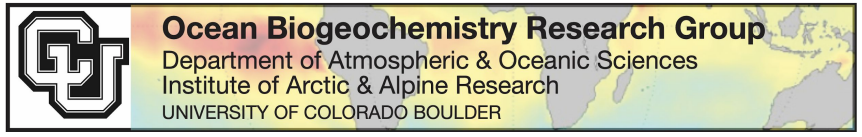
Skillful predictions of multiple marine stressors in the surface and subsurface ocean

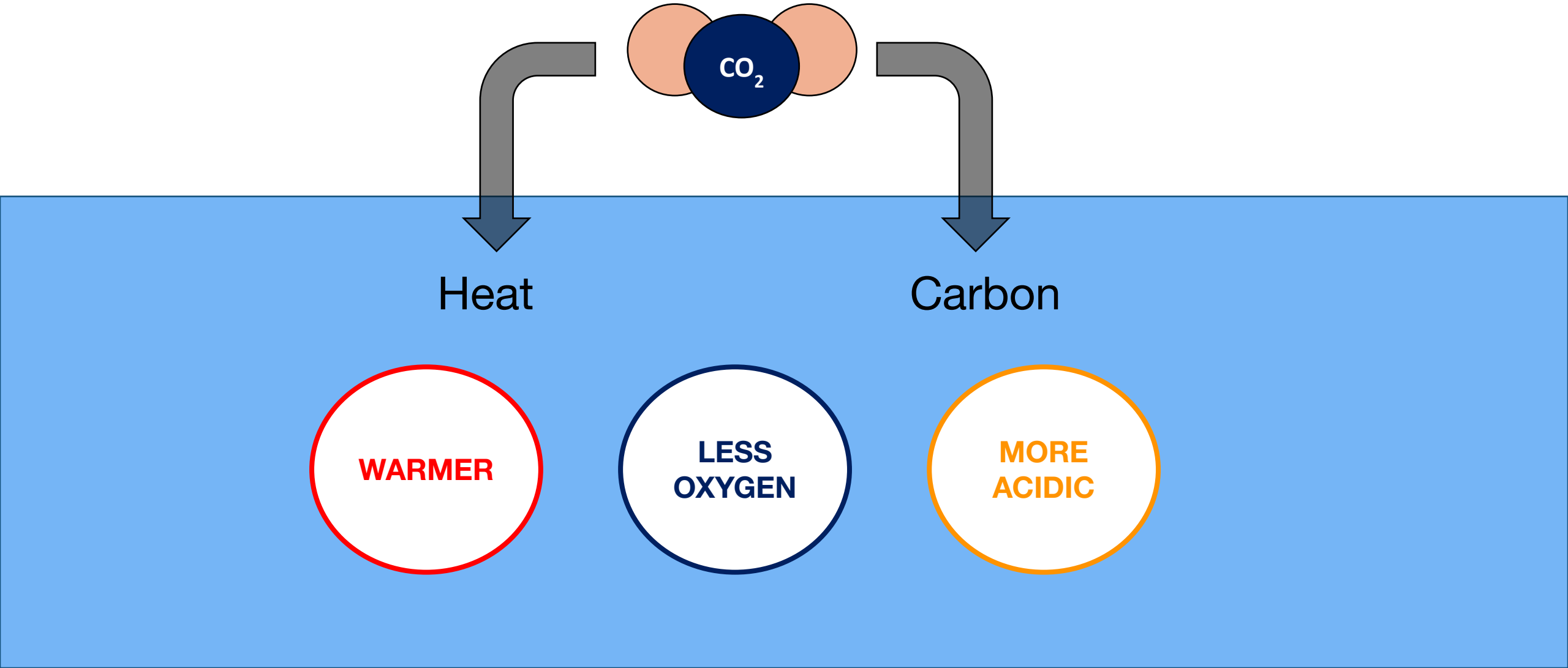
Sam Mogen (he/him)

University of Colorado Boulder

Nicole Lovenduski, Lydia Kepler, Jonathan Sharp, Steven Yeager, Steven Bograd, Elliot Hazen, Michael Jacox, Nathali Cordero Quiros, Mercedes Pozo Buil, Emanuele Di Lorenzo

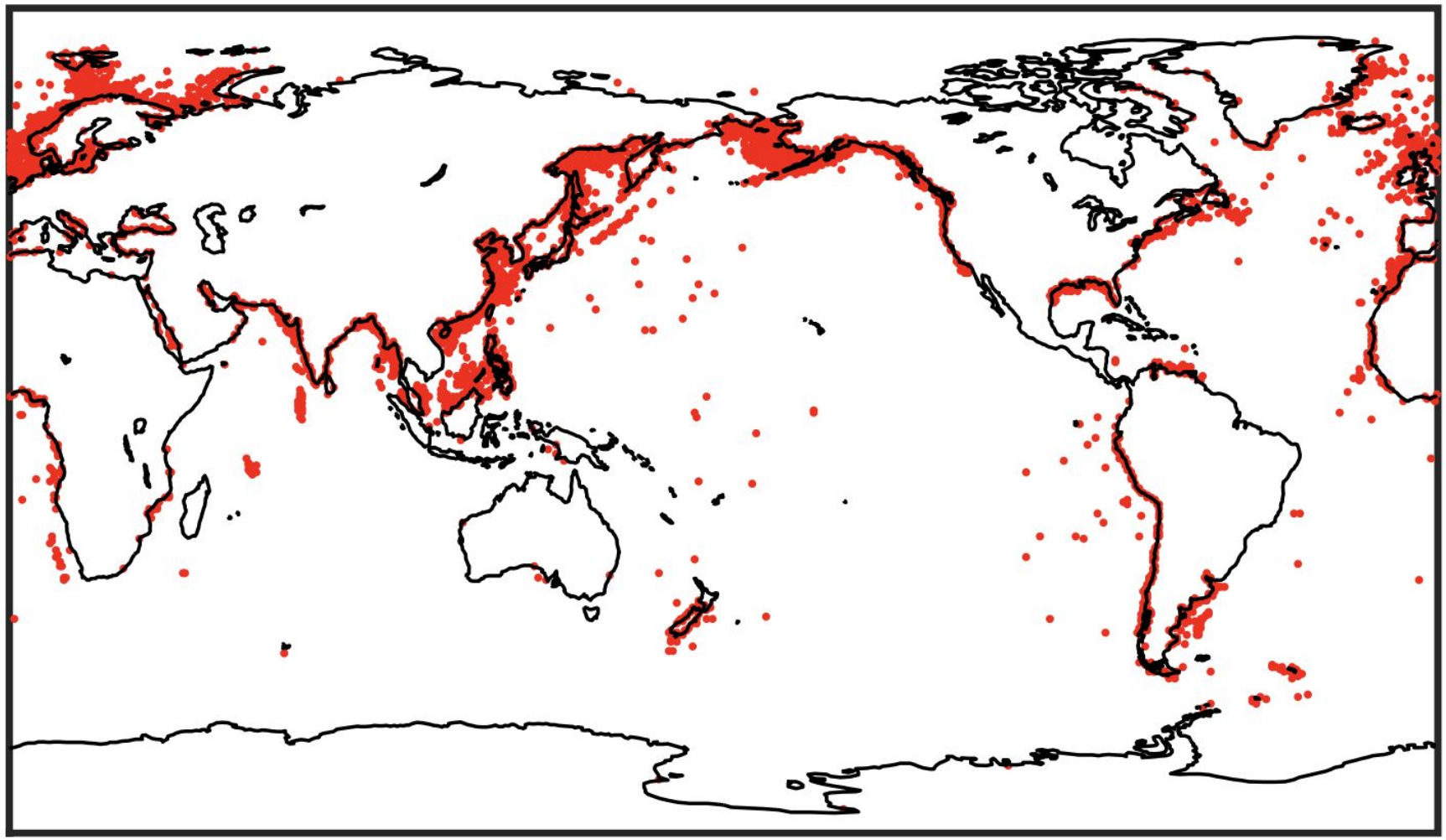


Climate Change:
a triple threat for marine ecosystems



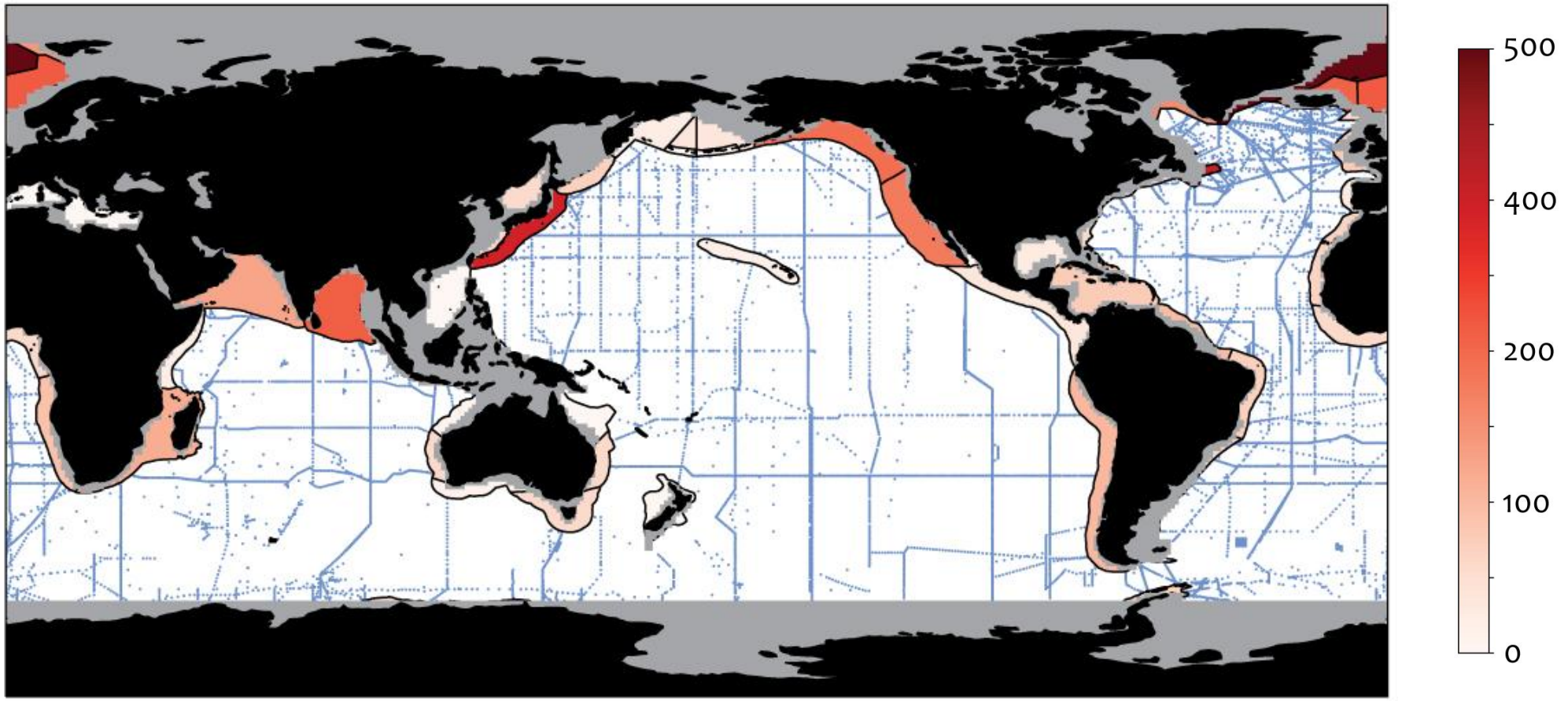
Predicting stressors in important fisheries

Fish catch > 1,000 metric tons in 2015



Watson and Tidd (2018)

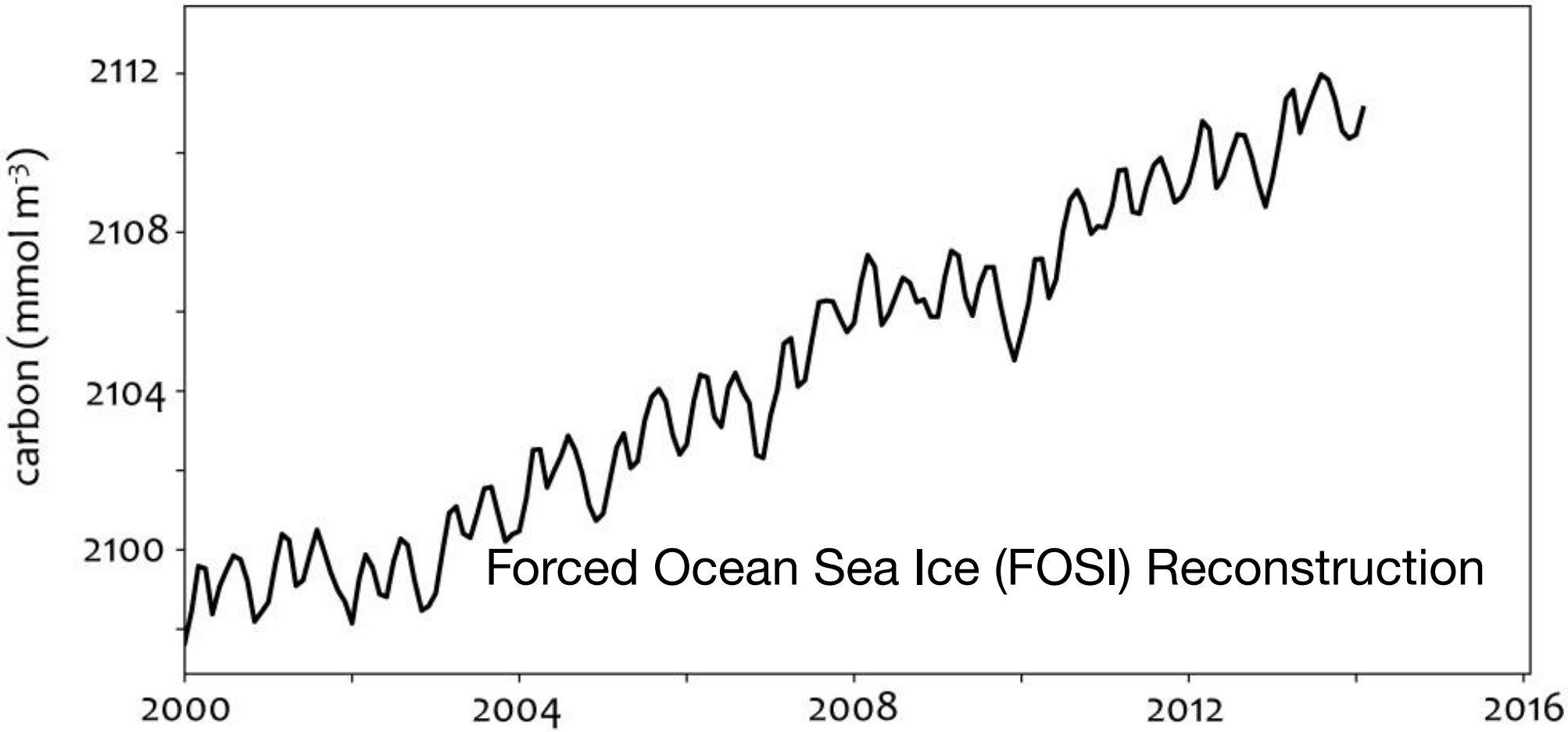
Novel observational products: **subsurface carbon and oxygen**



(number of observations)

Sharp et al 2023, in review;
Keppler et al. 2023, in review

CESM Seasonal to Multiyear Large Ensemble (SMYLE)



Yeager et al. 2022

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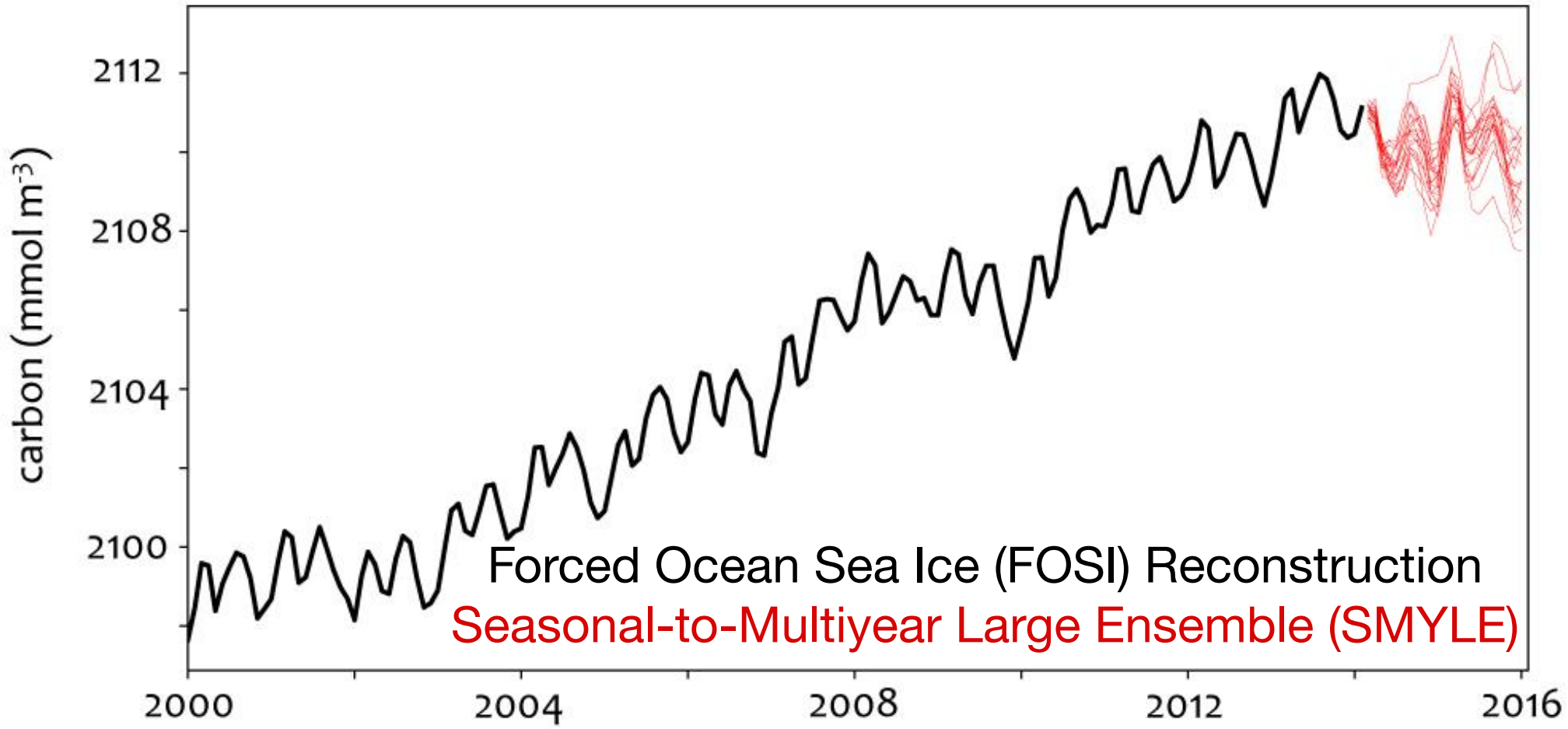

Yeager et al. 2022

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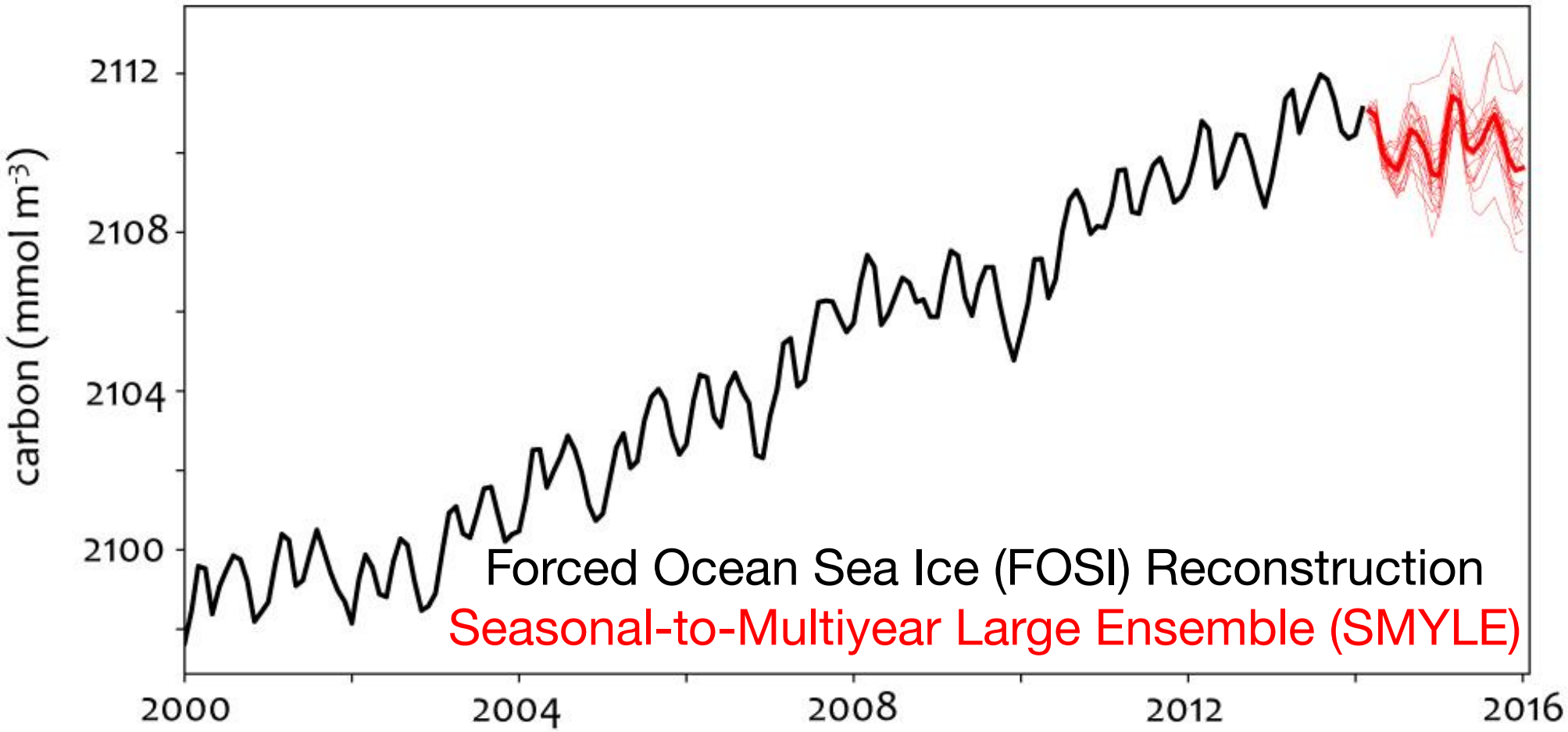

Yeager et al. 2022

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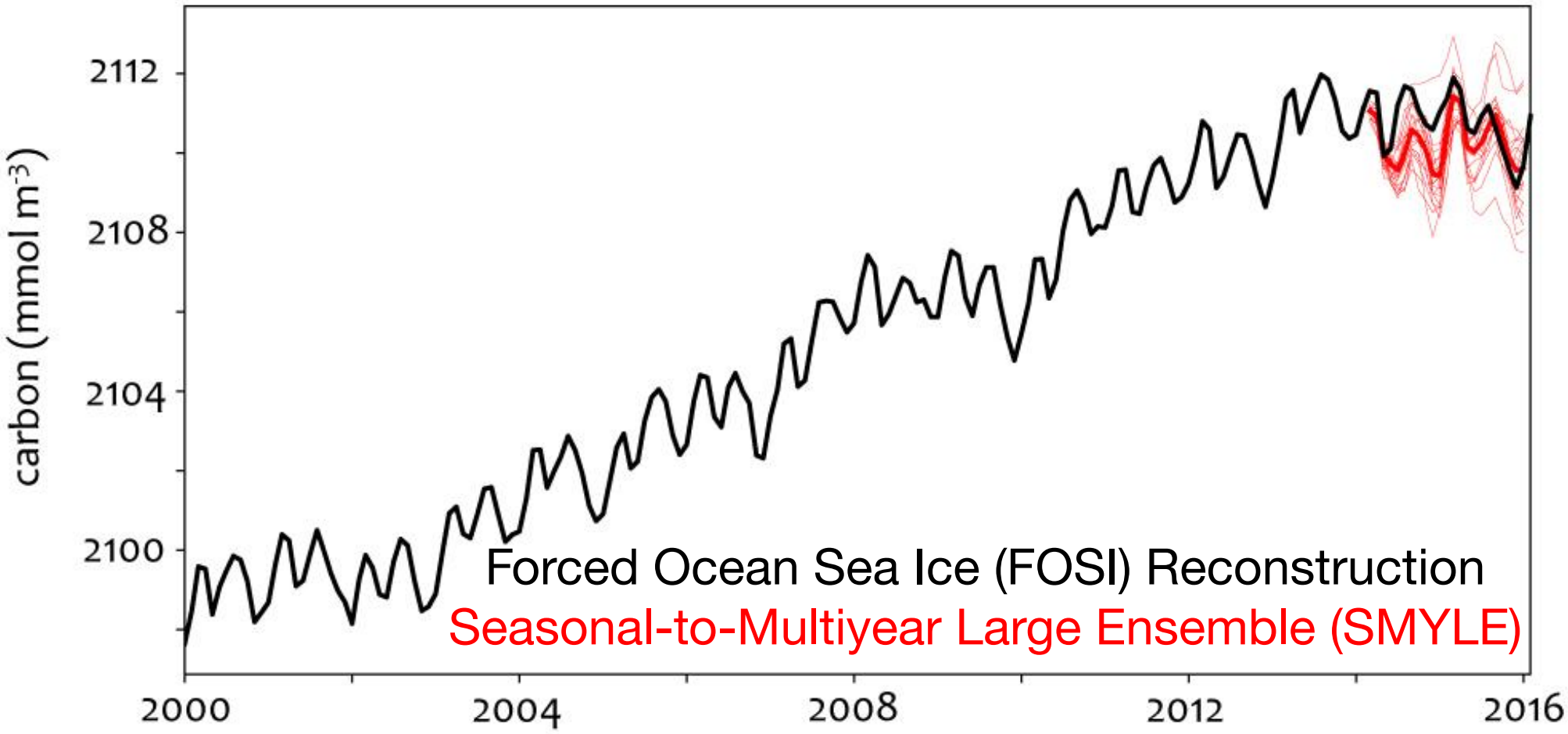
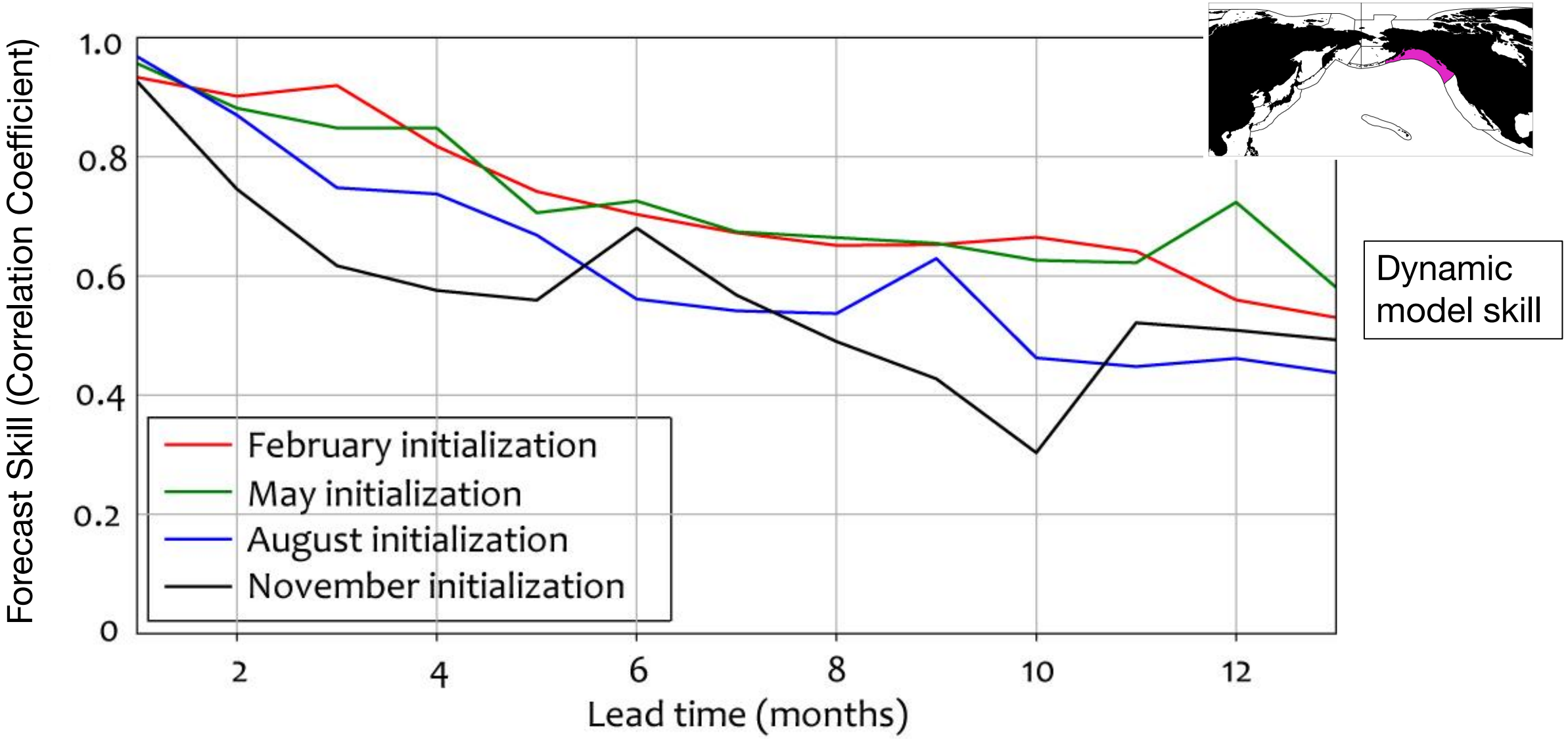


Yeager et al. 2022

Skillful SST forecasts in the Gulf of Alaska



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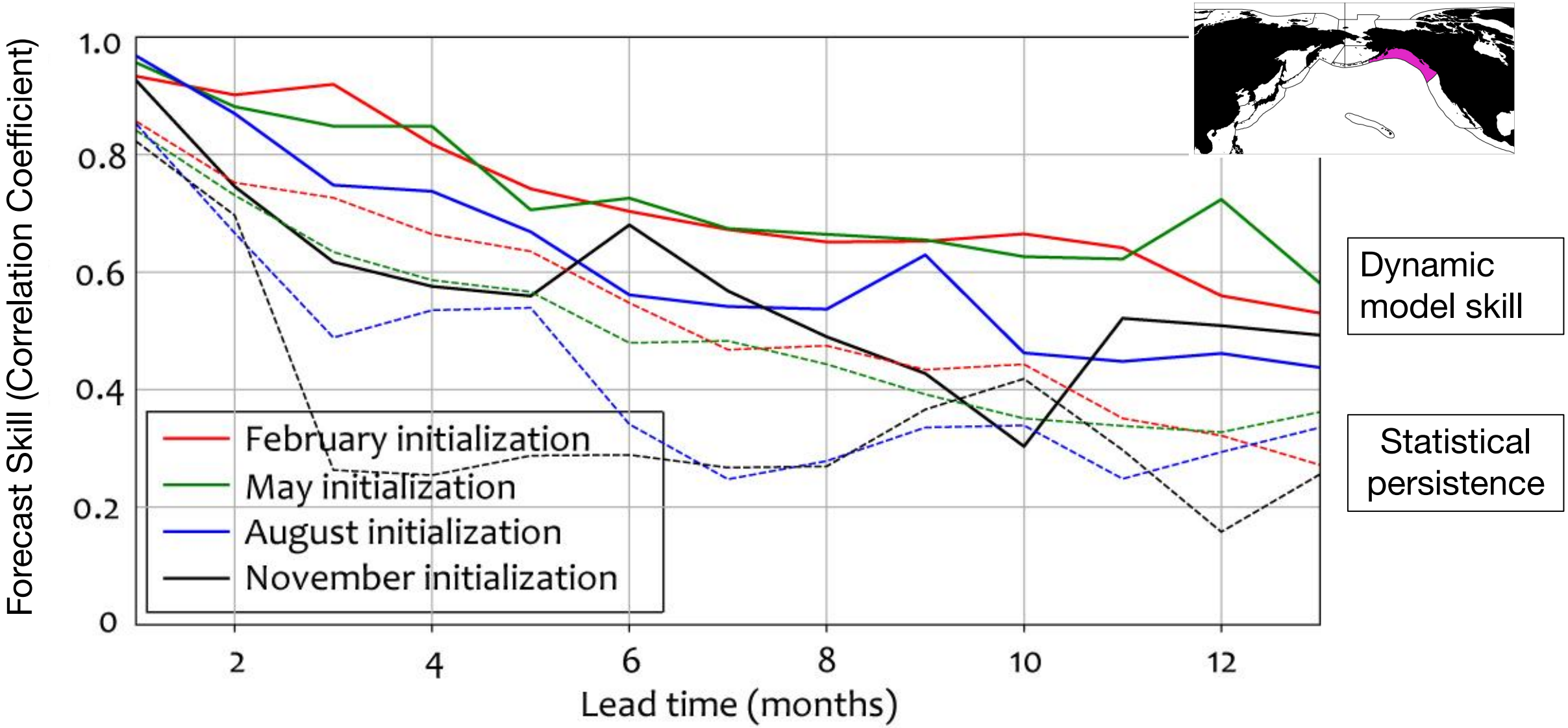
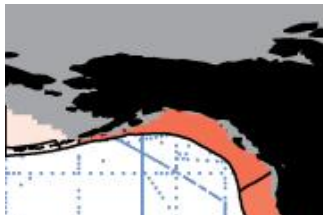
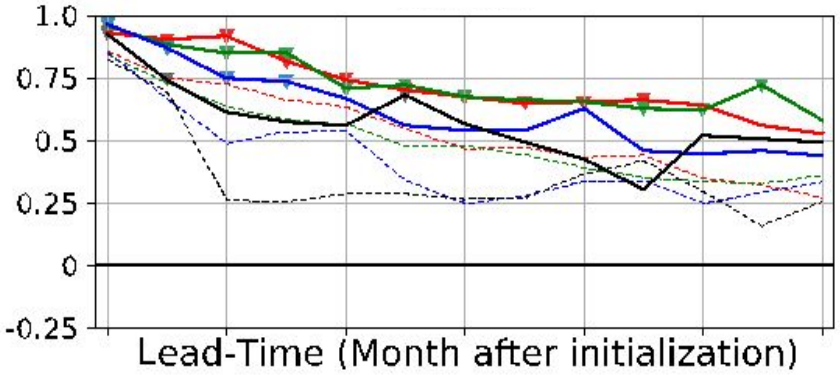


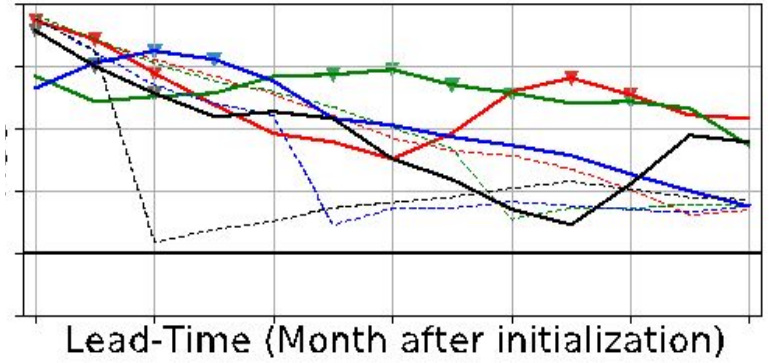
Gulf of Alaska

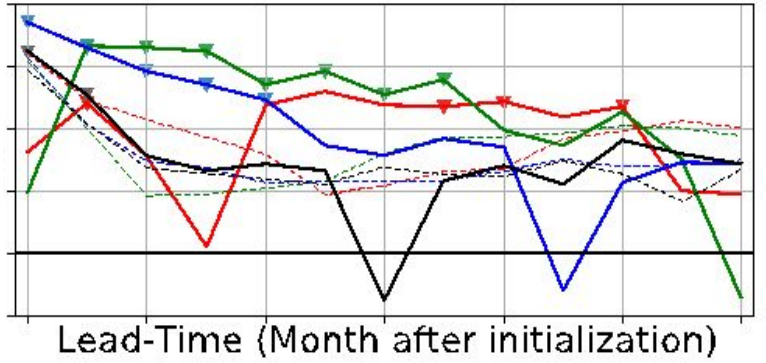


Temperature | Carbon | Oxygen

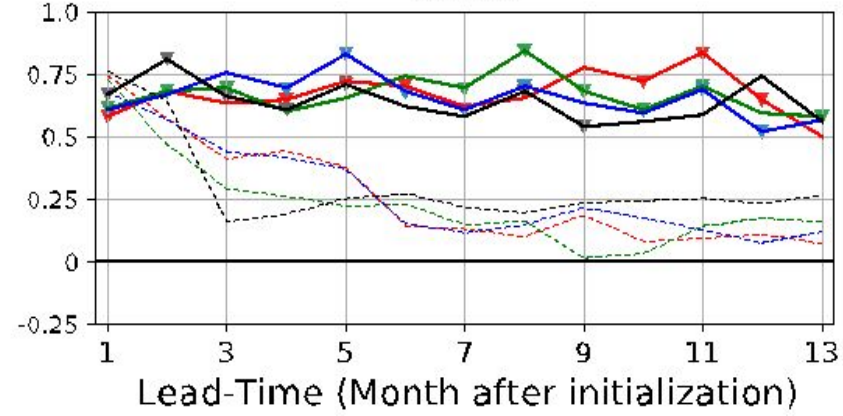
Surface

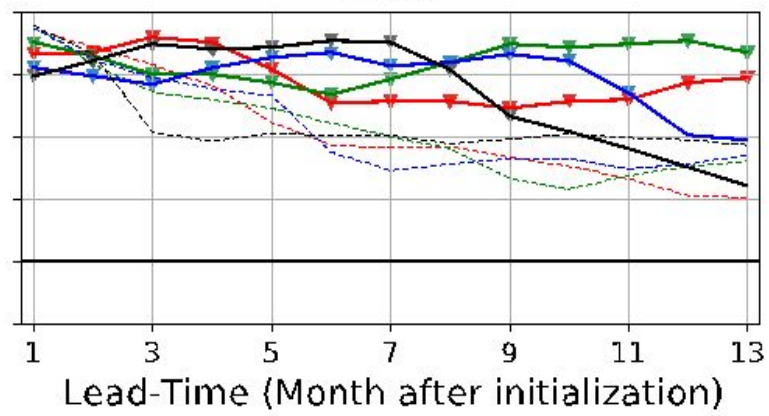


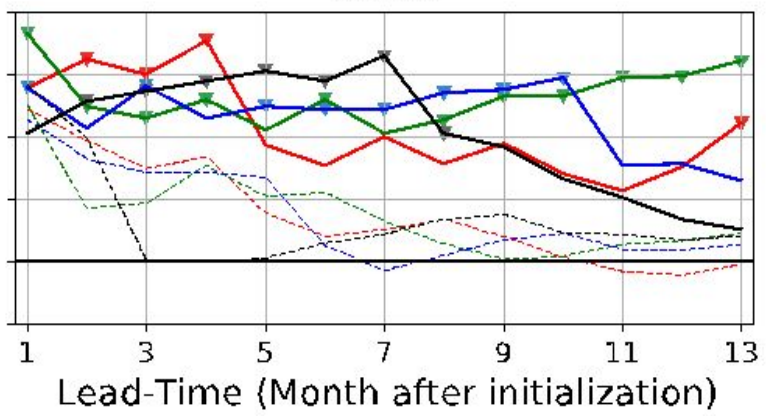




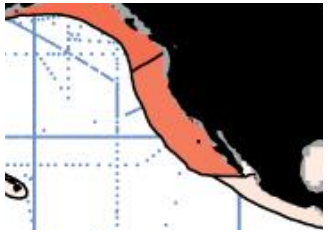
300 m





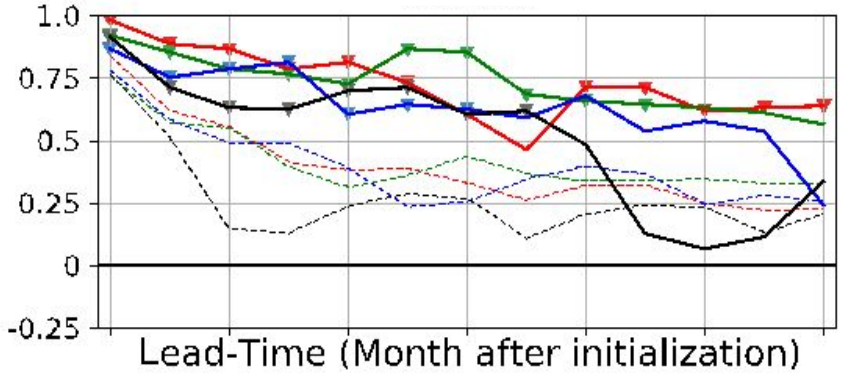


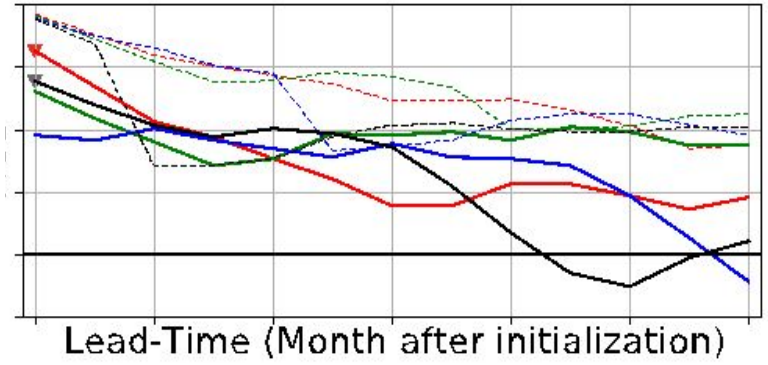
California Current

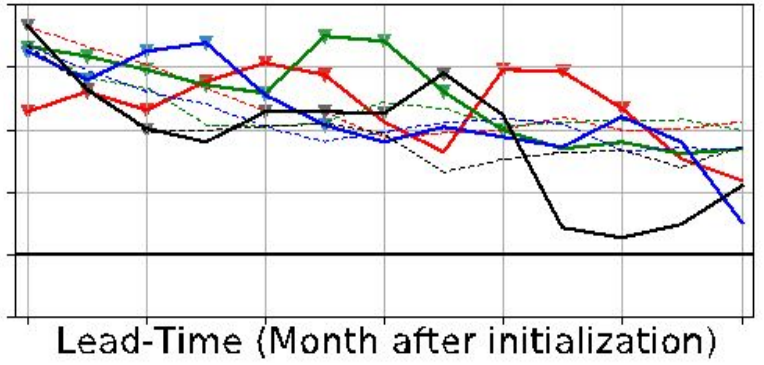


Temperature | Carbon | Oxygen

Surface







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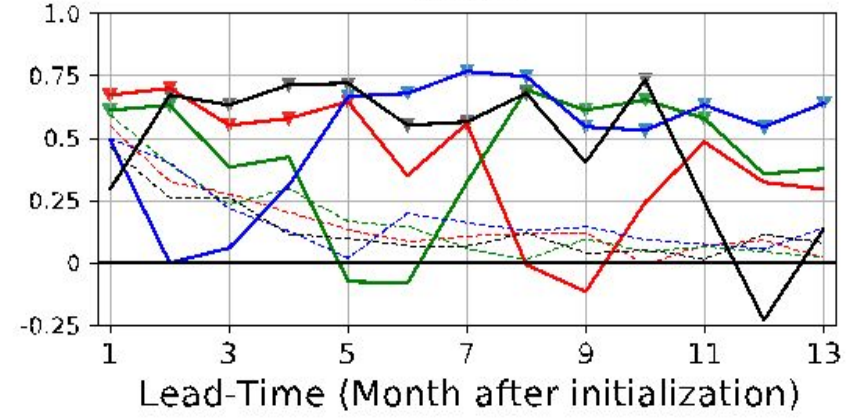
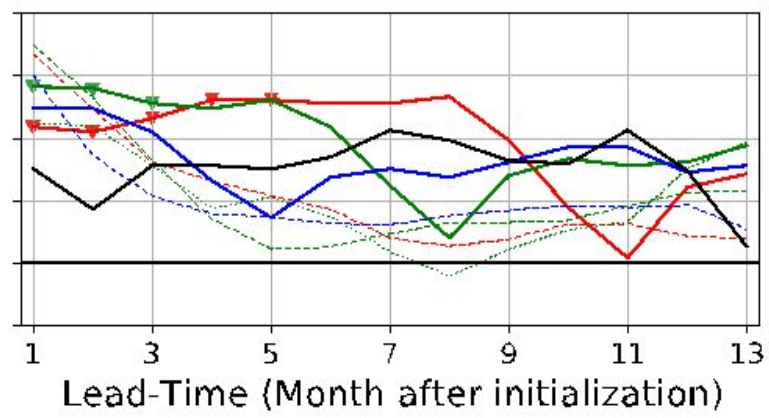
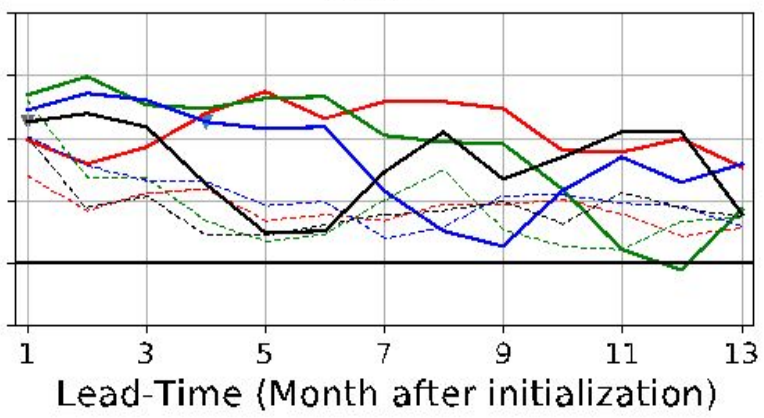
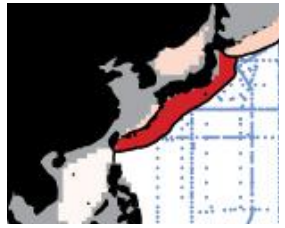




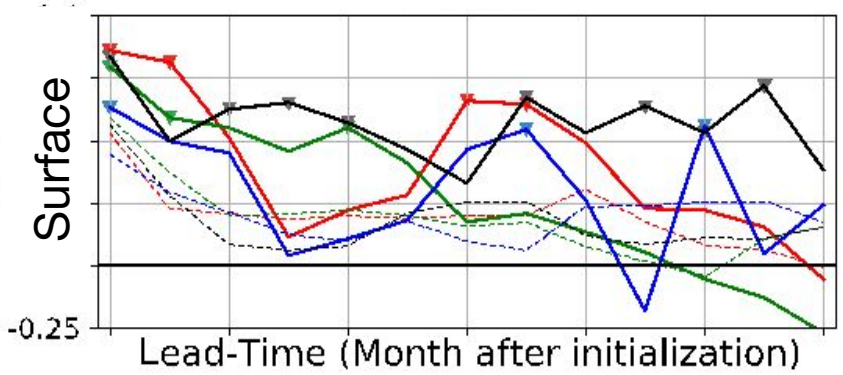


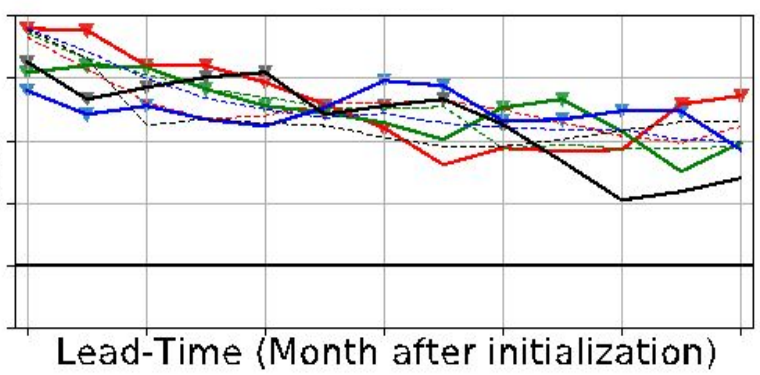
Kuroshio Current

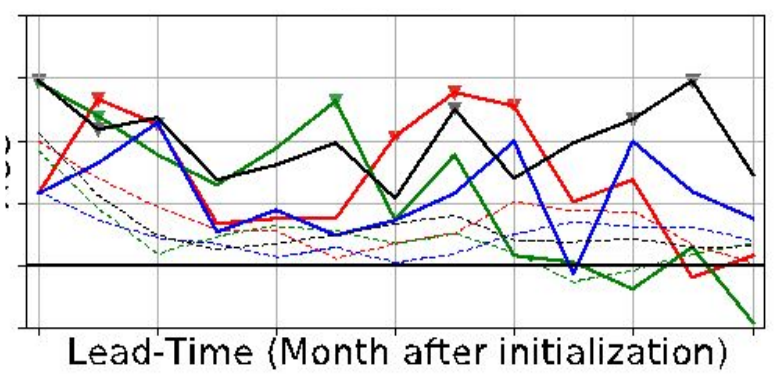


Temperature | Carbon | Oxygen

ACC Surface







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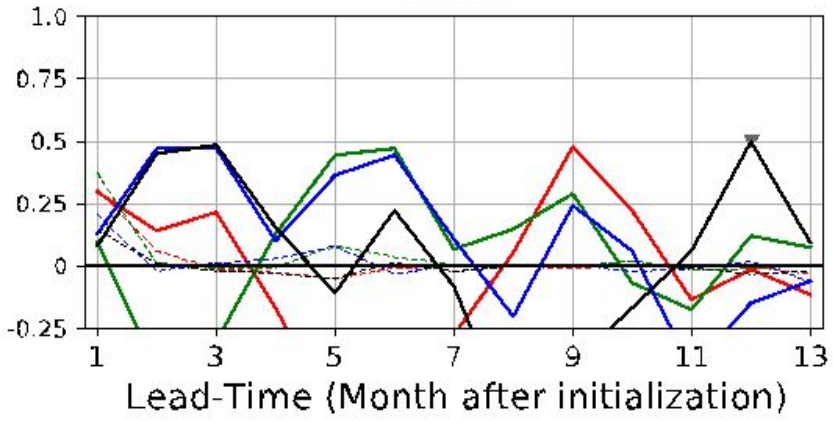
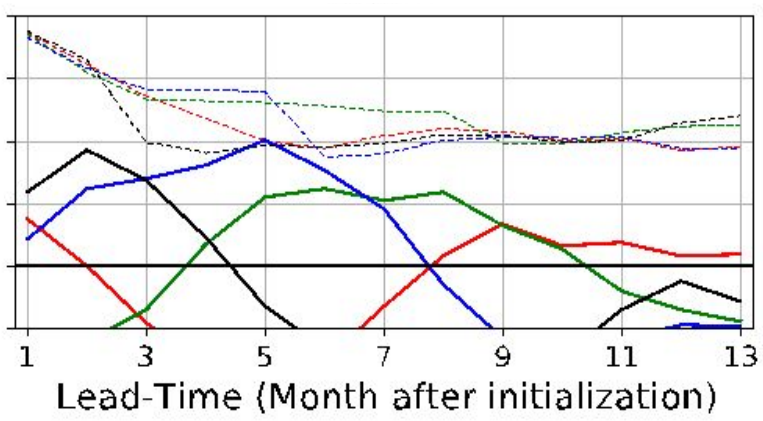
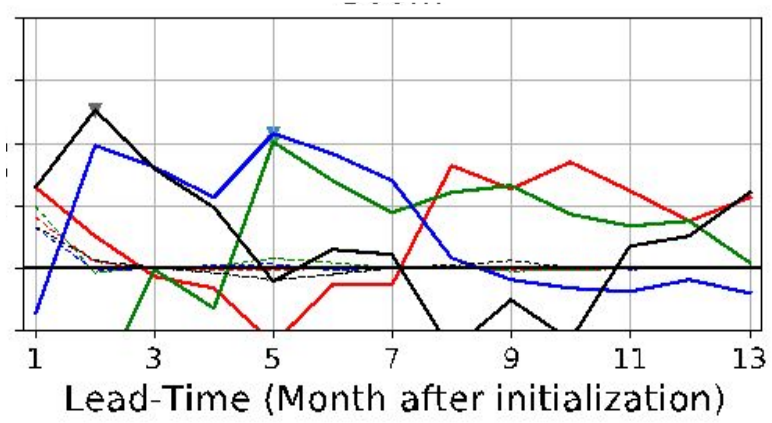
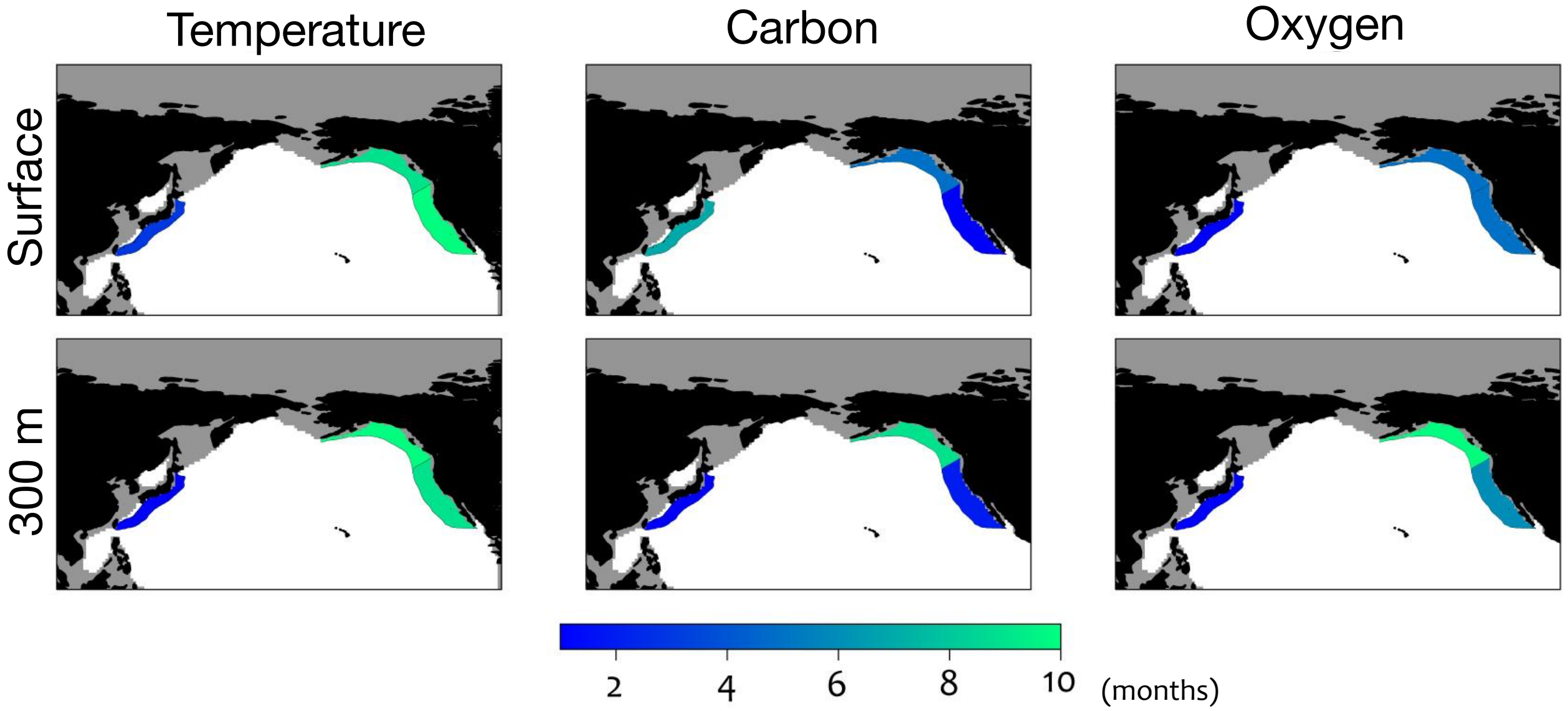


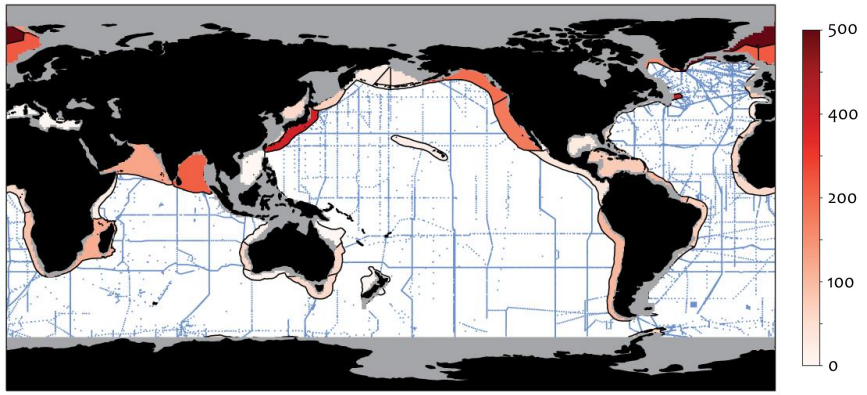




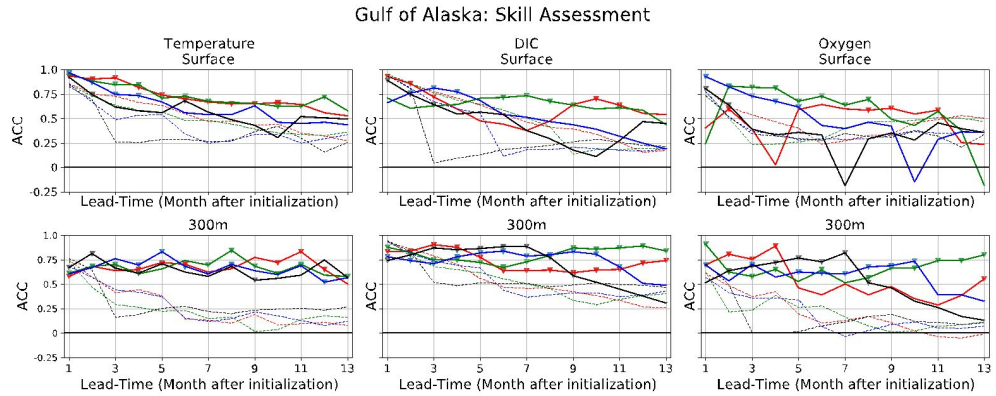
Long-lasting skill in the North Pacific



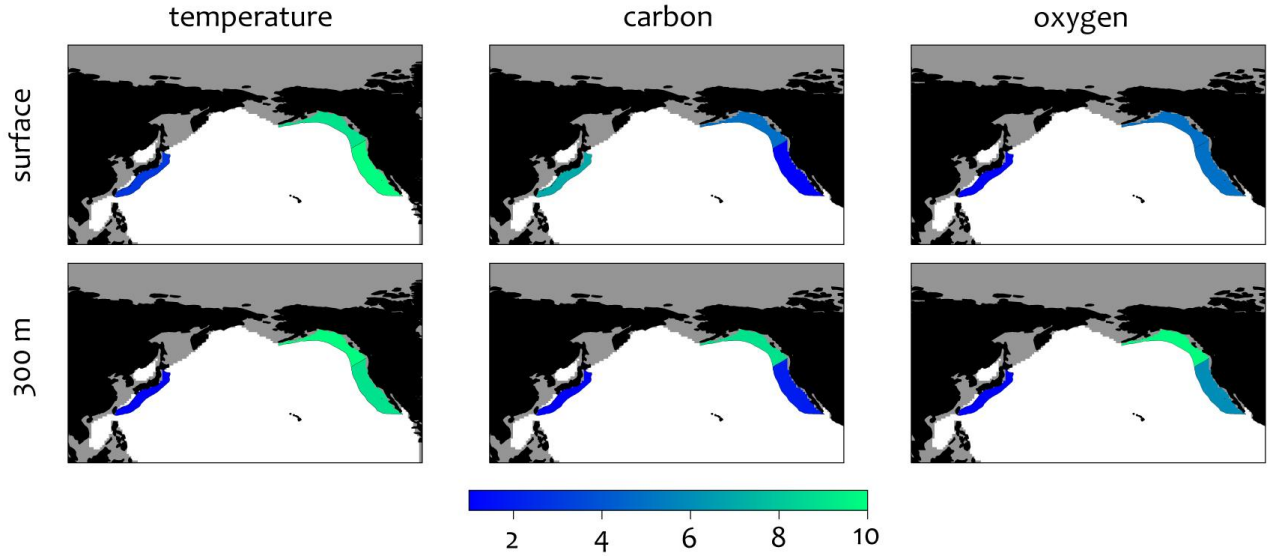
Conclusions



Novel observational products allow us to validate subsurface predictions of biogeochemistry for the first time



CESM SMYLE accurately predicts surface and subsurface marine stressors



We have up to 10 months of useful forecast in important LMEs

Want to learn more?

manuscript submitted to *Earth's Future*

Skillful predictions of multiple marine stressors in the surface and subsurface ocean

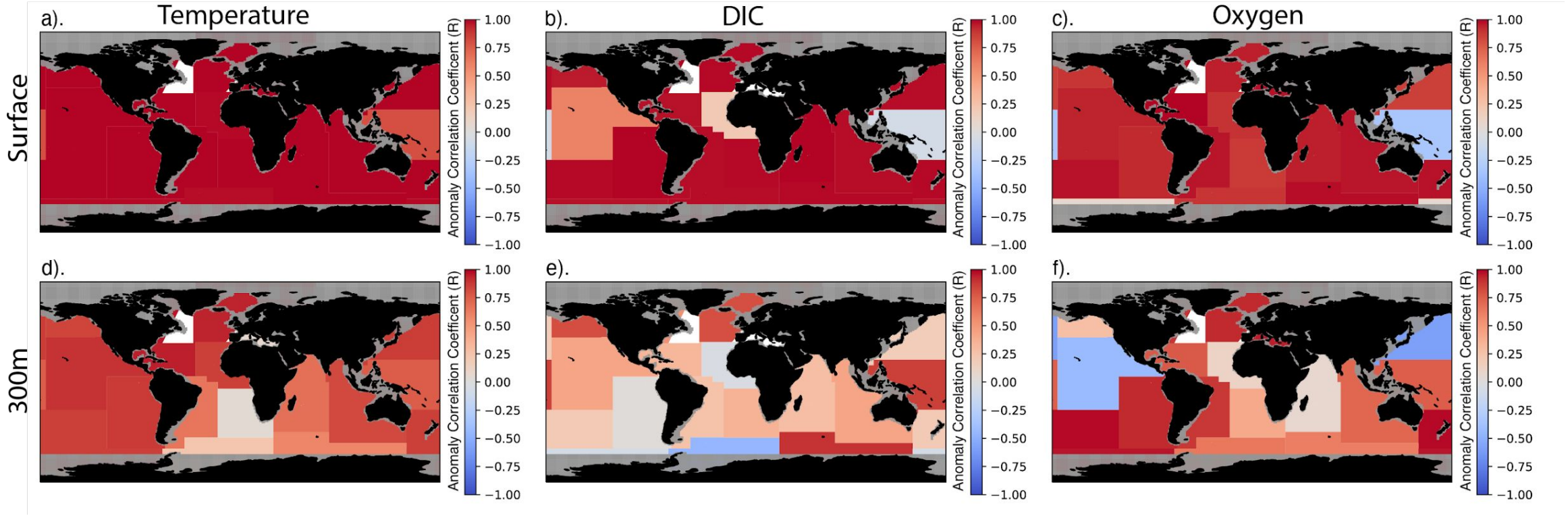
Samuel C. Mogen[1], Nicole S. Lovenduski[1], Stephen Yeager [2], Lydia Keppler[3], Jonathan Sharp[4], Steven J. Bograd[5], Nathali Cordero Quiros[5,7], Emanuele Di Lorenzo[8], Elliott L. Hazen[5], Michael G. Jacox[5,6], Mercedes Pozo Buil[5,7]

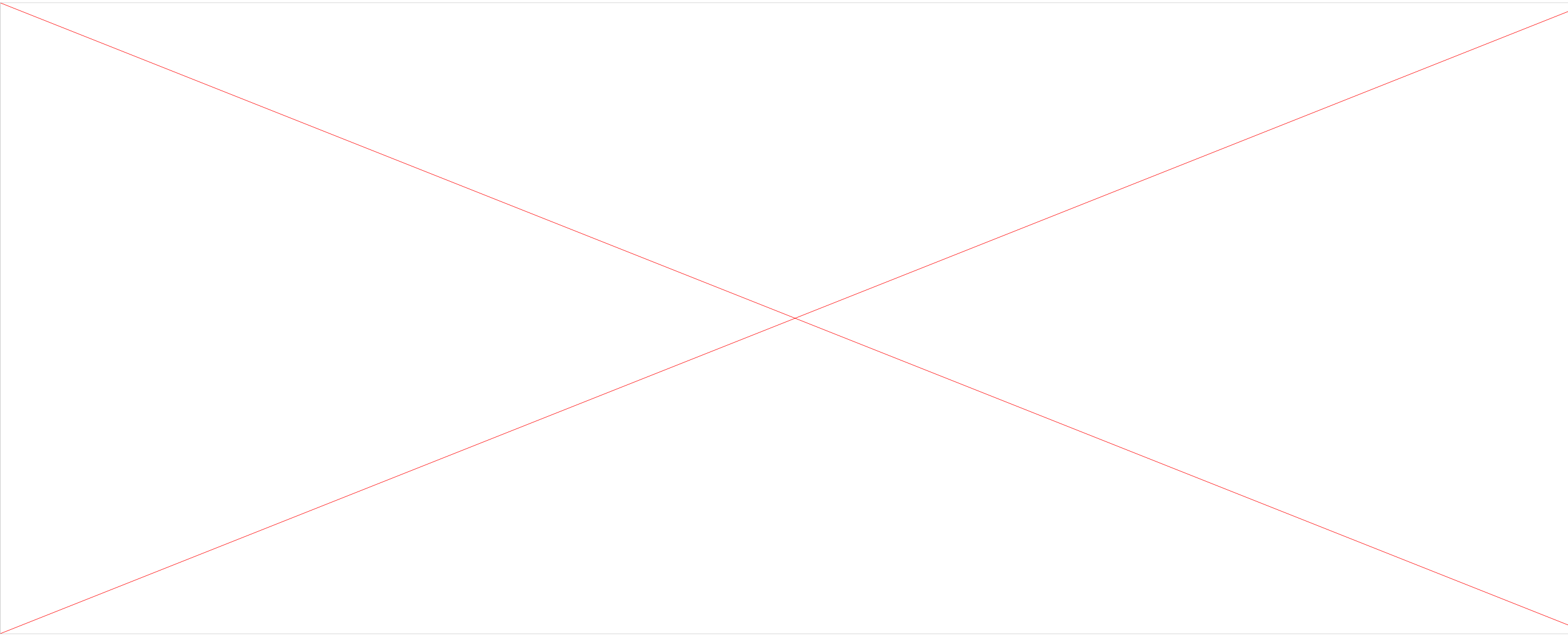
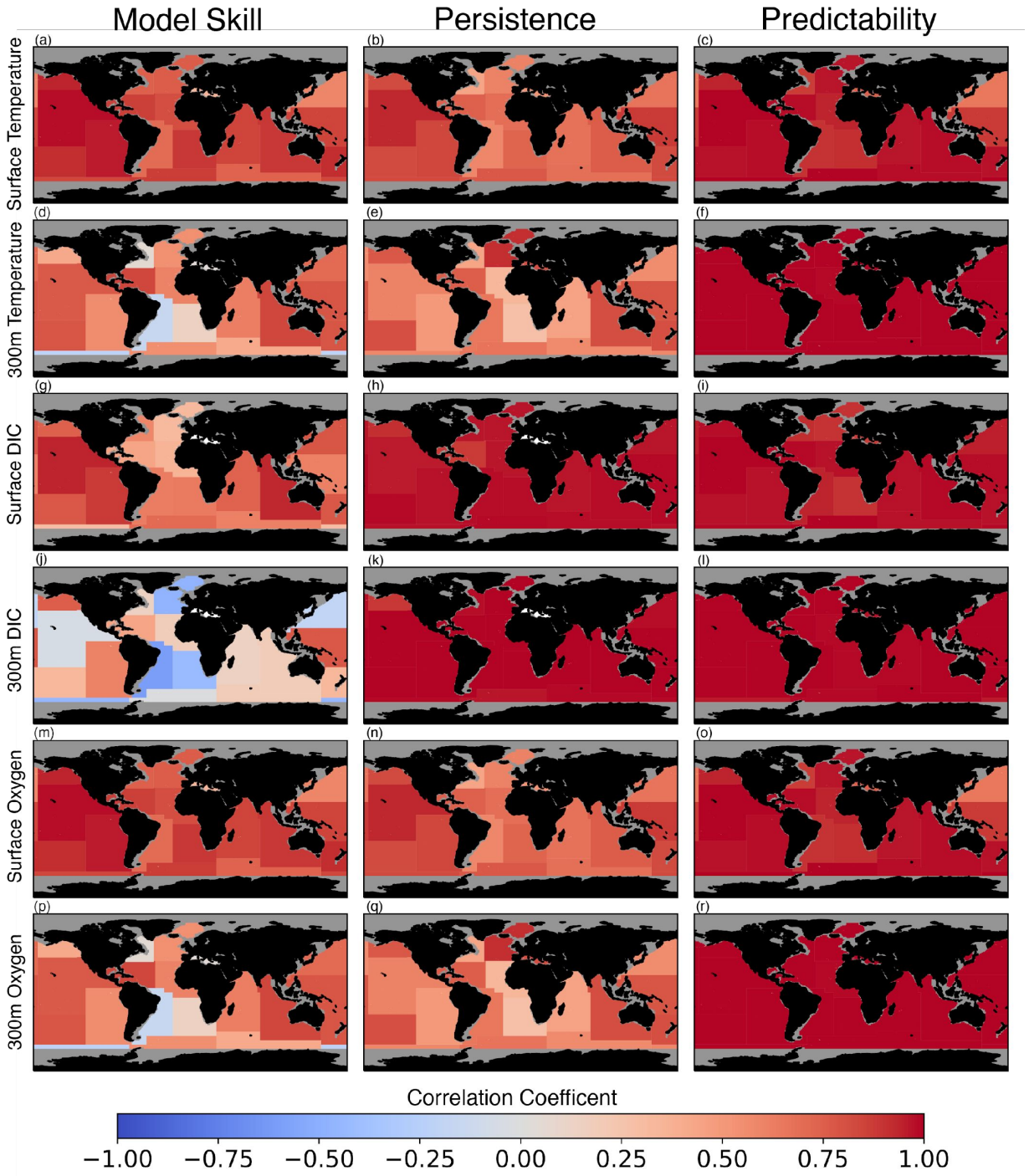
[1]Department of Atmospheric and Oceanic Sciences and Institute of Arctic and Alpine Research, University of Colorado, Boulder, CO, USA
[2]National Center for Atmospheric Research Climate and Global Dynamics Lab, Boulder, CO, USA
[3]Scripps Institution of Oceanography, La Jolla, CA, USA
[4]National Oceanic and Atmospheric Administration Pacific Marine Environmental Lab, Seattle, WA, USA
[5]National Oceanic and Atmospheric Administration Southwest Fisheries Science Center, Monterey, CA, USA
[6]National Oceanic and Atmospheric Administration Physical Sciences Laboratory, Boulder, CO, USA
[7]Institute of Marine Sciences, University of California, Santa Cruz, CA, USA
[8]School of Earth and Atmospheric Science, Georgia Tech, Atlanta, GA, USA

Mogen et al., in prep. for Earth's Future

Backup slides

Validation of seasonal climatology (FOSI vs Obs)





Model Skill, Persistence and Predictability at the first lead-time