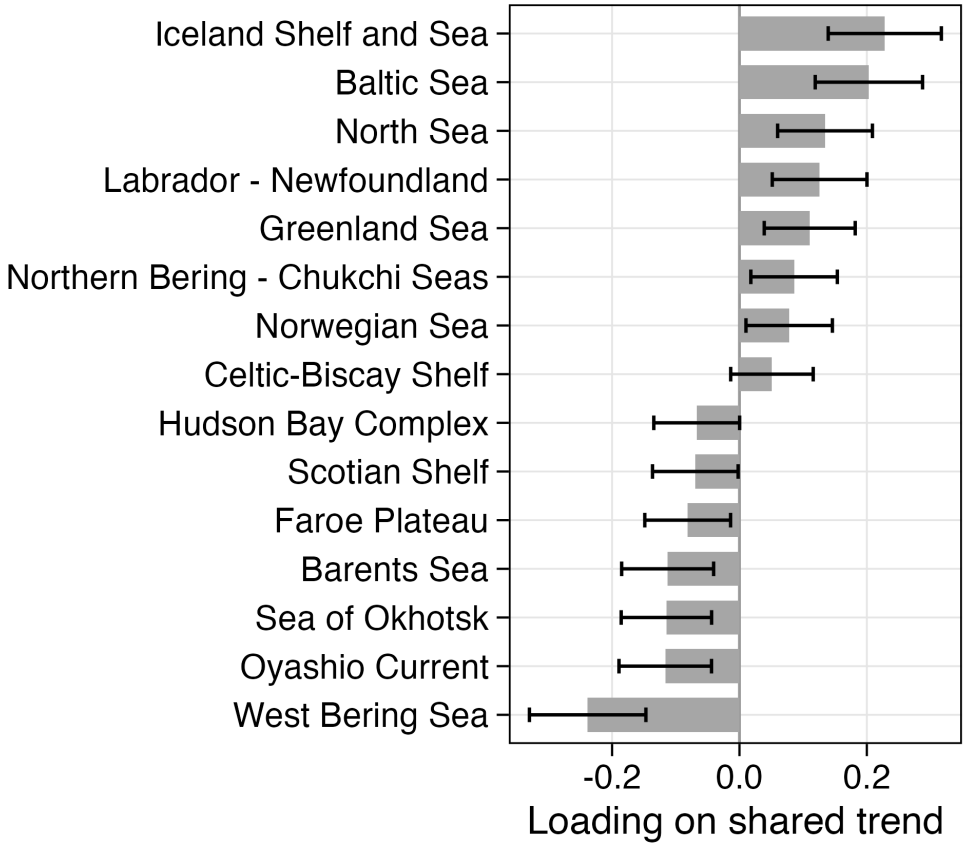
Risk of consecutive heatwave years with observed trend, high vs low autocorrelation



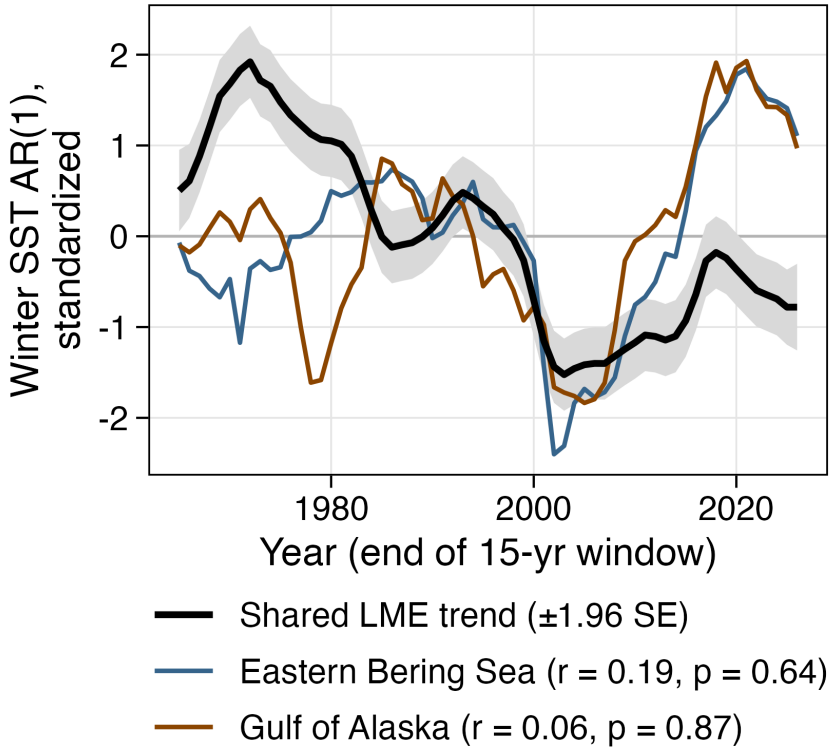
Reddening is *not* shared across other boreal ecosystems

Dynamic Factor Analysis model for shared trends in SST AR(1) values

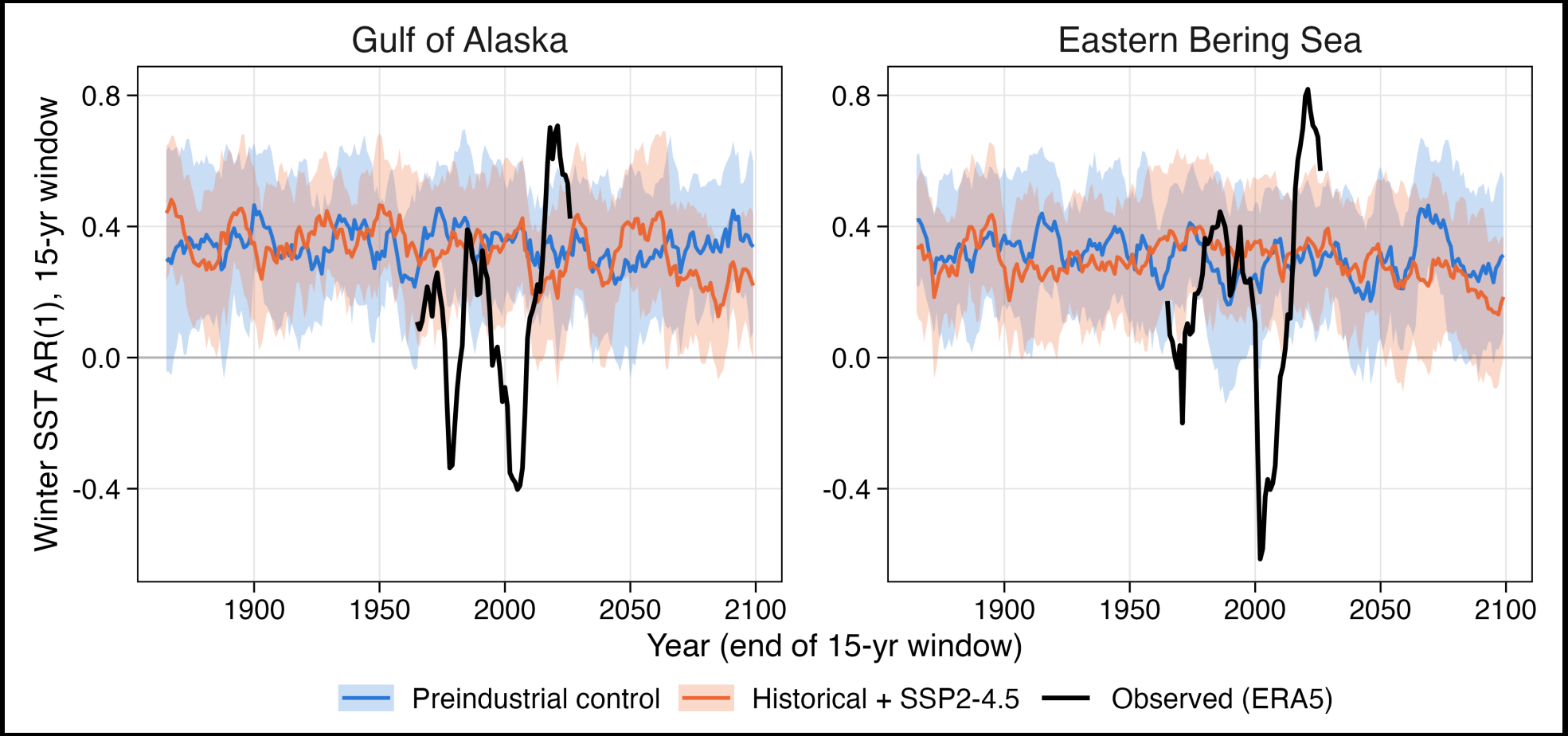
Loadings



Shared trend and correlation with GOA/EBS

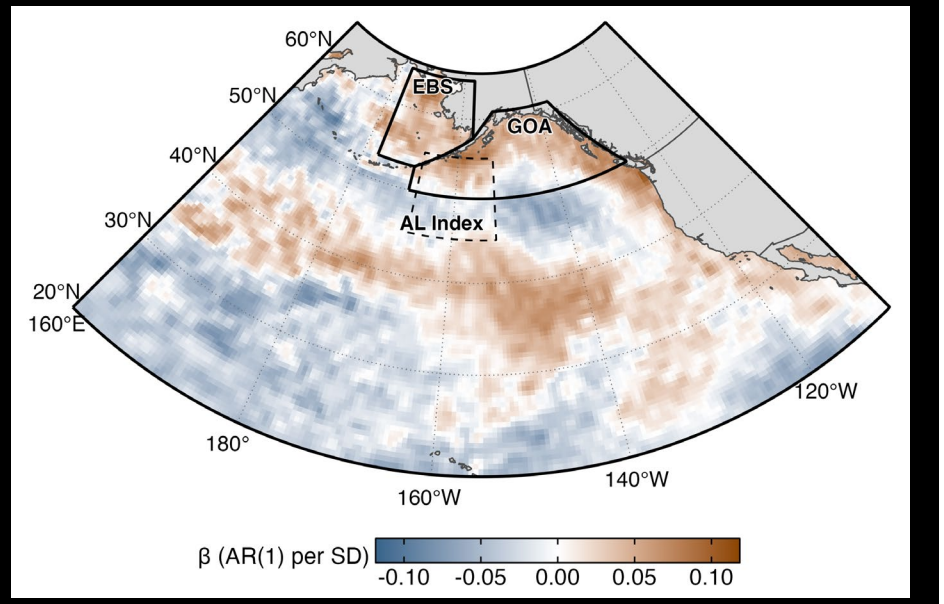


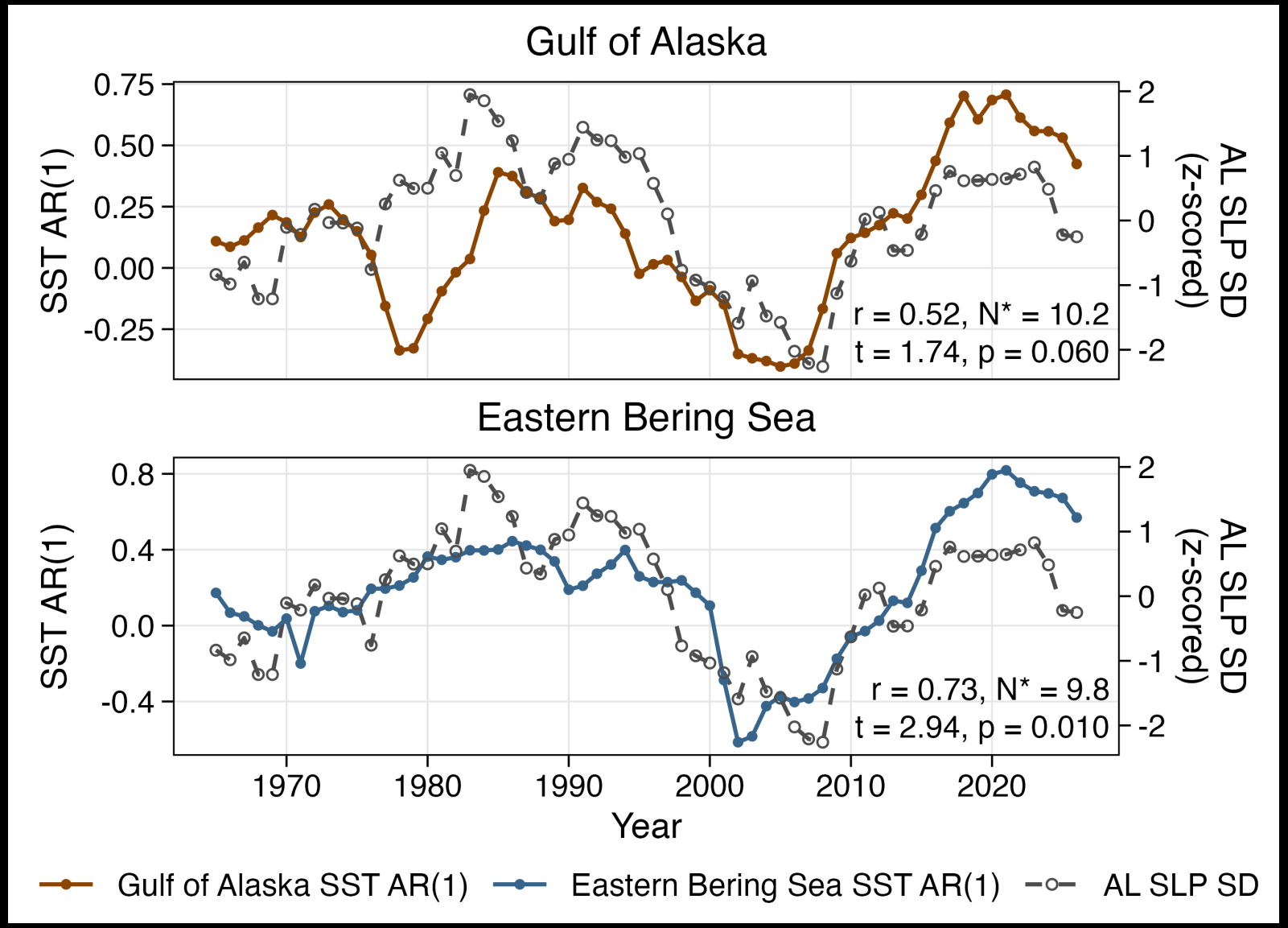
Climate models do *not* predict reddening with anthropogenic forcing



- 21 CMIP6 models
- Weighted by skill and independence for autocorrelation, variability, bias, and trend
- Models consistently under-estimate observed range of AR(1) values

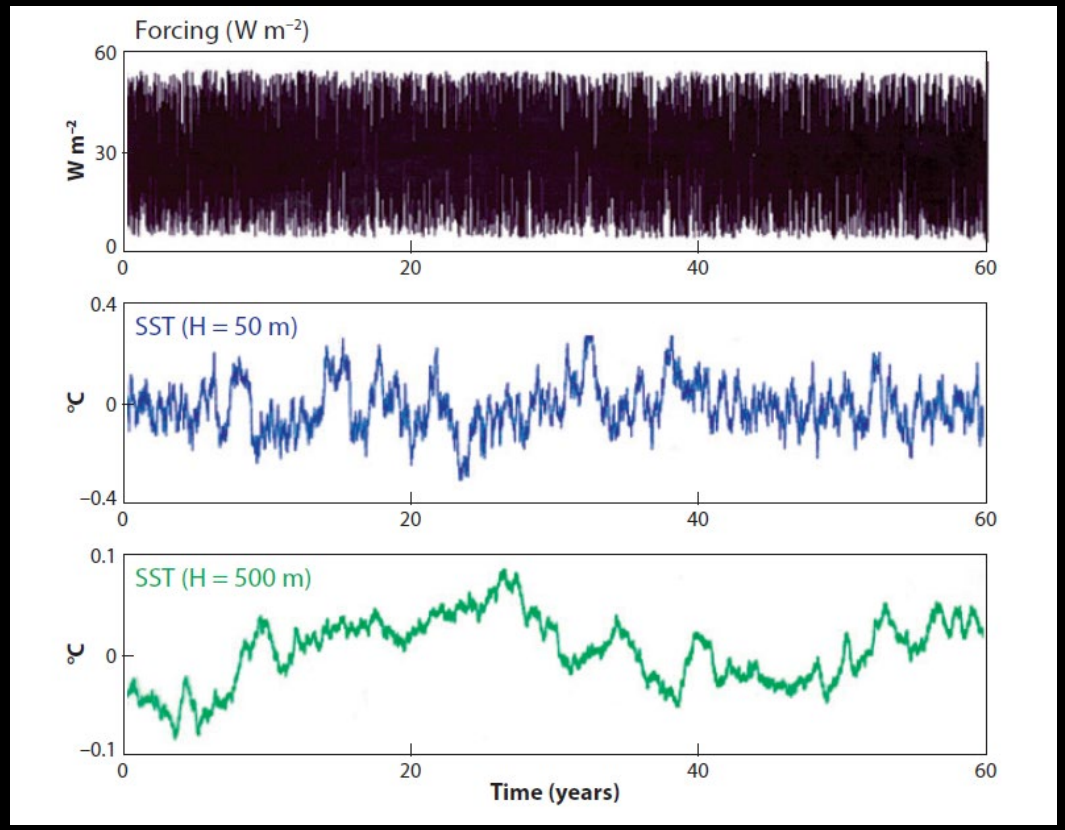
Nonstationary Aleutian Low variability tracks SST reddening





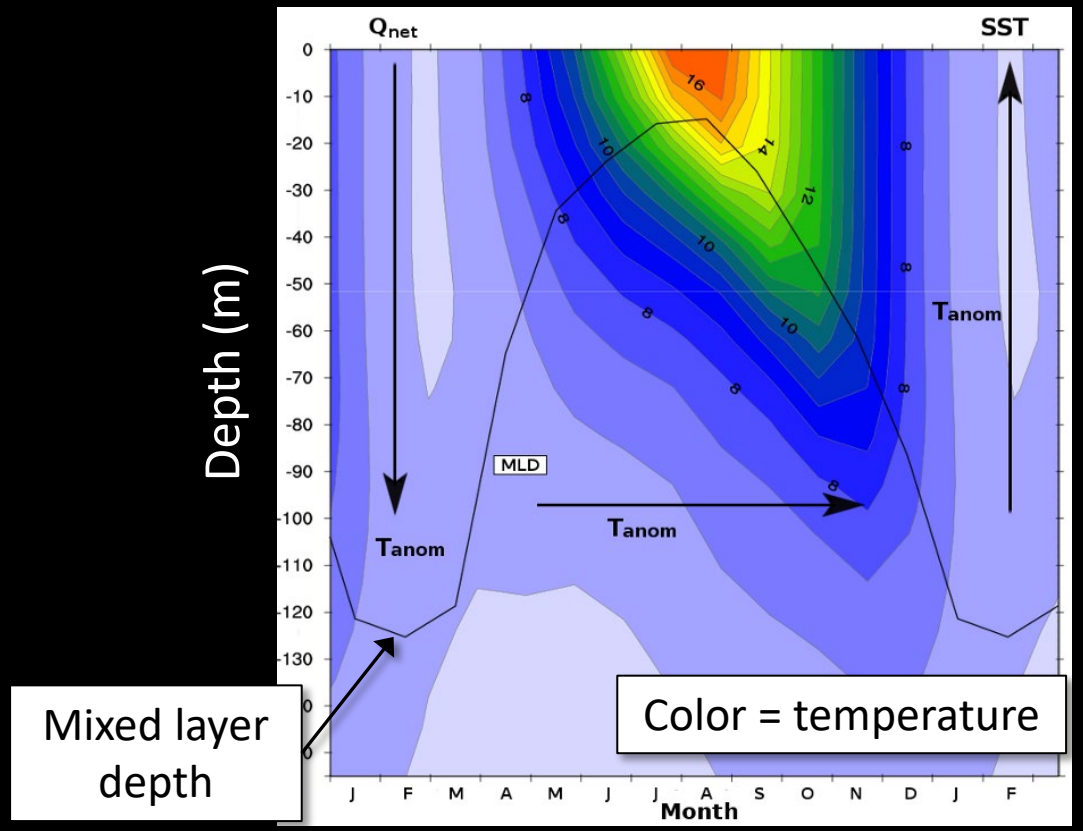
Can mixed layer depth dynamics explain the effect of nonstationary Aleutian Low variability on SST reddening?

Mixed layer depth determines SST autocorrelation



Deser et al. 2010. Annu. Rev. Mar. Sci.

Seasonal mixing drives SST reemergence

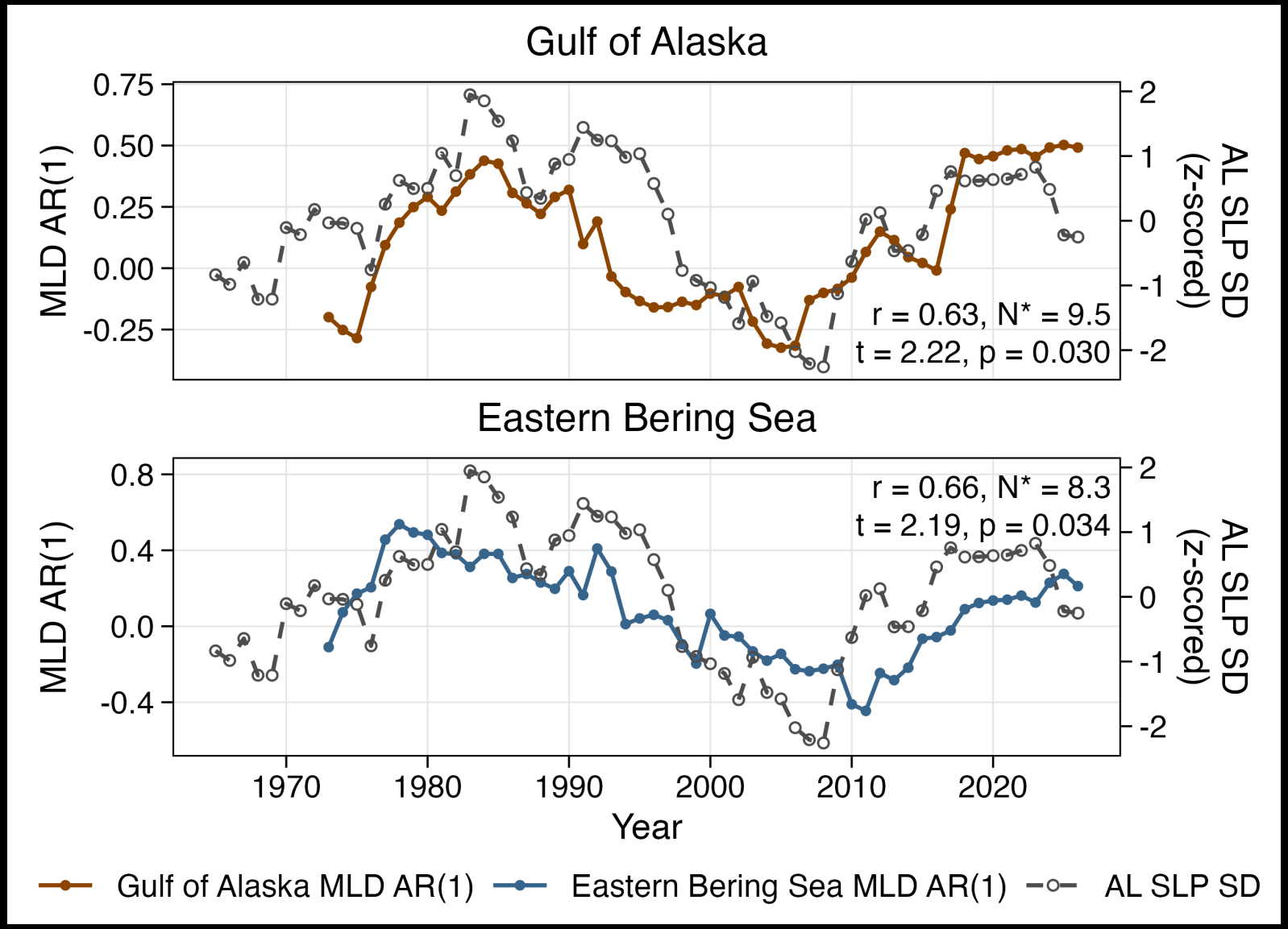


Mixed layer depth

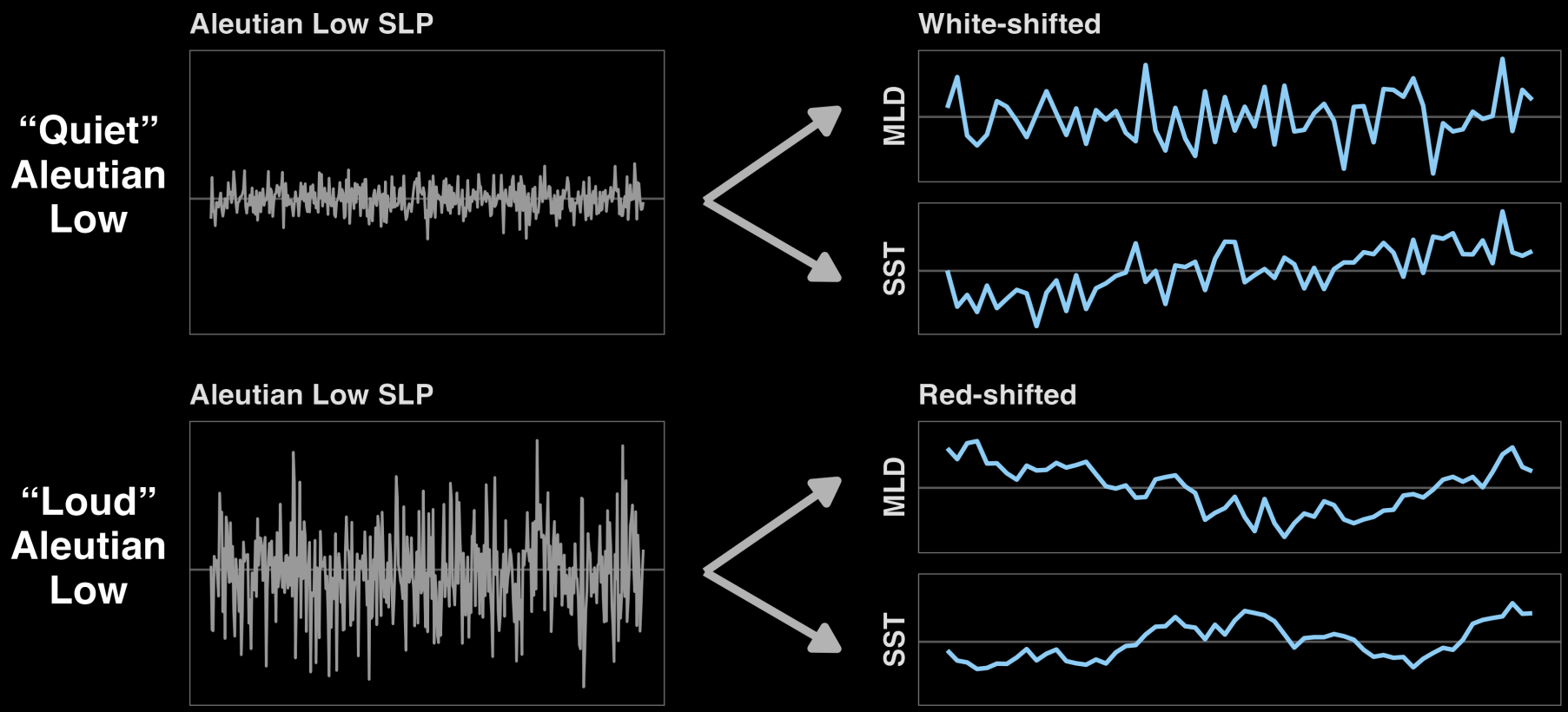
Color = temperature

Winter Summer Winter

Aleutian Low SLP variability drives MLD autocorrelation

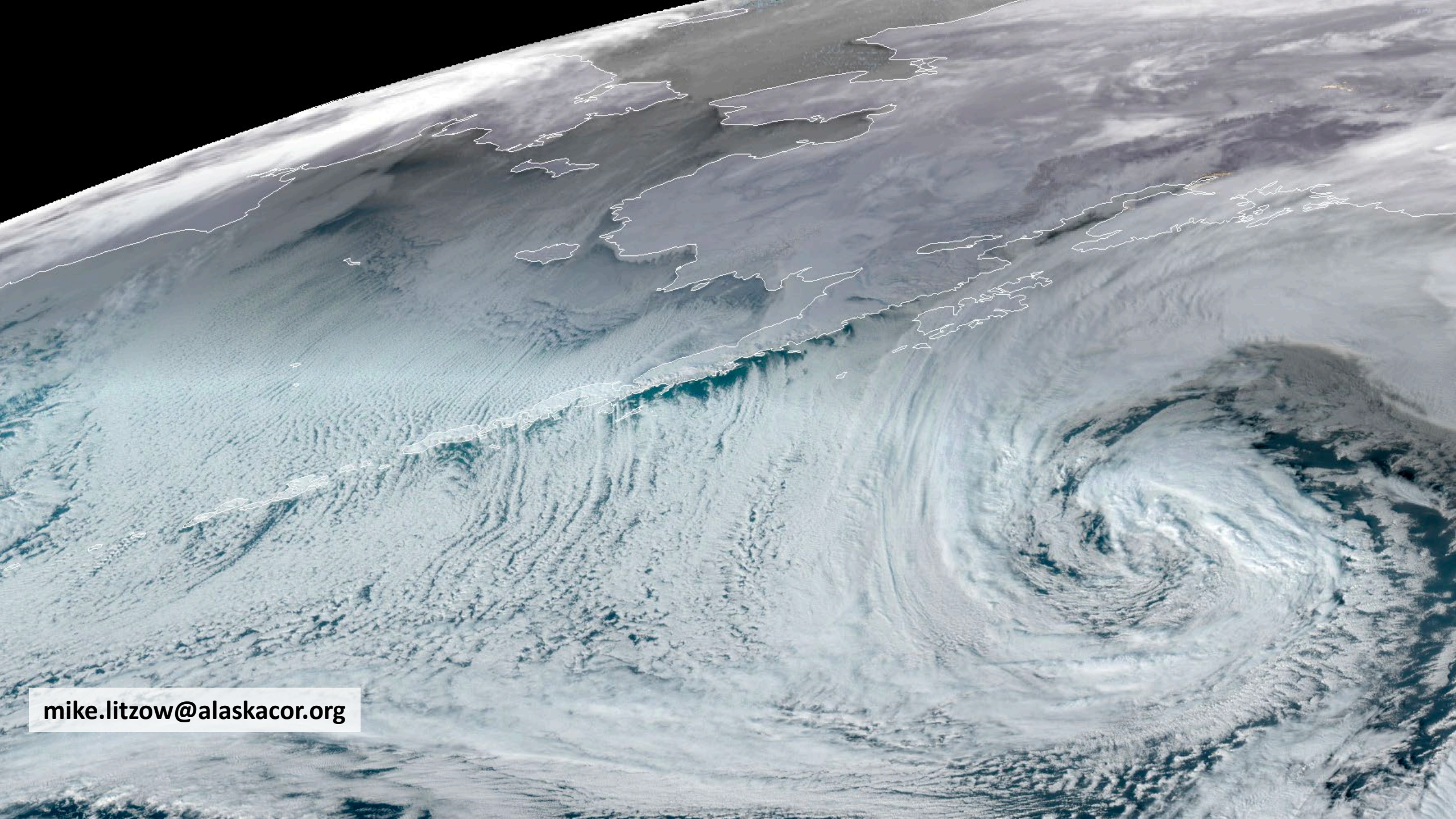


Conceptual model and take-homes



~~CESM2 Fully-coupled / mechanically decoupled experiment~~

- Reddening is regional in scale, affects both MLD and SST, and sharply increases the chances of multi-year extreme events
- Statistical evidence for link with nonstationary Aleutian Low variability is strong
- Physical explanation for nonstationary Aleutian Low variability -> ocean reddening is needed



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