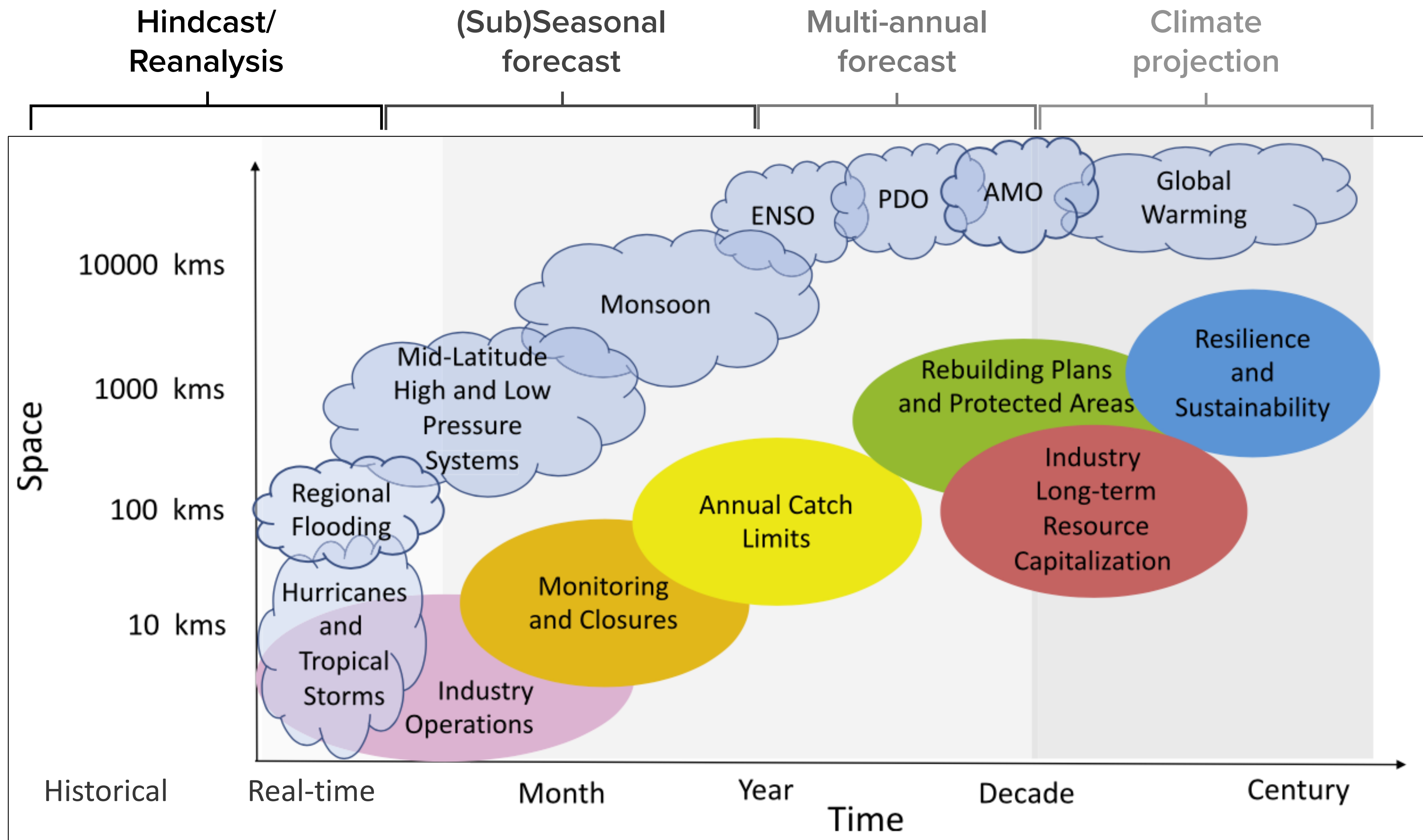


Timescales and Mechanisms of Marine Ecosystem Predictability Along the US West Coast

Mike Jacox

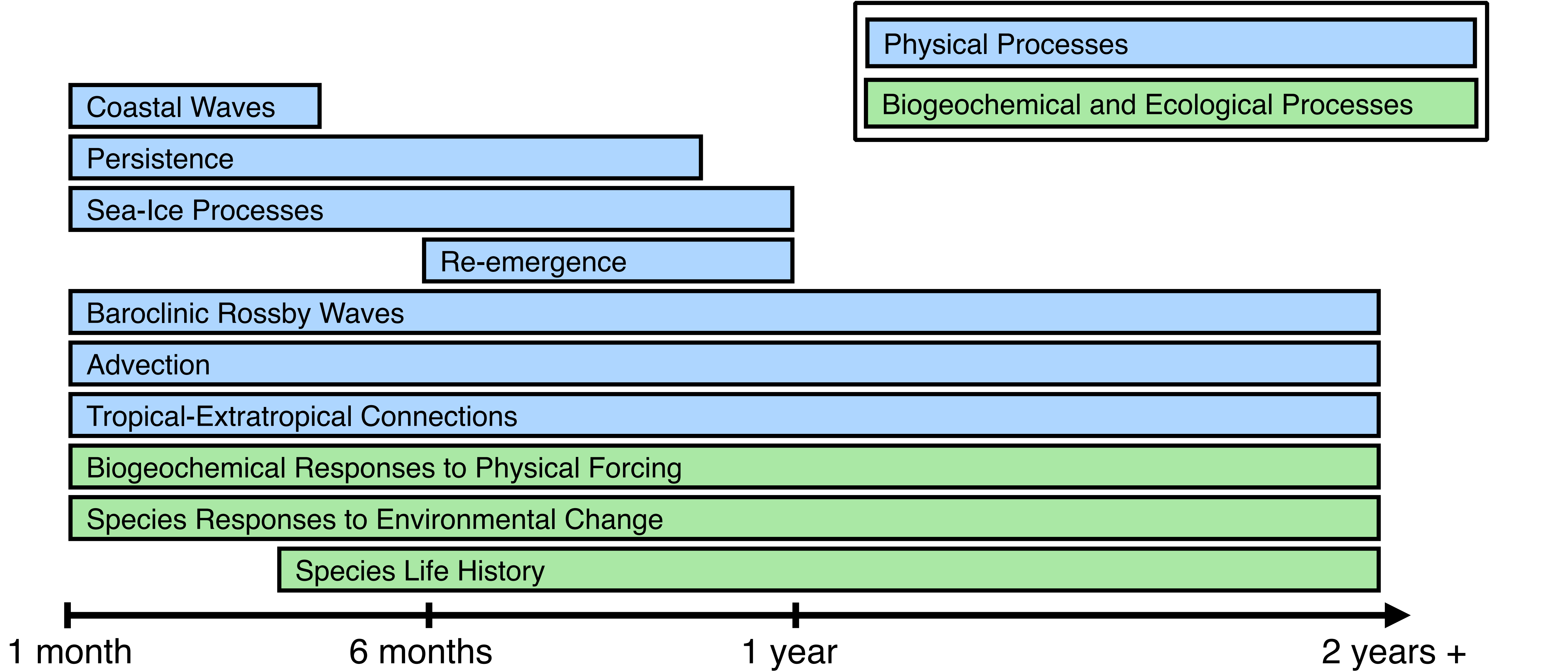
NOAA Southwest Fisheries Science Center
NOAA Physical Sciences Laboratory

US Clivar Workshop
Daily to Decadal Ecological Forecasting along North American Coastlines
April 12, 2022



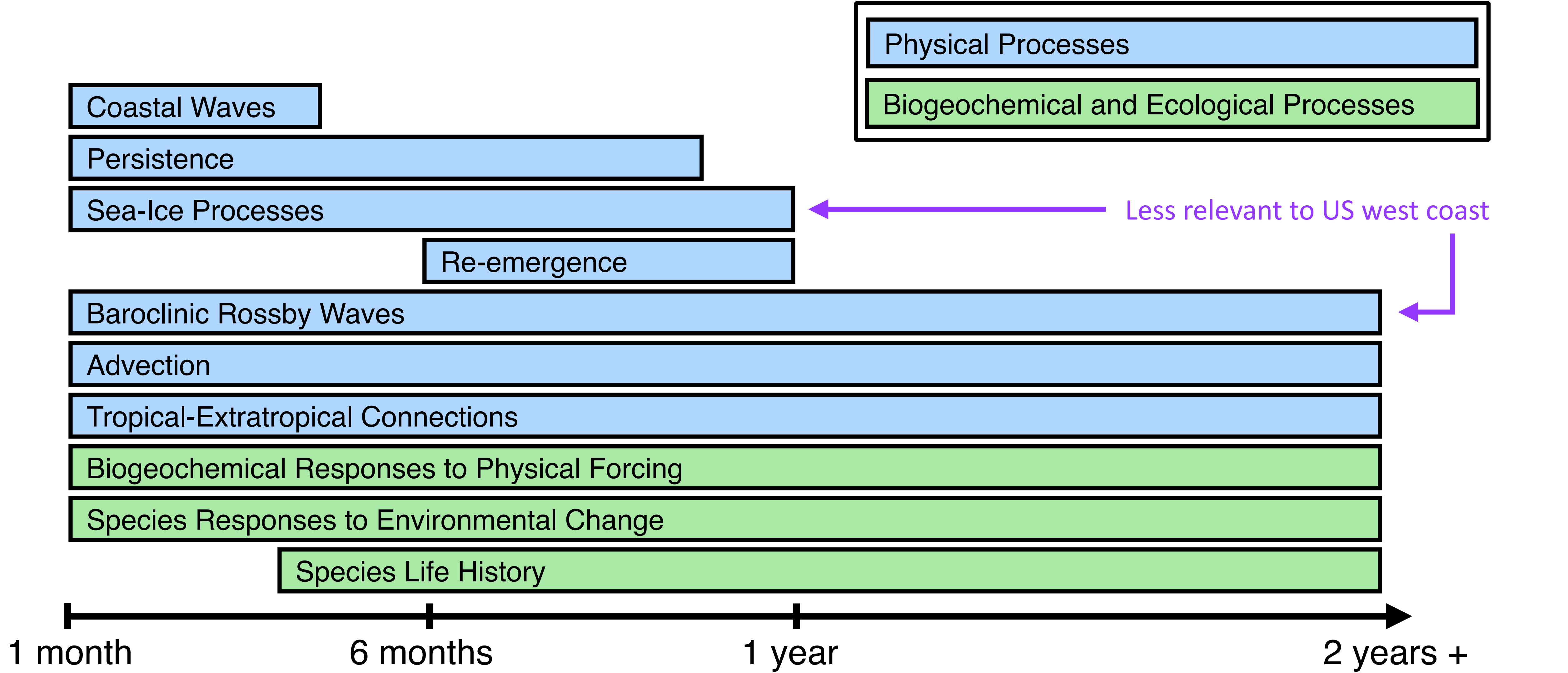
Adapted from Tommasi et al. (2017)

Mechanisms of Marine Ecosystem Predictability



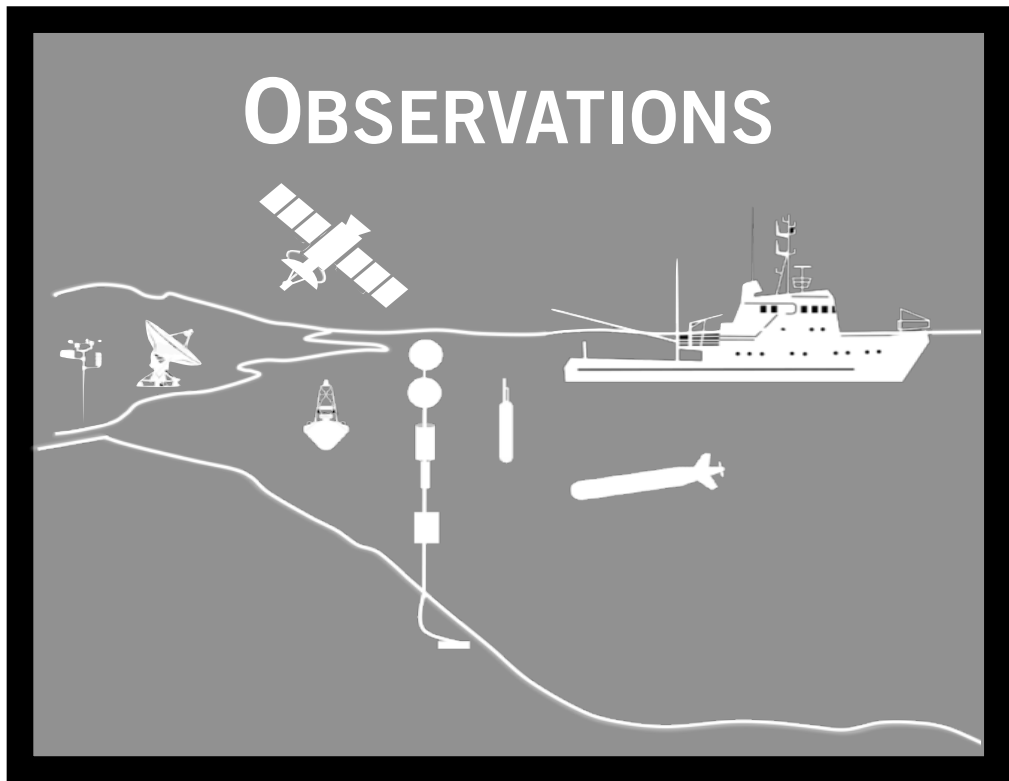
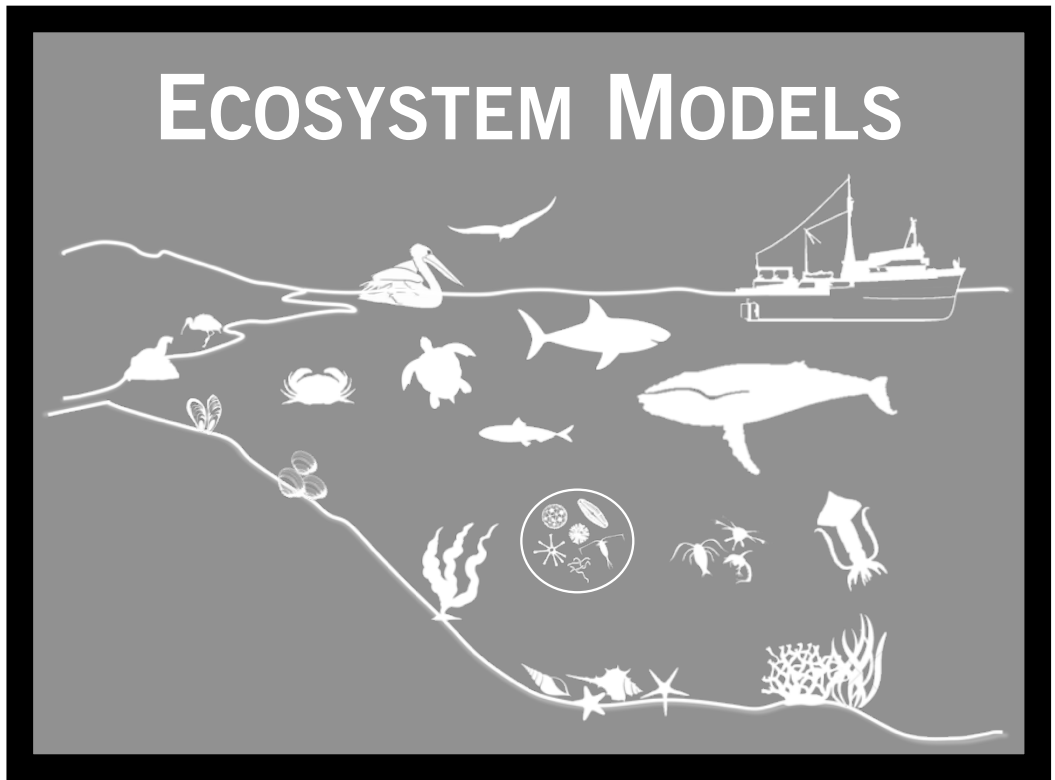
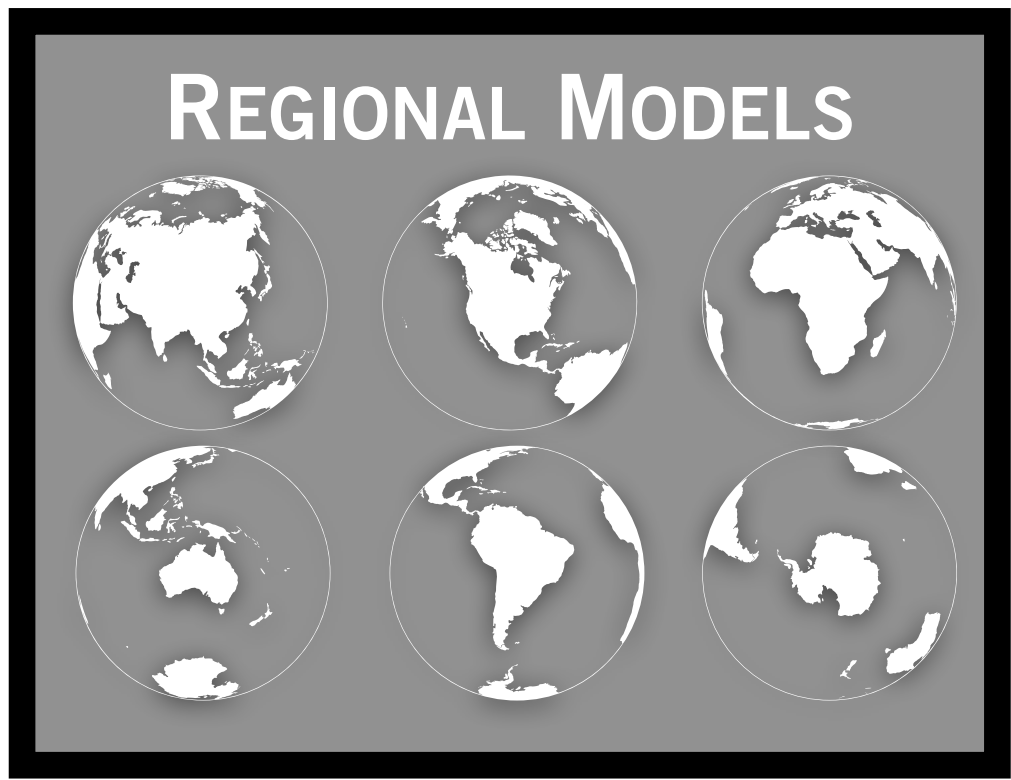
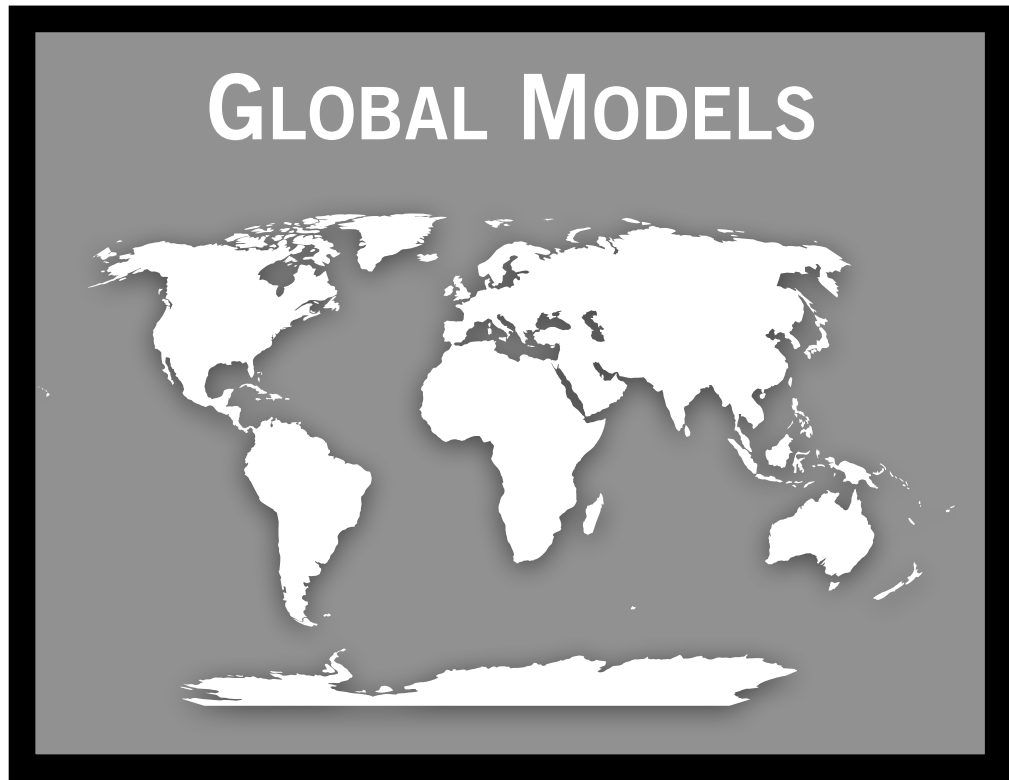
Jacox et al. (2020)

Mechanisms of Marine Ecosystem Predictability



Jacox et al. (2020)

Marine Ecosystem Forecasting Tools

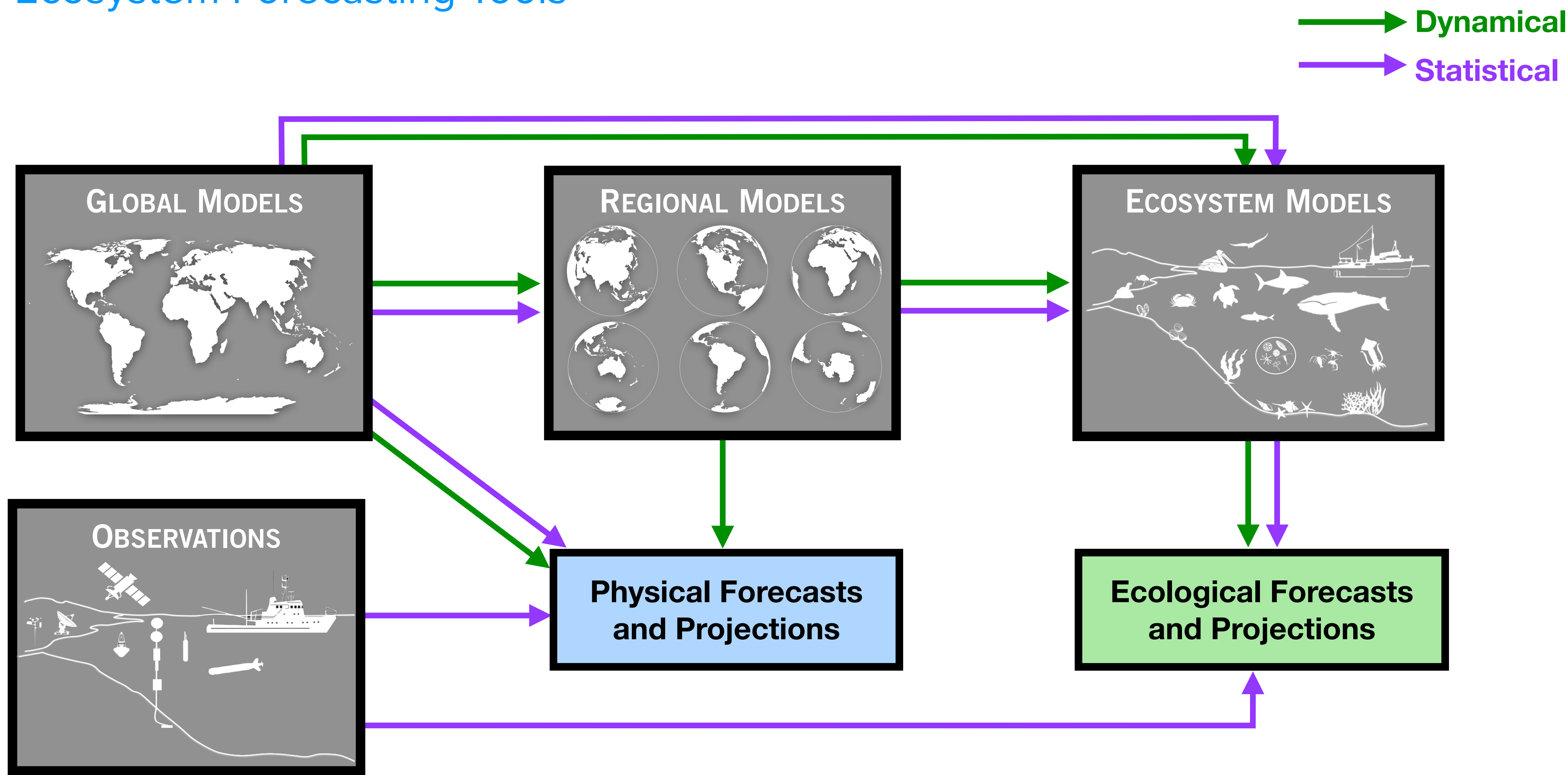


**Physical Forecasts
and Projections**

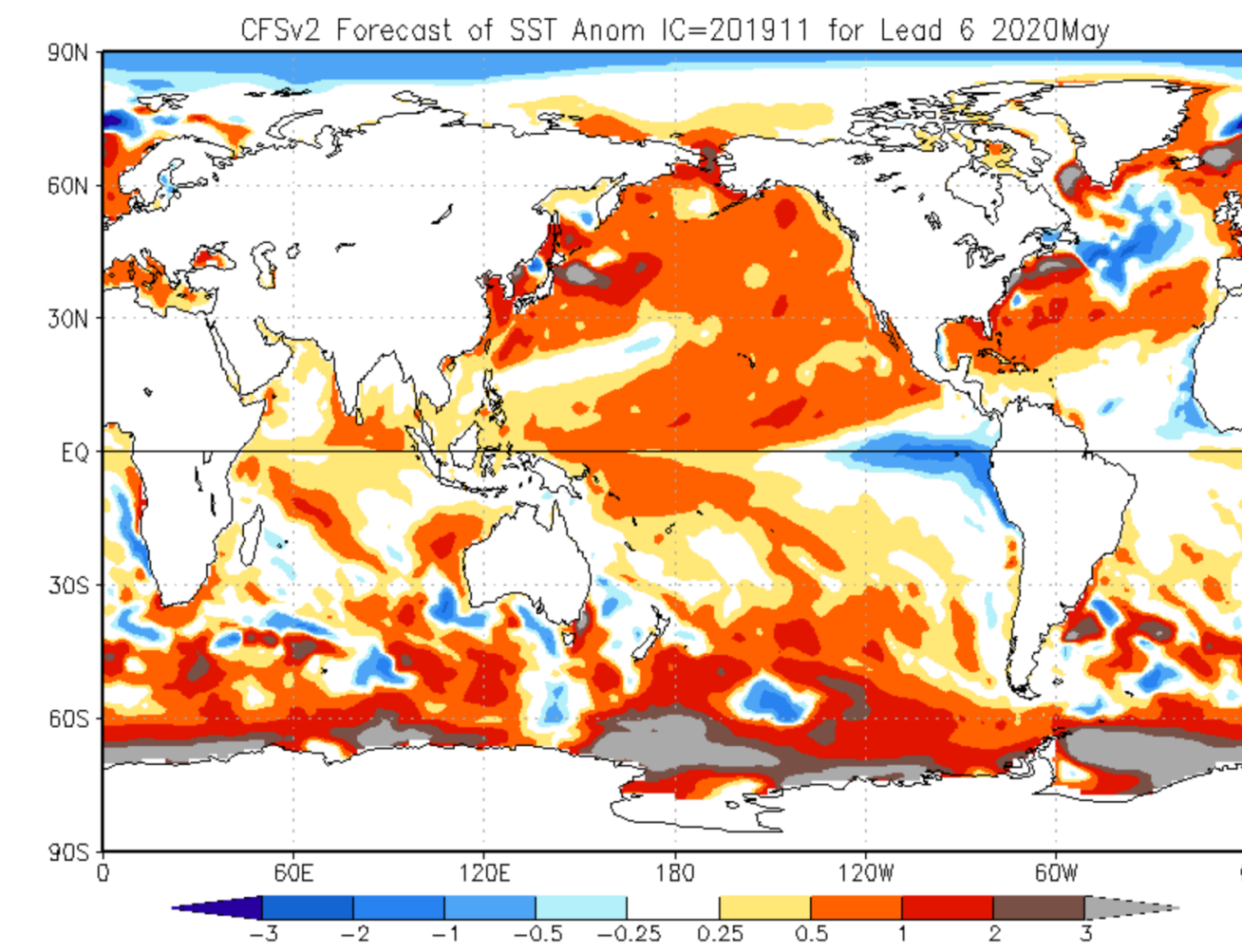
**Ecological Forecasts
and Projections**

Jacox et al. (2020)

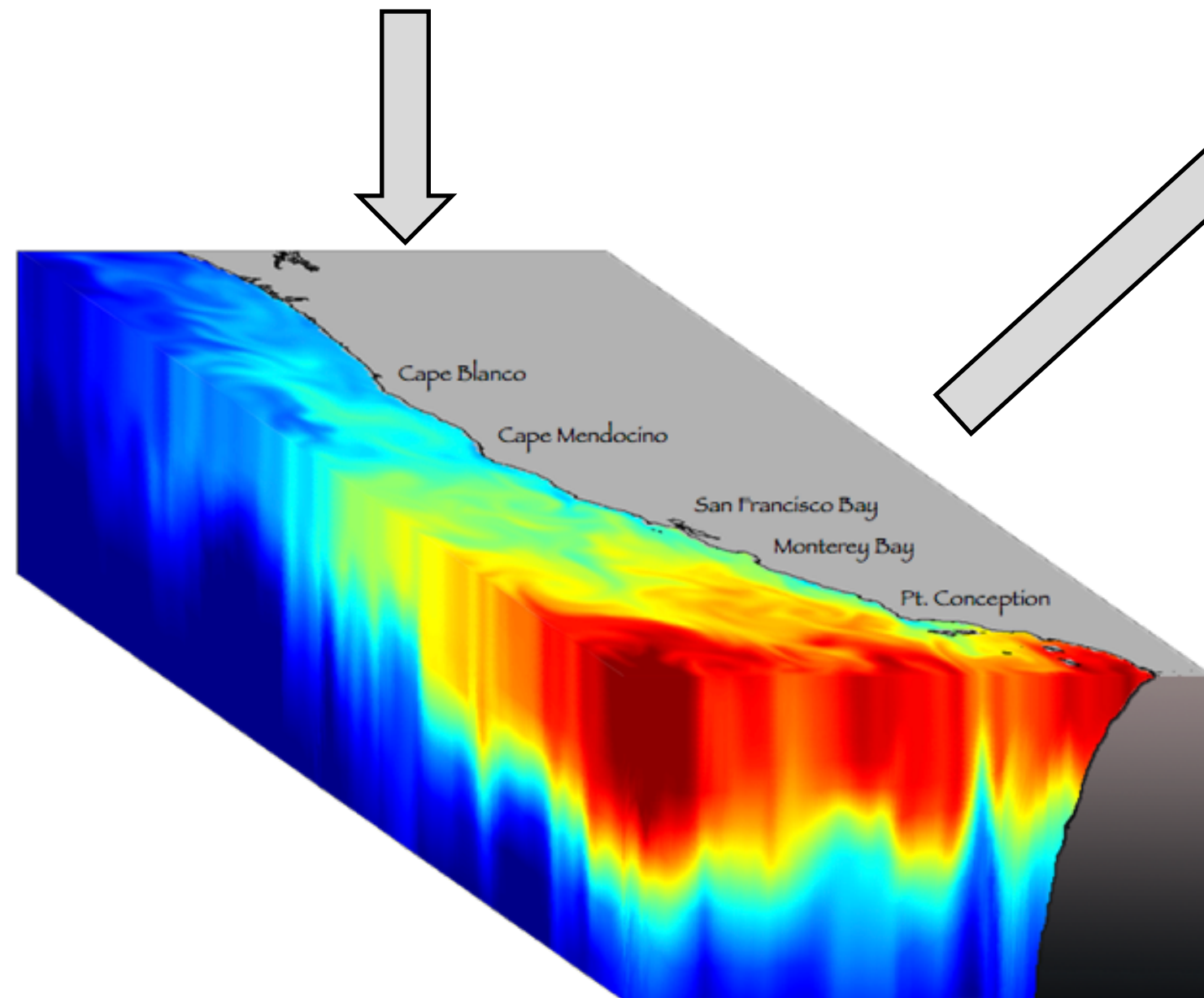
Marine Ecosystem Forecasting Tools



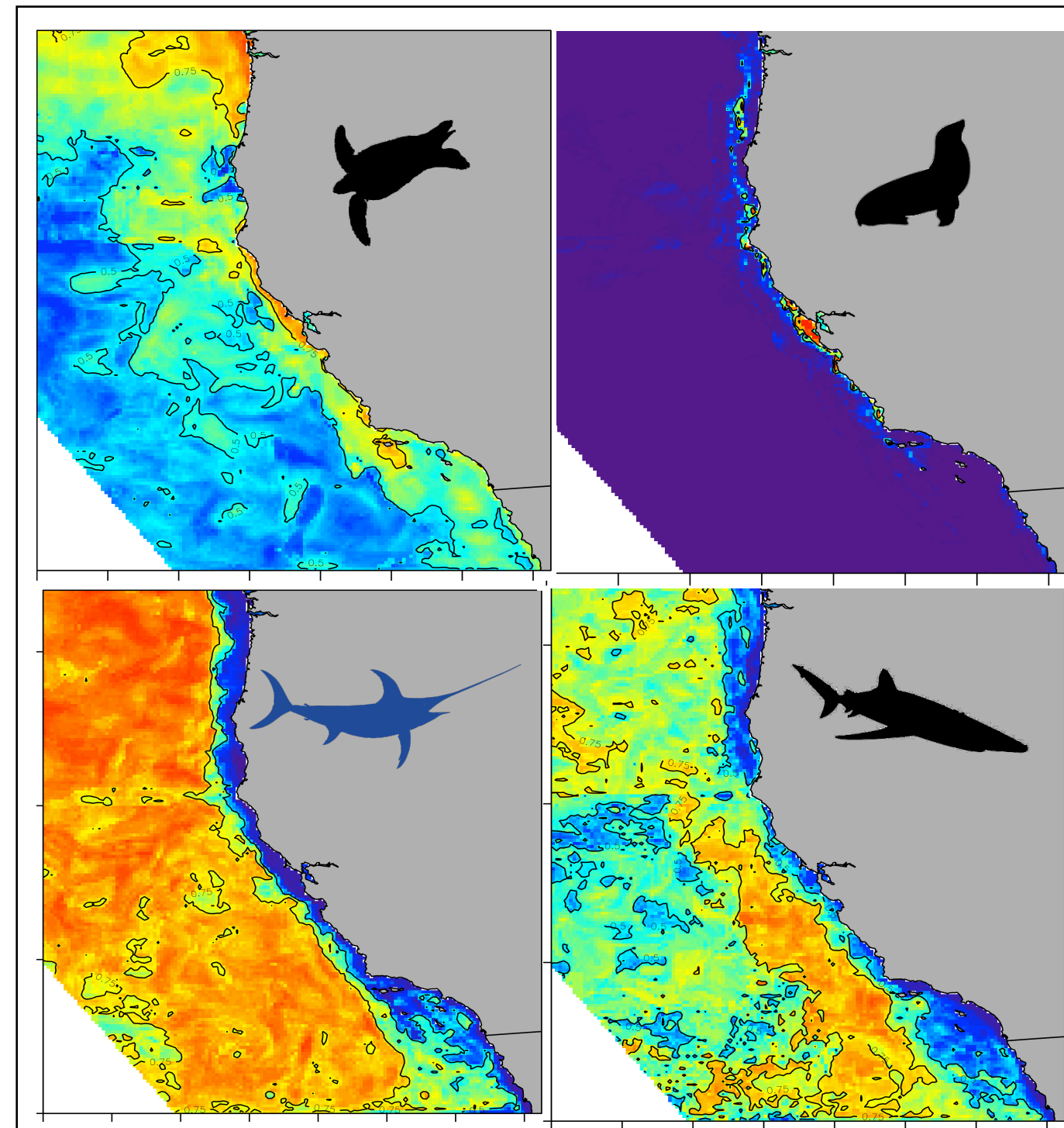
Jacox et al. (2020)



Climate Forecasts

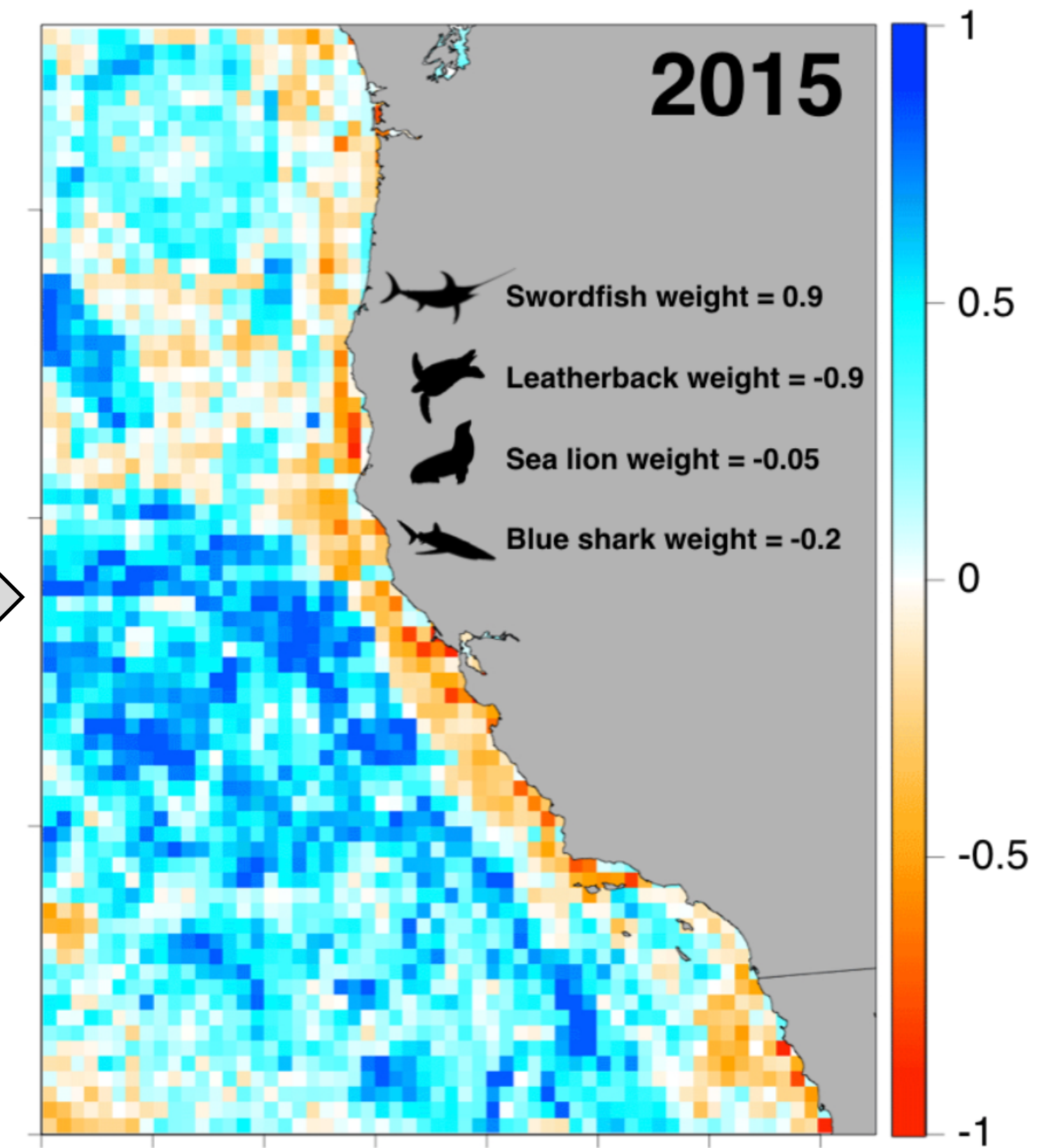


Regional forecasts from ocean models

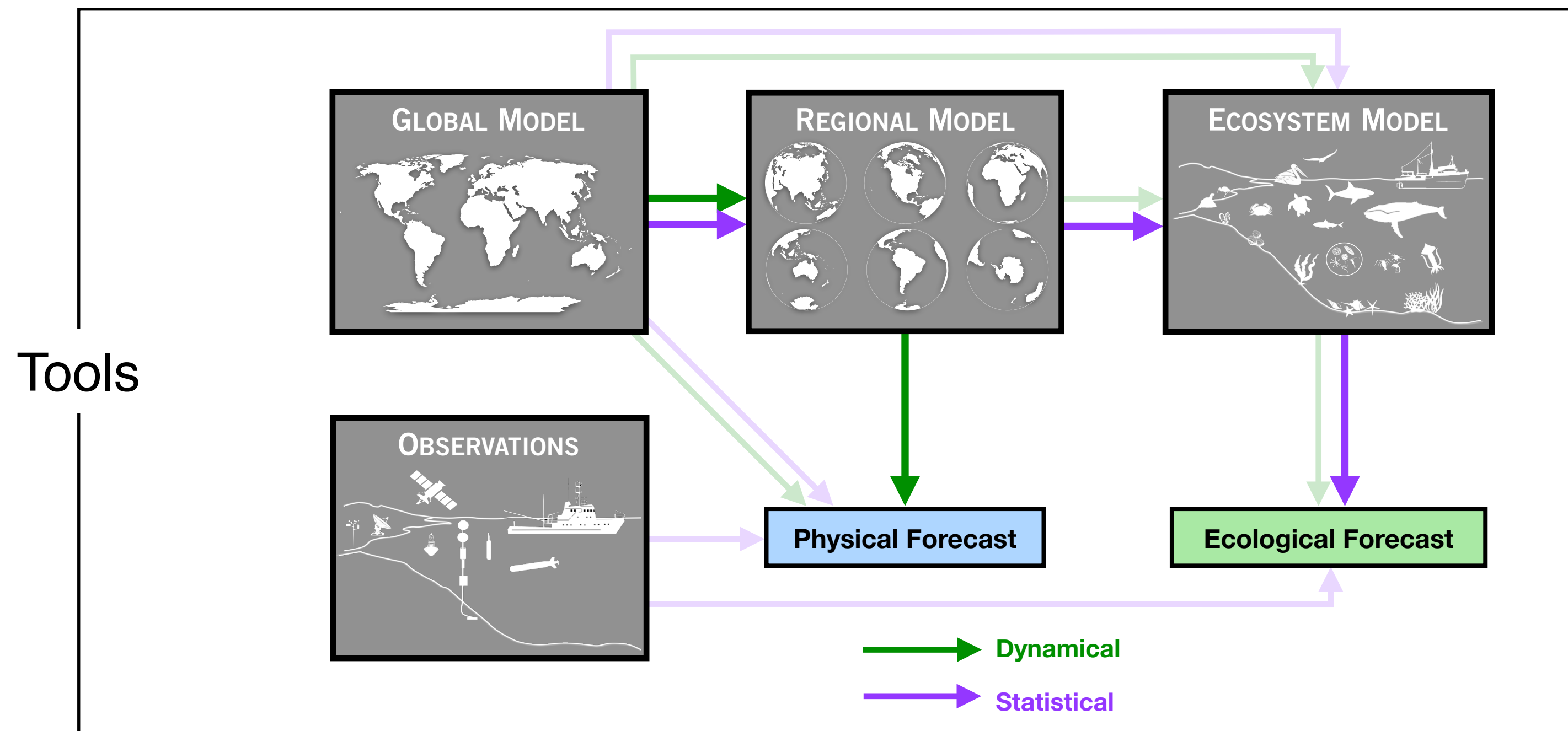


Predicted habitat suitability

EcoCast Integrated fishing suitability

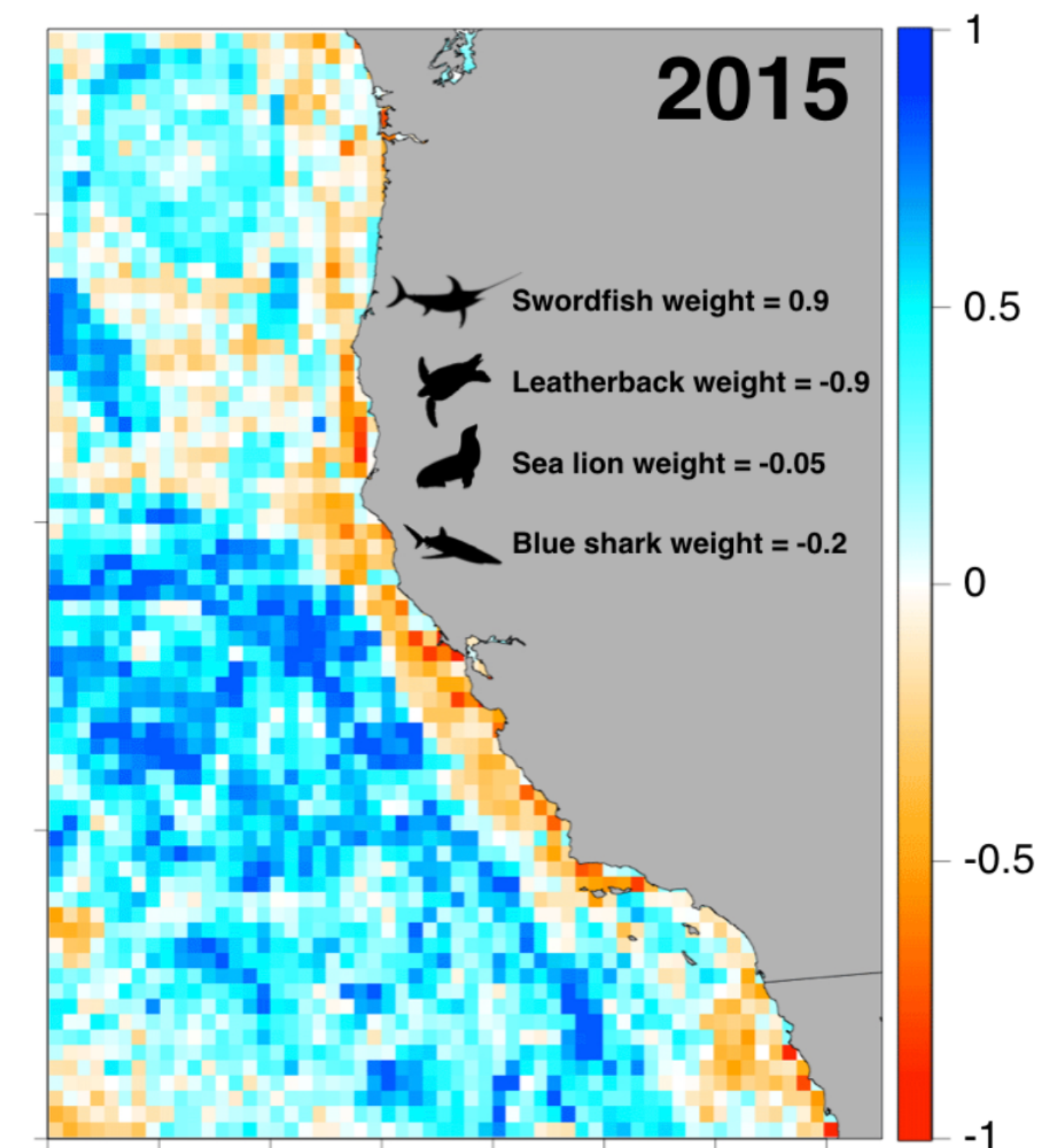


Hazen et al. (2018)
Welch et al. (2019)

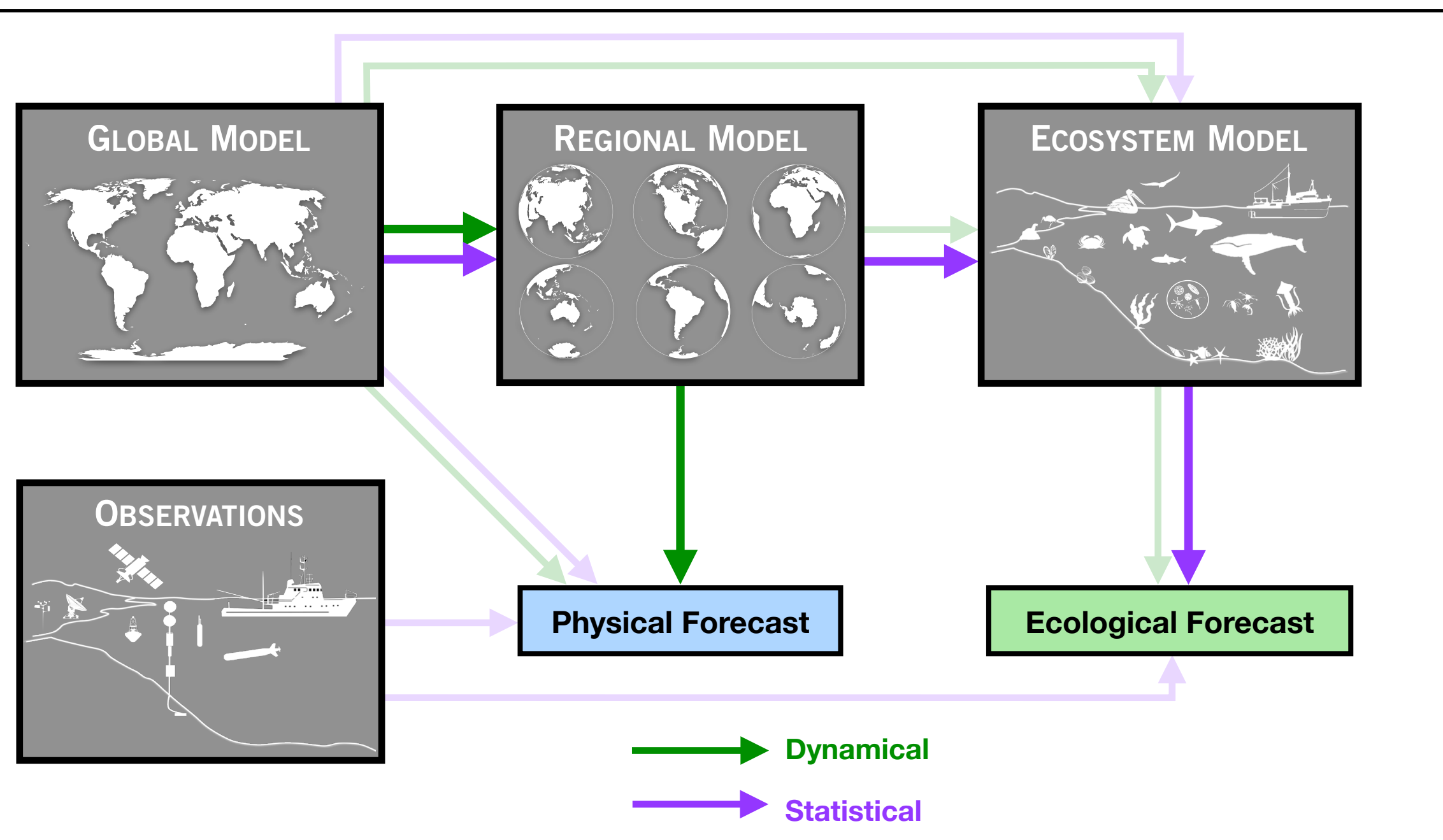


EcoCast

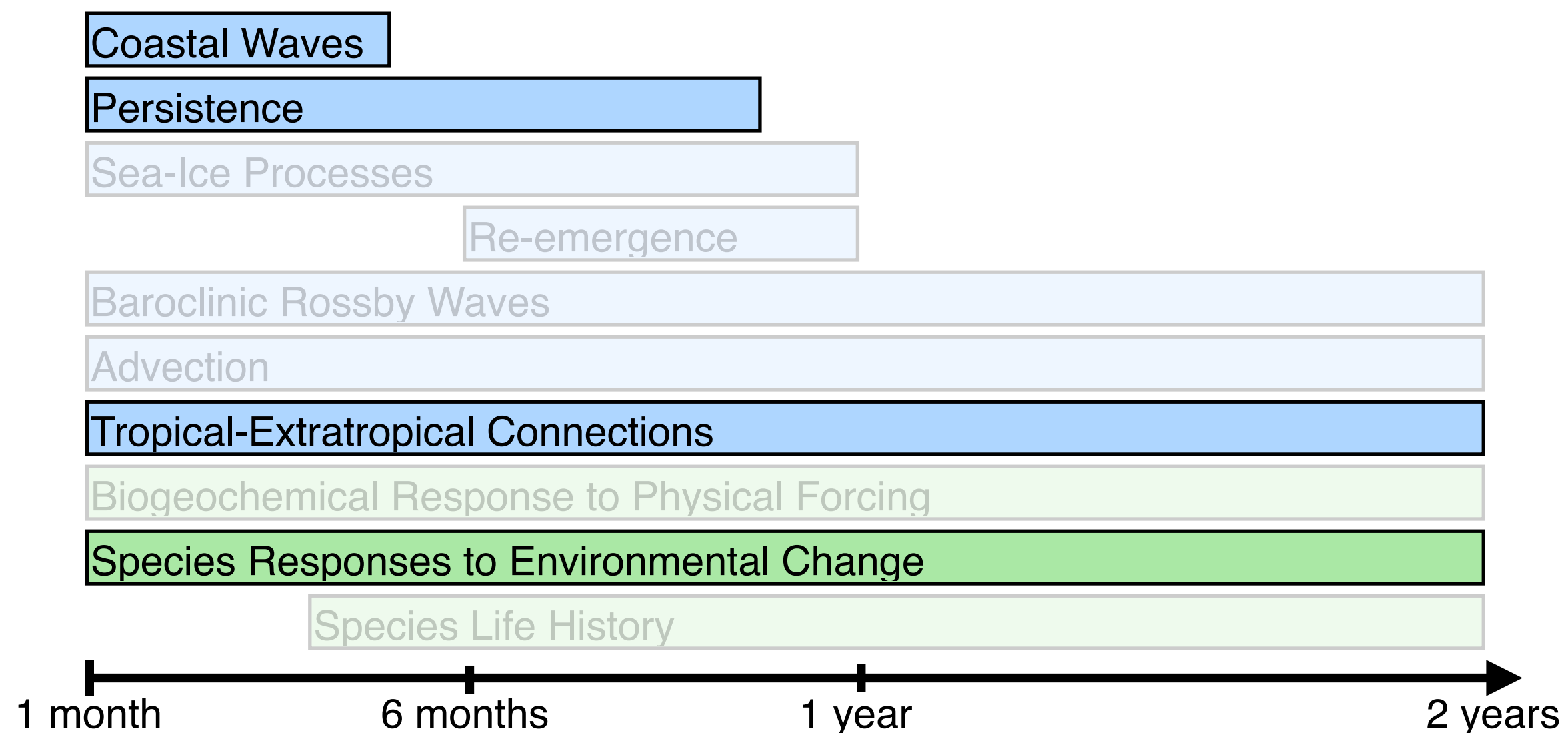
Integrated fishing suitability



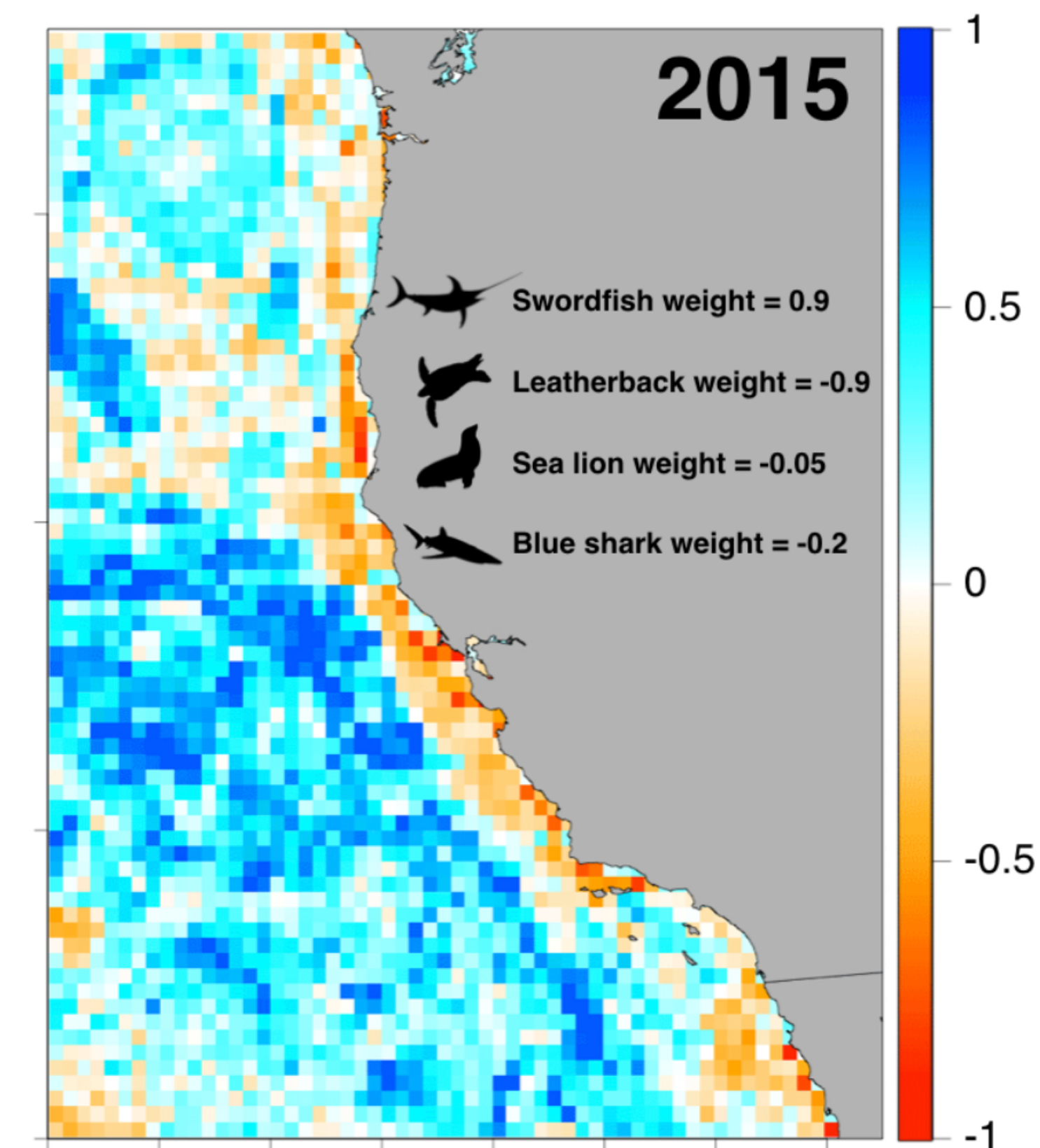
Tools

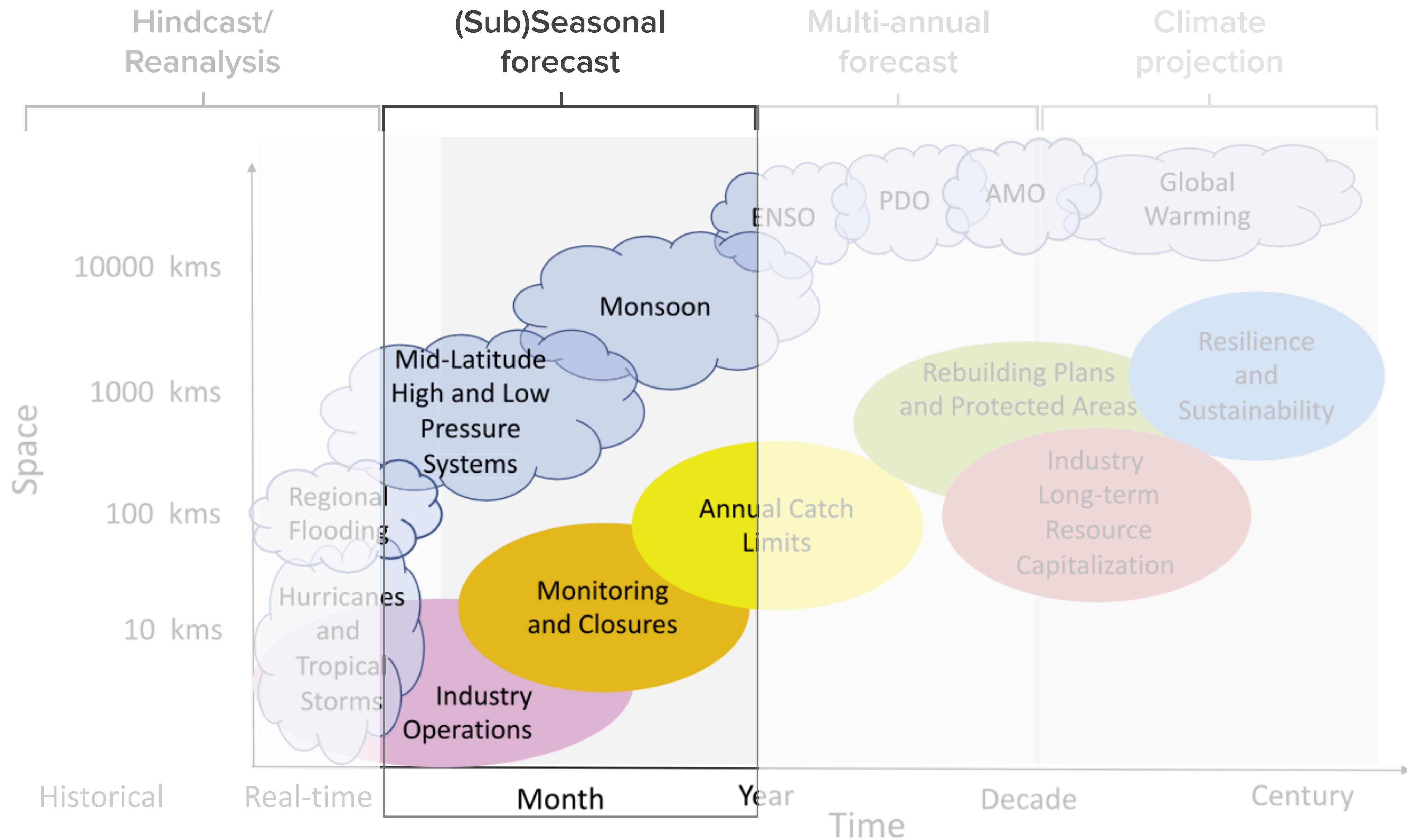


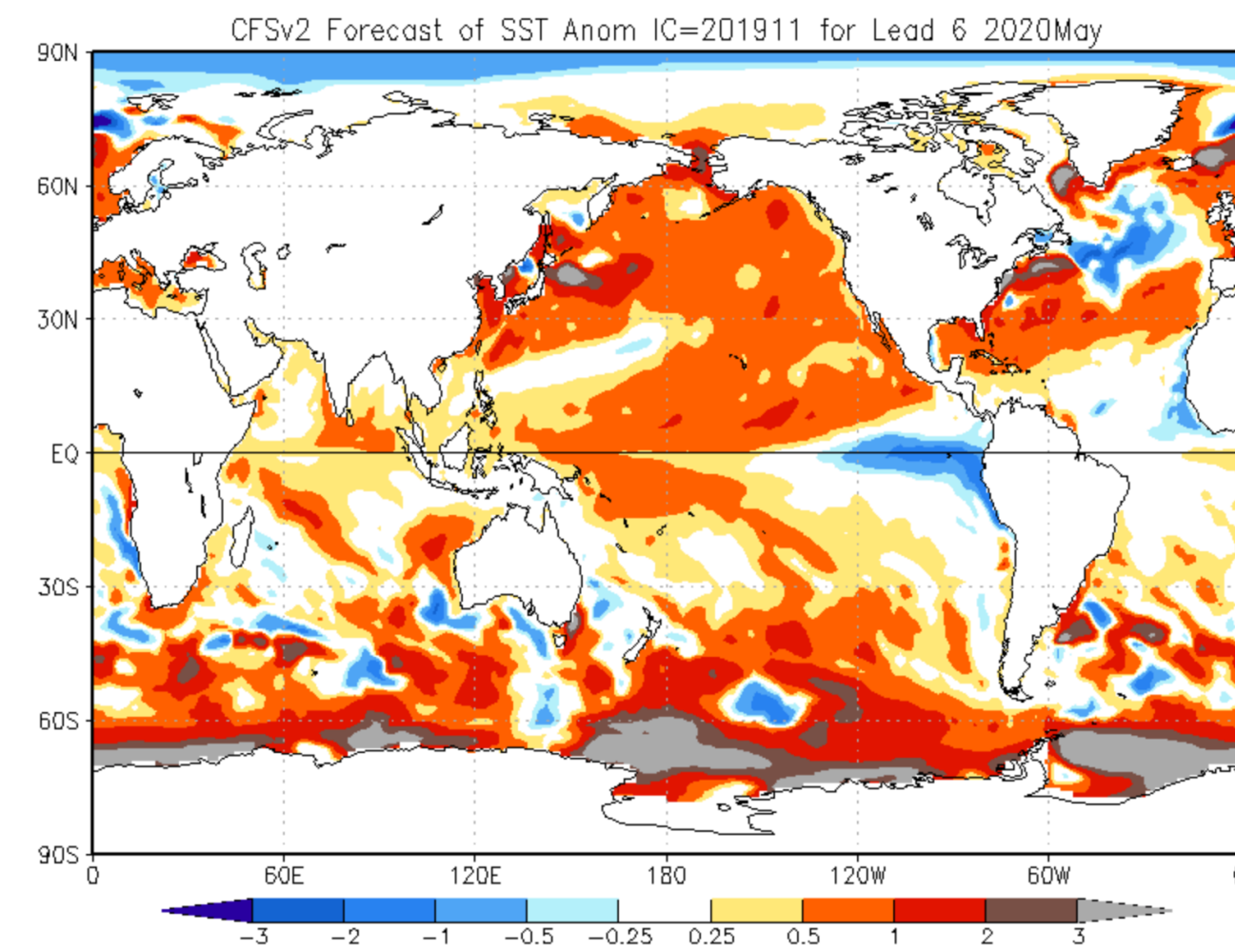
Mechanisms



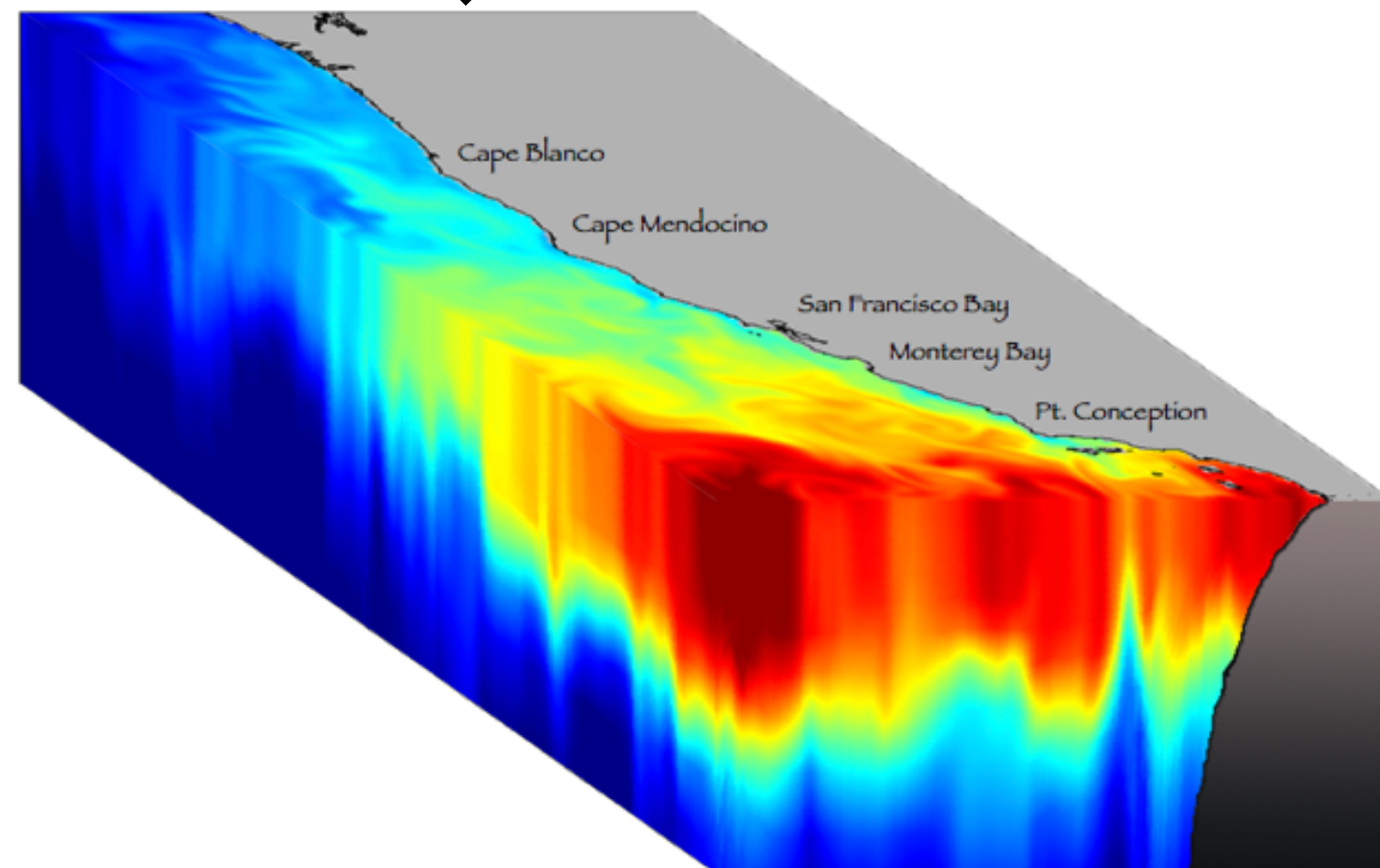
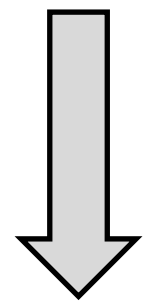
EcoCast Integrated fishing suitability







Climate Forecasts



Regional forecasts from ocean models

Forecast configuration

ROMS West Coast grid (0.1° resolution; ~ 10 km)

Forecasts initialized twice per year (January and July)

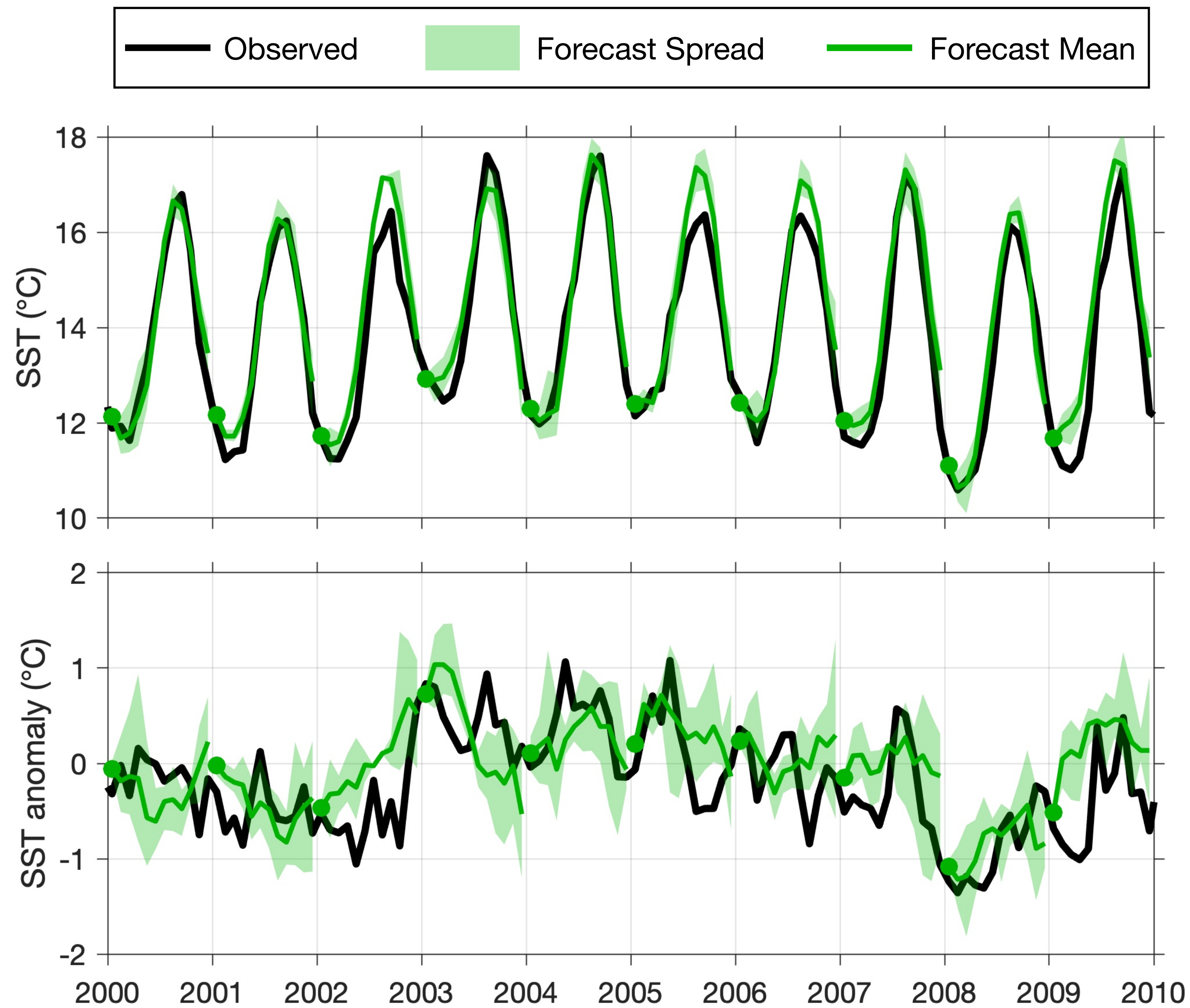
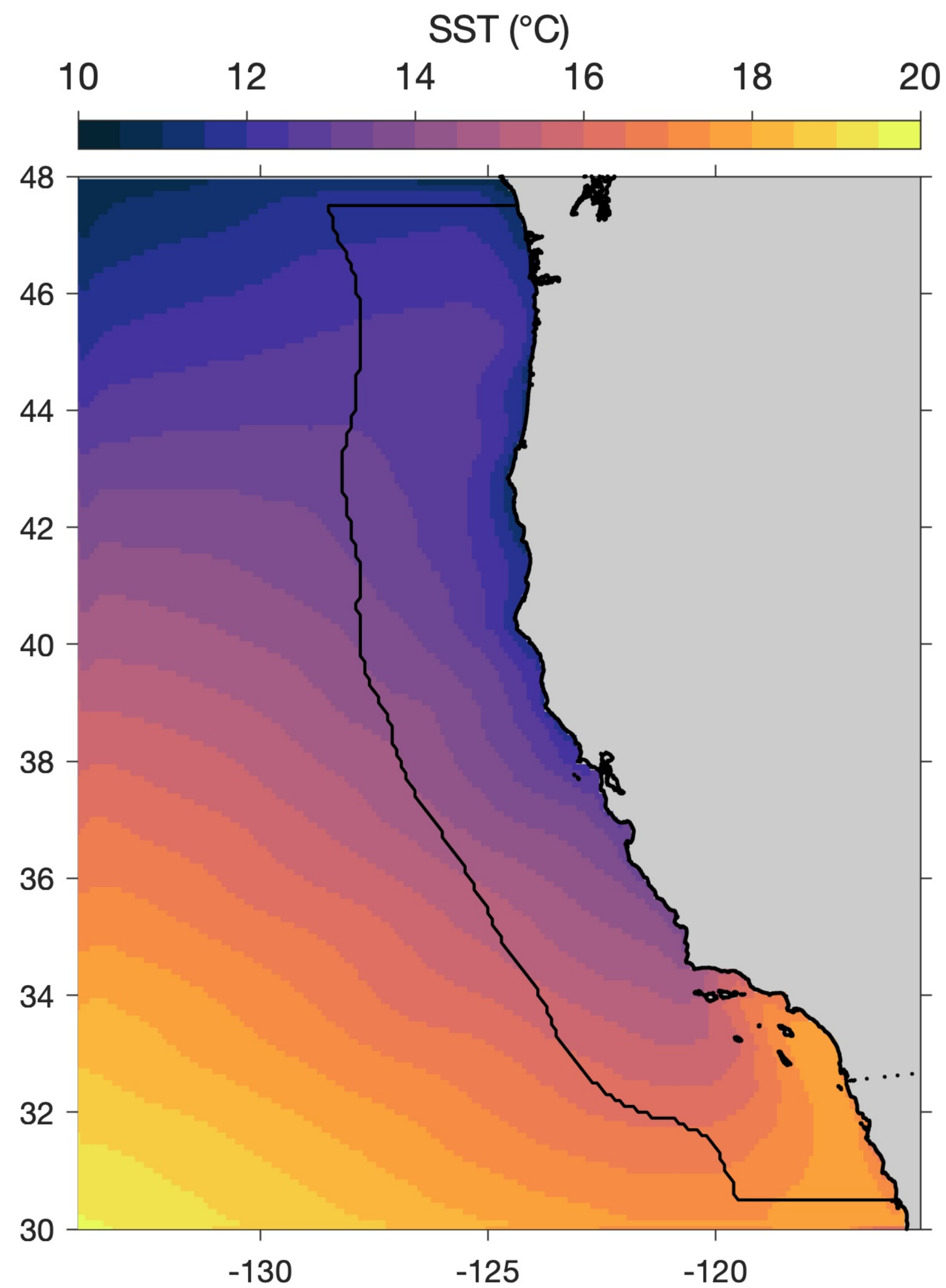
1982 to 2010

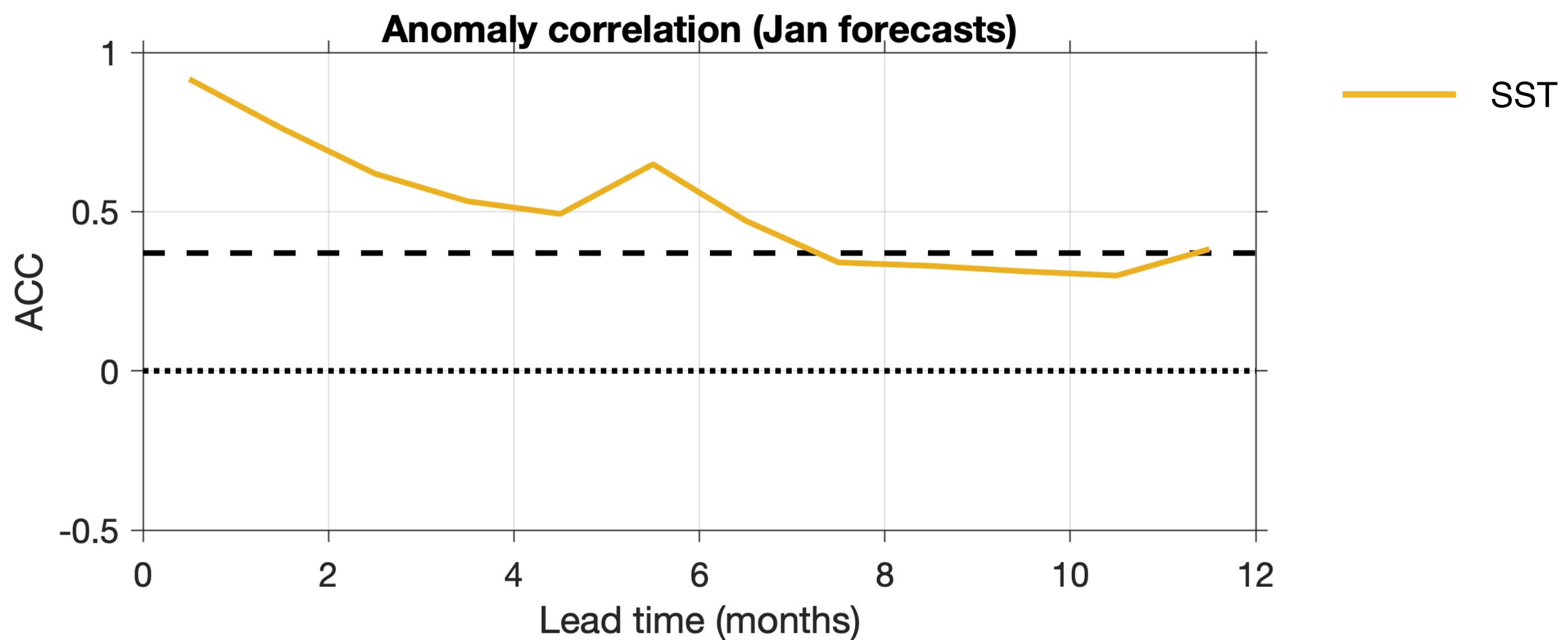
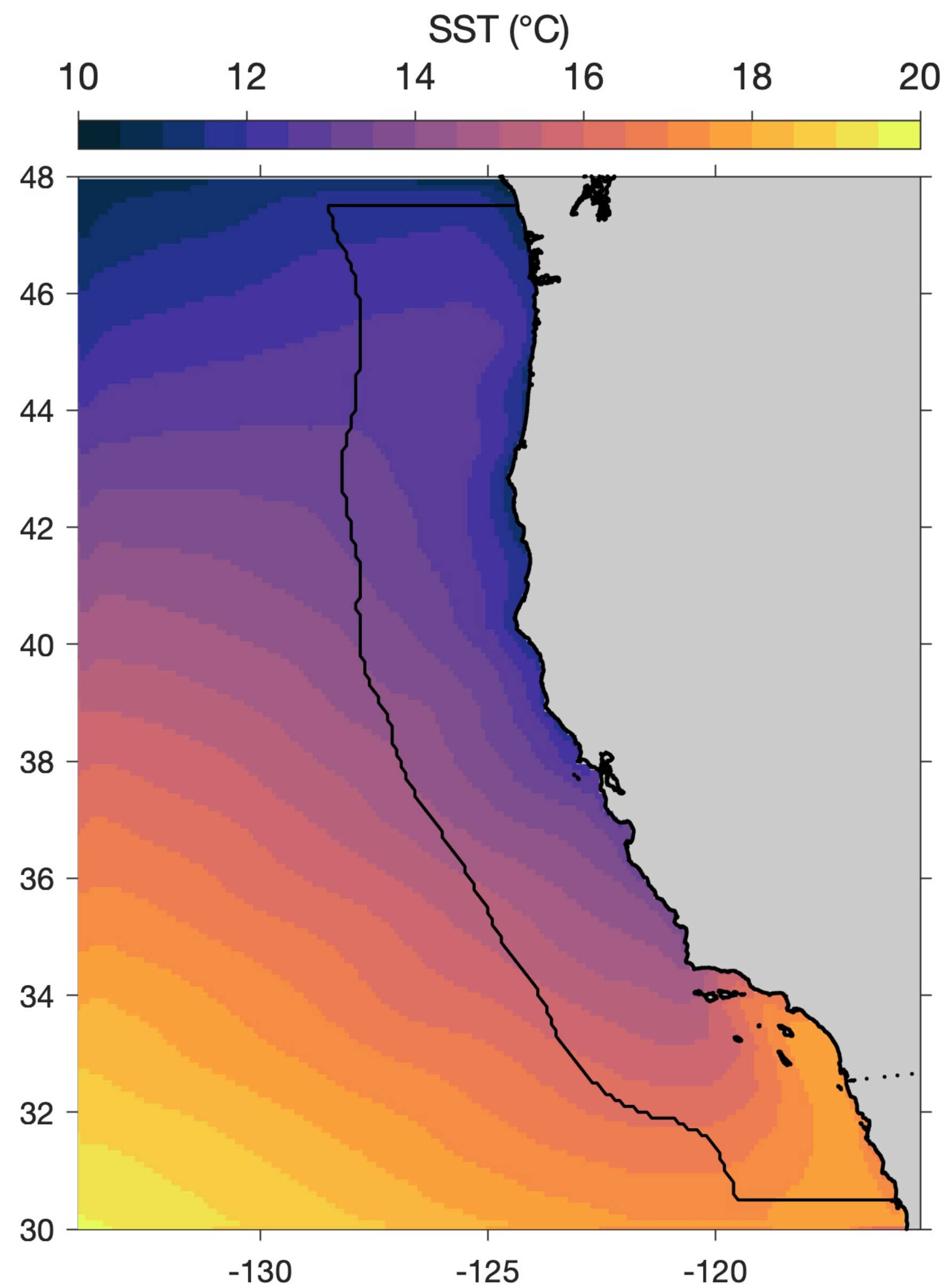
12-month forecasts

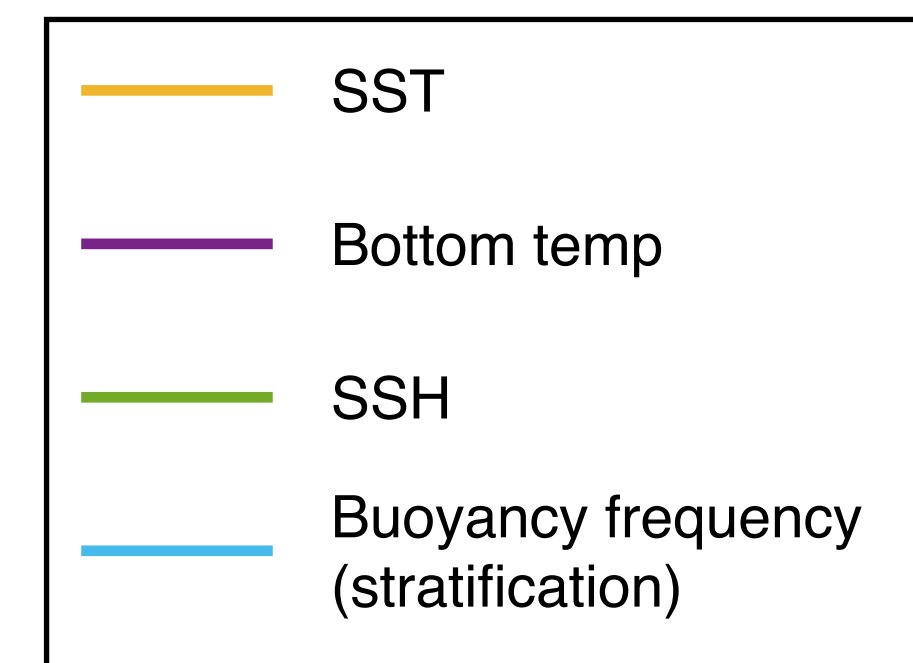
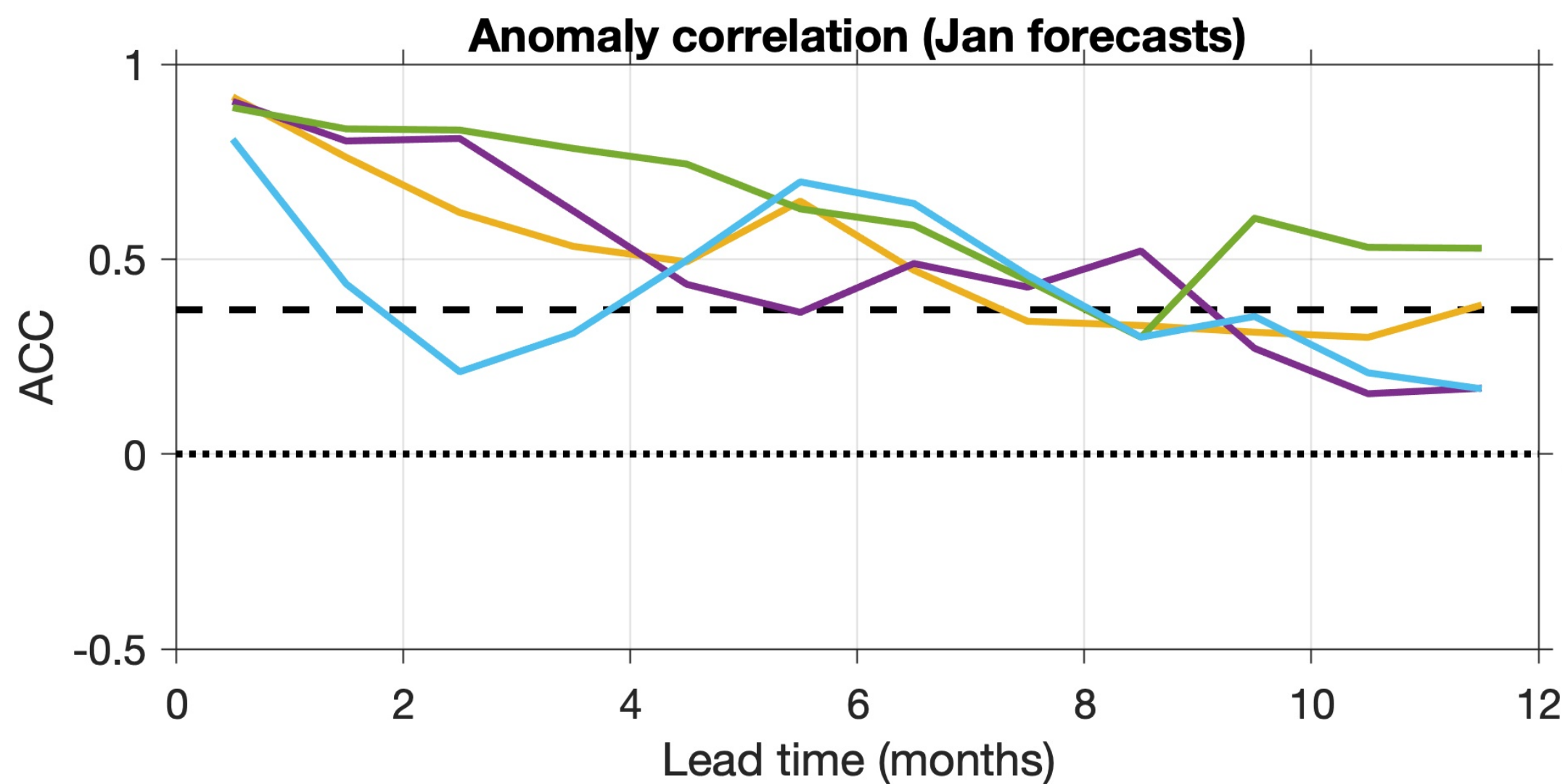
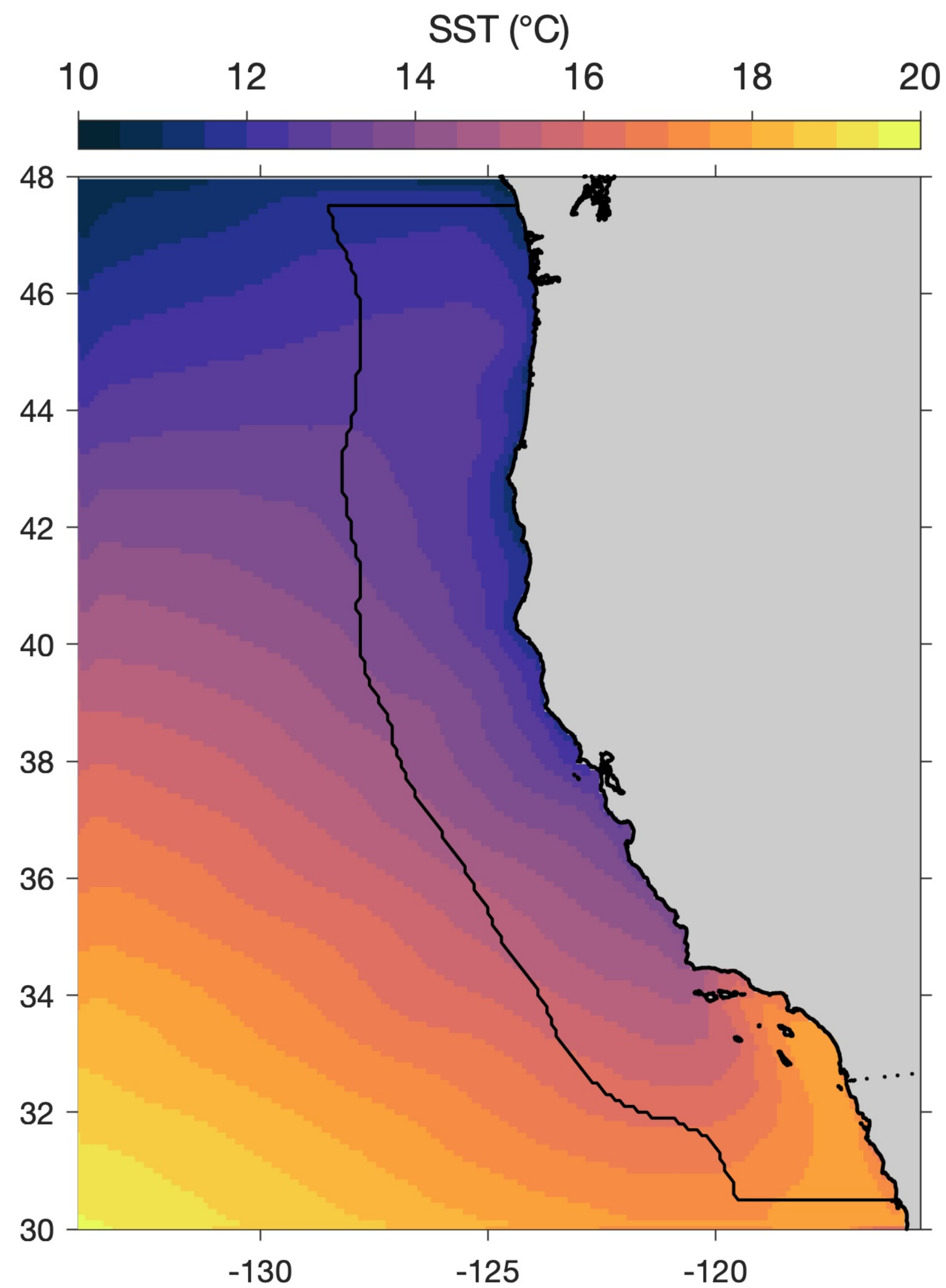
Three ensemble members

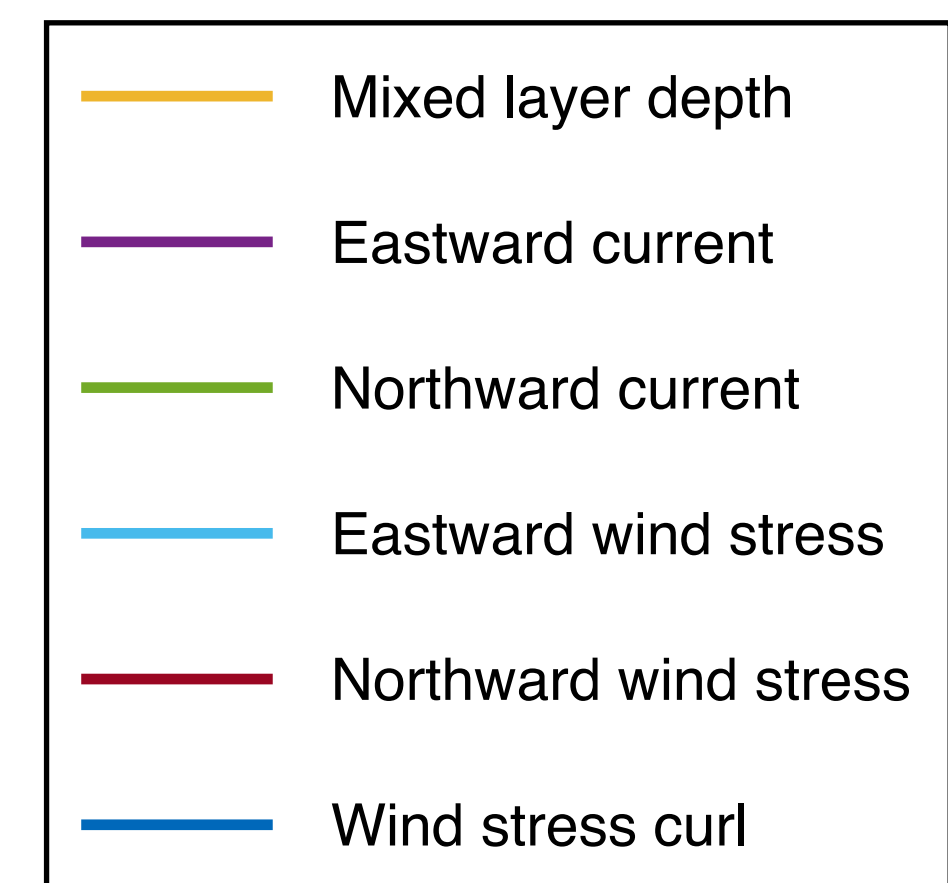
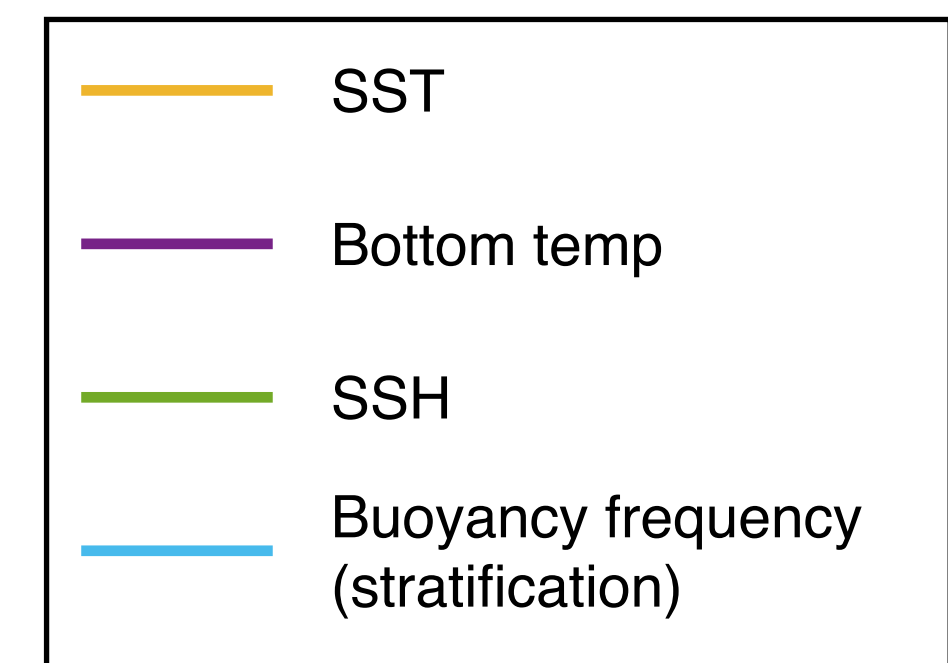
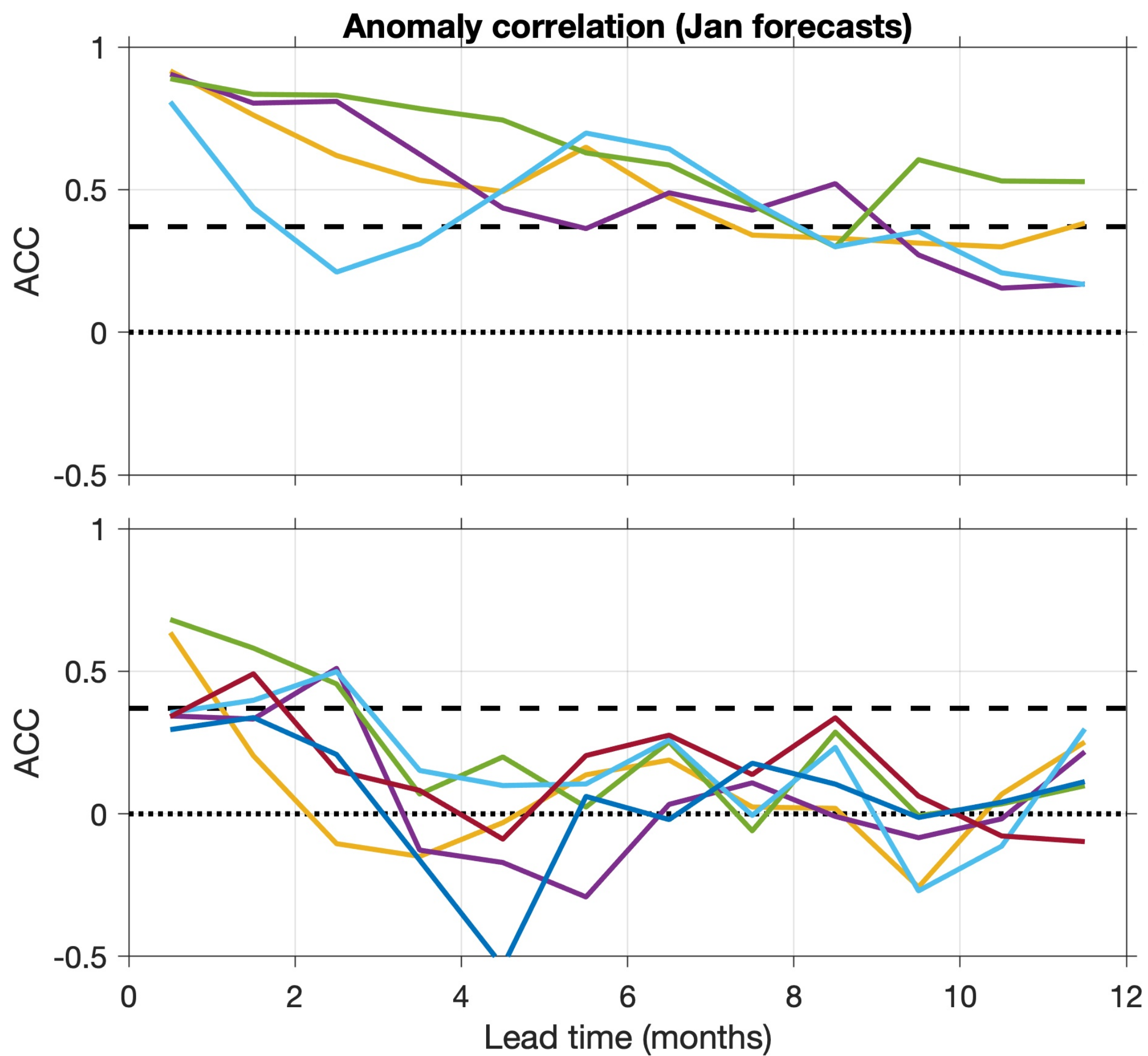
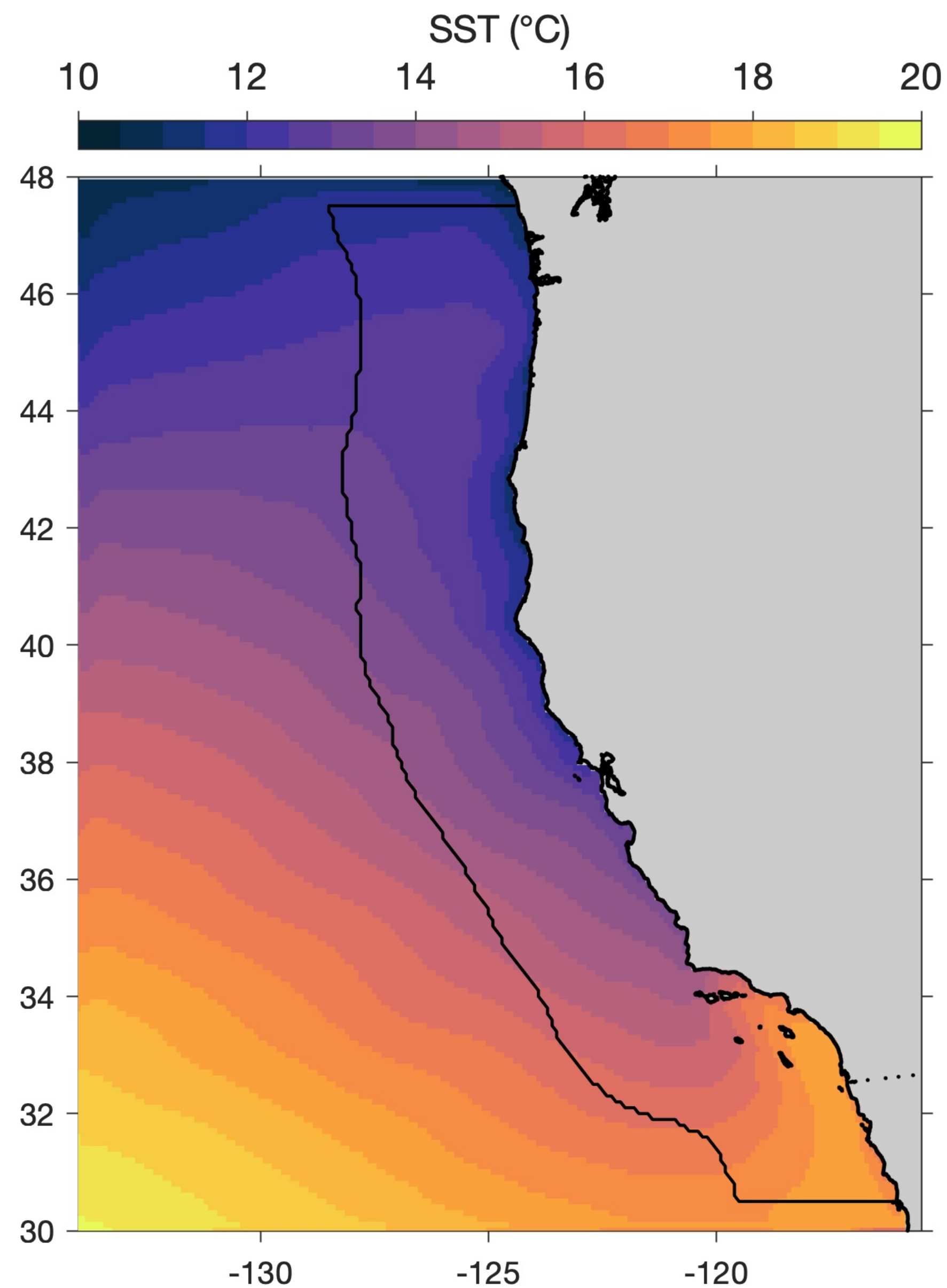
*See Sam Siedlecki's presentation for more west coast seasonal forecasting (including biogeochemistry!)

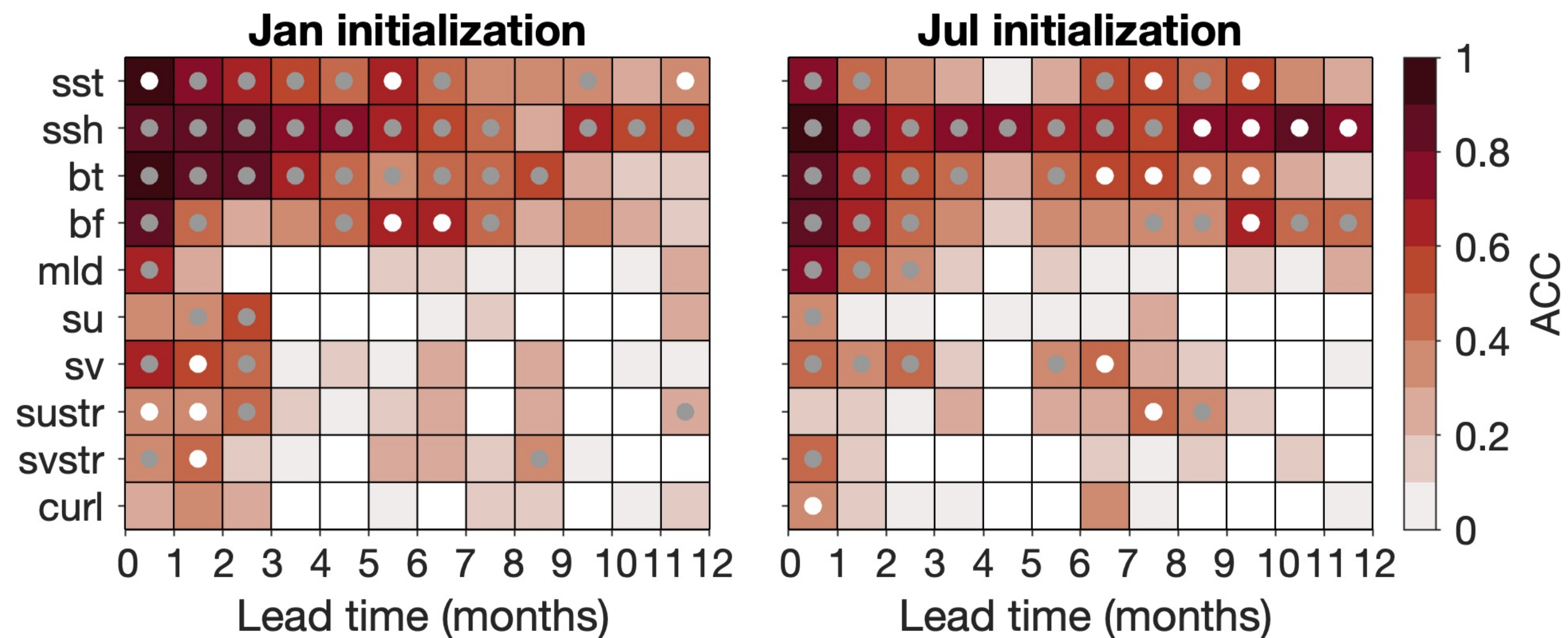
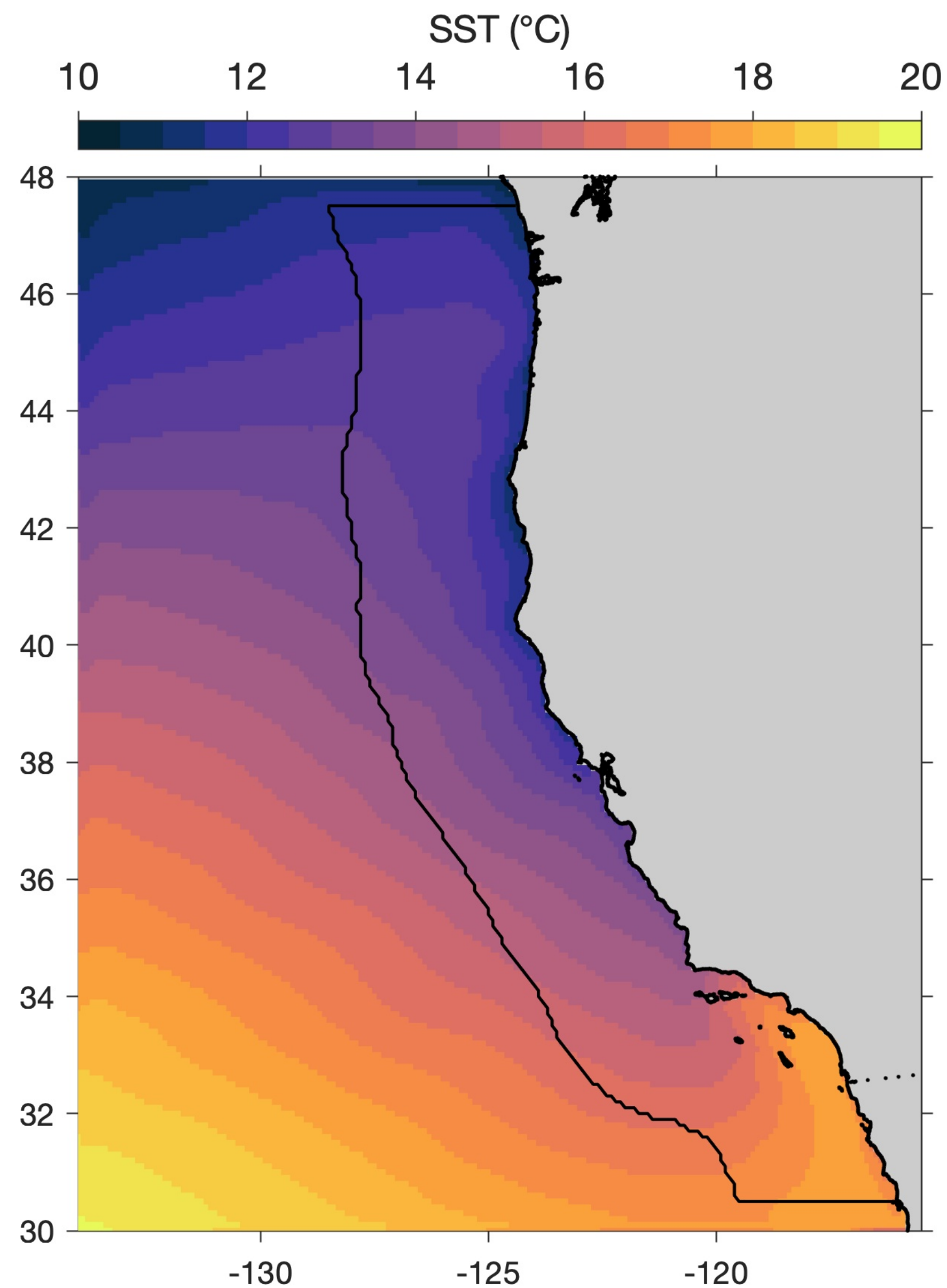
* See Dillon Amaya's presentation for west coast subseasonal forecasting (including Kelvin waves!)



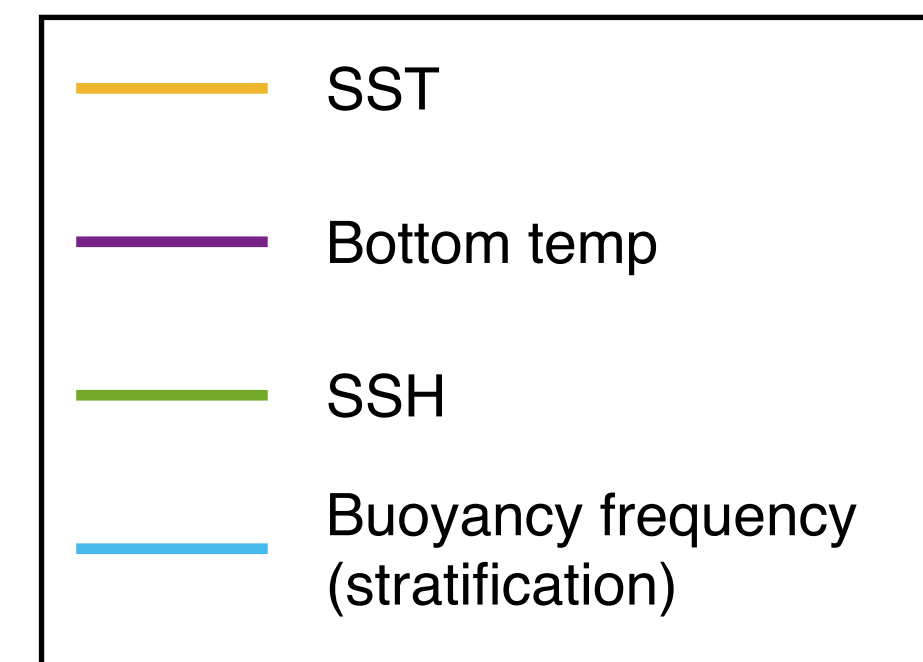
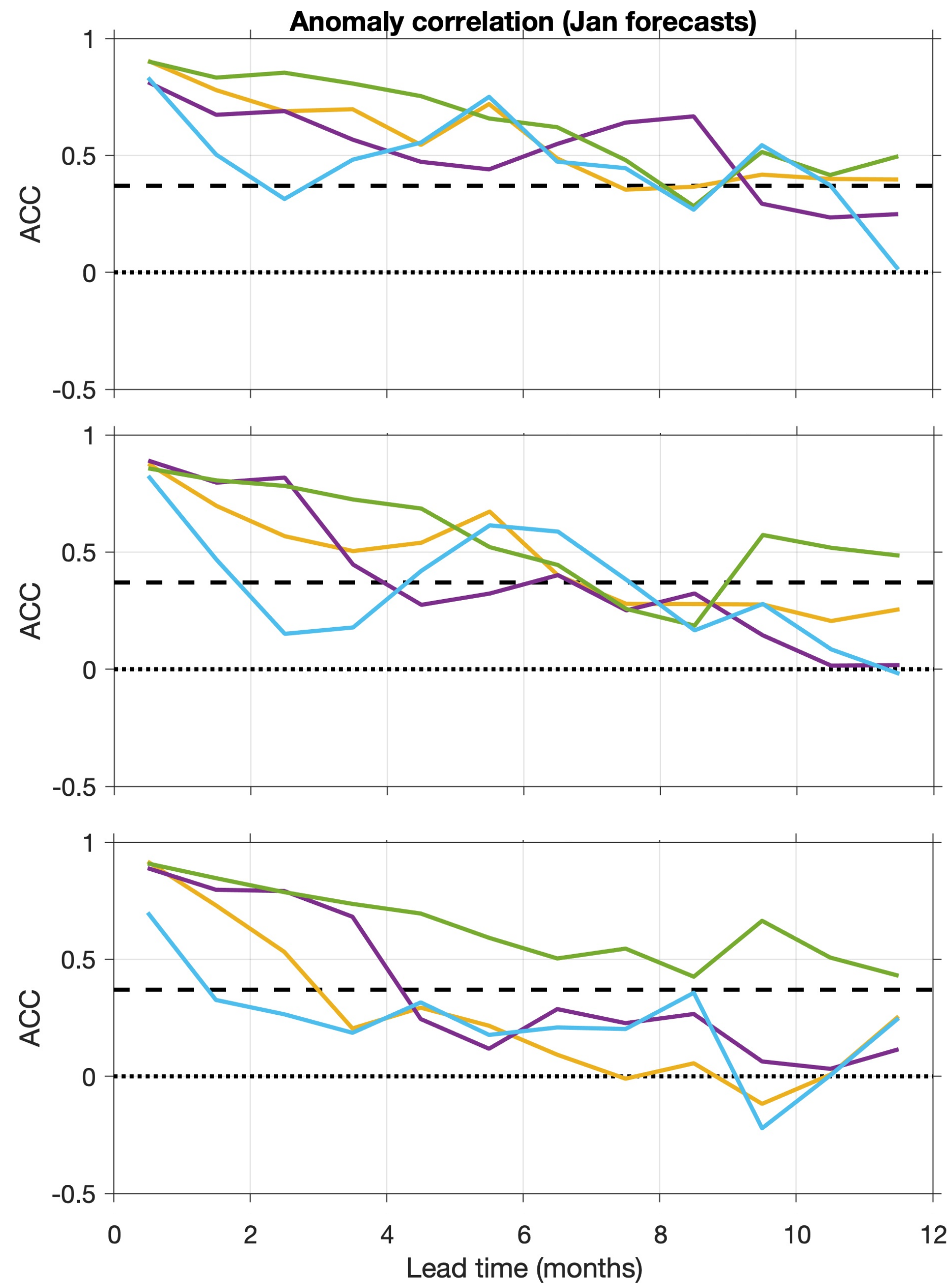
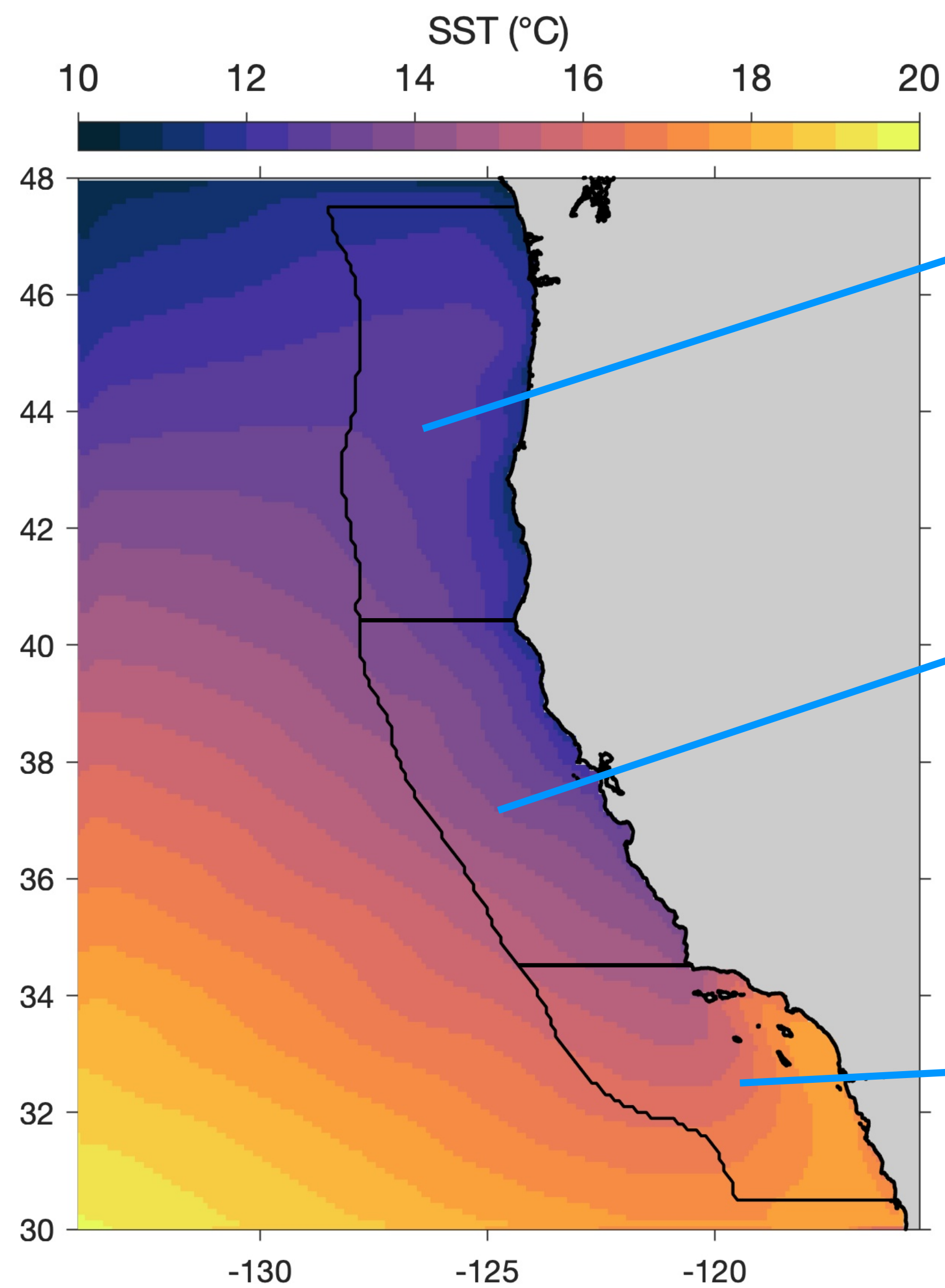


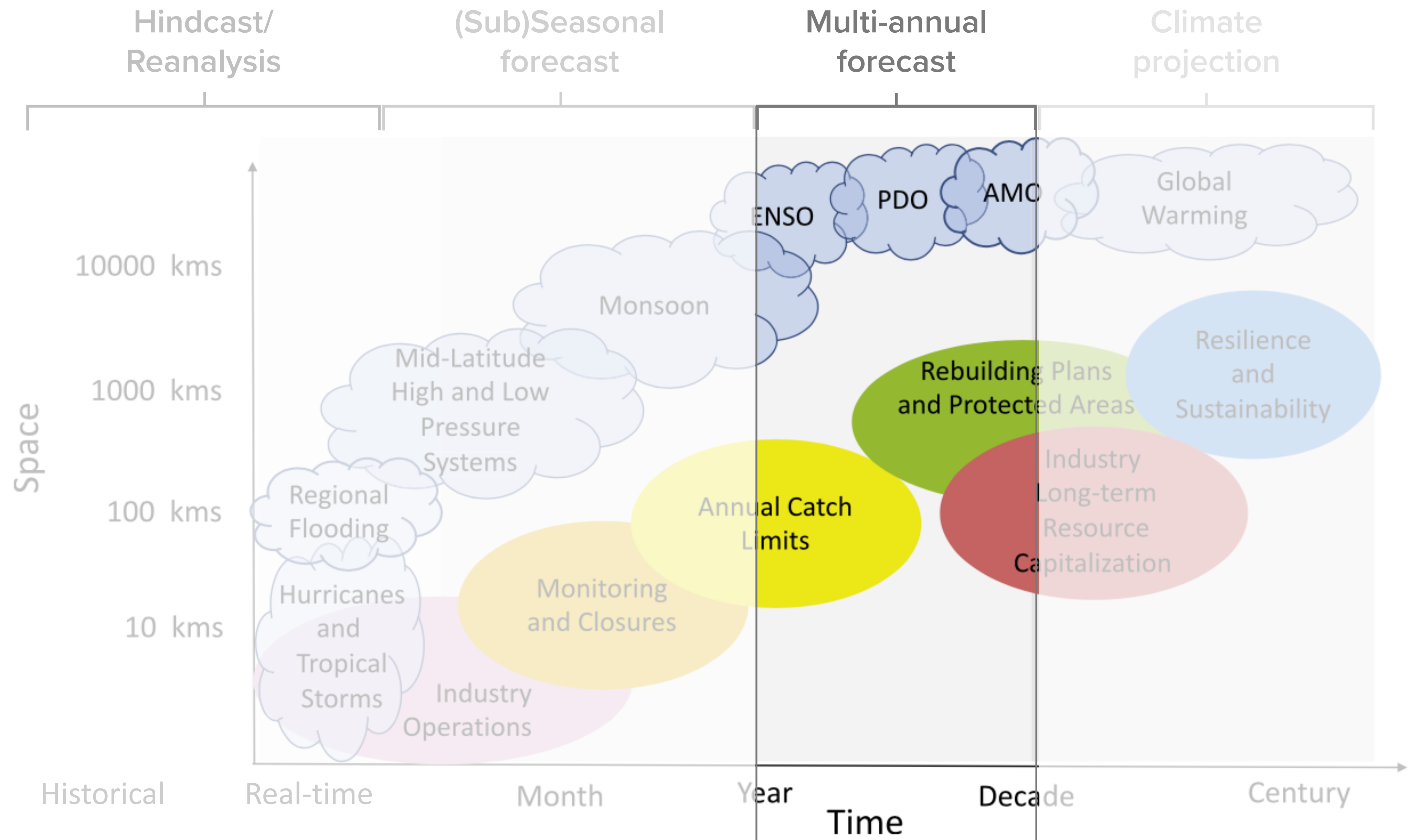


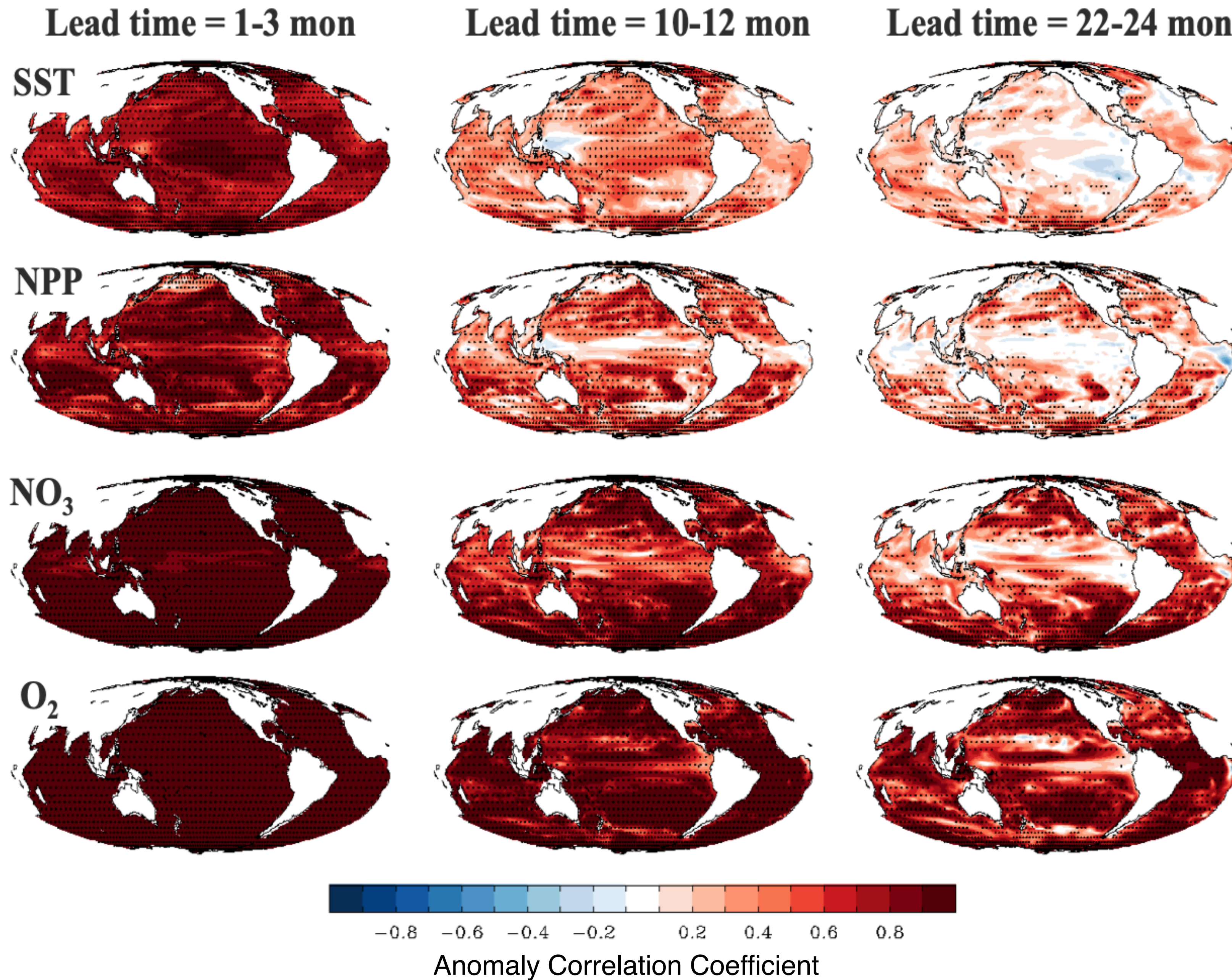




- Skill significantly above zero
- Skill significantly better than persistence forecast

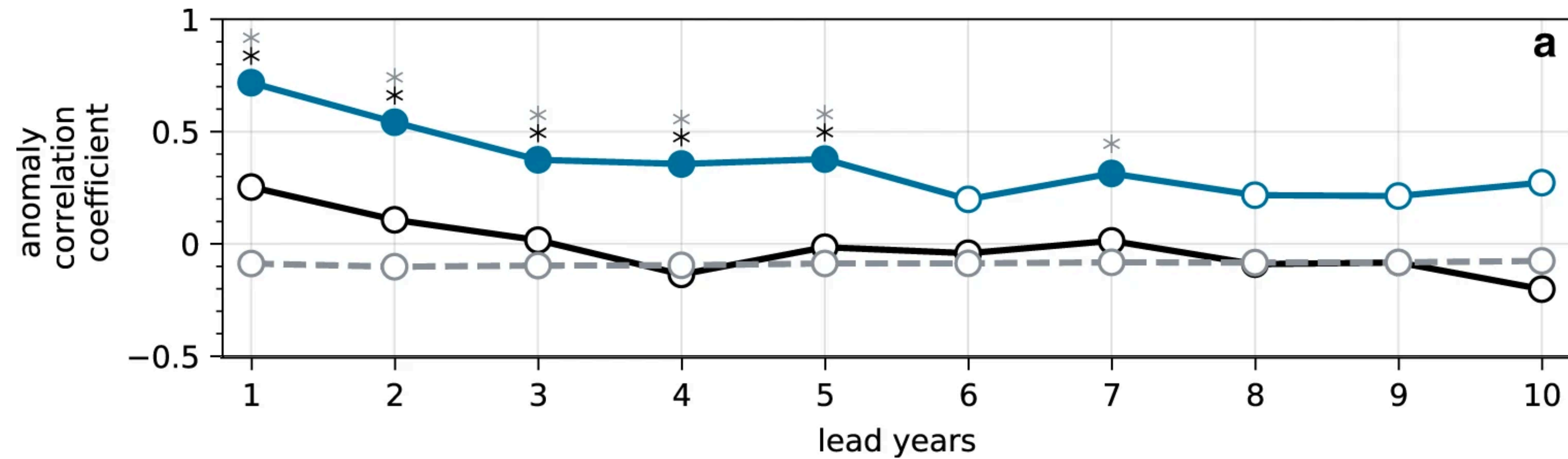






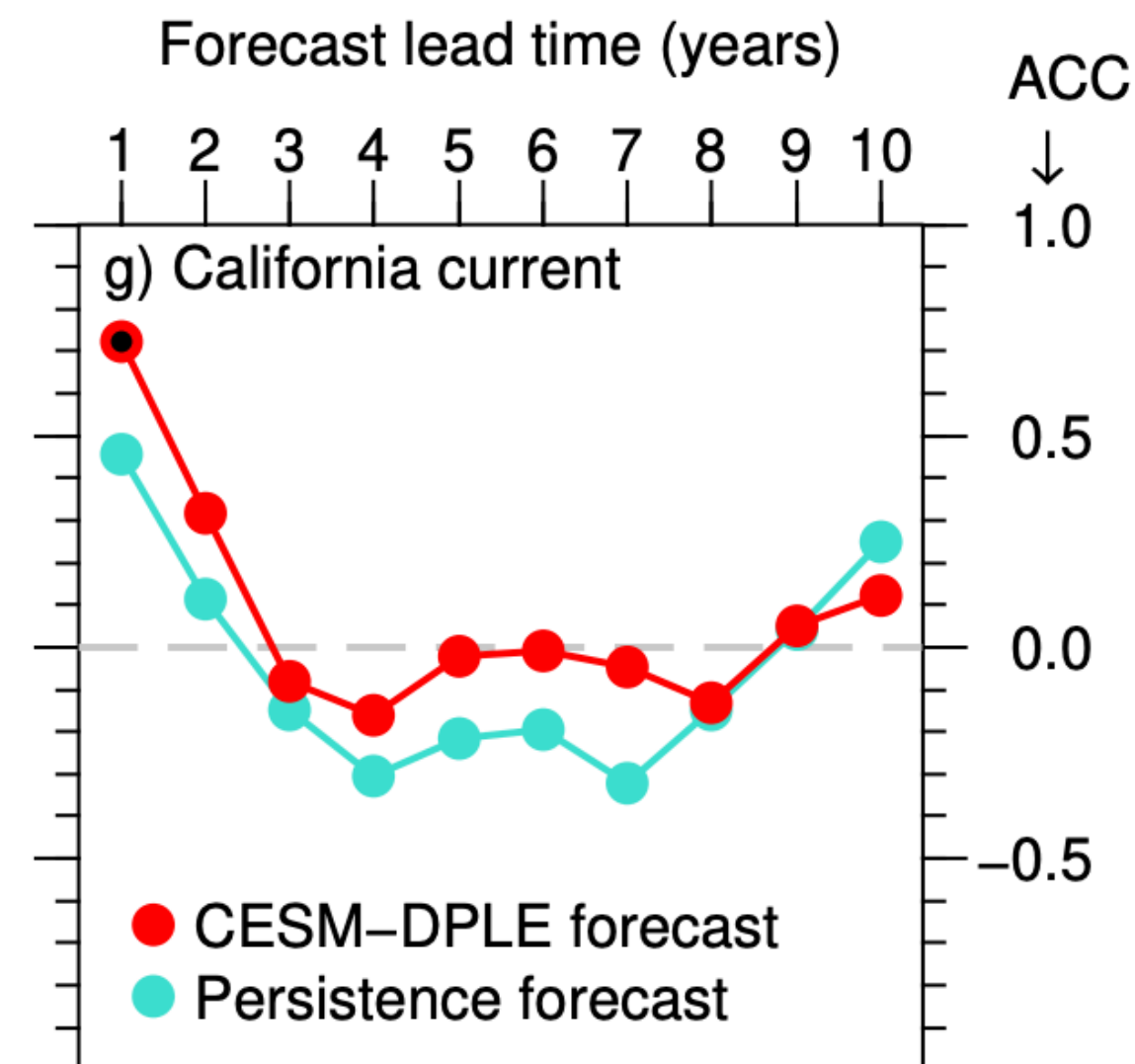
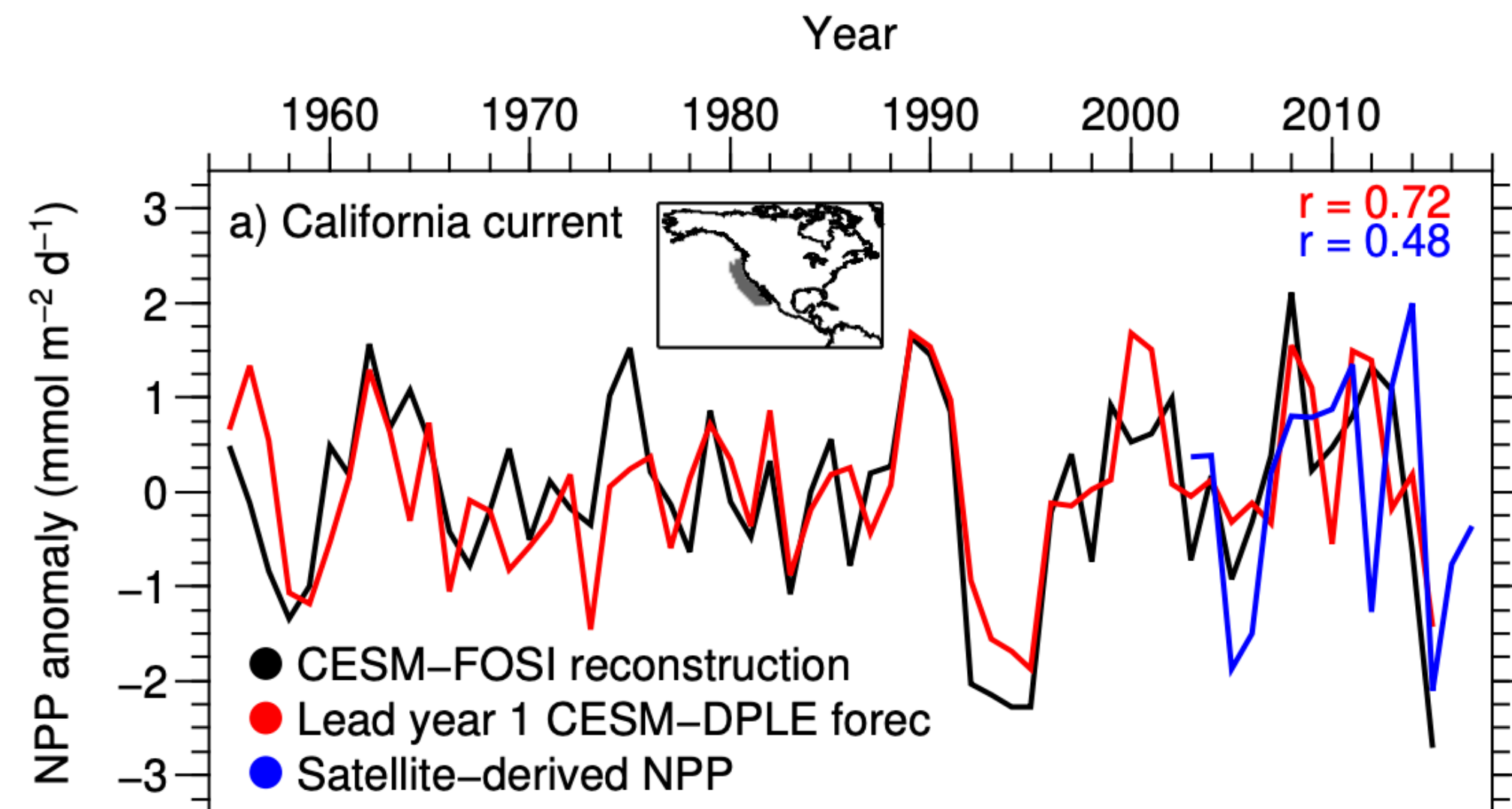
Park et al. 2019

Surface pH



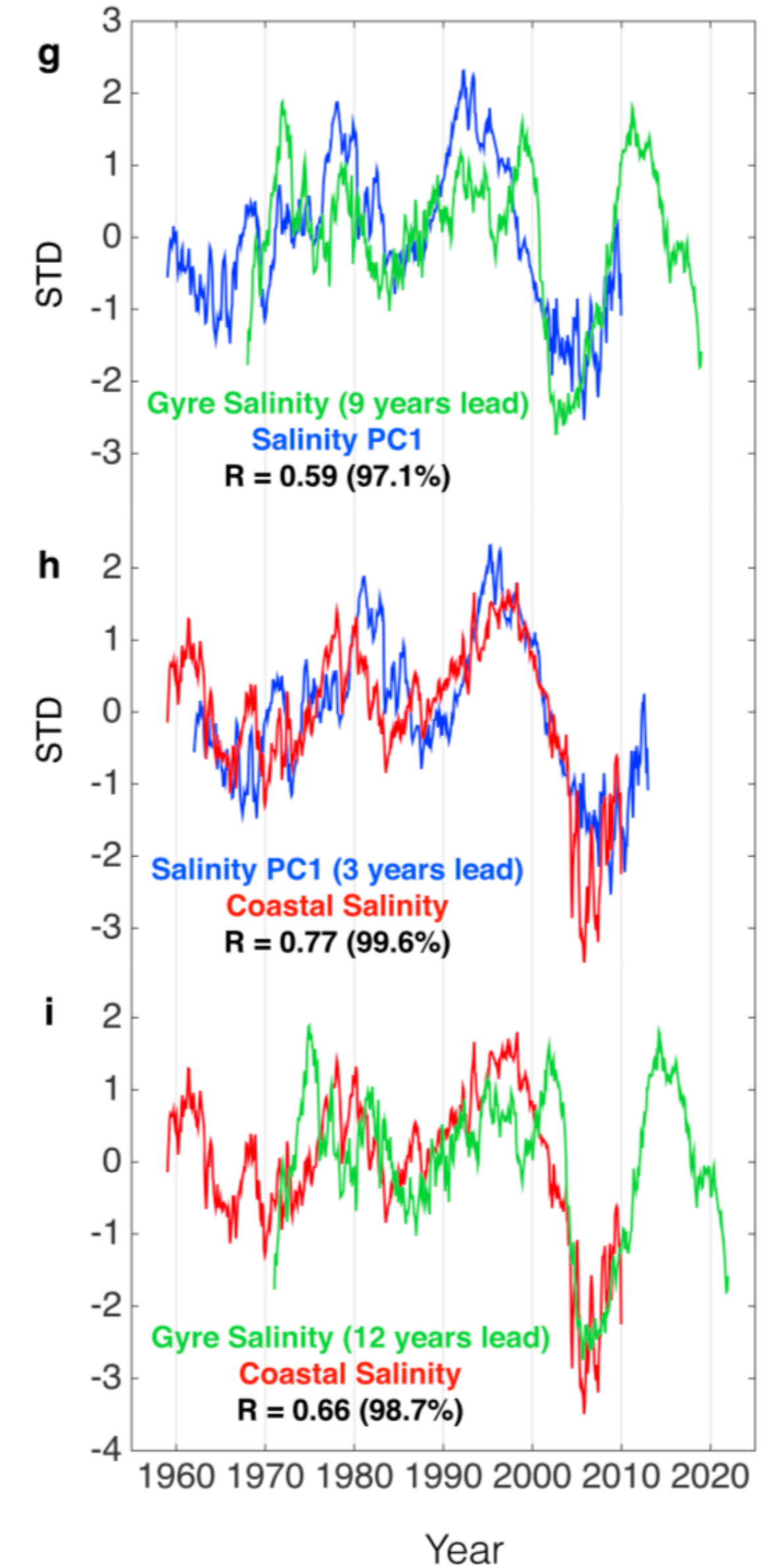
Brady et al. 2020

Net primary production



Krumhardt et al. 2020

Salinity (oxygen proxy)



Pozo Buil and Di Lorenzo (2019)

Connecting physical forecasts to ecological forecasts

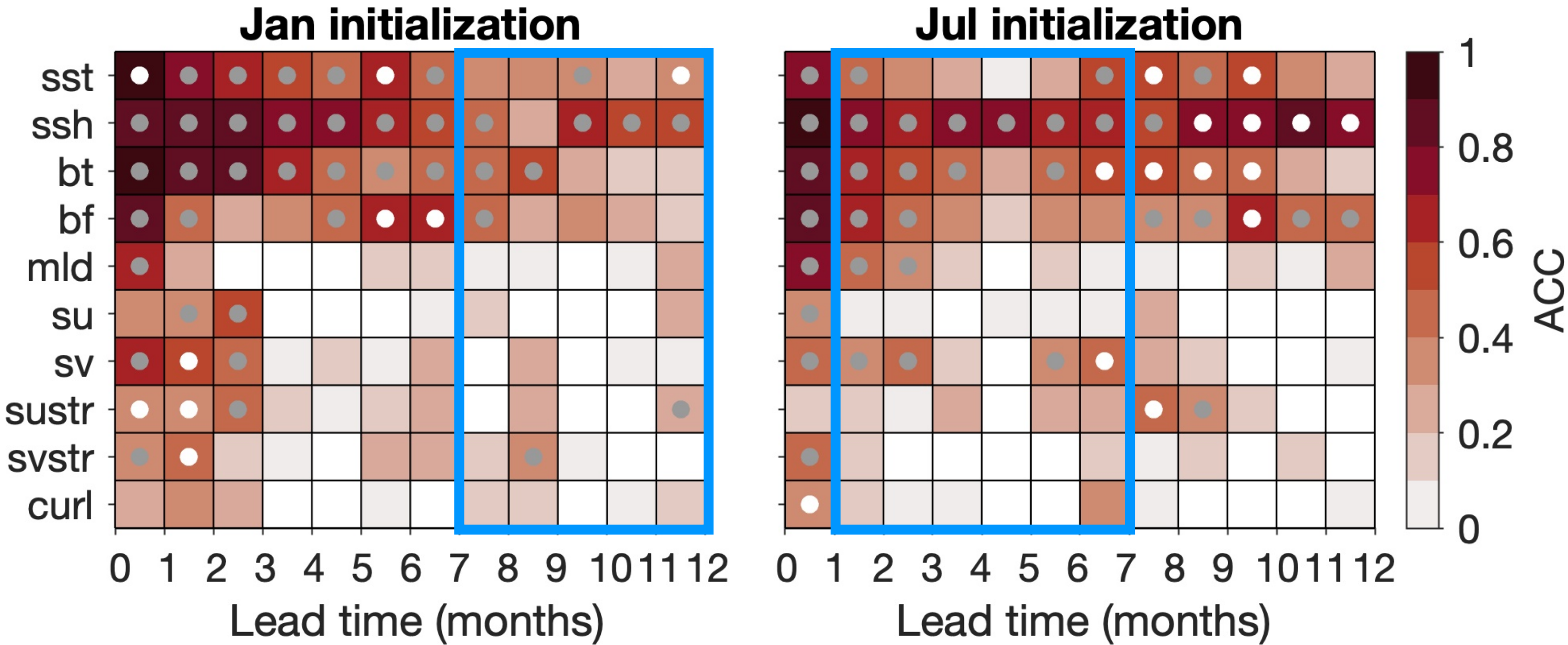
Application	Region	Key physical variables	Forecast month
EcoCast	West Coast	Full suite *	Aug-Jan
TOTAL (loggerheads)	Southern CA	SST anomaly	Dec-Jul
Whale ship strikes	Southern CA	Full suite *	May-Nov
Sardine recruitment	Southern CA	SST, SSH	Mar-May
Whale entanglement	West Coast	SST (habitat compression)	Mar-Nov
Albacore distribution	OR/WA	Full suite *	Jun-Nov
Squid fishery forecast	West Coast	SST, SSH	Mar-Apr
Salmon survival	Central/northern CA	SSH, Currents, Upwelling	Mar-Jun

*Full suite
SST
SSH
Surface currents (u,v)
Wind Stress (u,v,curl)
Mixed layer depth
Stratification

Connecting physical forecasts to ecological forecasts

Application	Region	Key physical variables	Forecast month
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*Full suite
SST
SSH
Surface currents (u,v)
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Connecting physical forecasts to ecological forecasts

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