Dynamically Downscaled Regional Projections of Ocean Acidification in the Main Hawaiian Islands

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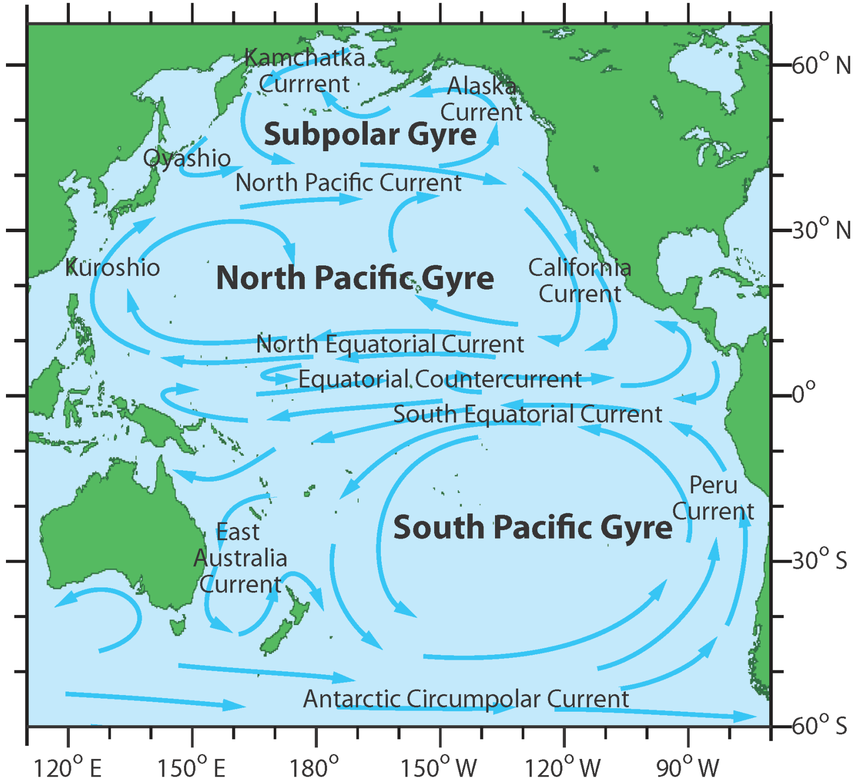
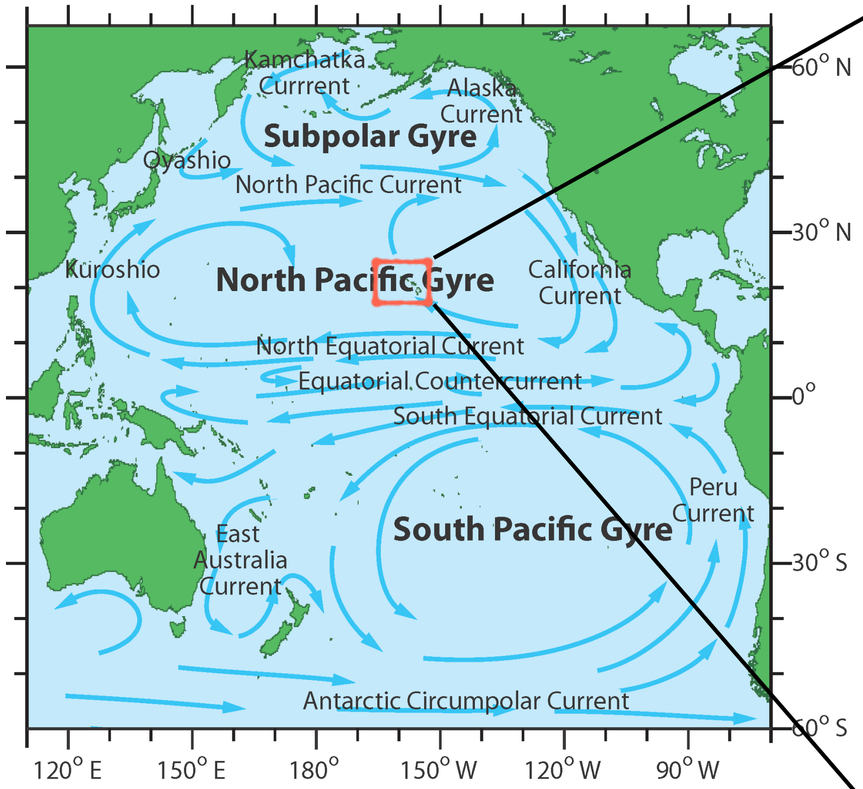
Ke Kulanui o Hawai'i ma Mānoa

Main Hawaiian Islands



Oceans of Data Institute, https://oceantracks.org

Main Hawaiian Islands



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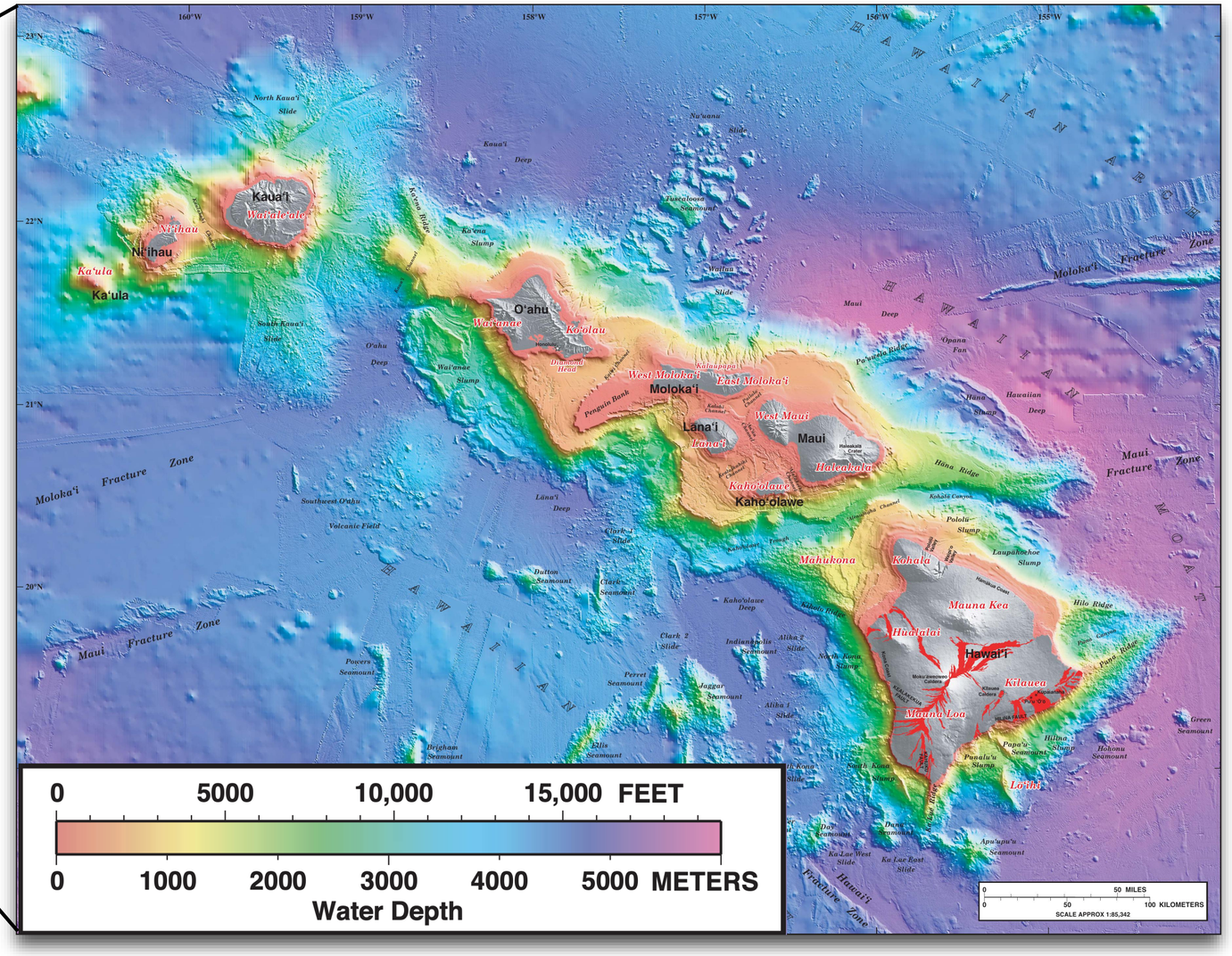
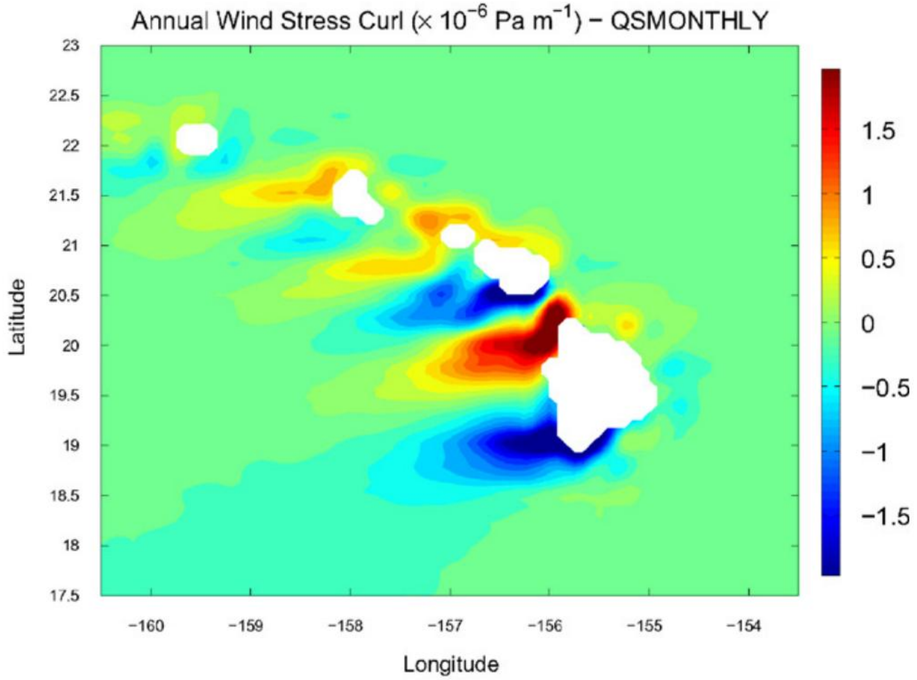
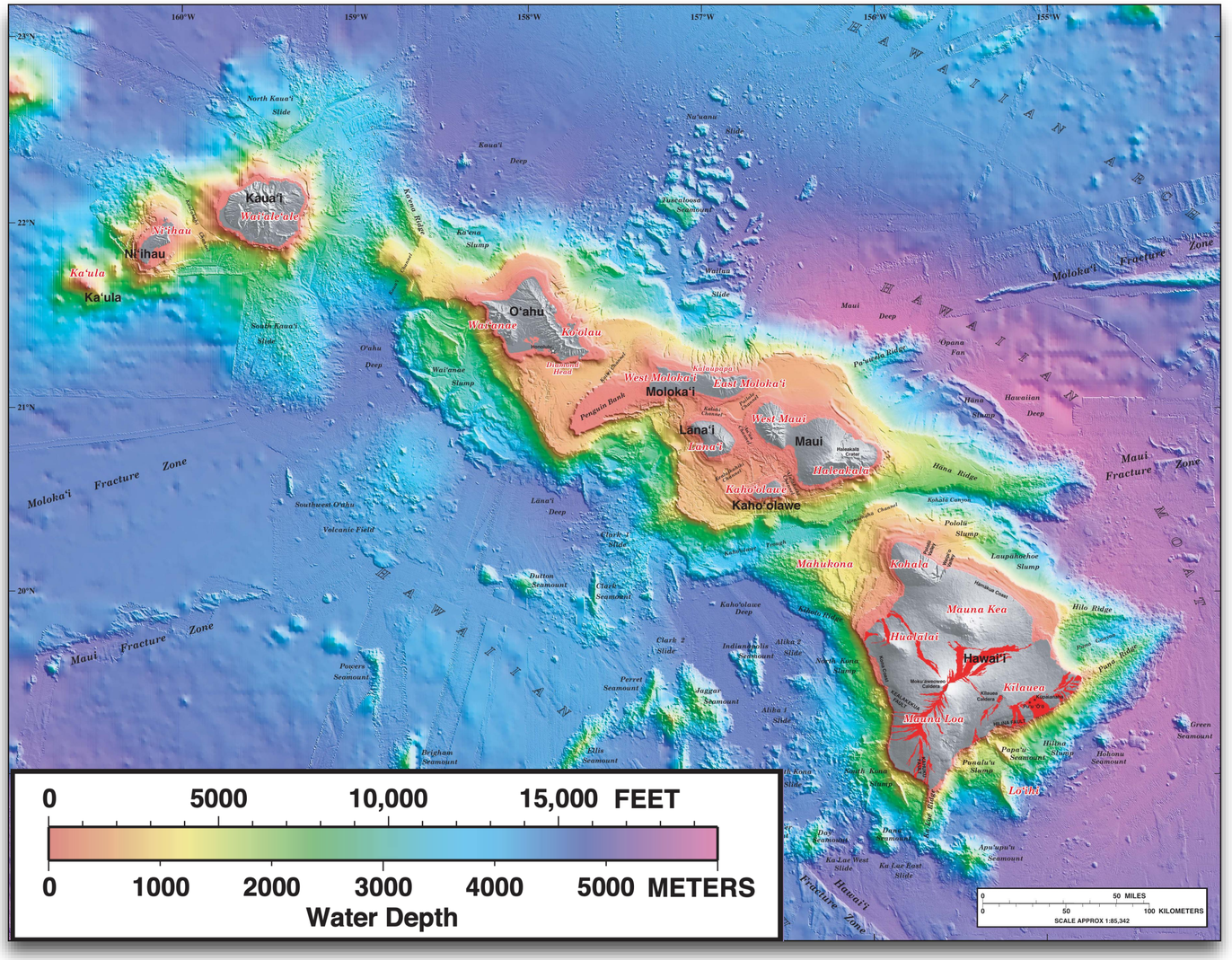


Eakins et al, https://pubs.usgs.gov/imap/2809/

Main Hawaiian Islands



Calil et al. 2008, Deep Sea Research II



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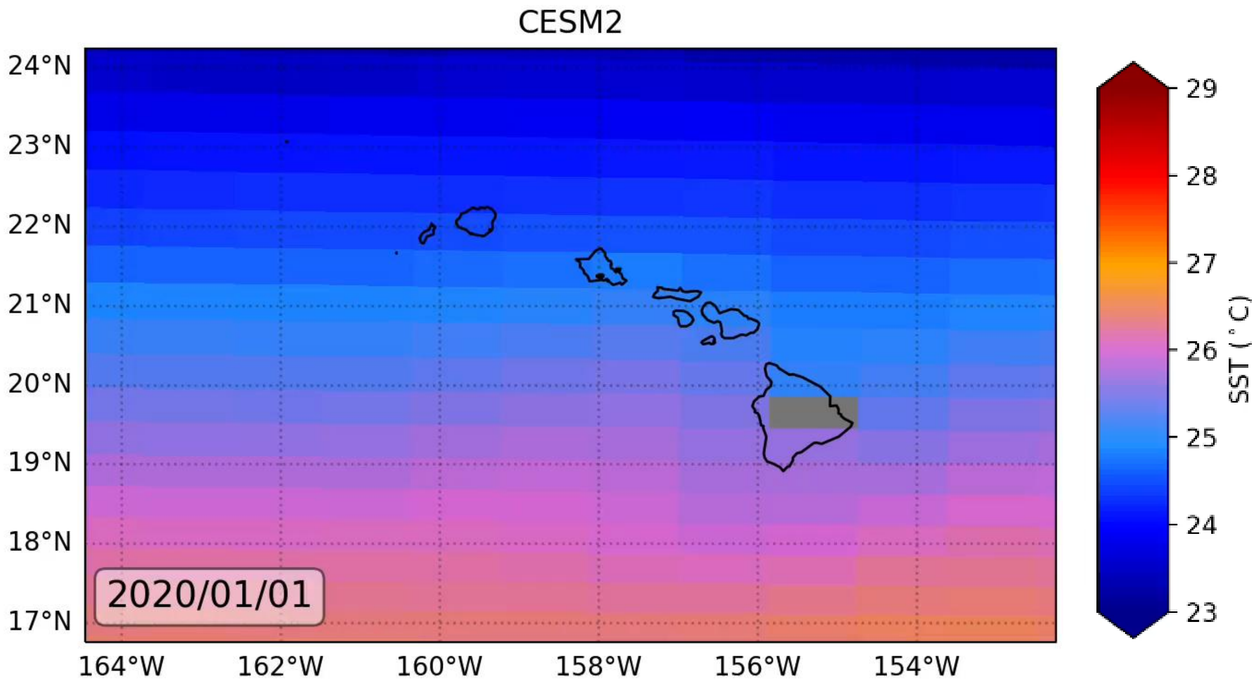
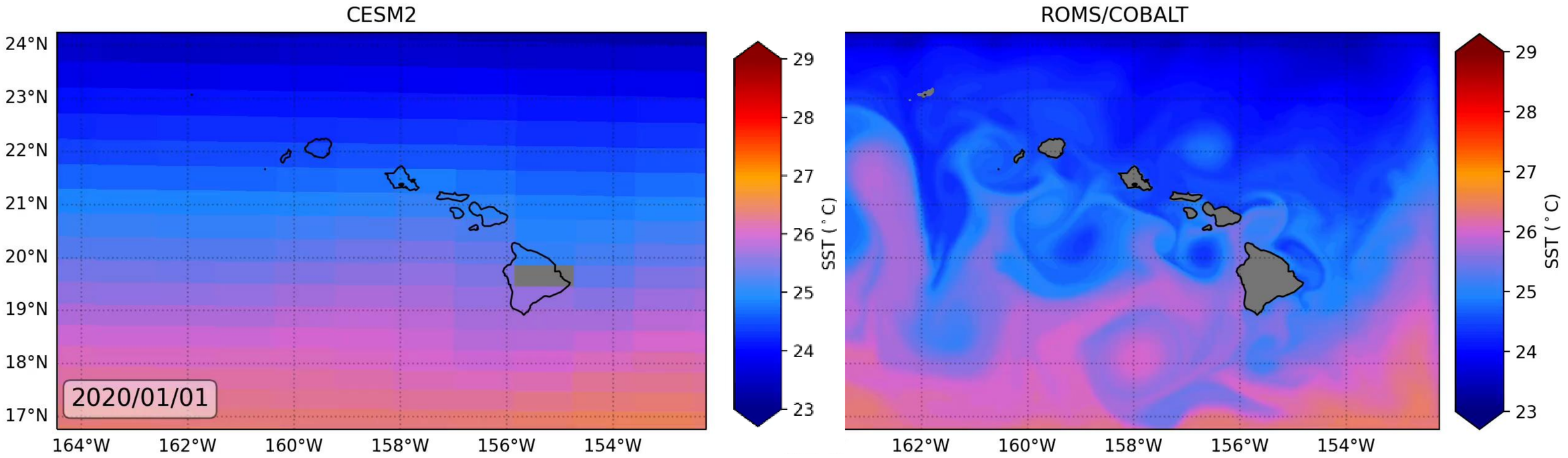
Dynamical downscaling of MHI domain



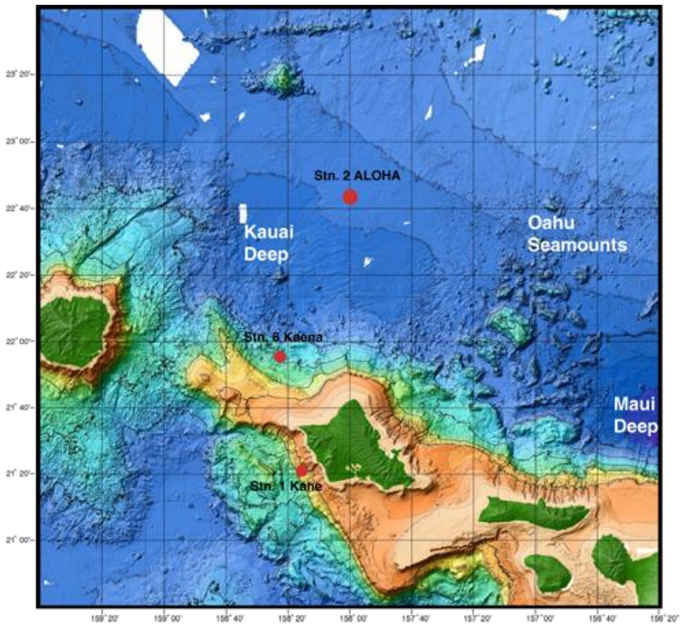
Dynamical downscaling of MHI domain



Friedrich et al. 2024: Submesoscale-permitting physical/biogeochemical future simulations for the main Hawaiian Islands, accepted

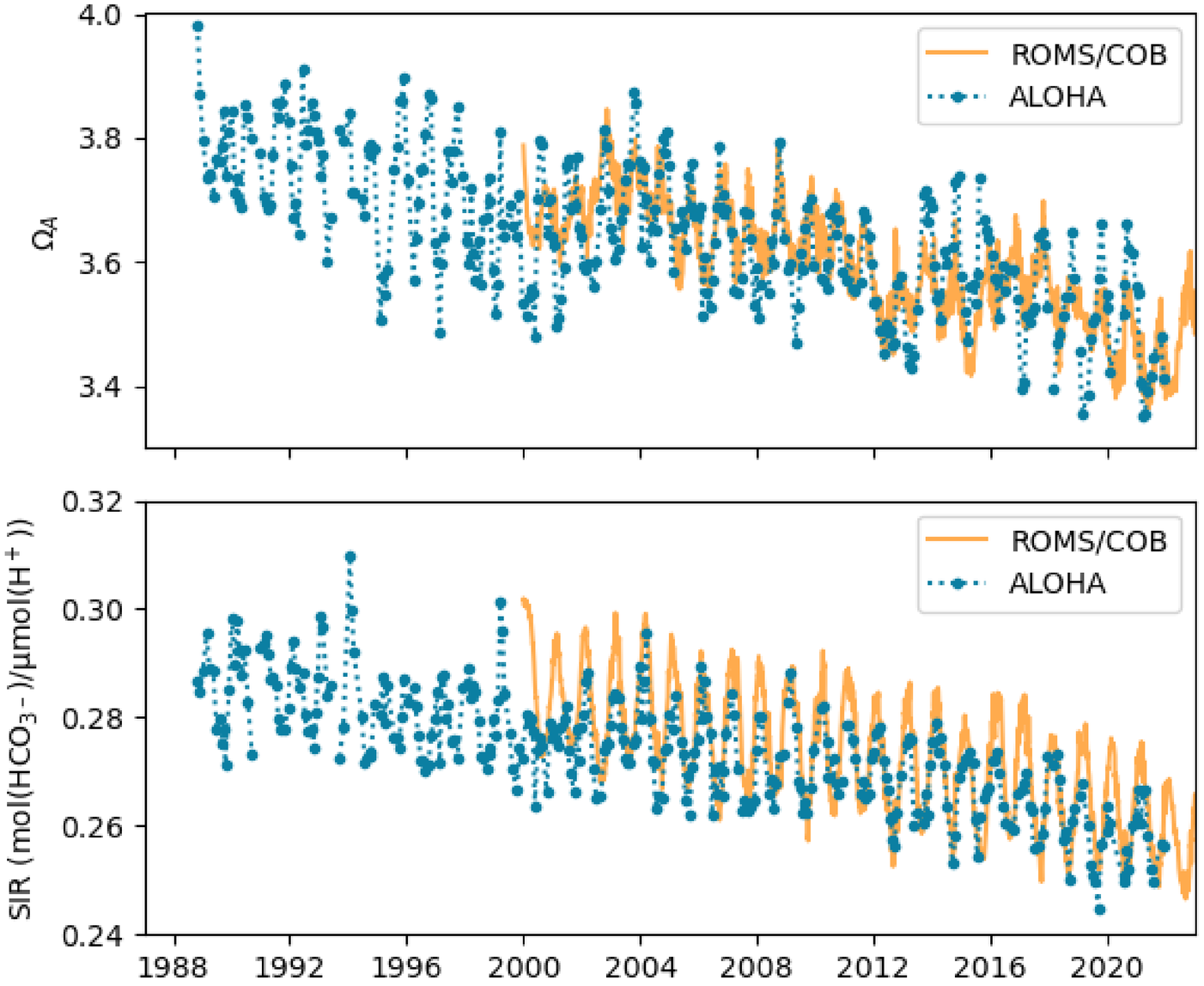
Liu et al. 2023: Climate downscaling for regional models with a neural network: A Hawaiian example

Validation: Hawaiian Ocean Time Series (30 m)

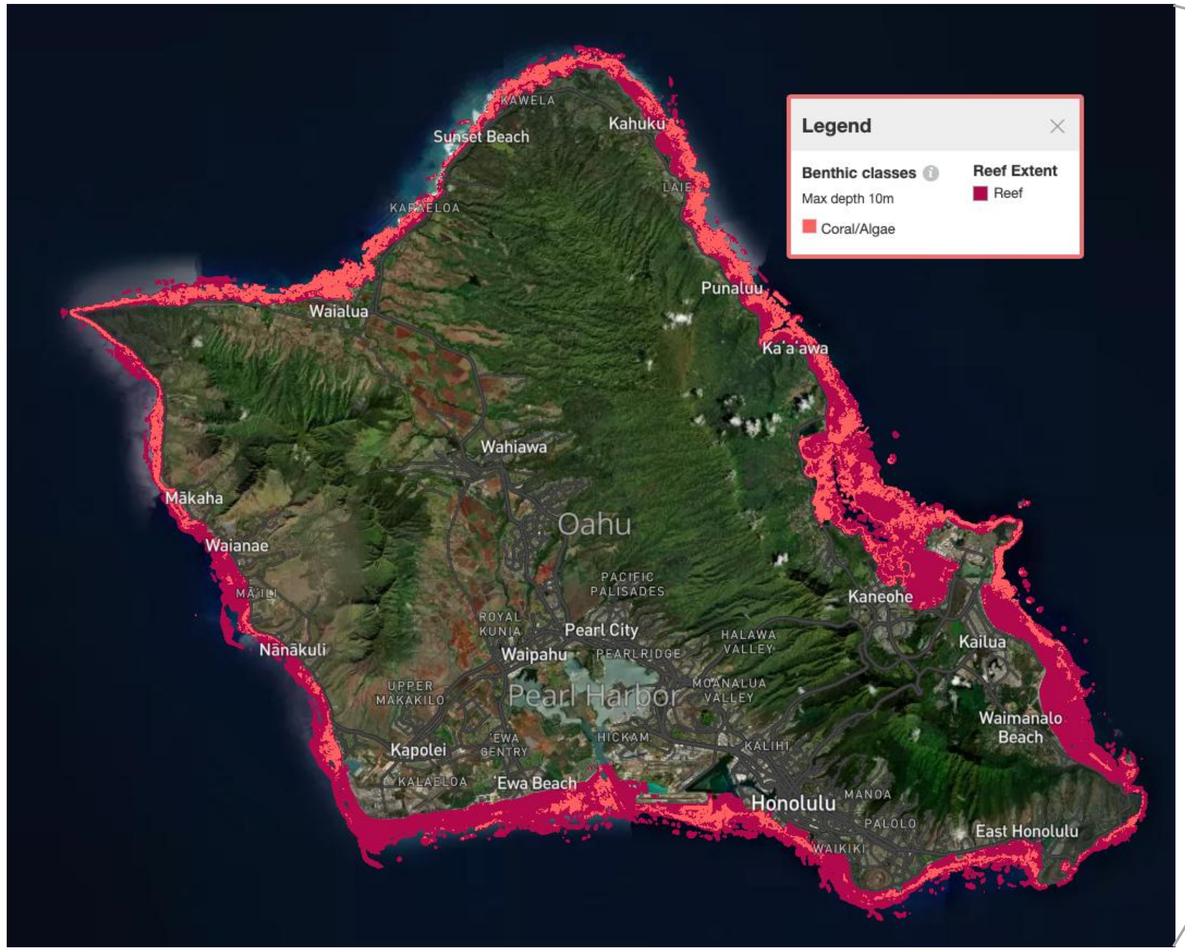


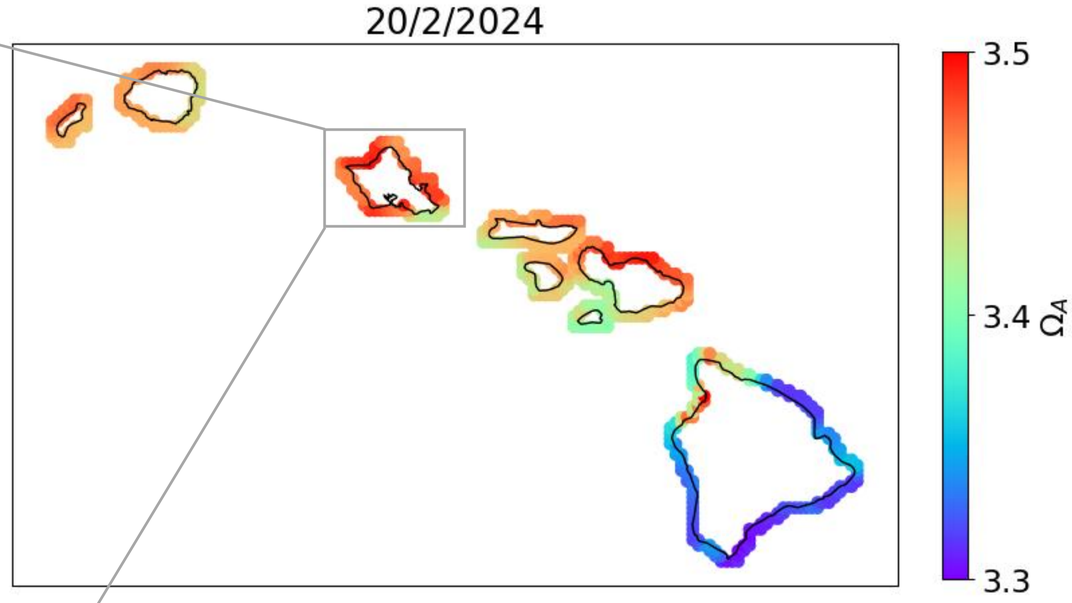
www.soest.hawaii.edu

Parameters: DIC, T, ALK, S



Fringing coral reefs

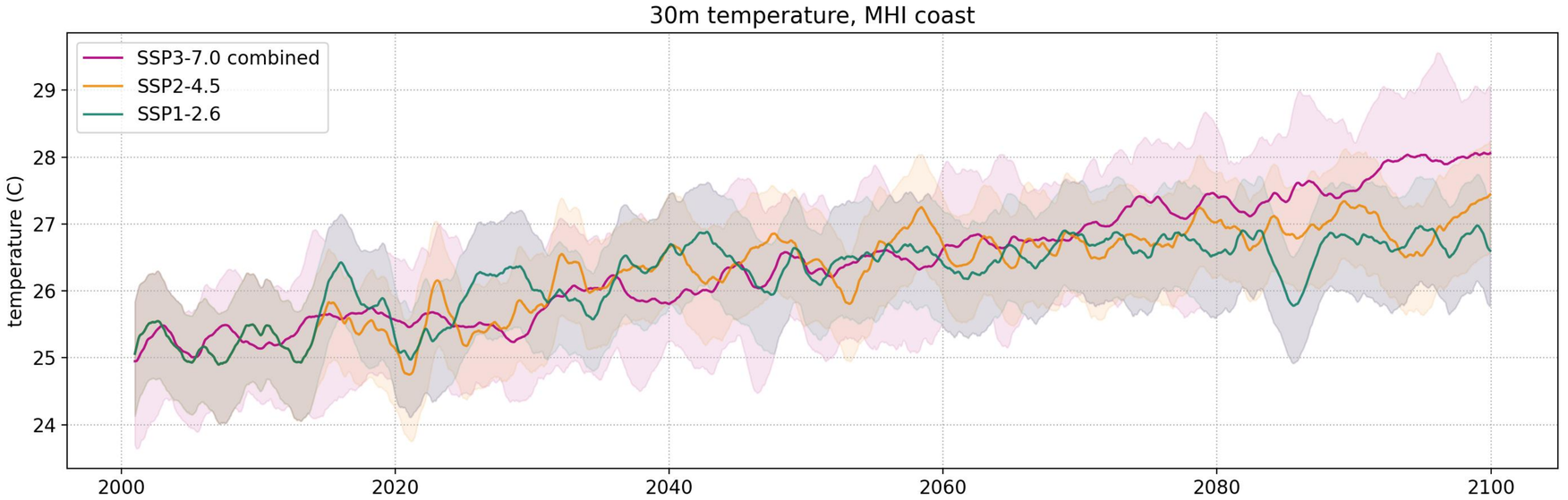


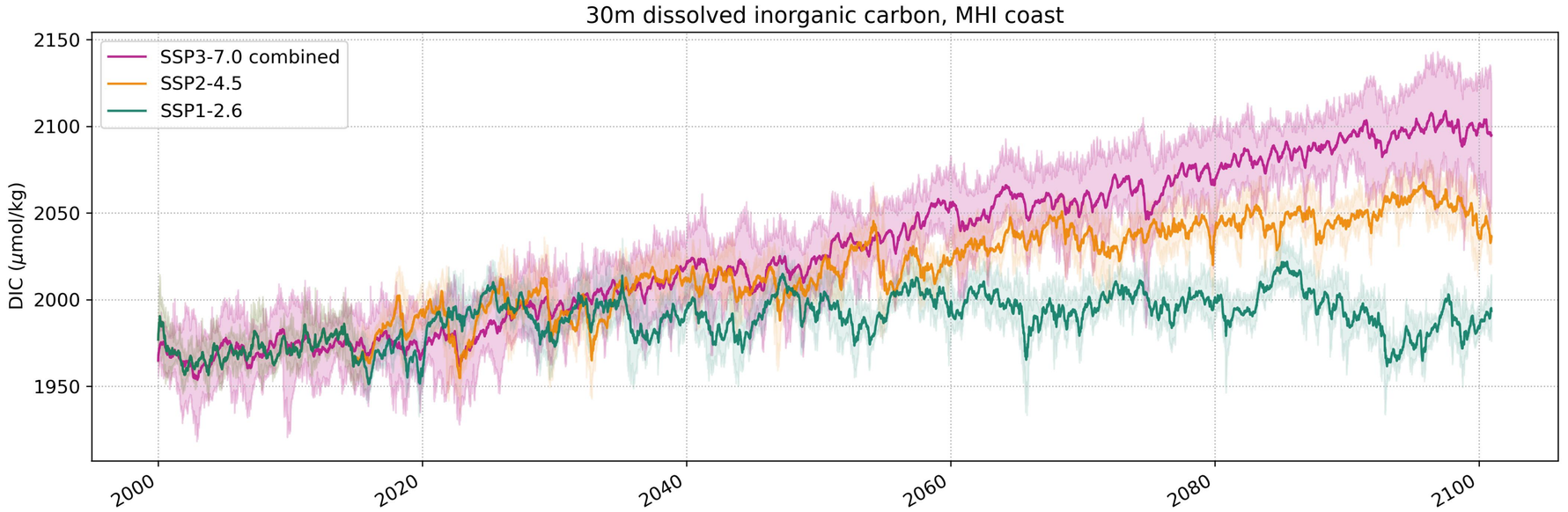


4 km horizontal resolution
~ 500 coastal grid cells

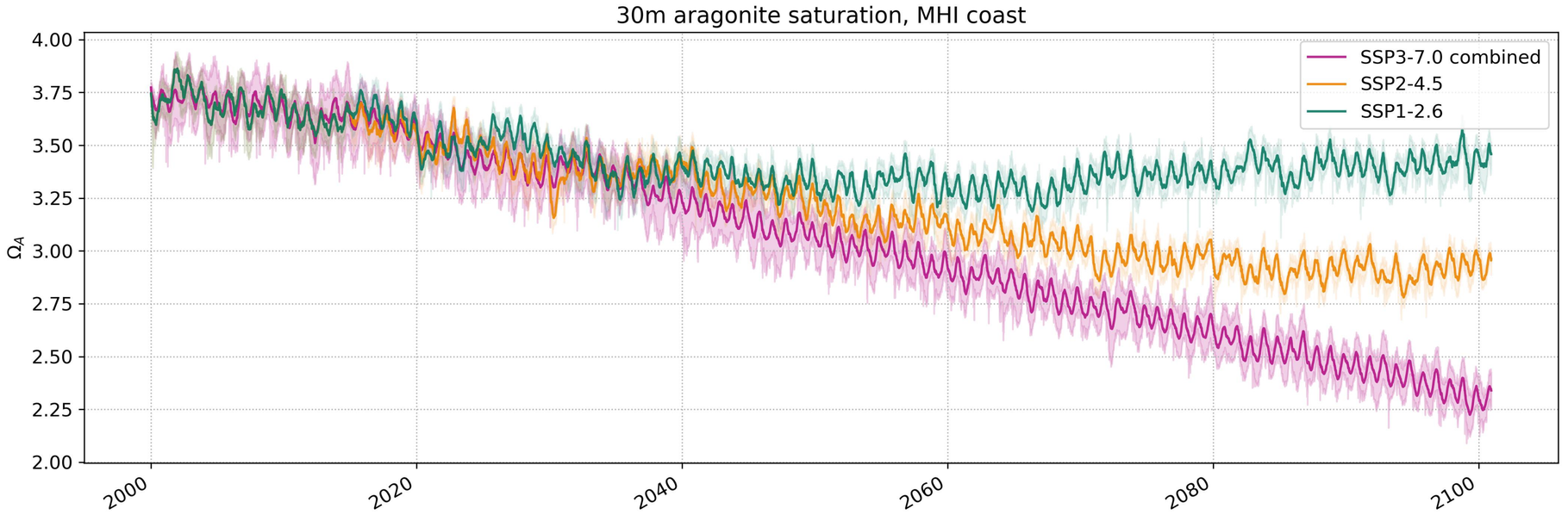
Source: https://allencoralatlas.org/

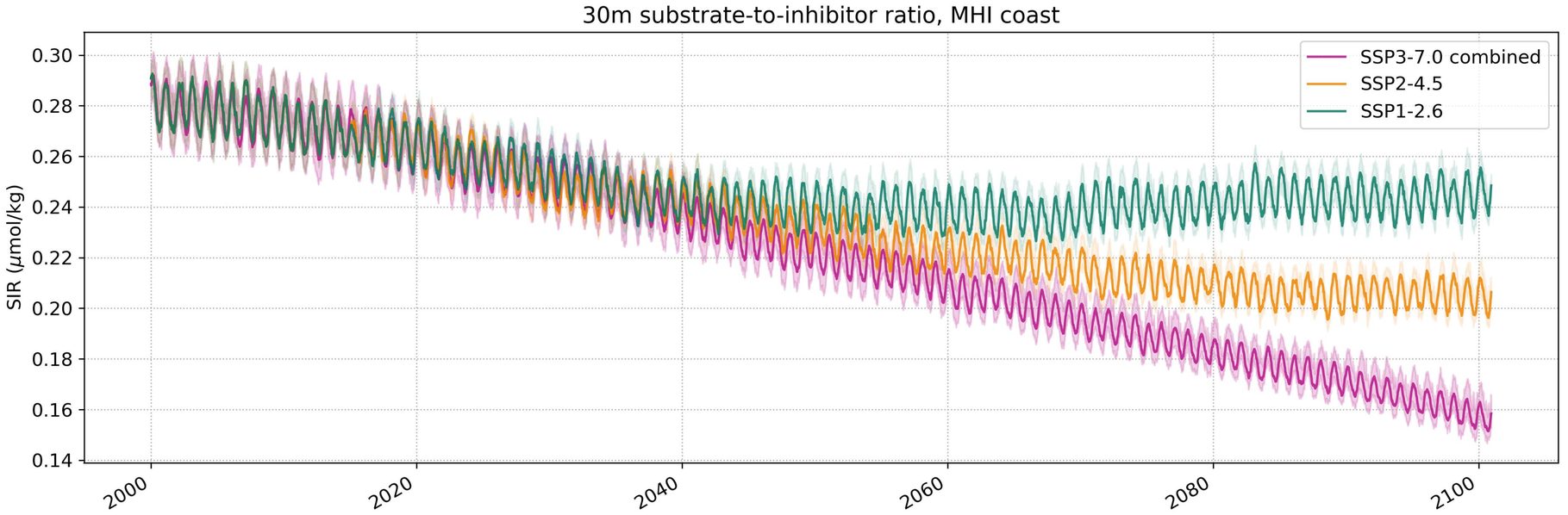
Temperature and DIC trends





CMIP6 coastal trends for ocean acidification





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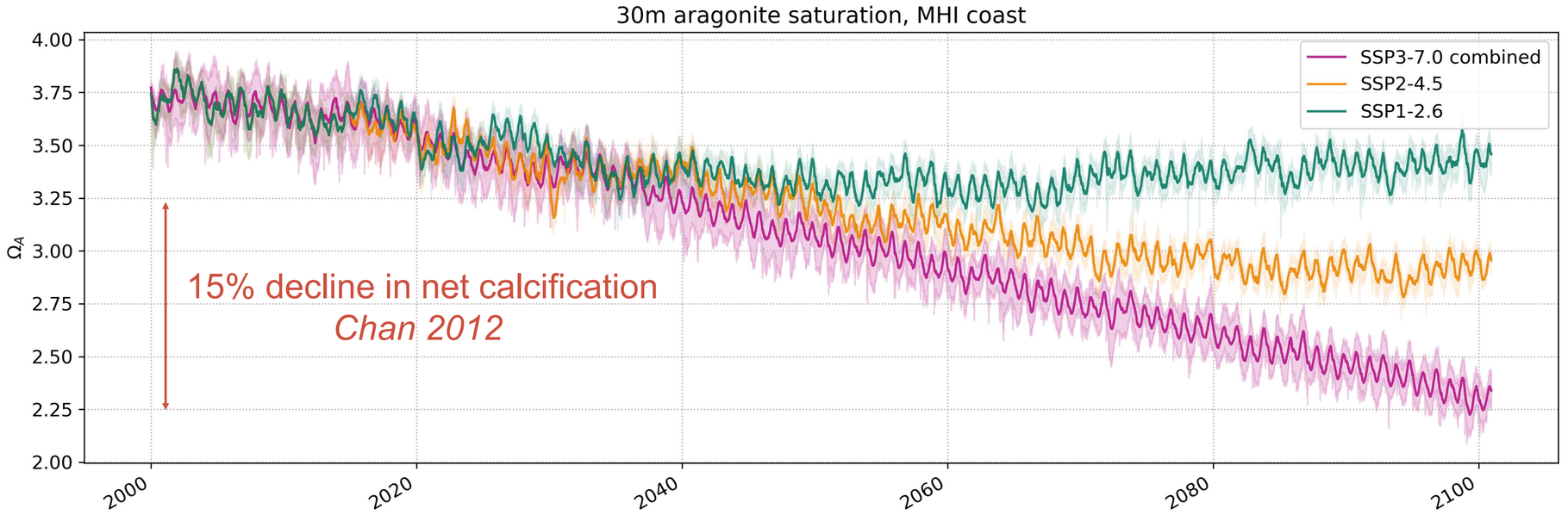

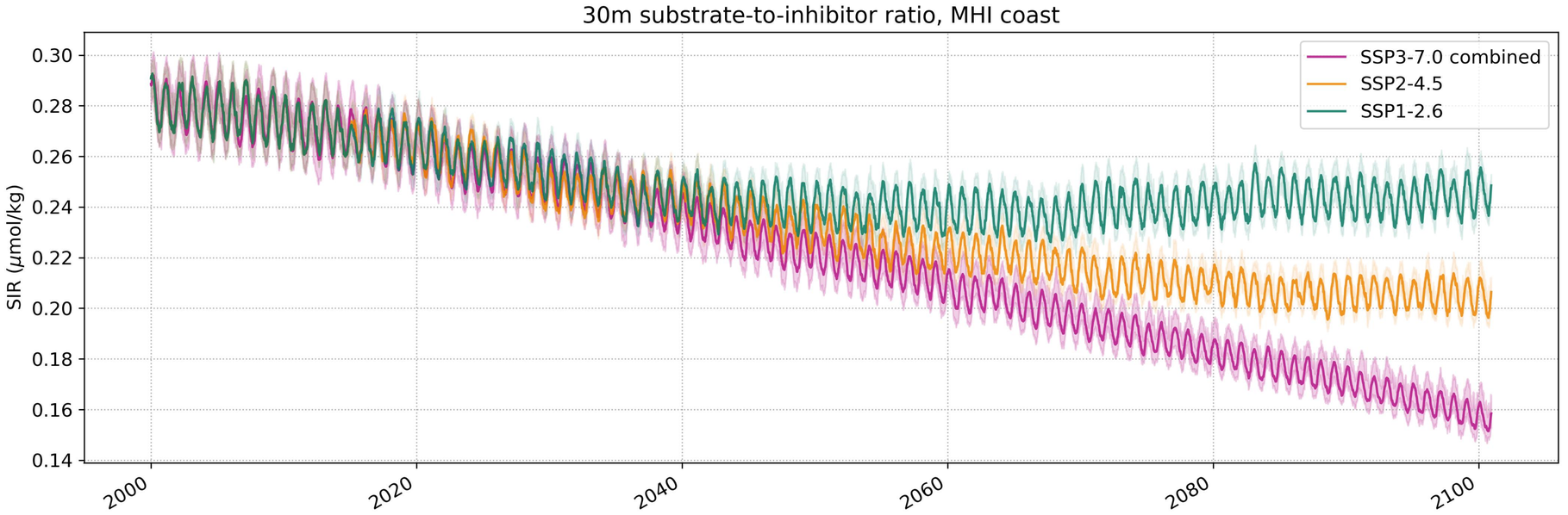

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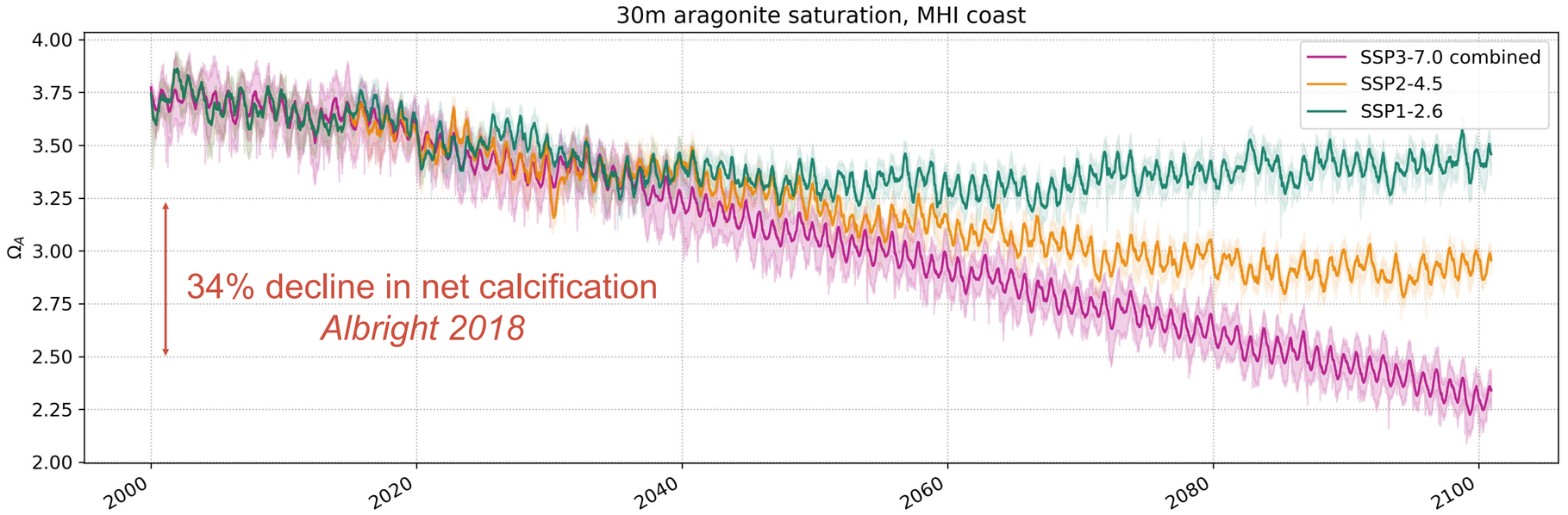

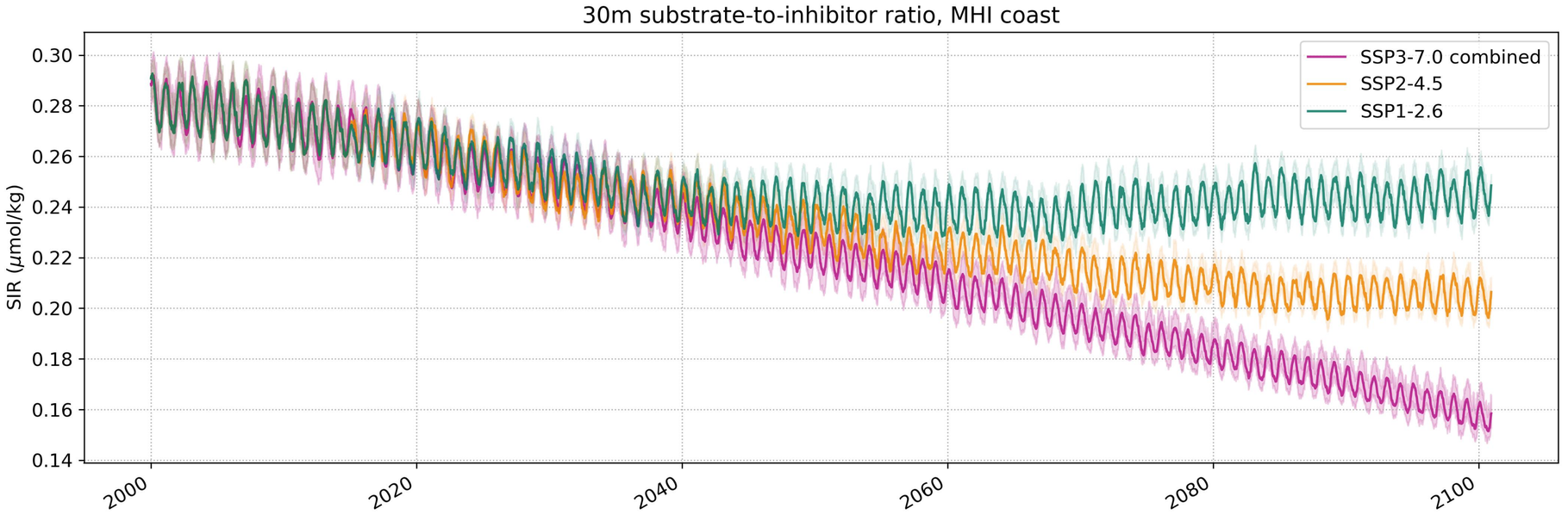

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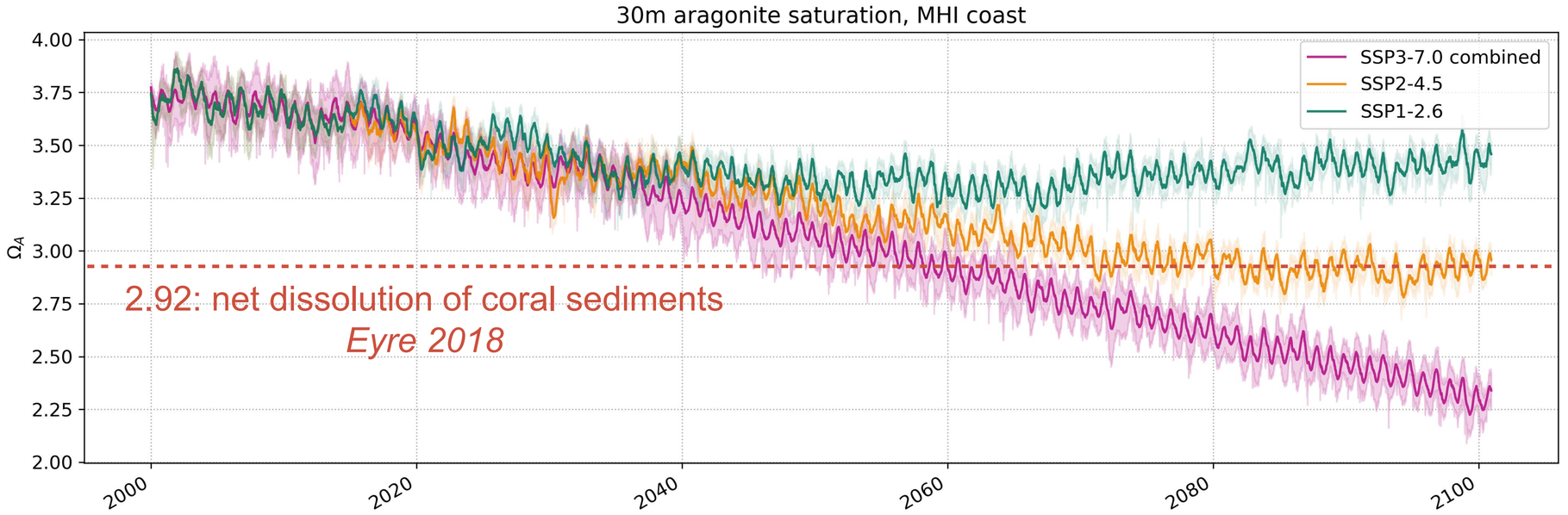
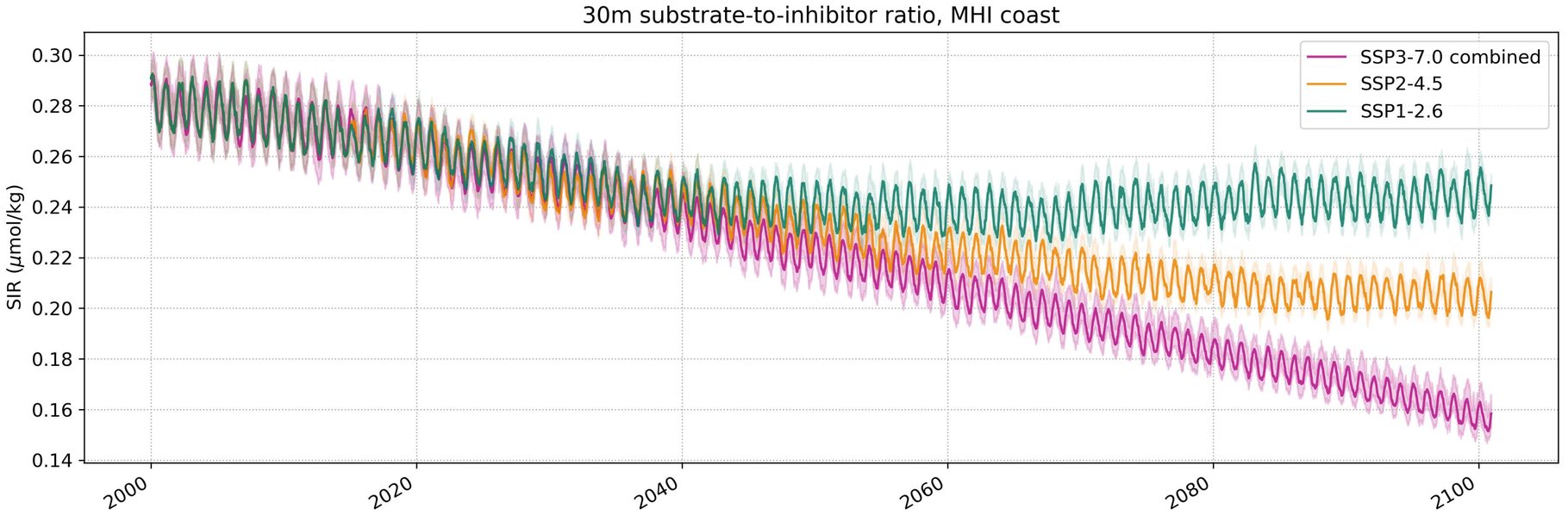
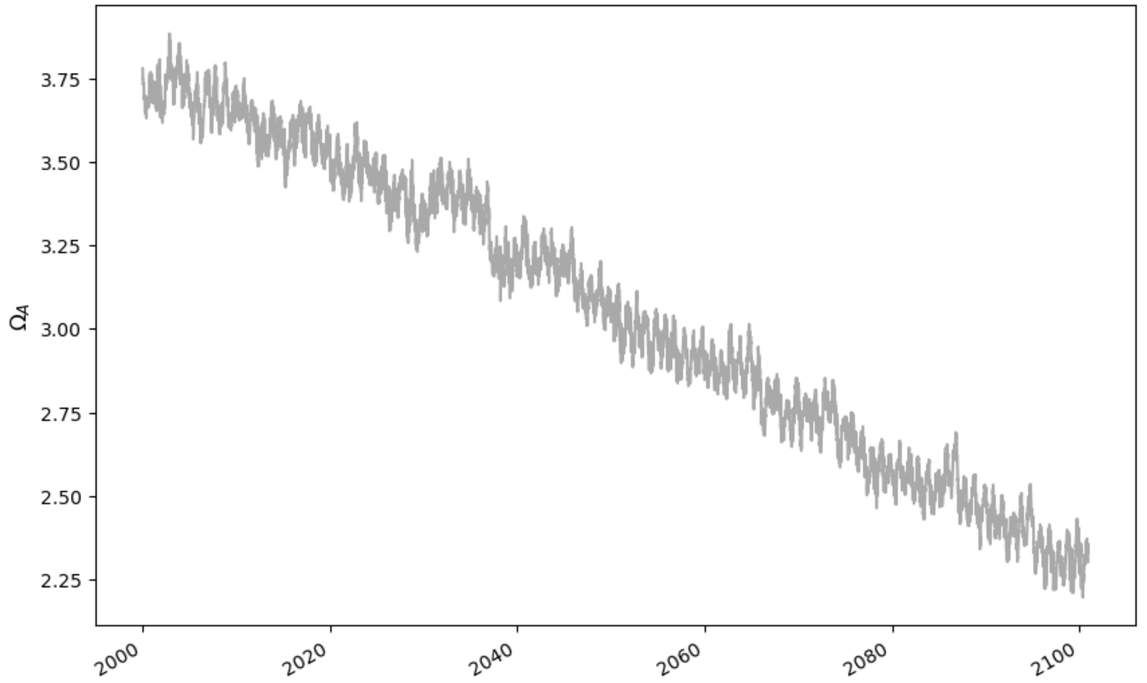
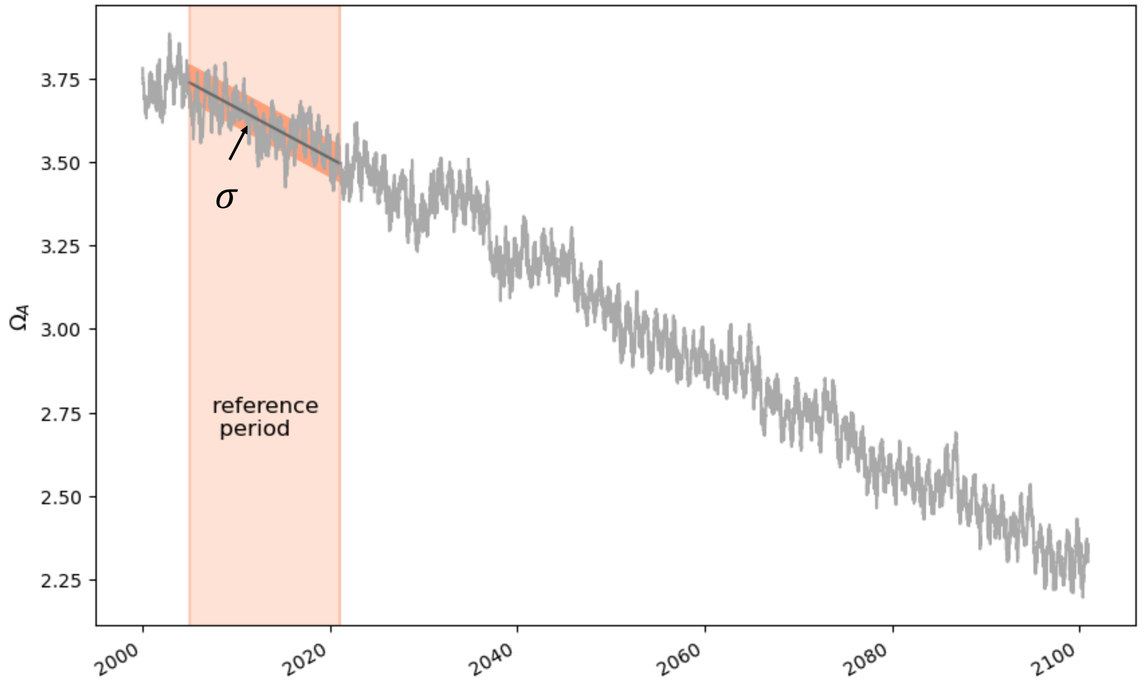




Novelty: departure from historical variability



Novelty: departure from historical variability



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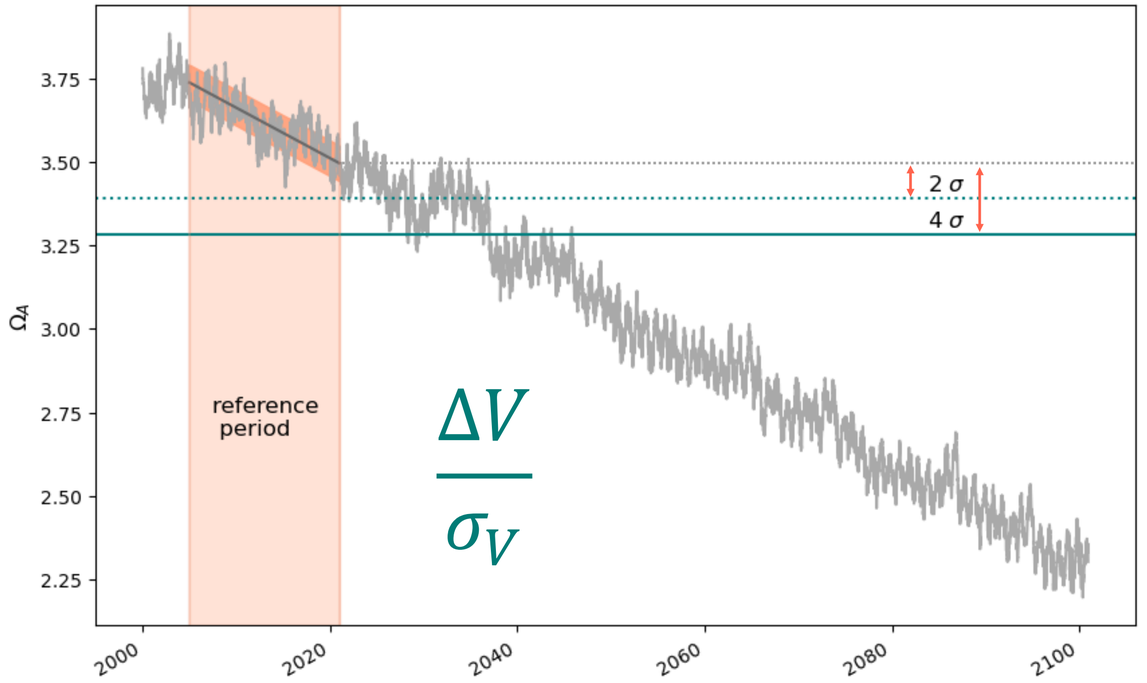

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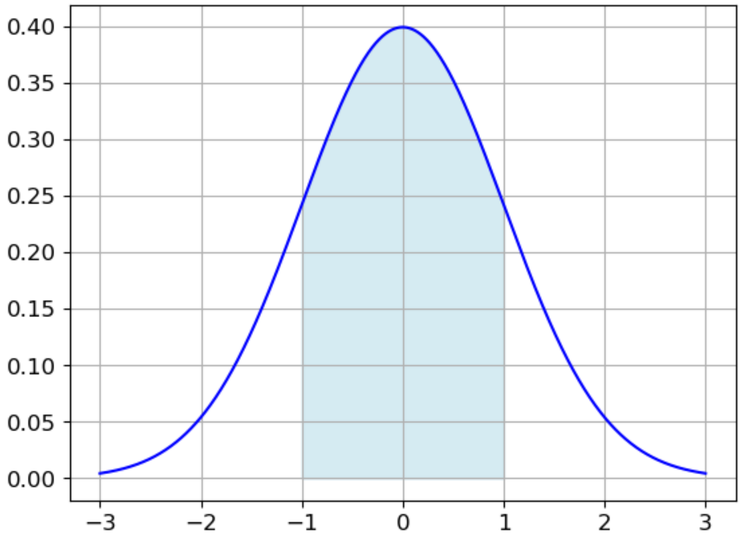

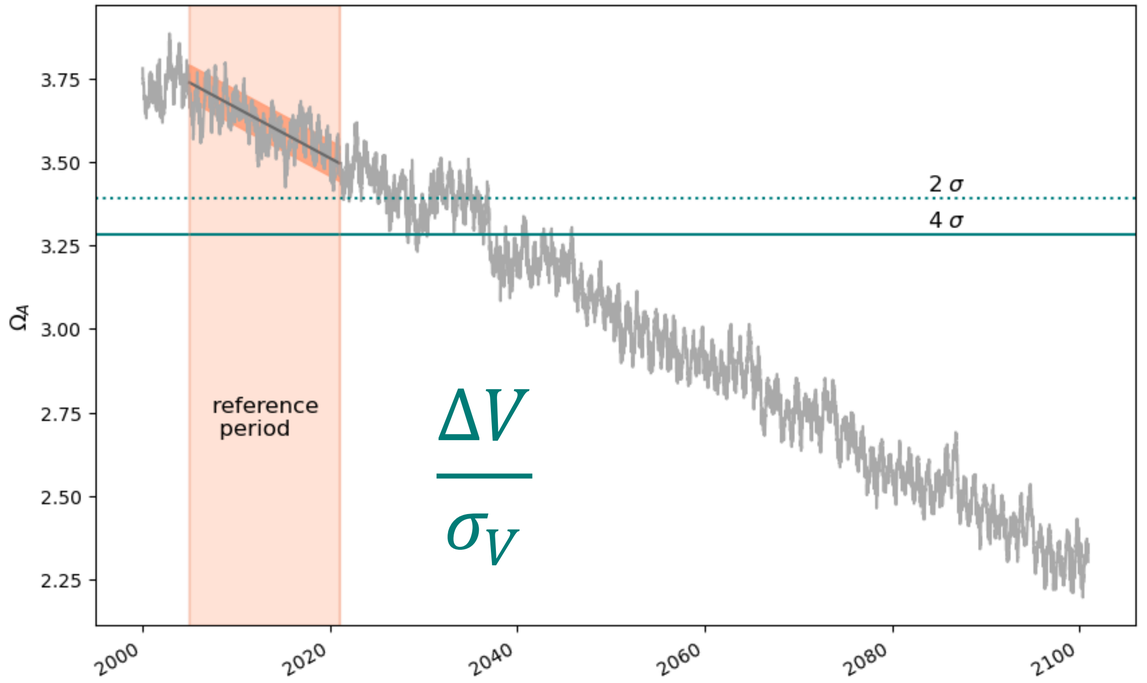

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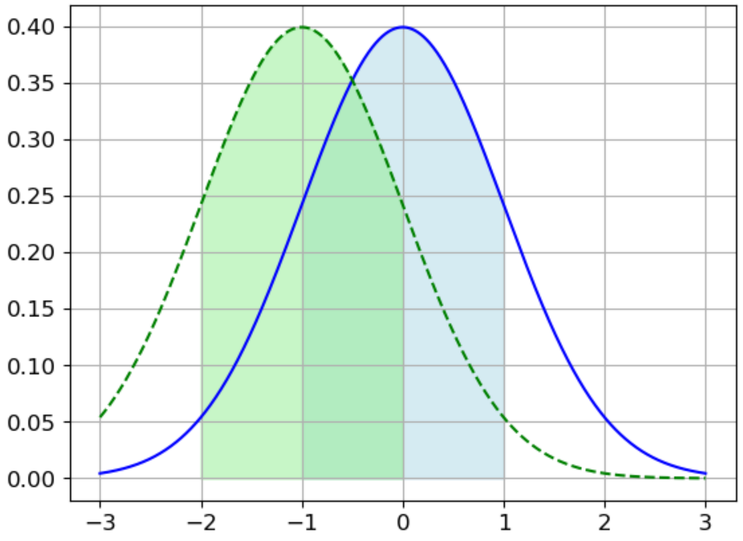

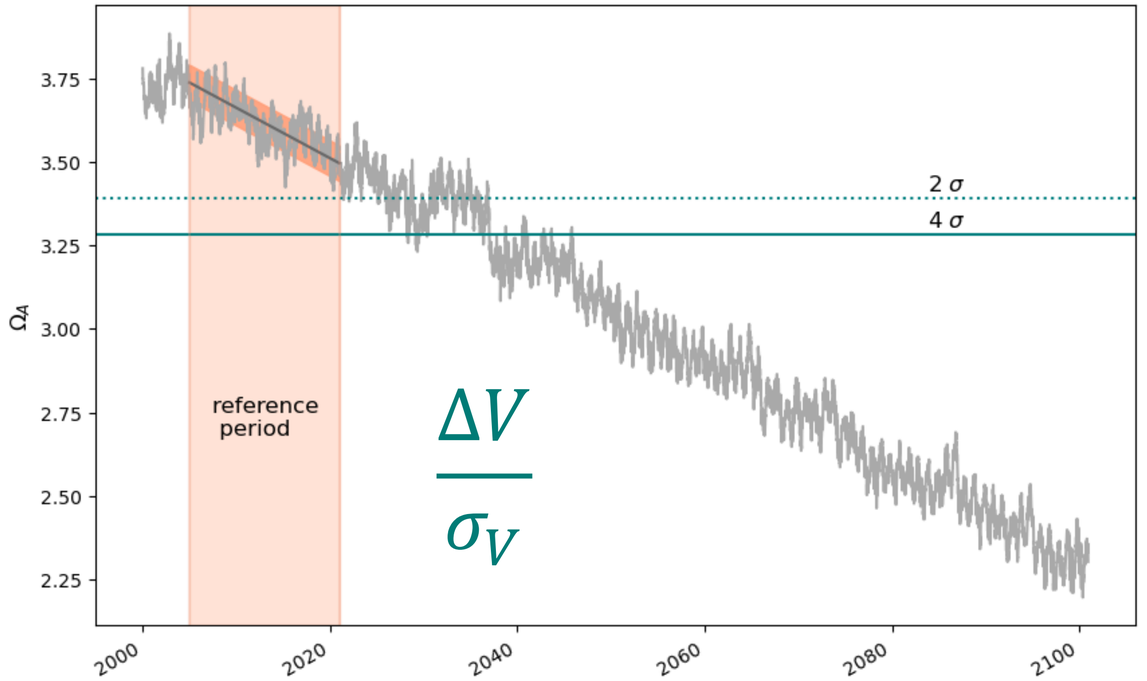

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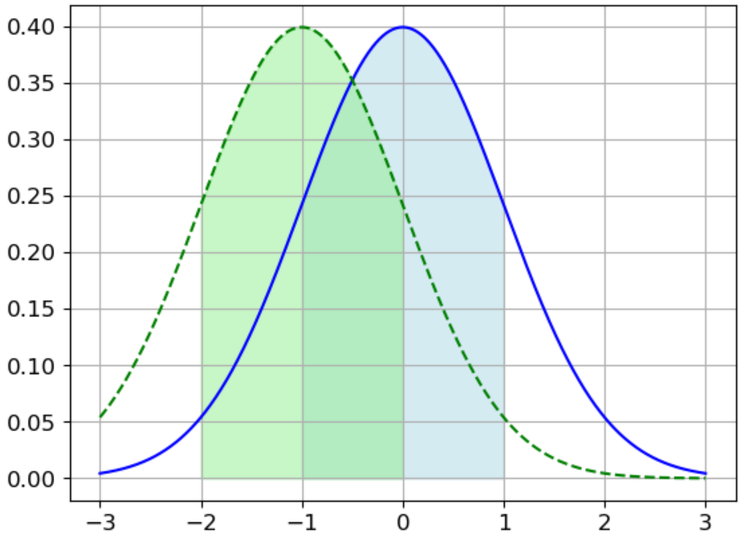
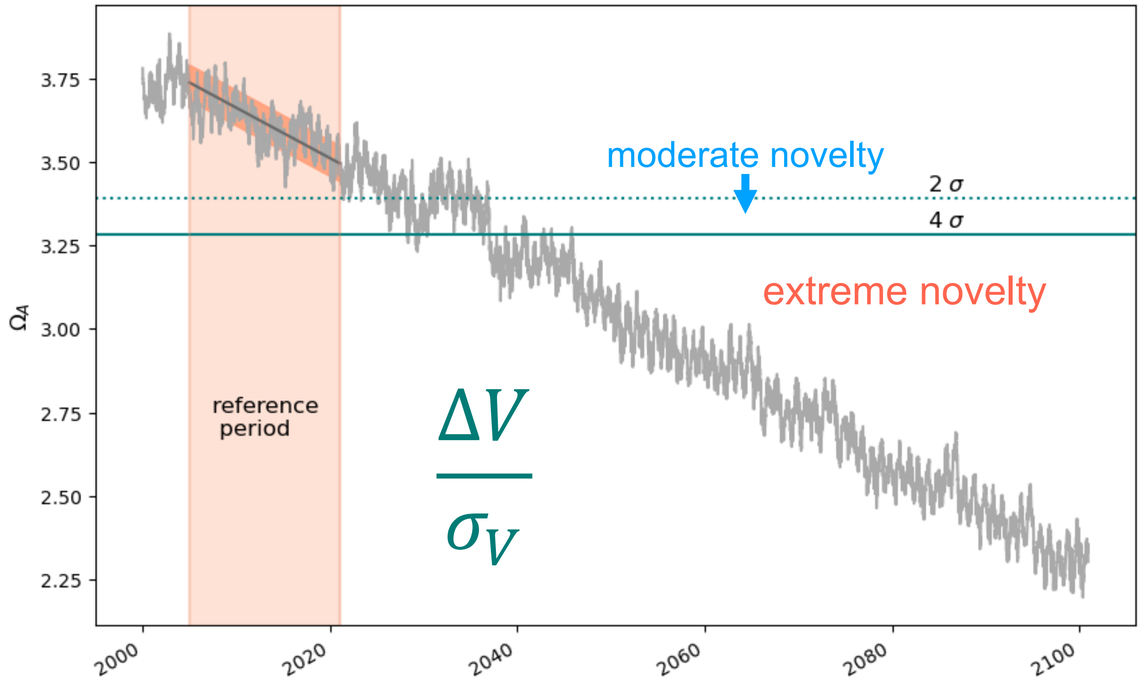
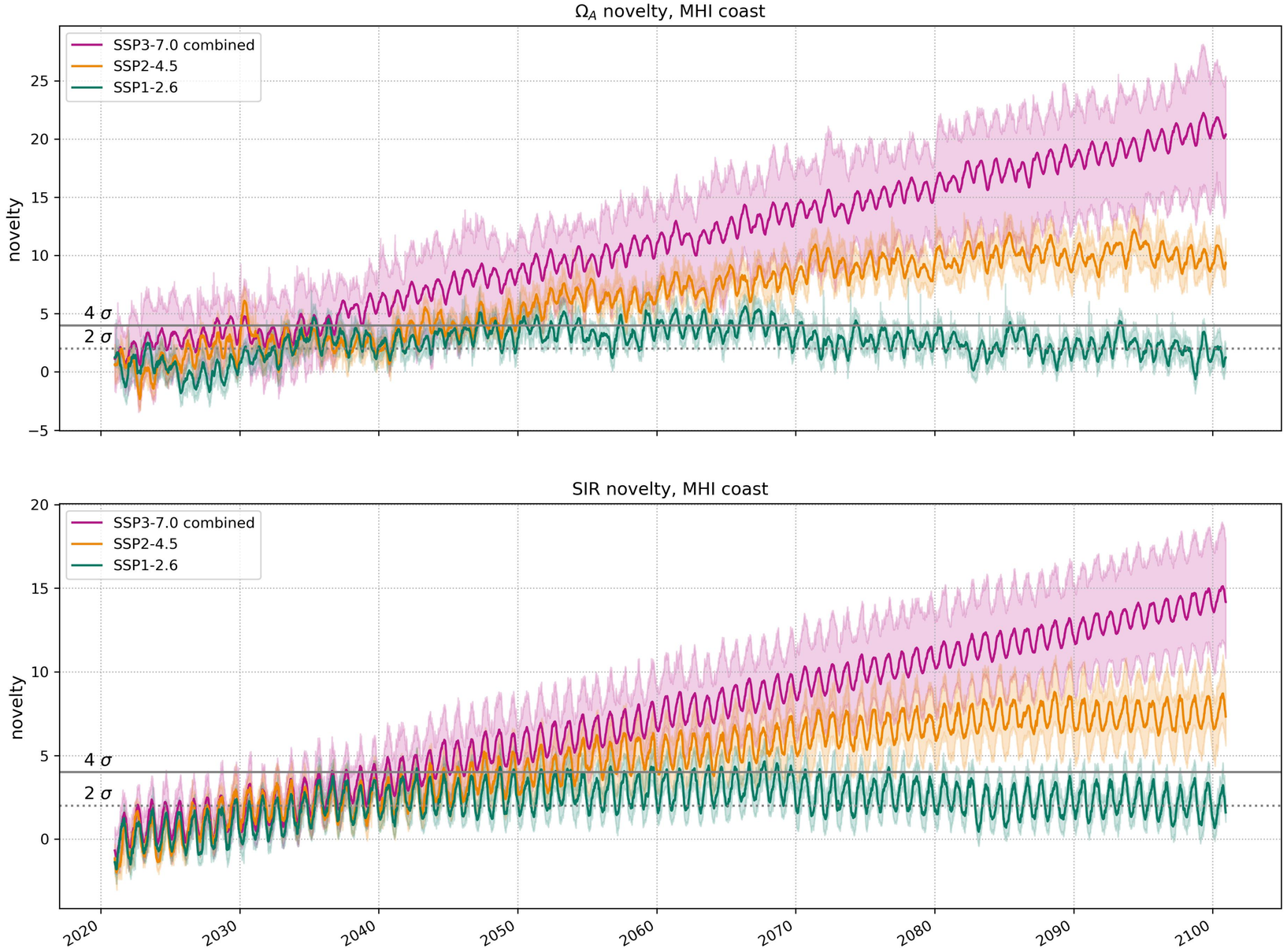
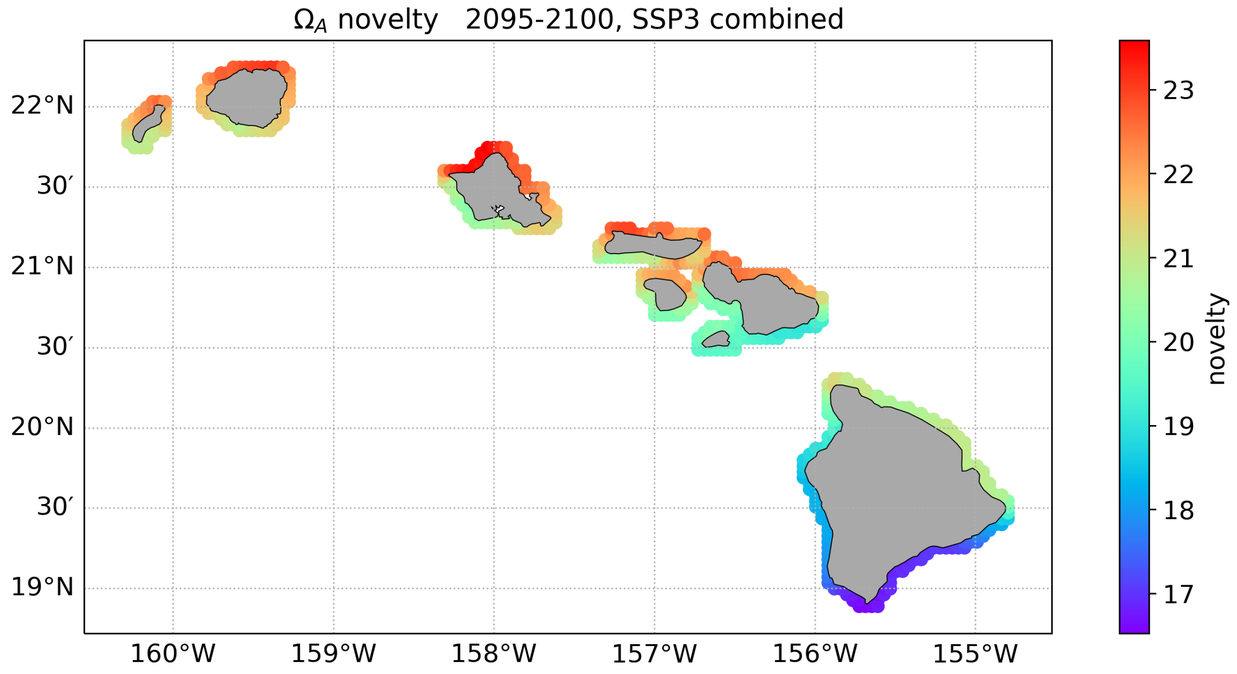




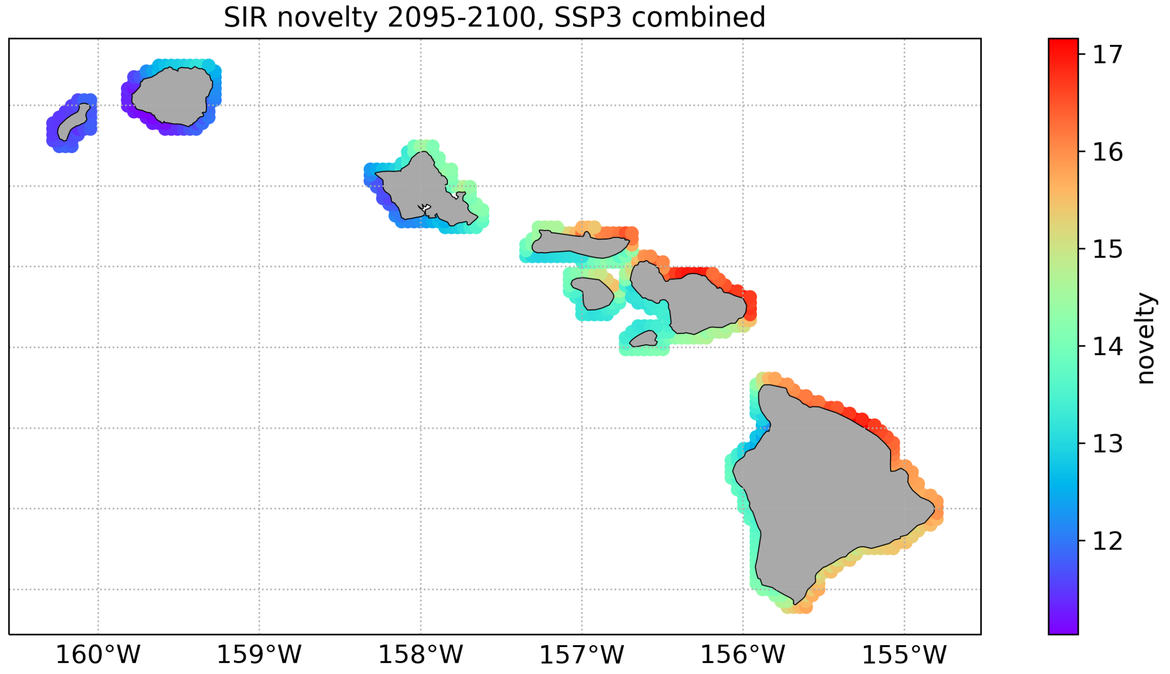
CMIP6 novelty estimates for MHI coast



Climate novelty along the coast in SSP3-7.0



driven by variability in DIC/alkalinity



driven by variability in temperature

Connecting ROMS/COBALT to Atlantis Ecosystem Model

Author: Lansing Perez, CP21B-01

ROMS/ COBALT model

Climate & ocean conditions

Biological conditions

Ecosystem management scenarios

Atlantis model

Ecosystem outcomes

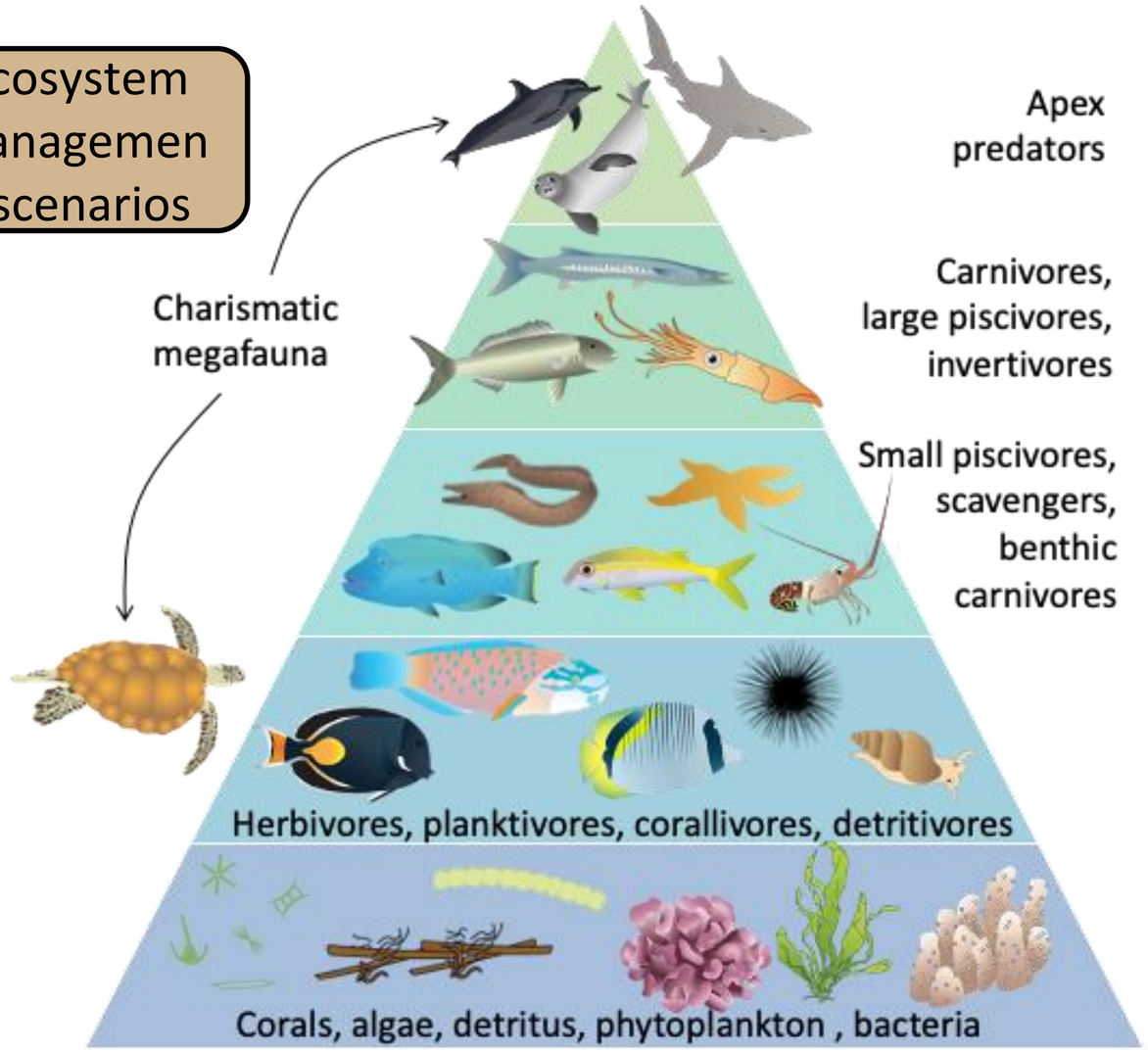
Ecological - economic model

Good & service flows

Reef fish
Recreation
Dive tourism

Vulnerabiliy

Livelihoods
Food
Cultural



Conclusions

- First dynamically downscaled ROMS/COBALT CMIP6 projections for the main Hawaiian Islands
- Unprecedented levels of ocean acidification expected in the next 30 years
- CMIP6 scenarios lead to qualitatively distinct implications for the end of century
- OA anomalies exceeding historical variability by factor 20 in 2100 in SSP3
- Temperature sensitivity of OA indices leads to contrasting spatial patterns of climate novelty

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