

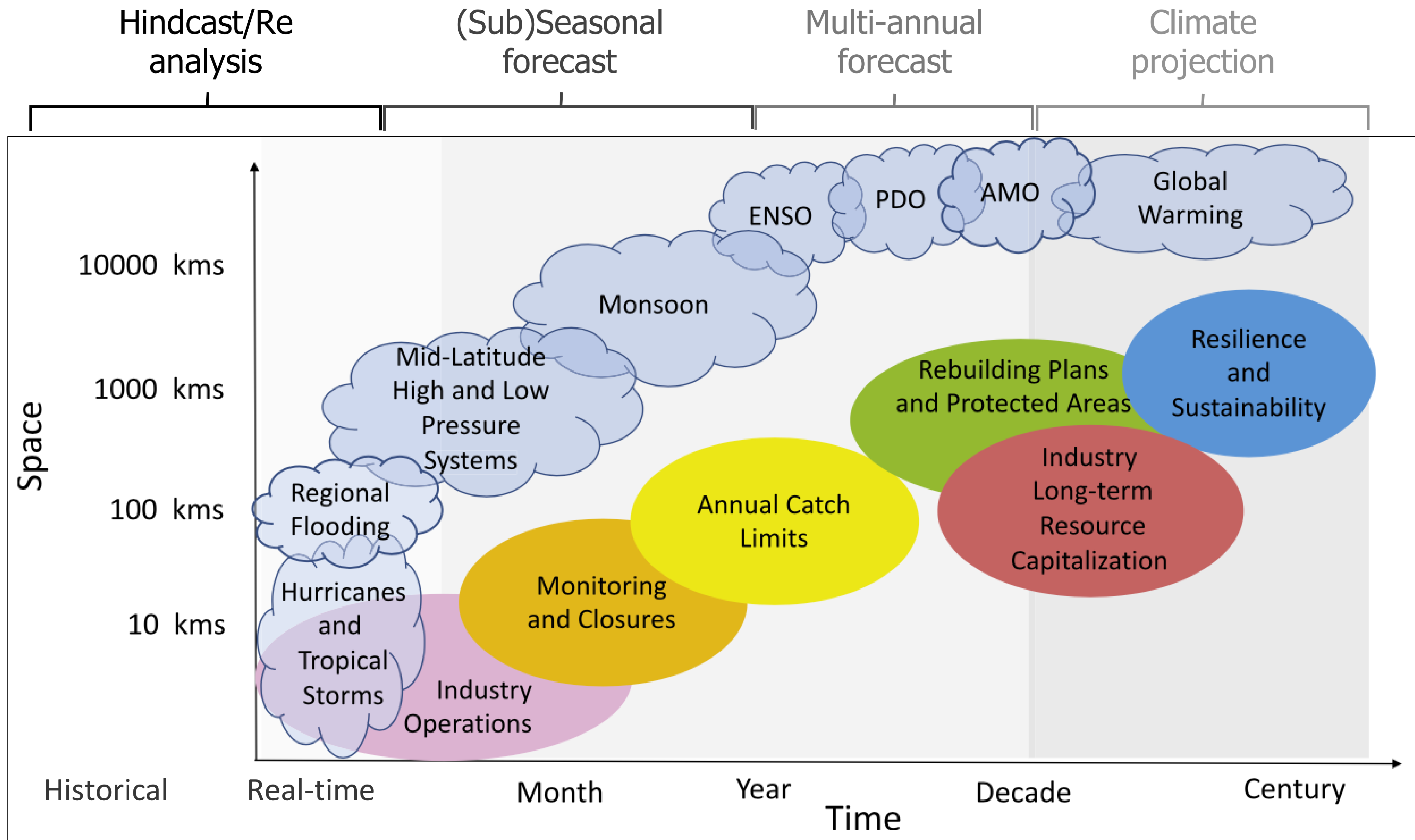
Seasonal-to-Interannual Prediction of Coastal Marine Ecosystems

Mike Jacox

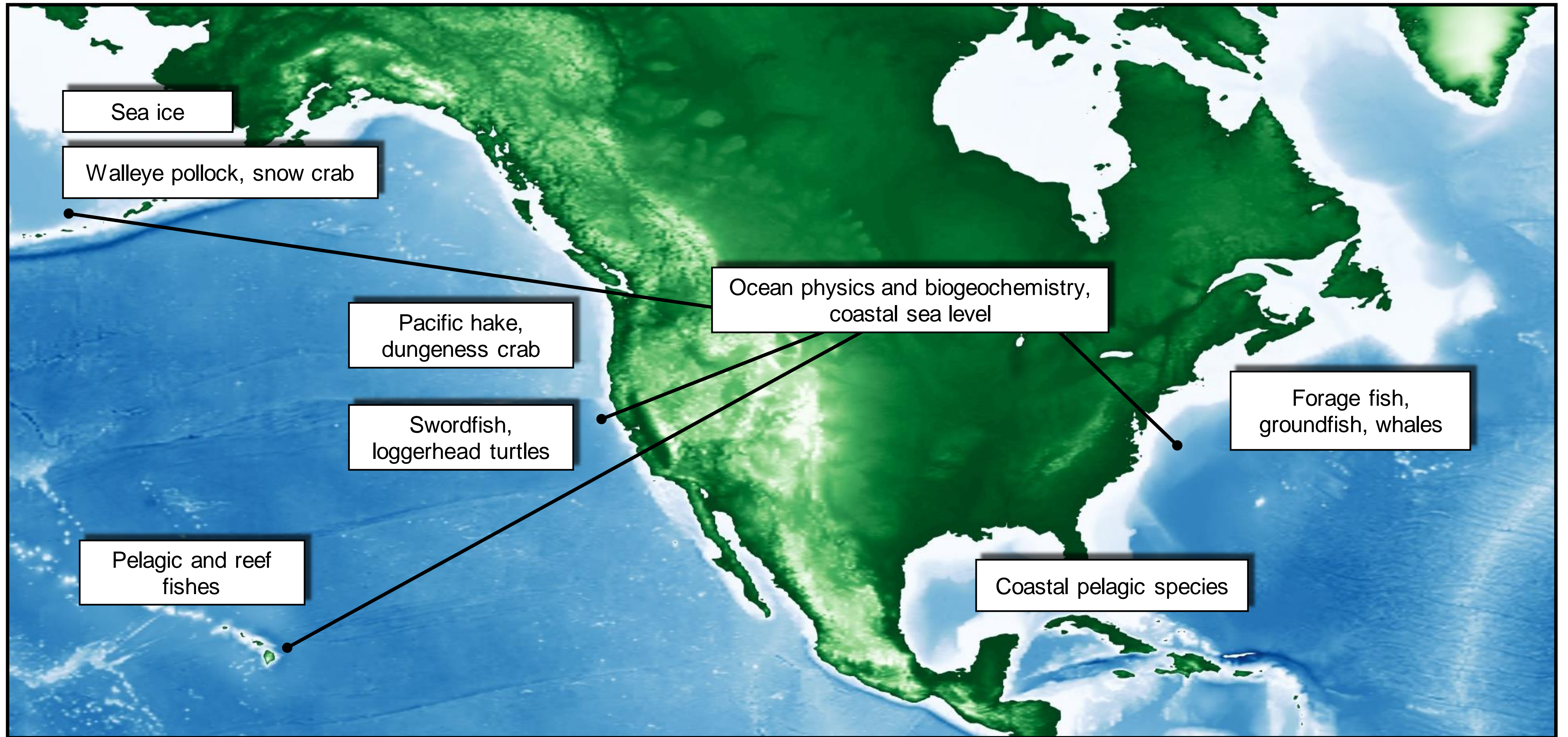
NOAA Southwest Fisheries Science Center
NOAA Earth System Research Laboratory

Basin-scale Events to Coastal Impacts
Climate and Ocean Modeling Workshop
May 10, 2022



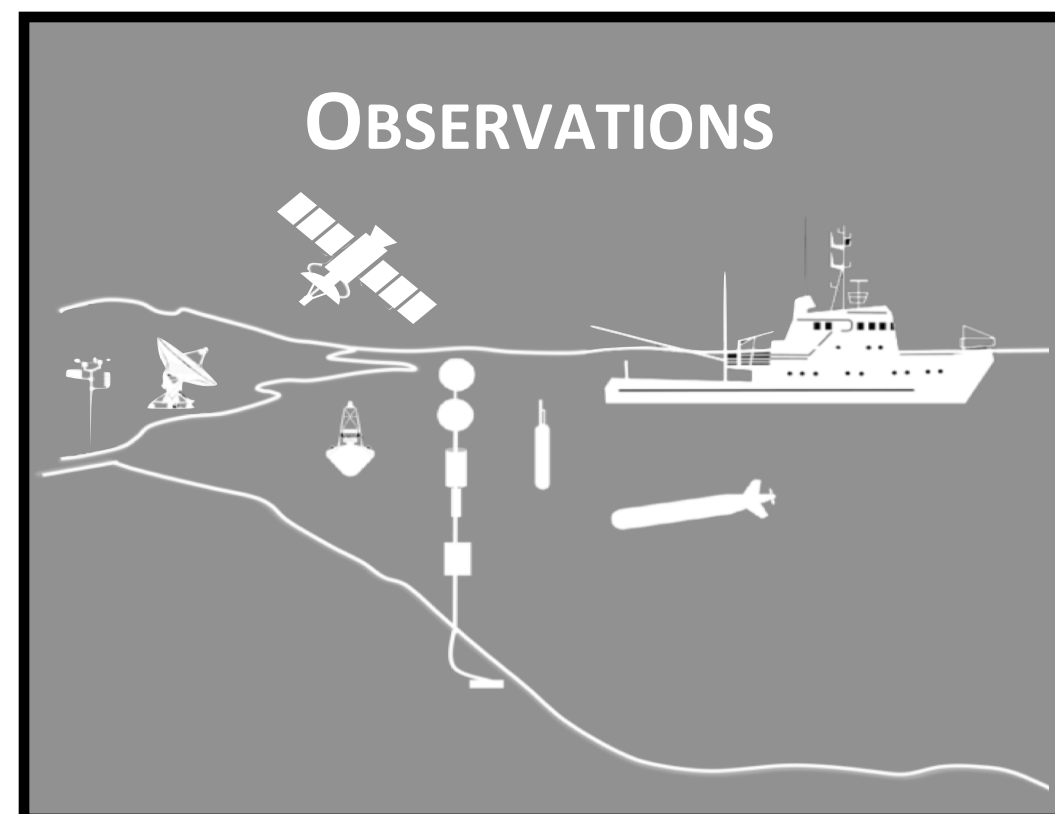
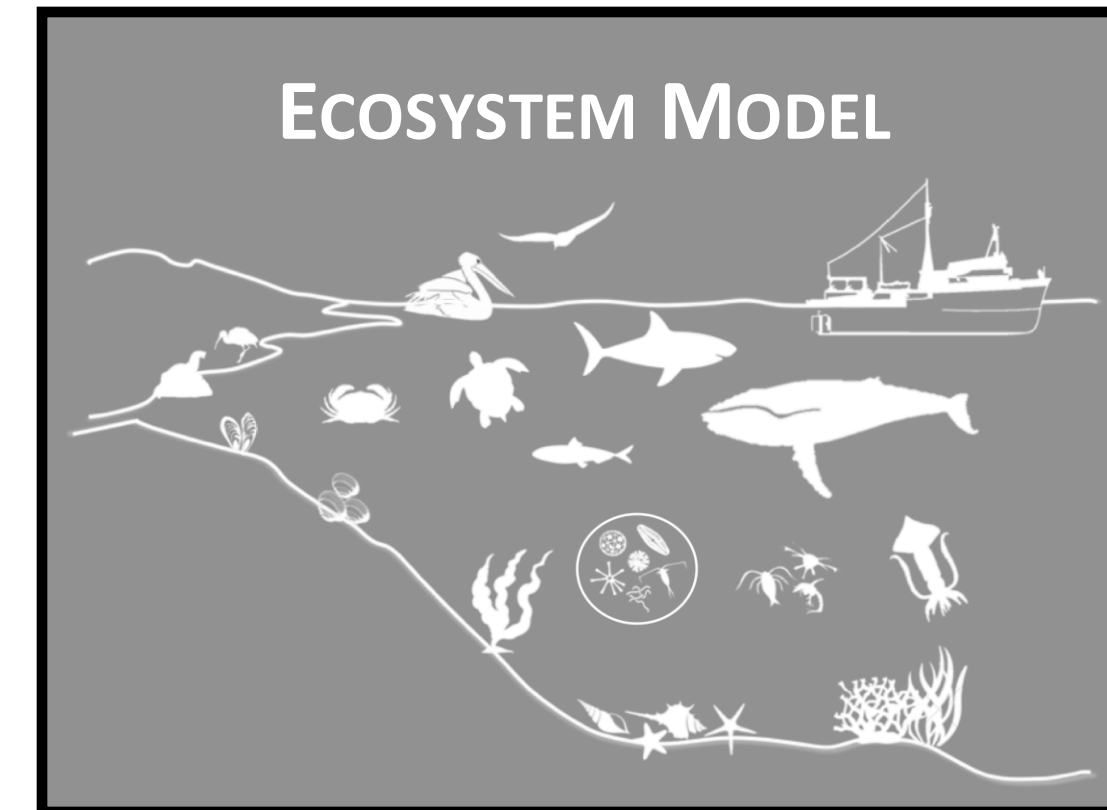
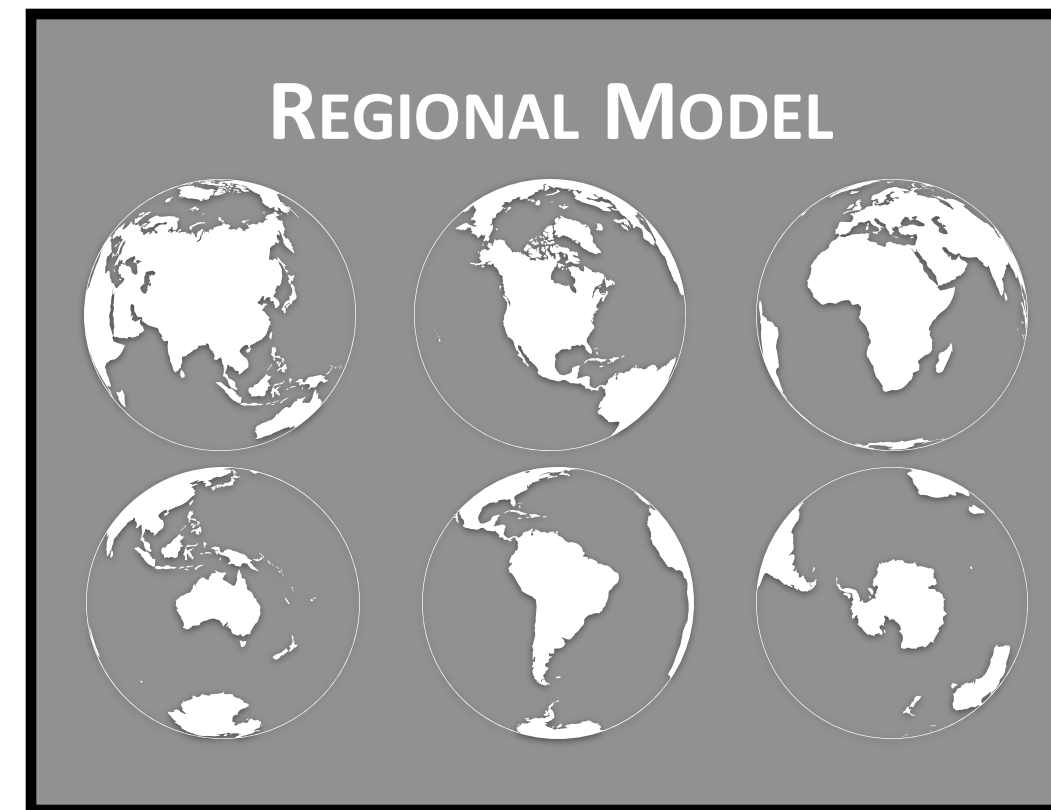
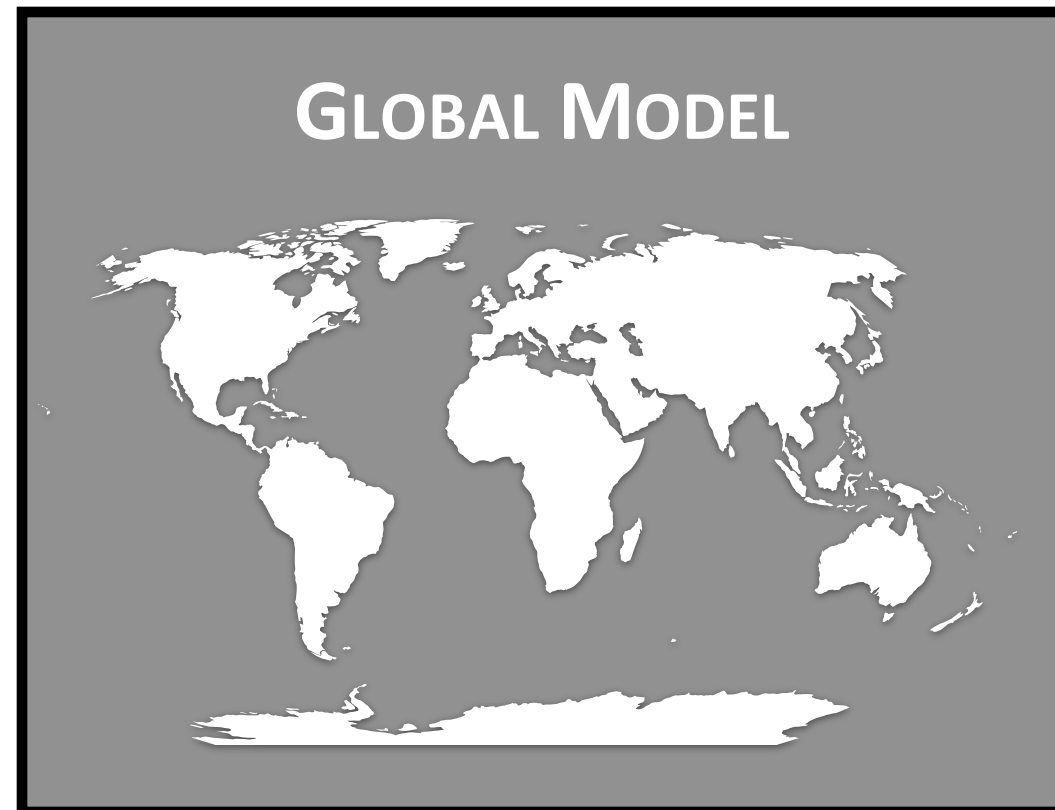


Modeling predictability of fisheries and other living marine resources



NOAA/MAPP funded projects (2017-2023)

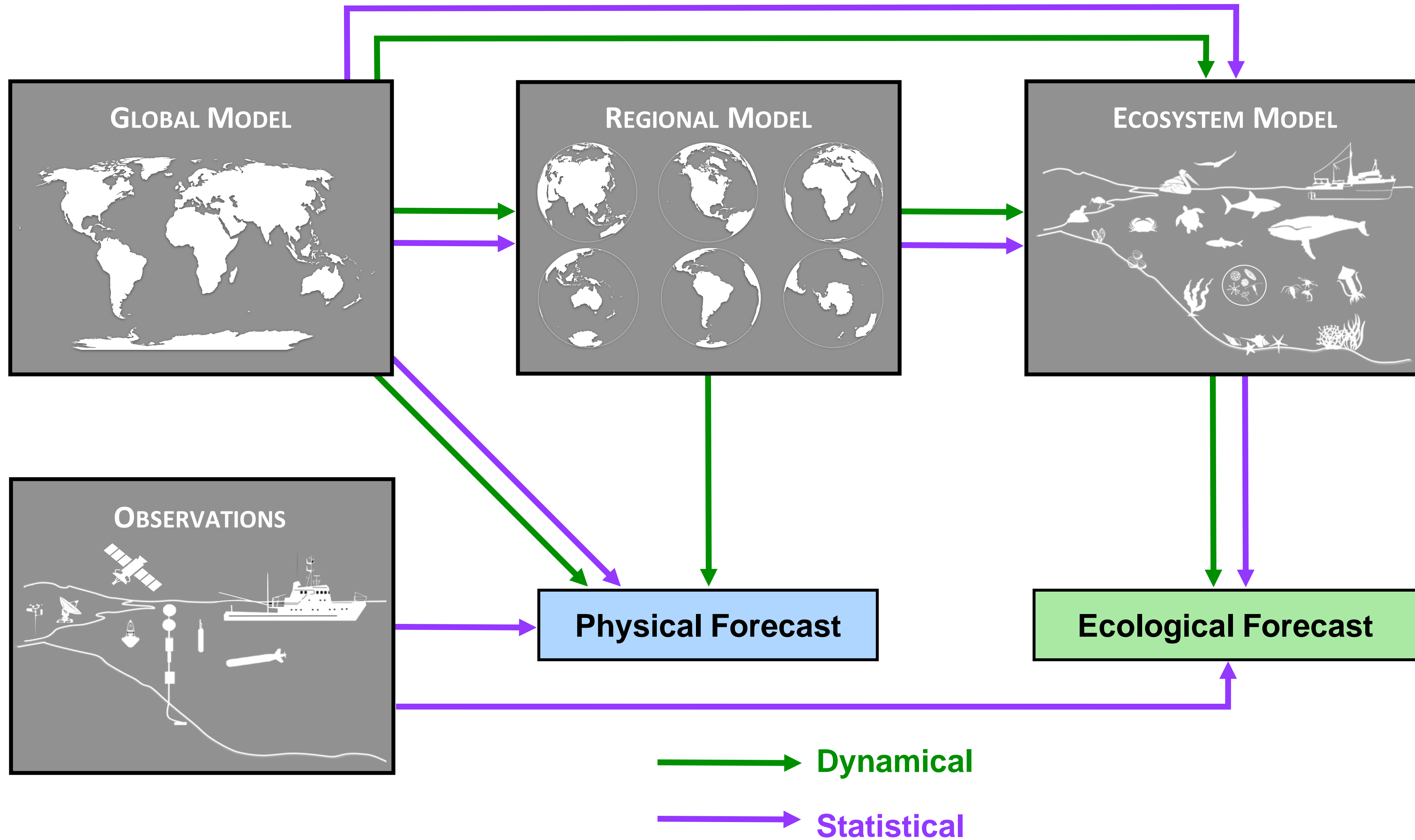
Forecast tools and methods



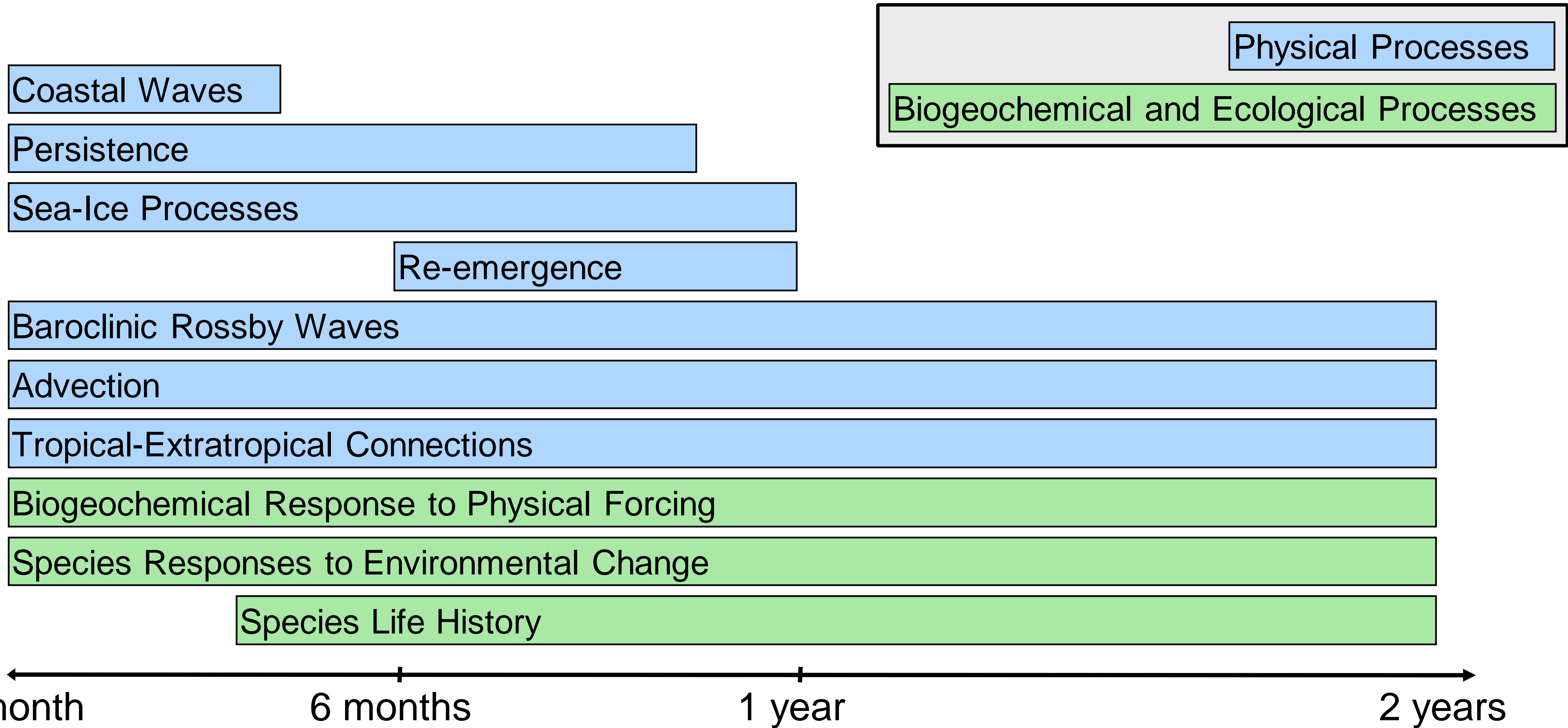
Physical Forecast

Ecological Forecast

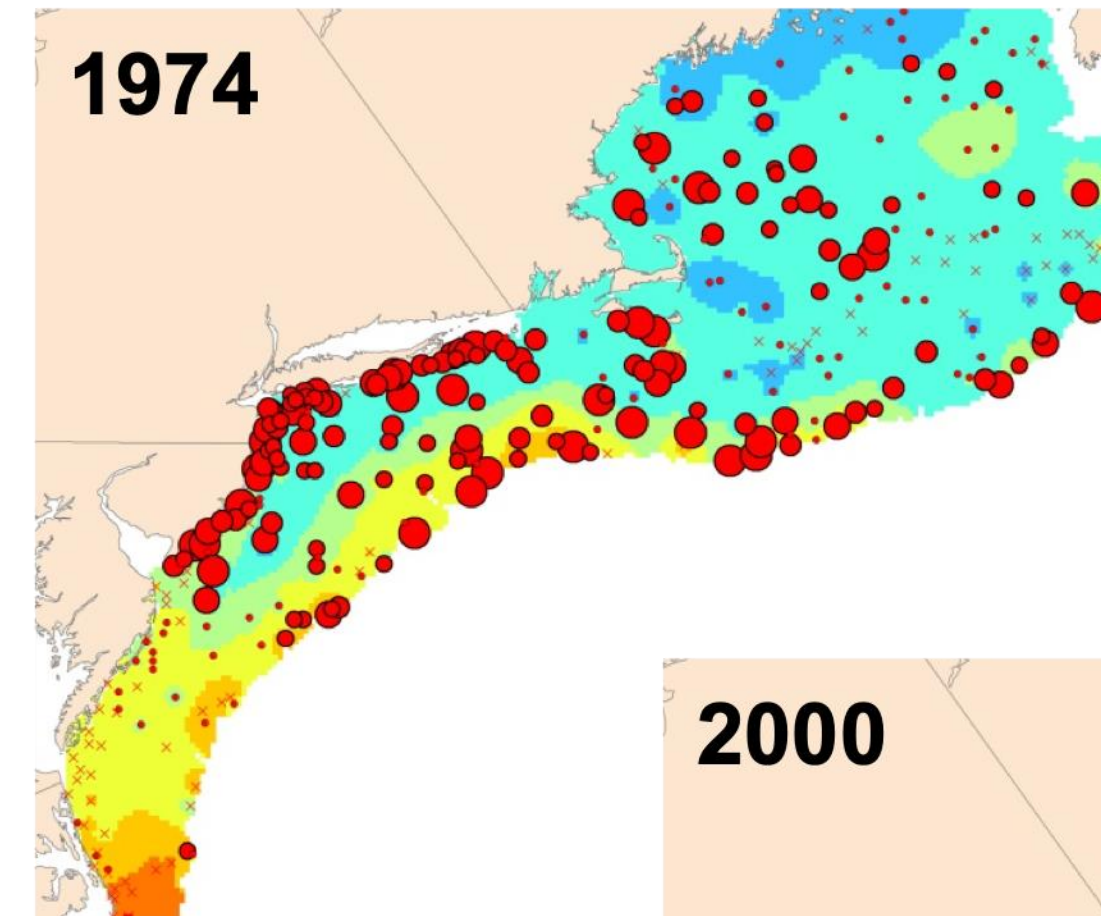
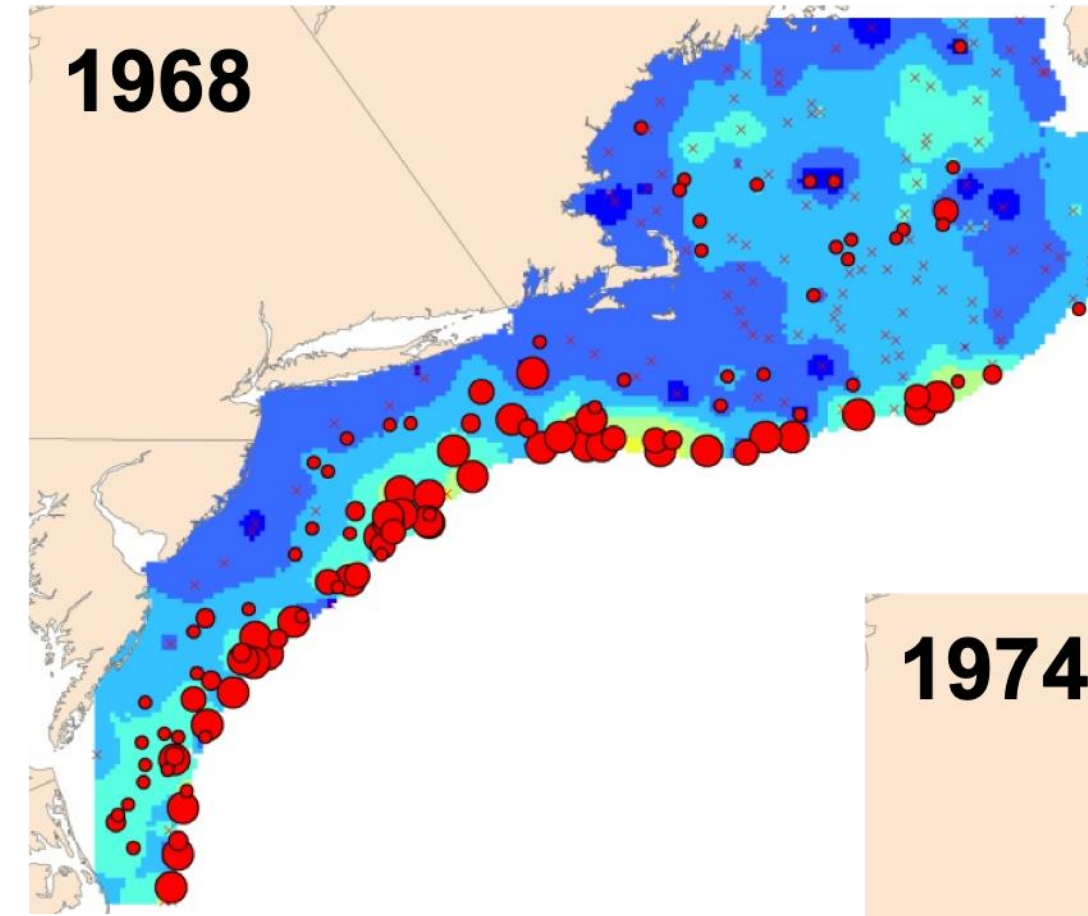
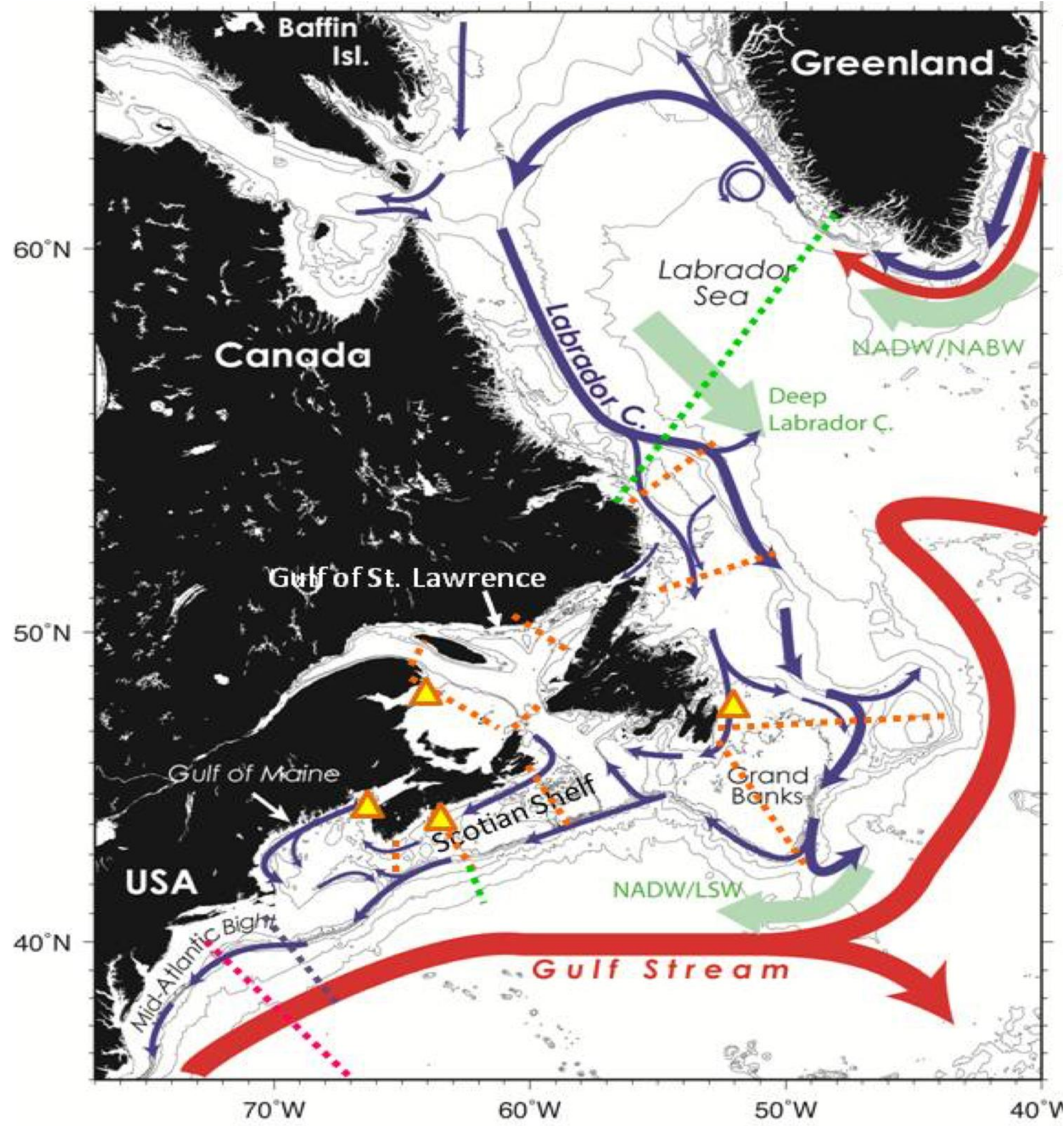
Forecast tools and methods



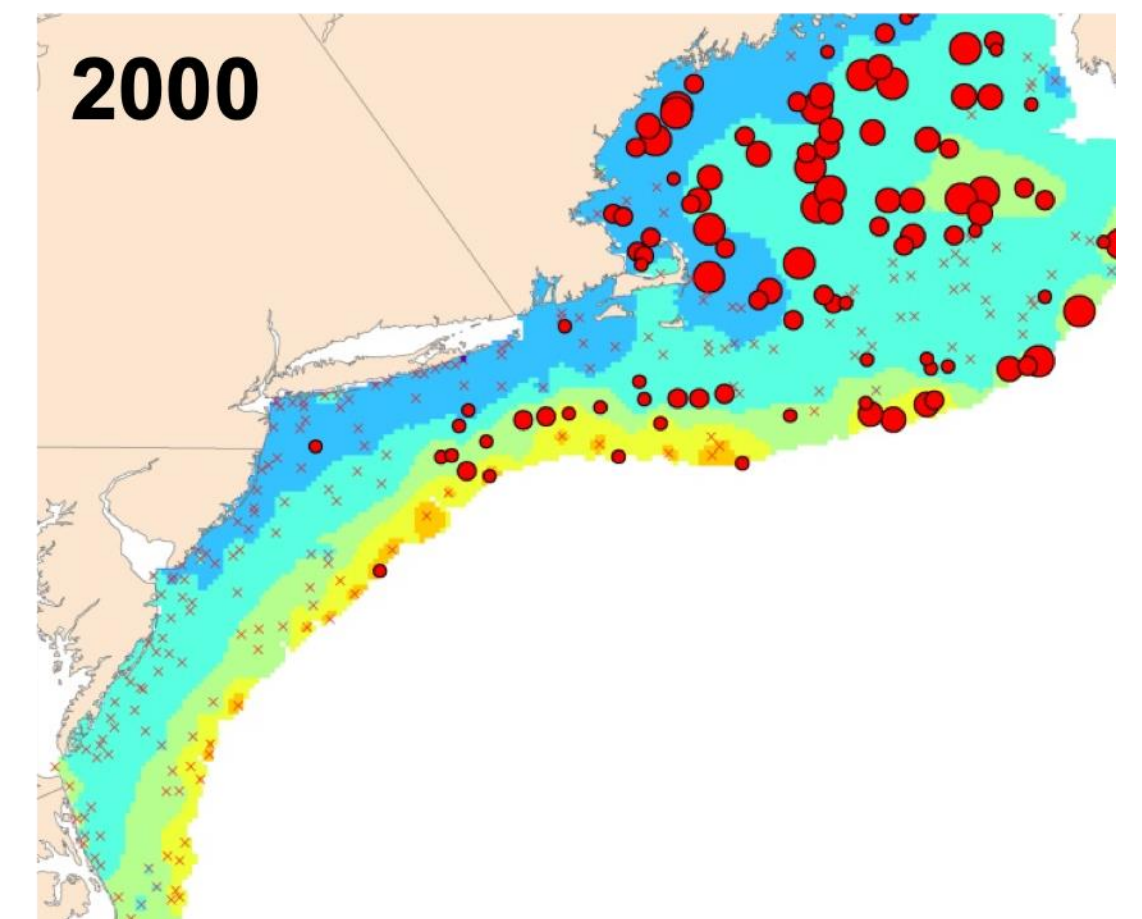
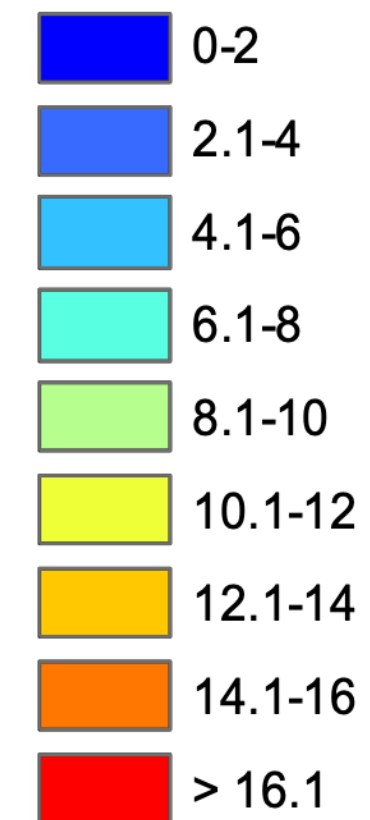
Mechanisms of predictability



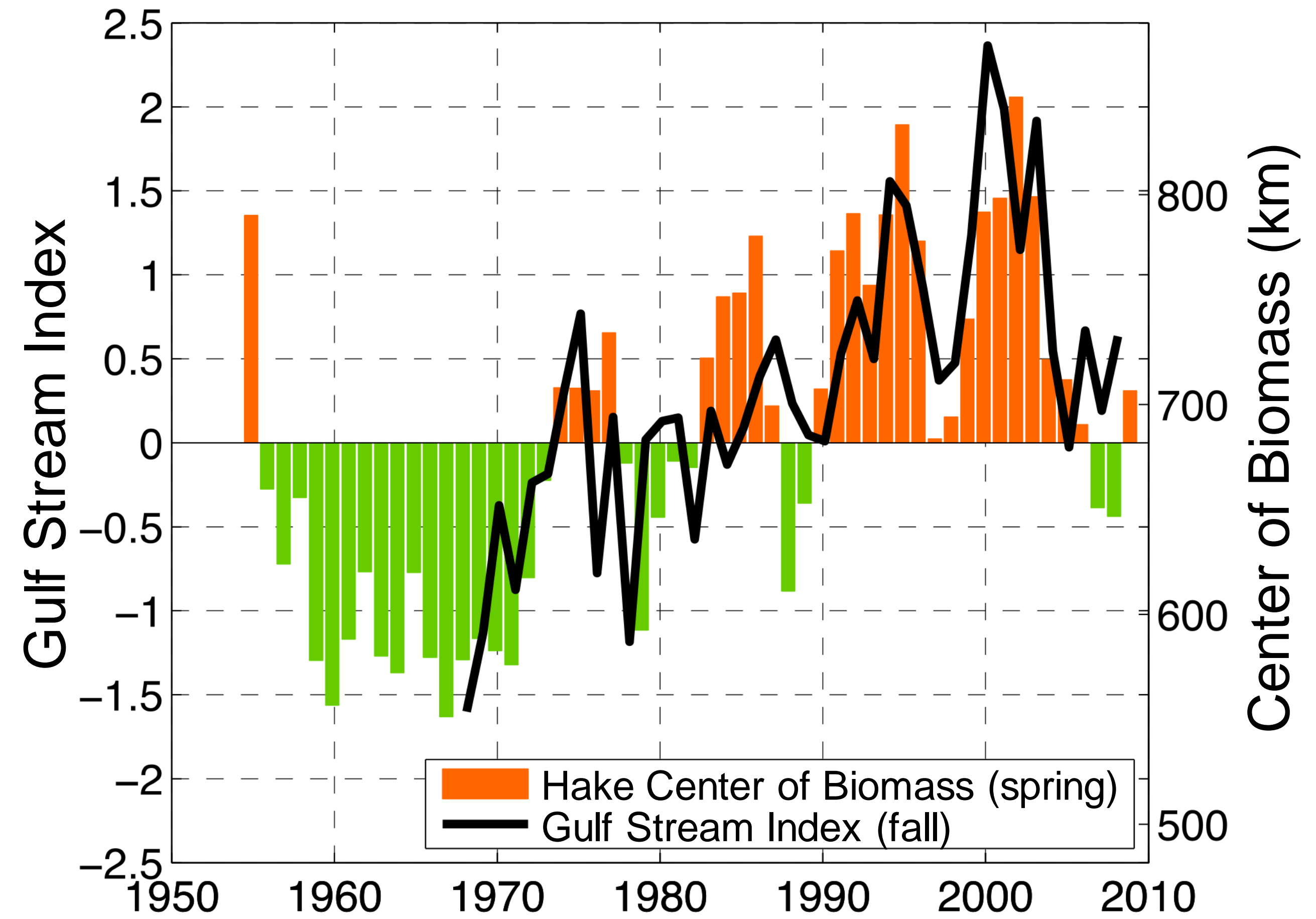
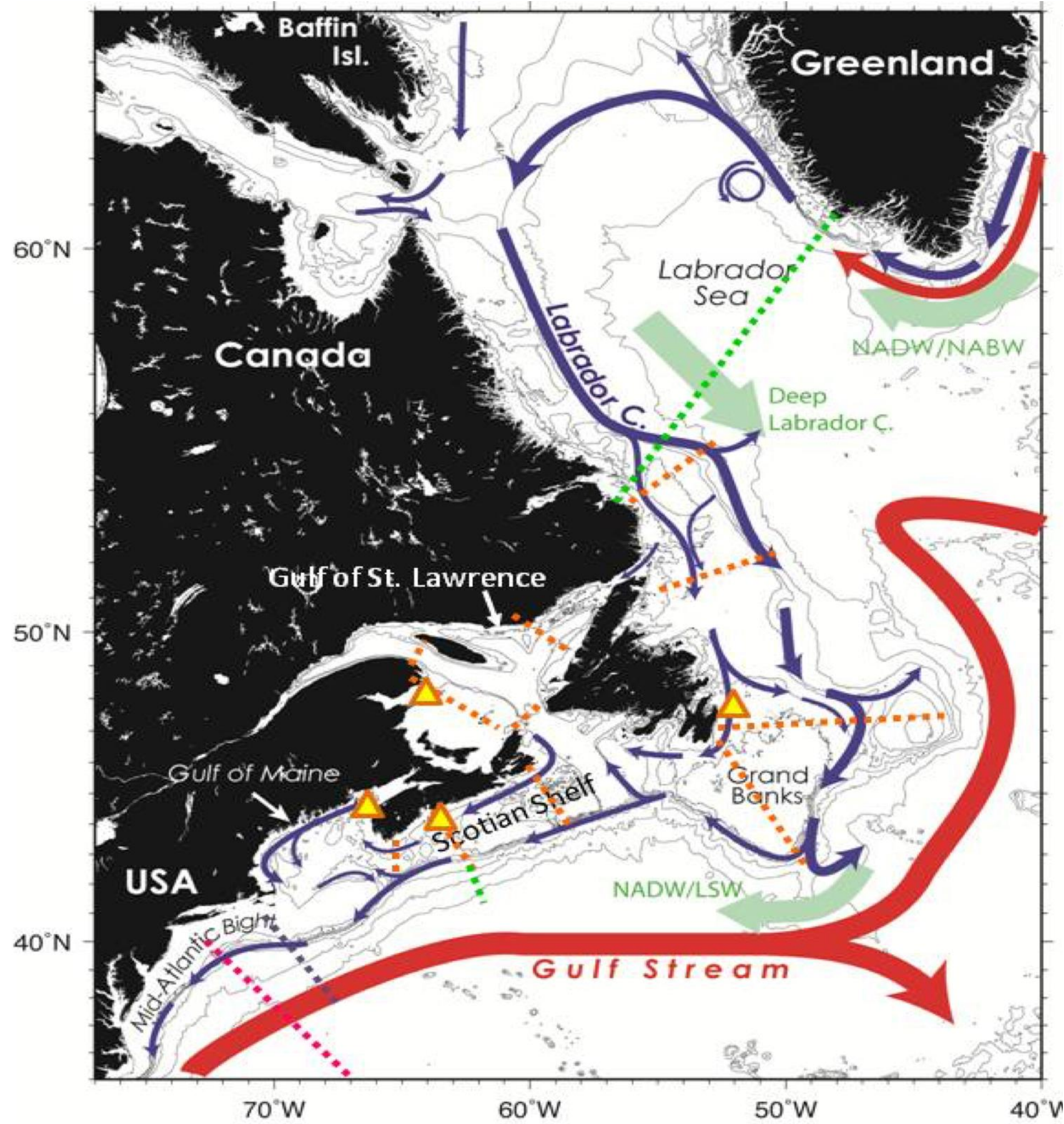
Forecast applications - Northeast U.S. silver hake

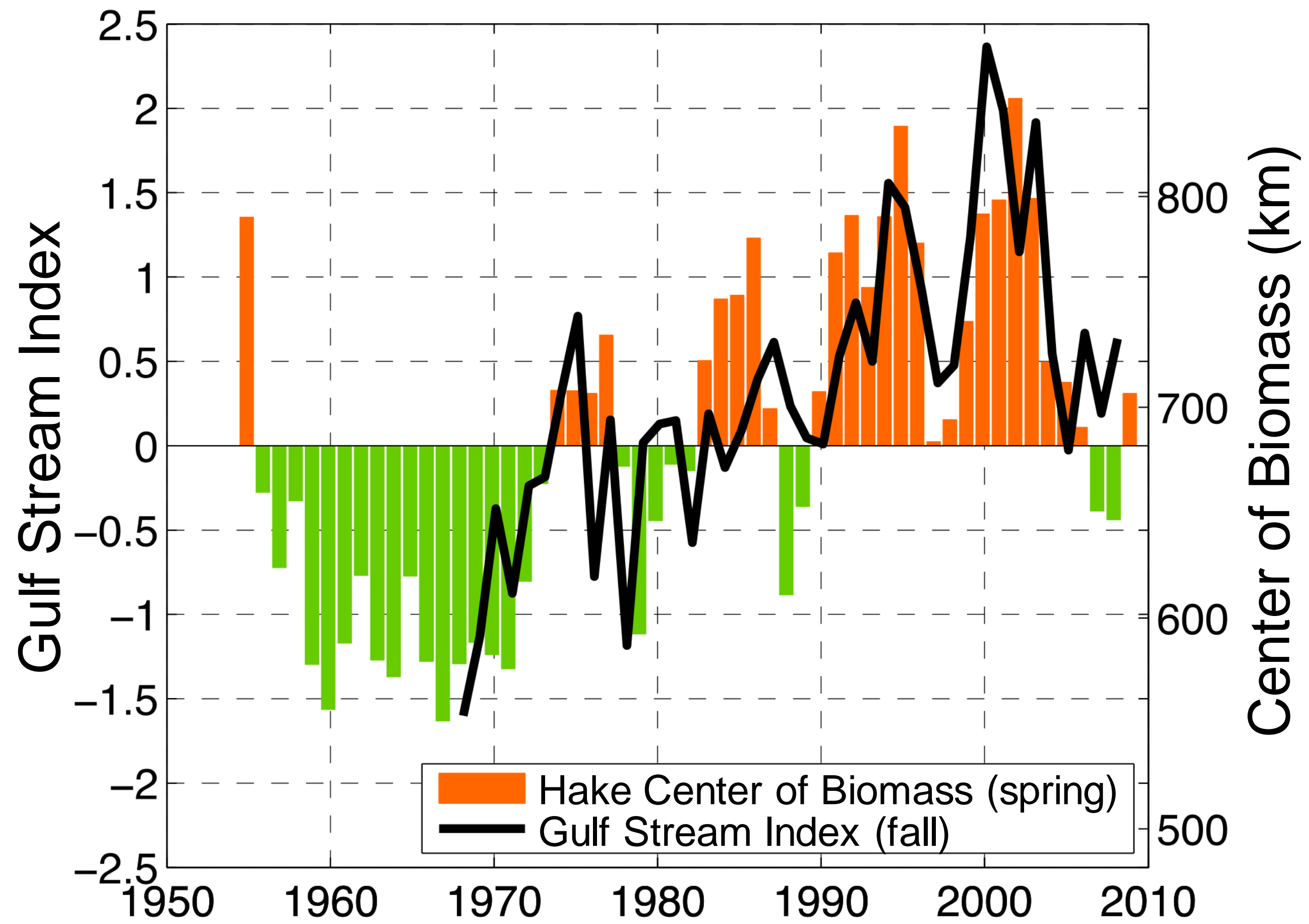
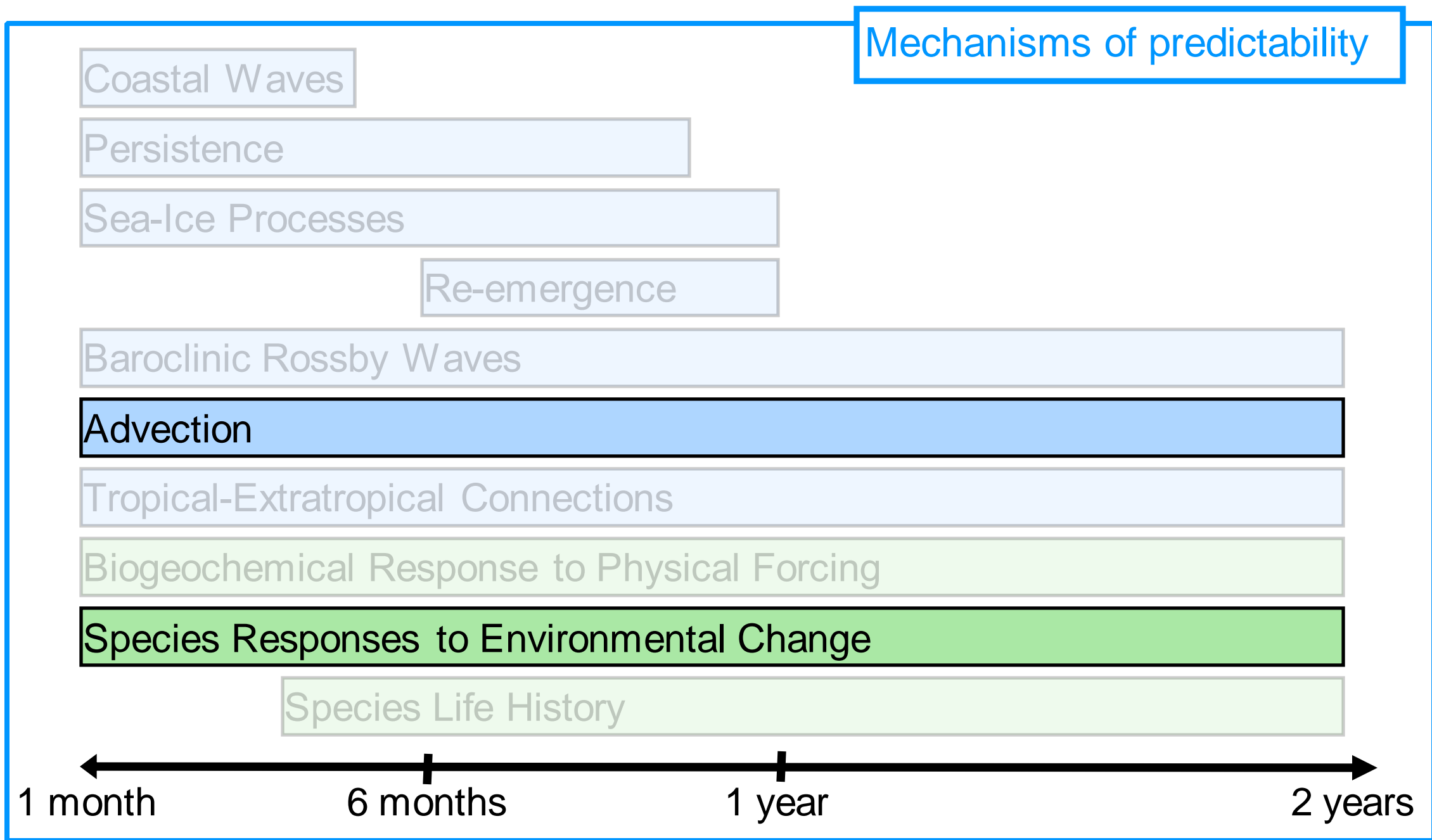
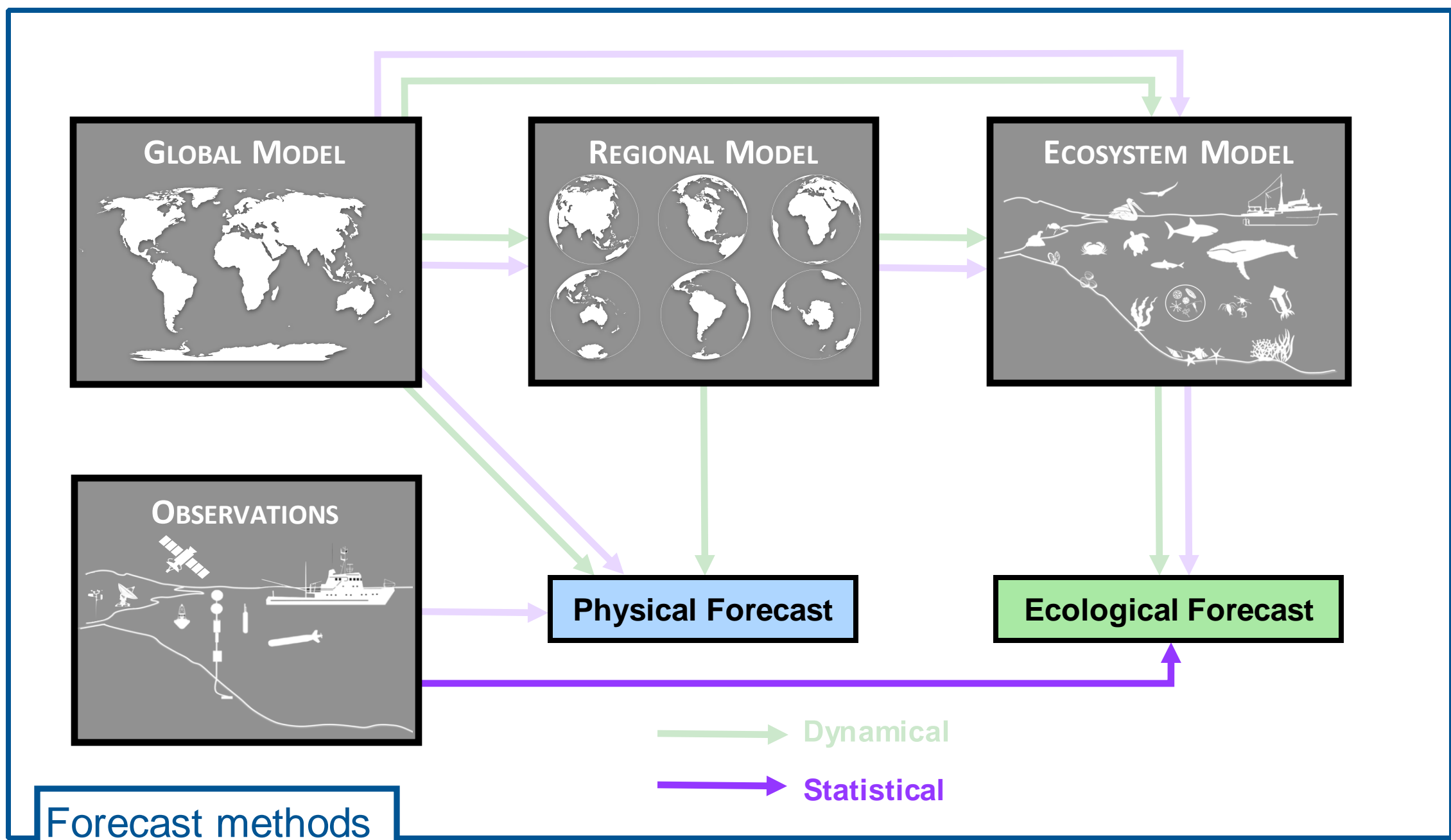


Temperature (C)

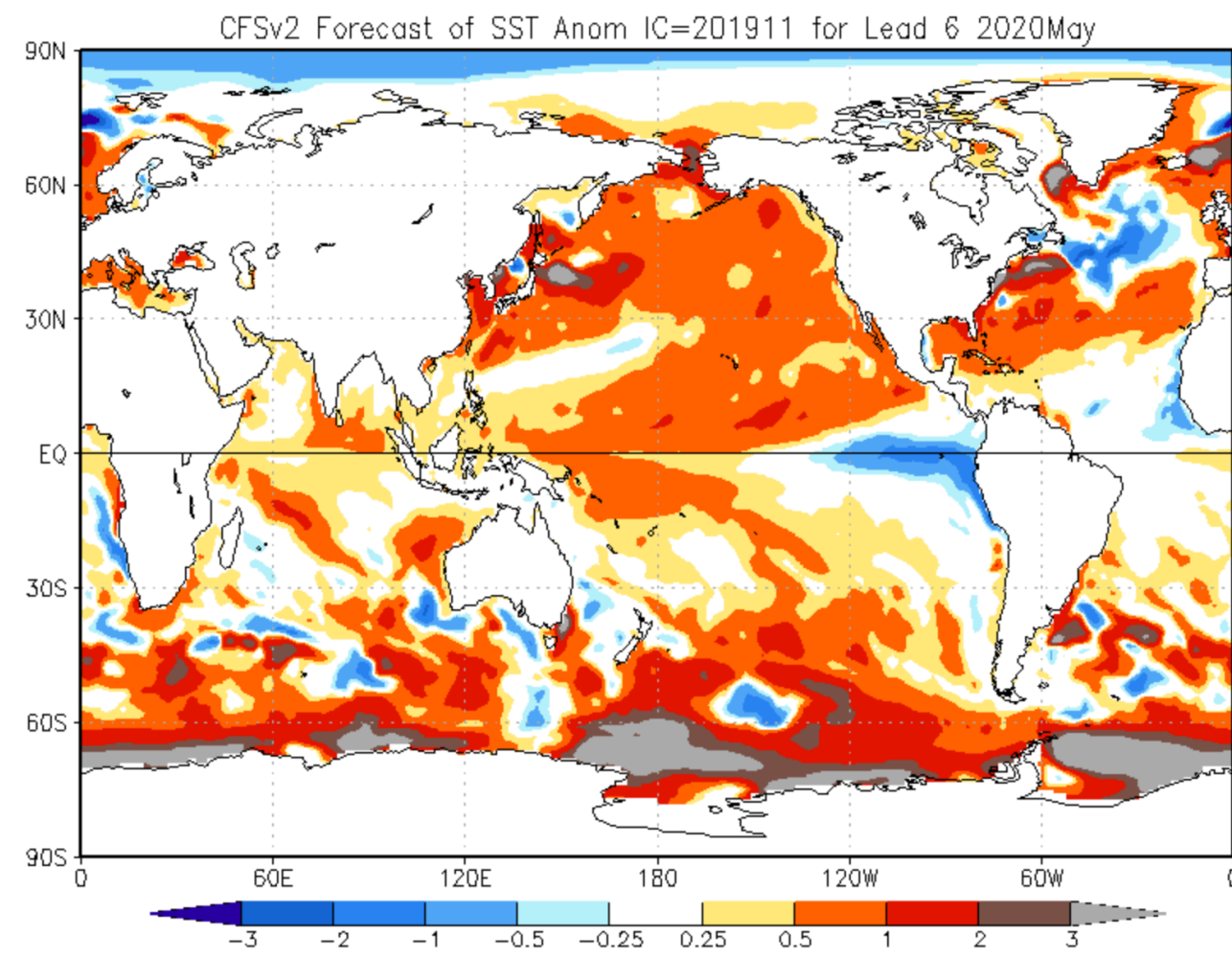


Forecast applications - Northeast U.S. silver hake

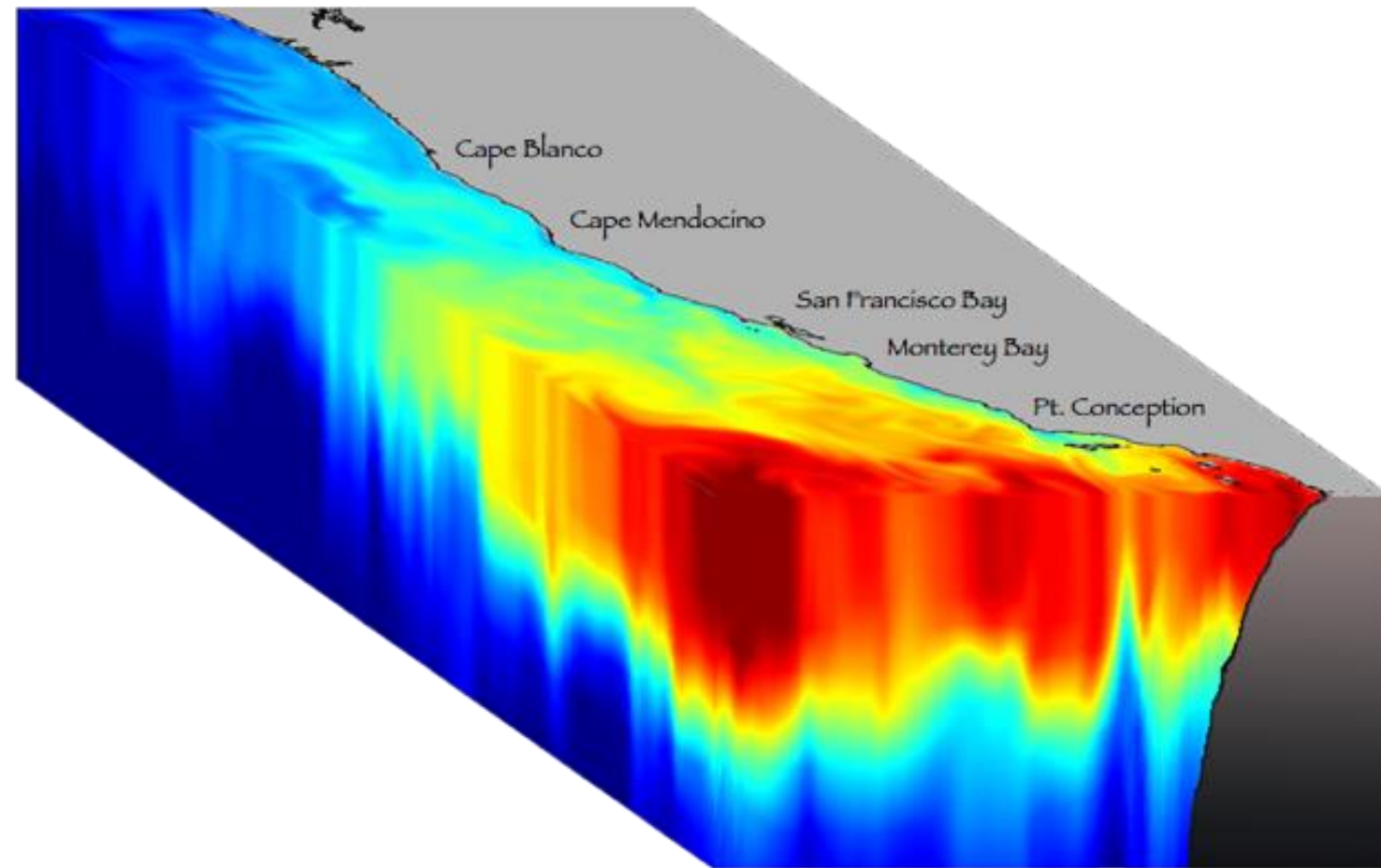
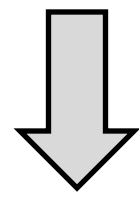




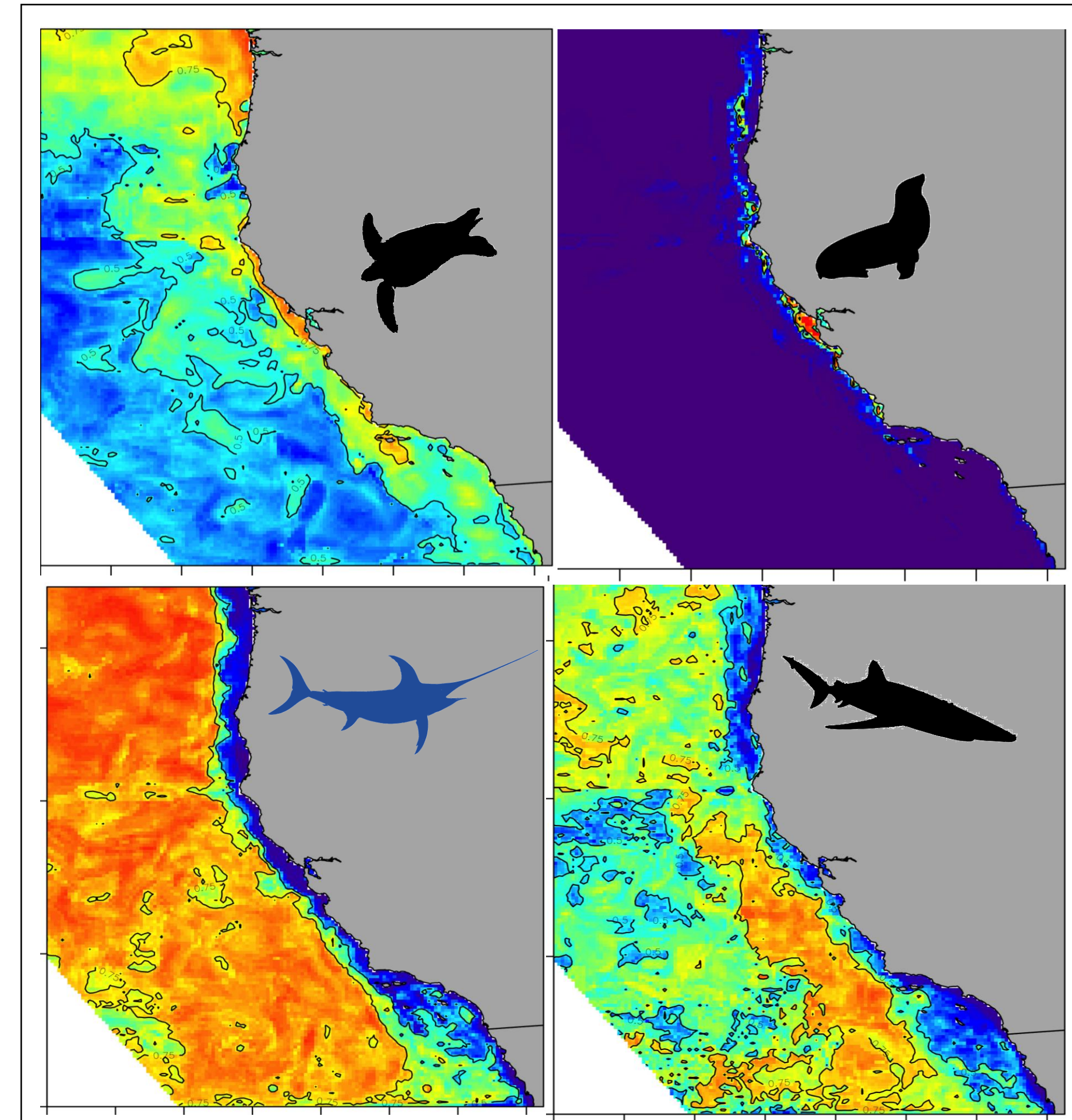
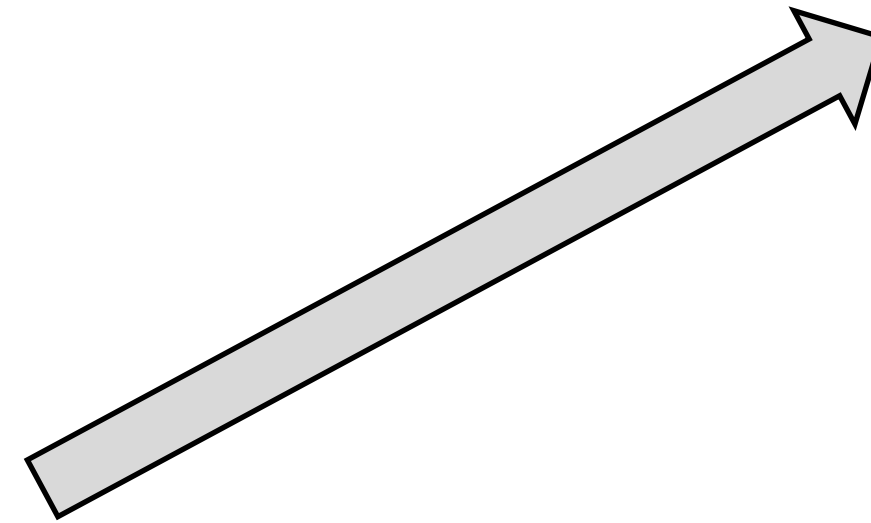
Forecast applications - U.S. west coast swordfish and bycatch species



Global climate forecast

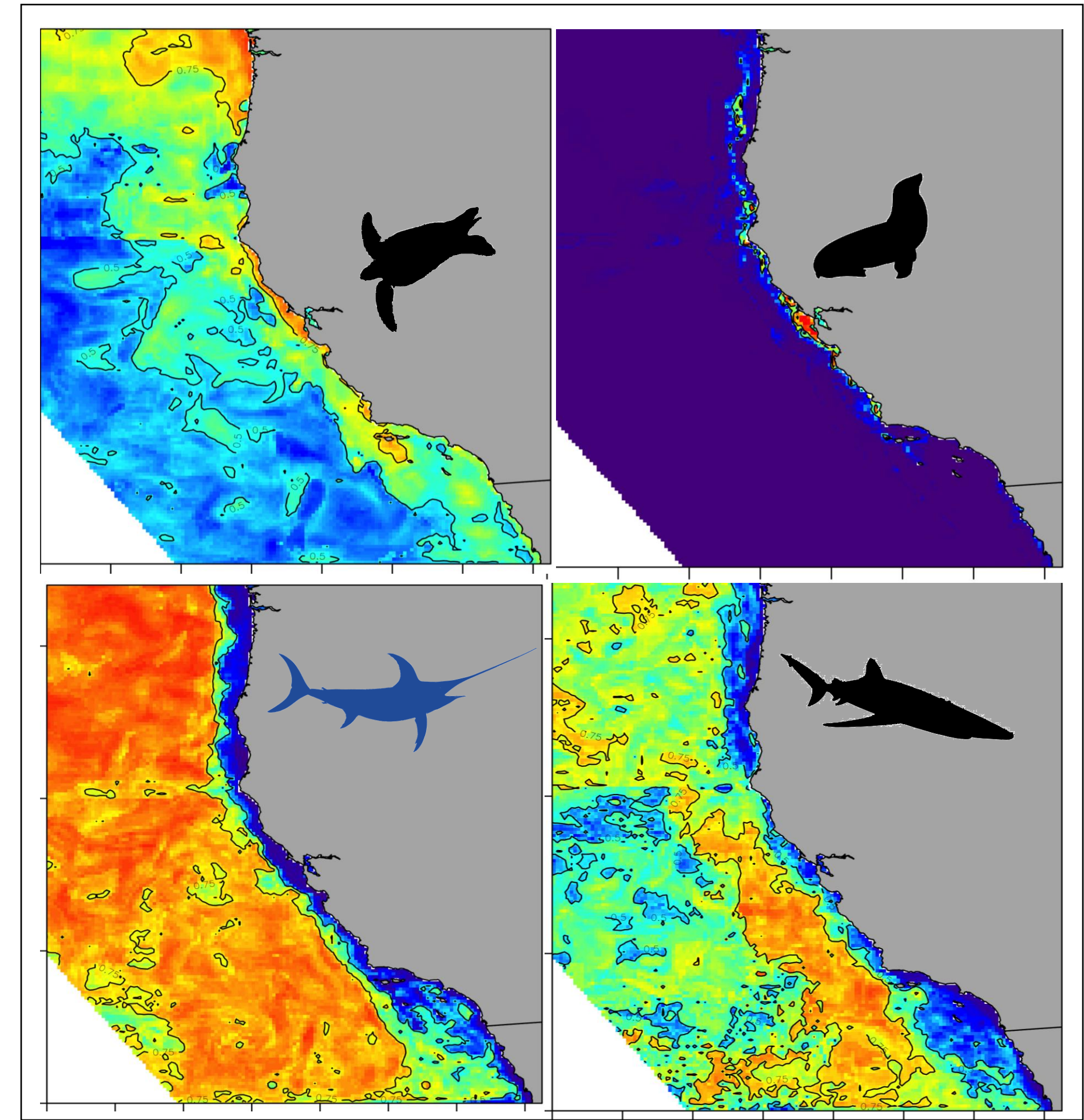
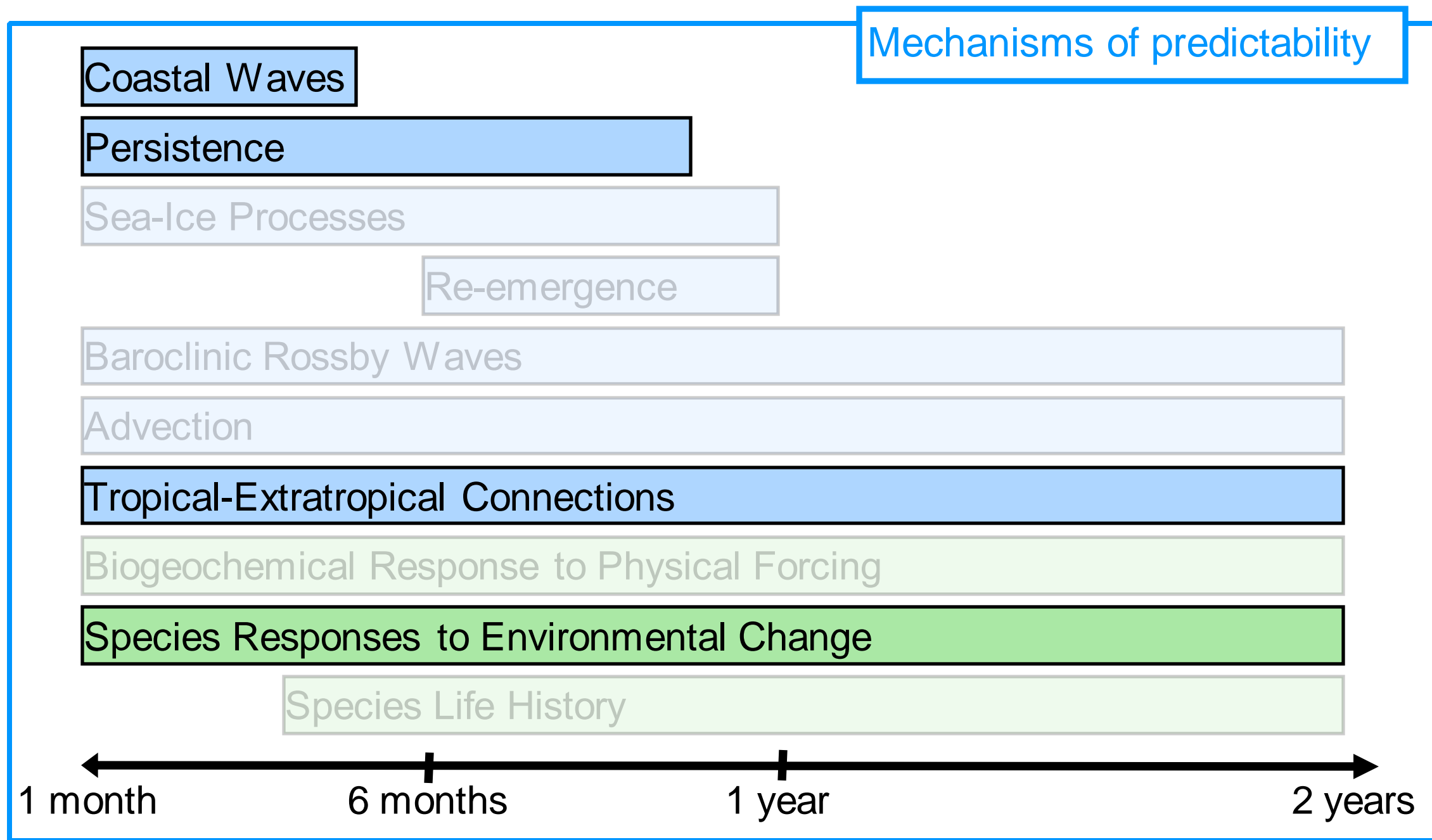
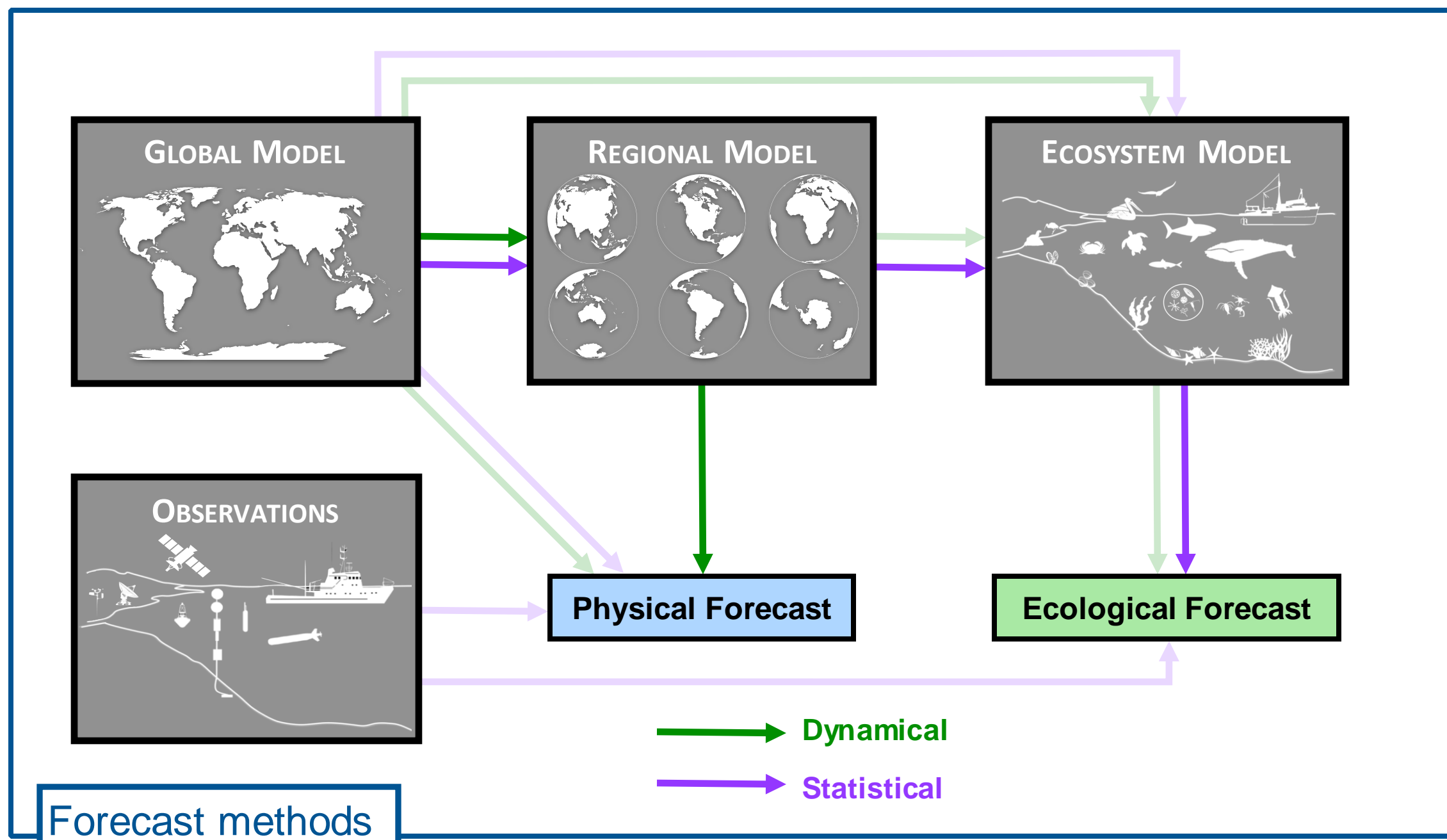


Regional ocean forecast



Predicted habitat suitability

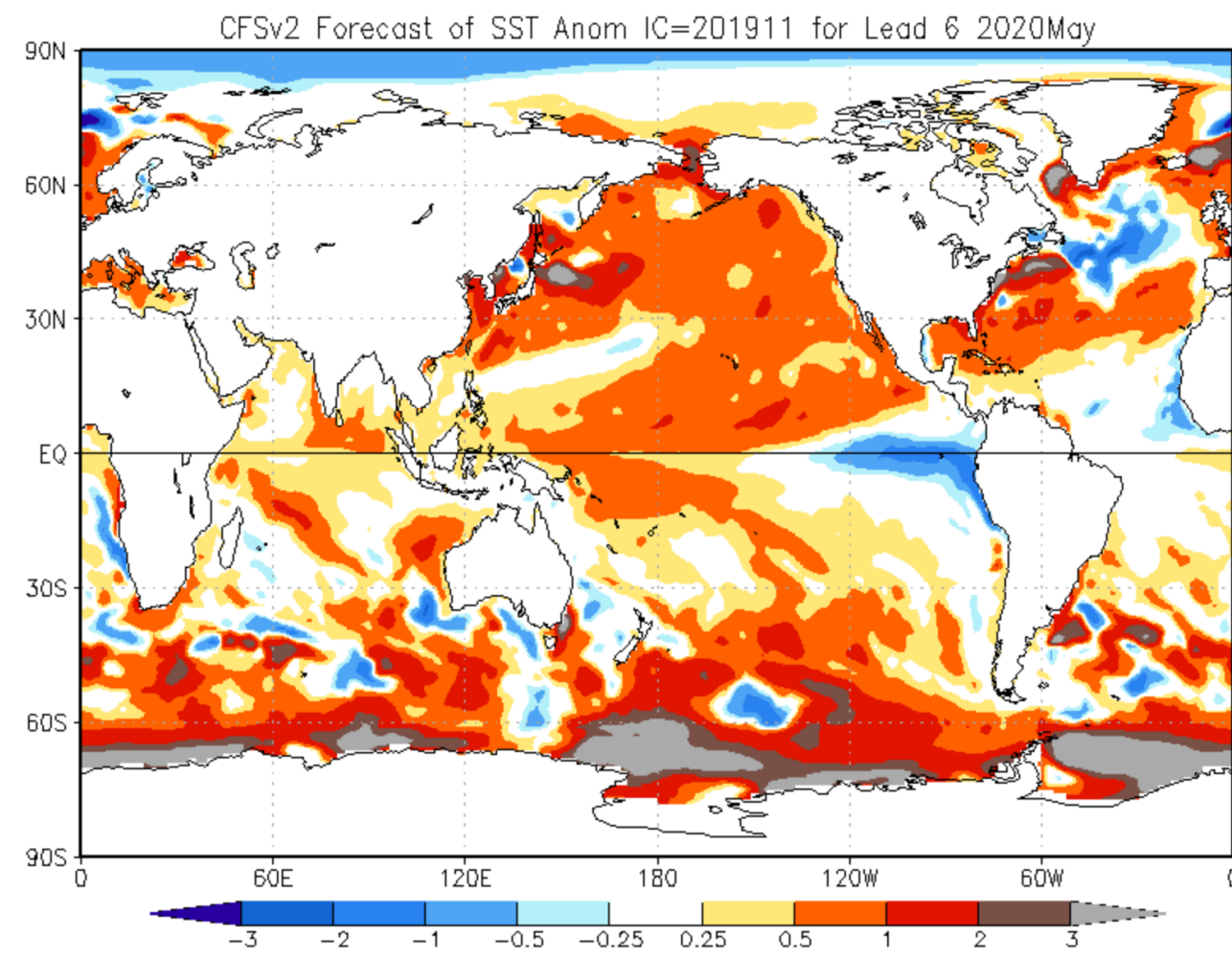
Hazen et al. (2018)
Welch et al. (2019)



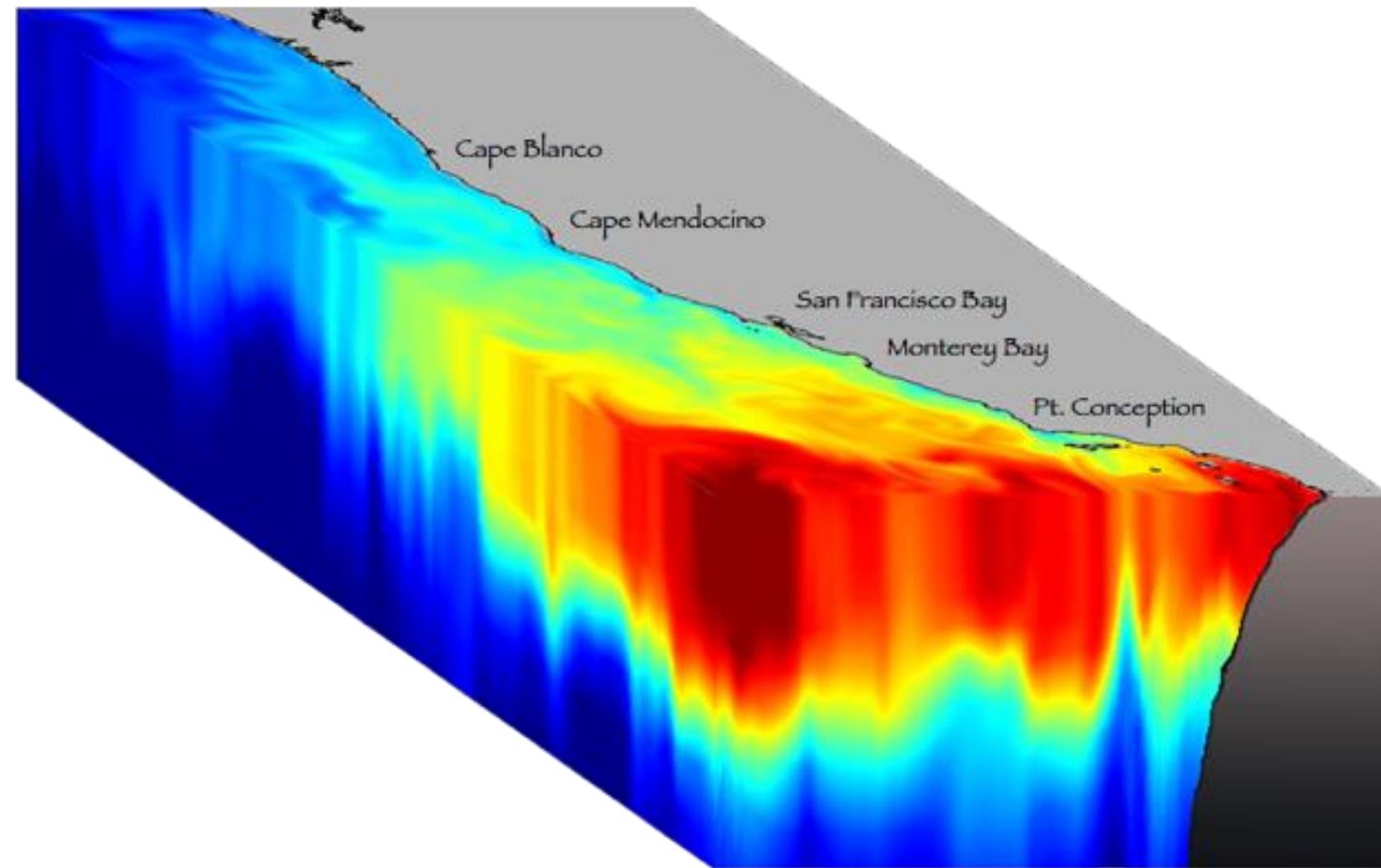
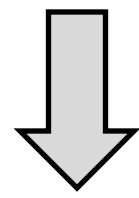
Predicted habitat suitability

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

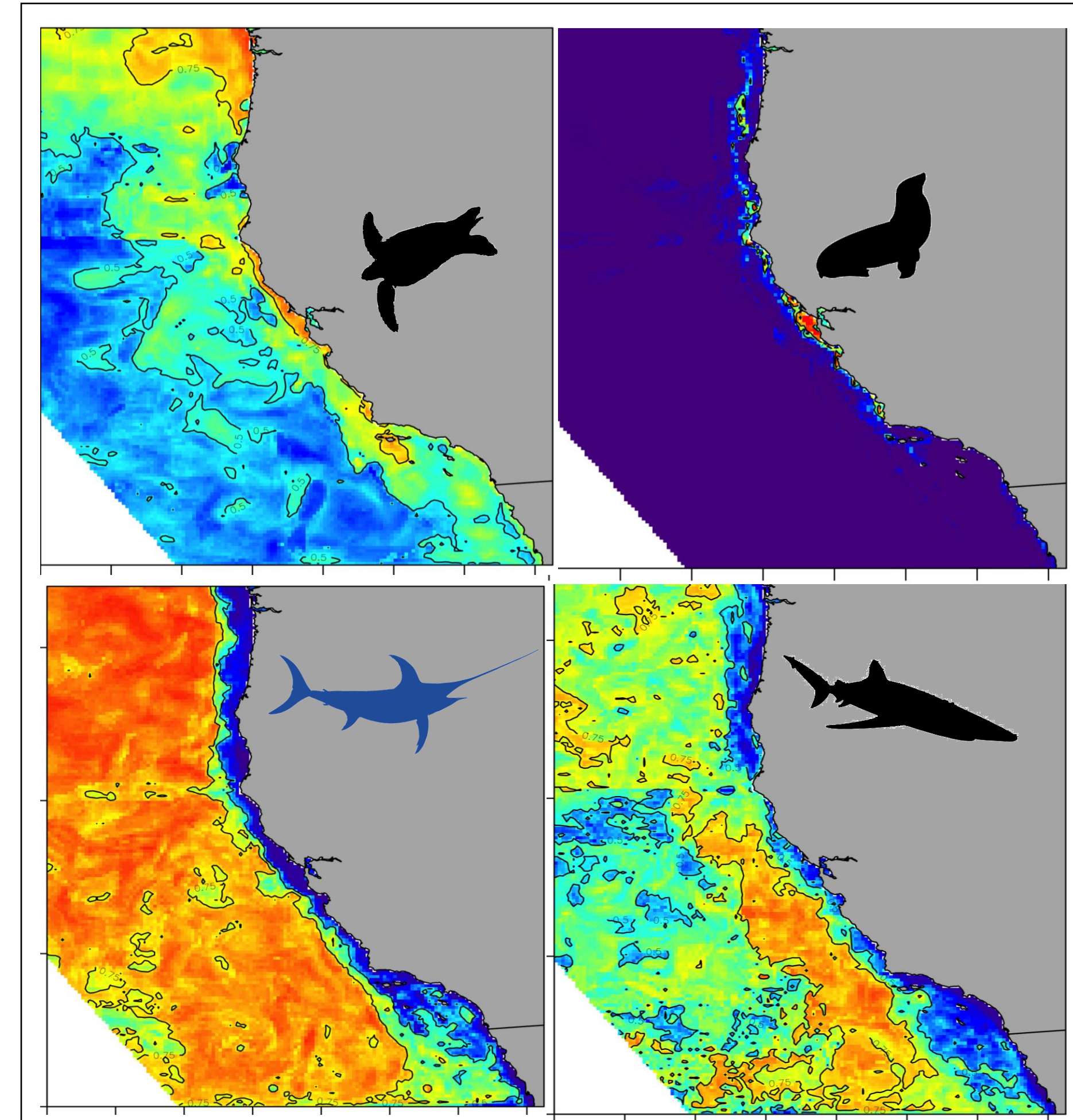
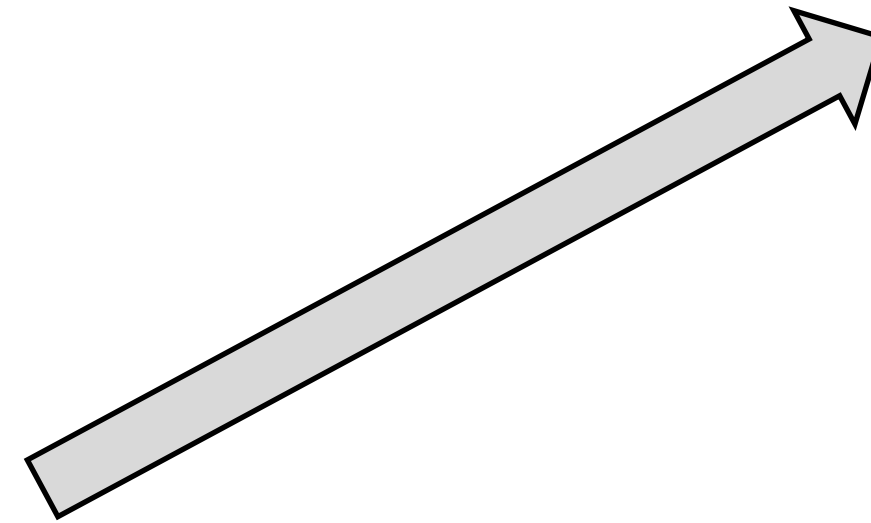
Forecast applications - U.S. west coast swordfish and bycatch species



Global climate forecast



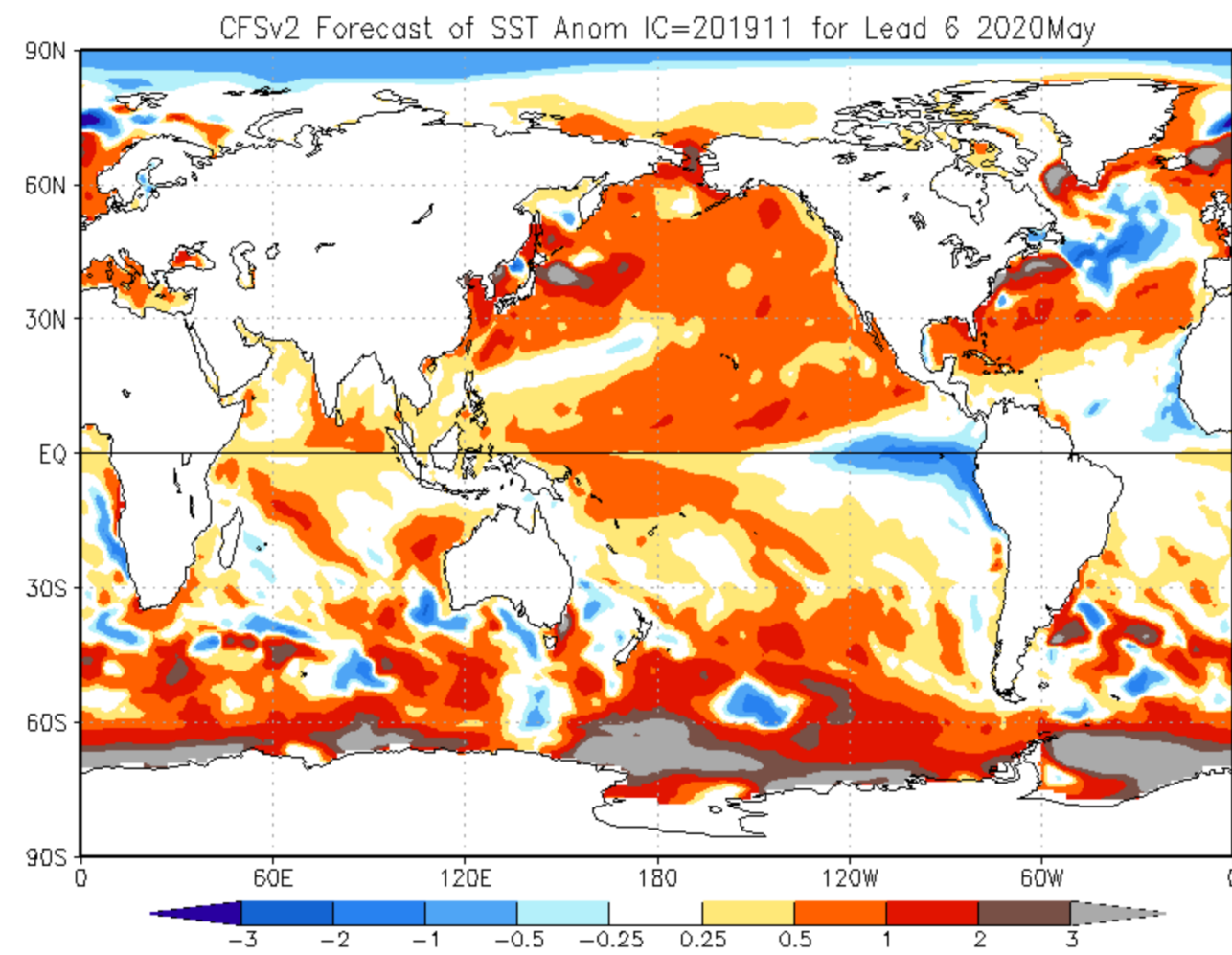
Regional ocean forecast



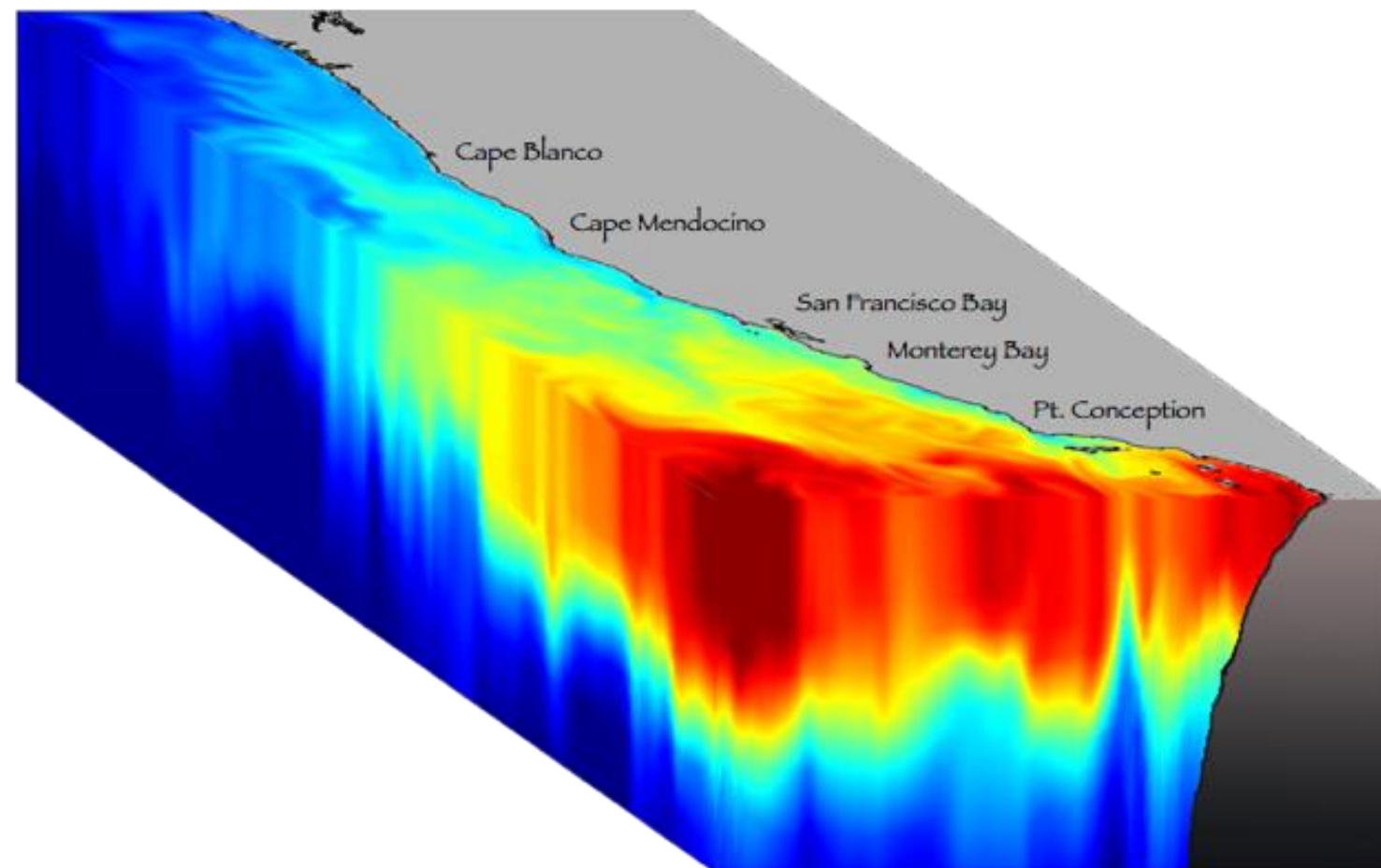
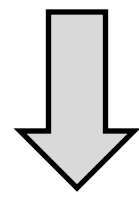
Predicted habitat suitability

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

Regional downscaling for the U.S. west coast



Global climate forecast



Regional ocean forecast

Forecast configuration

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

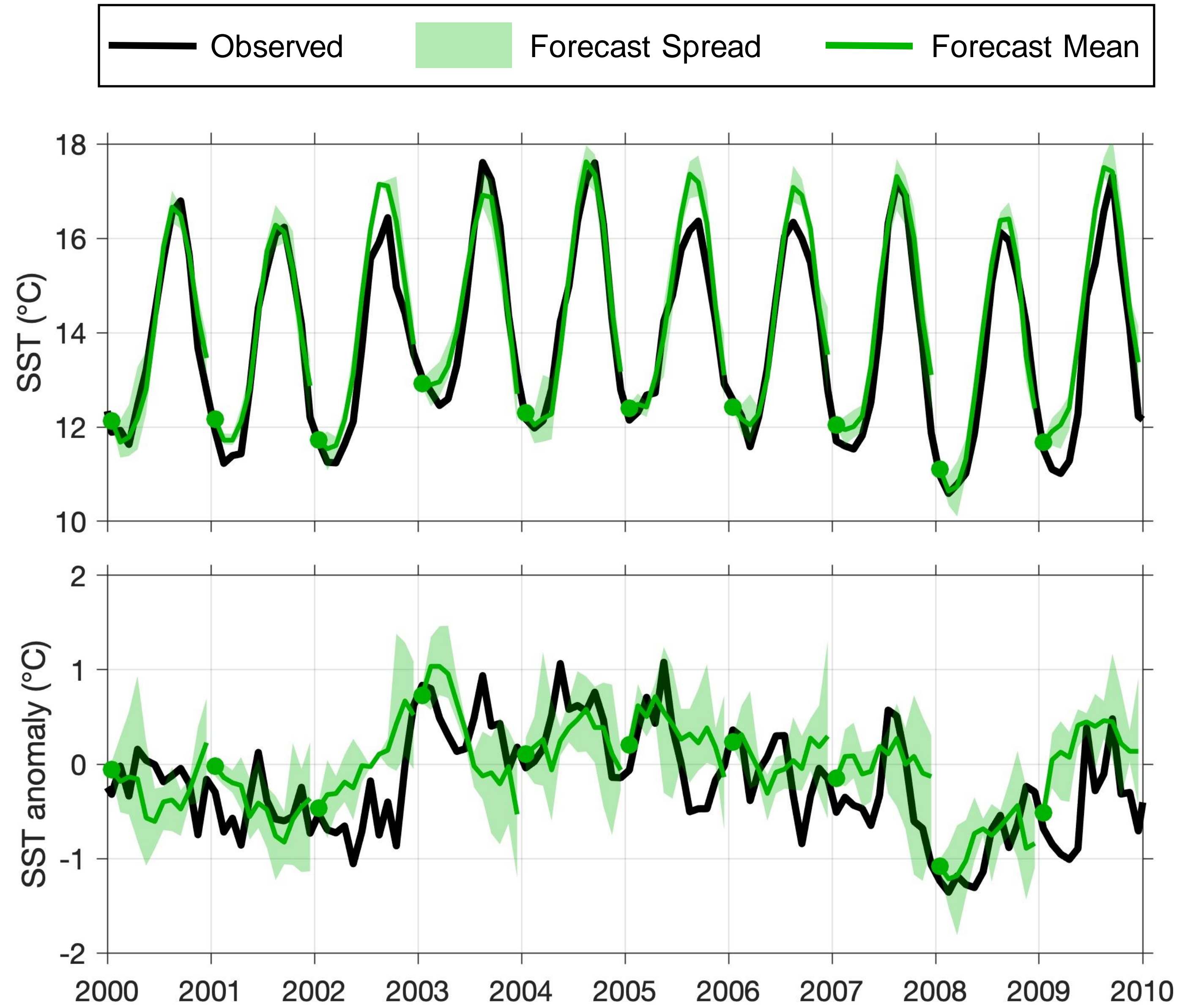
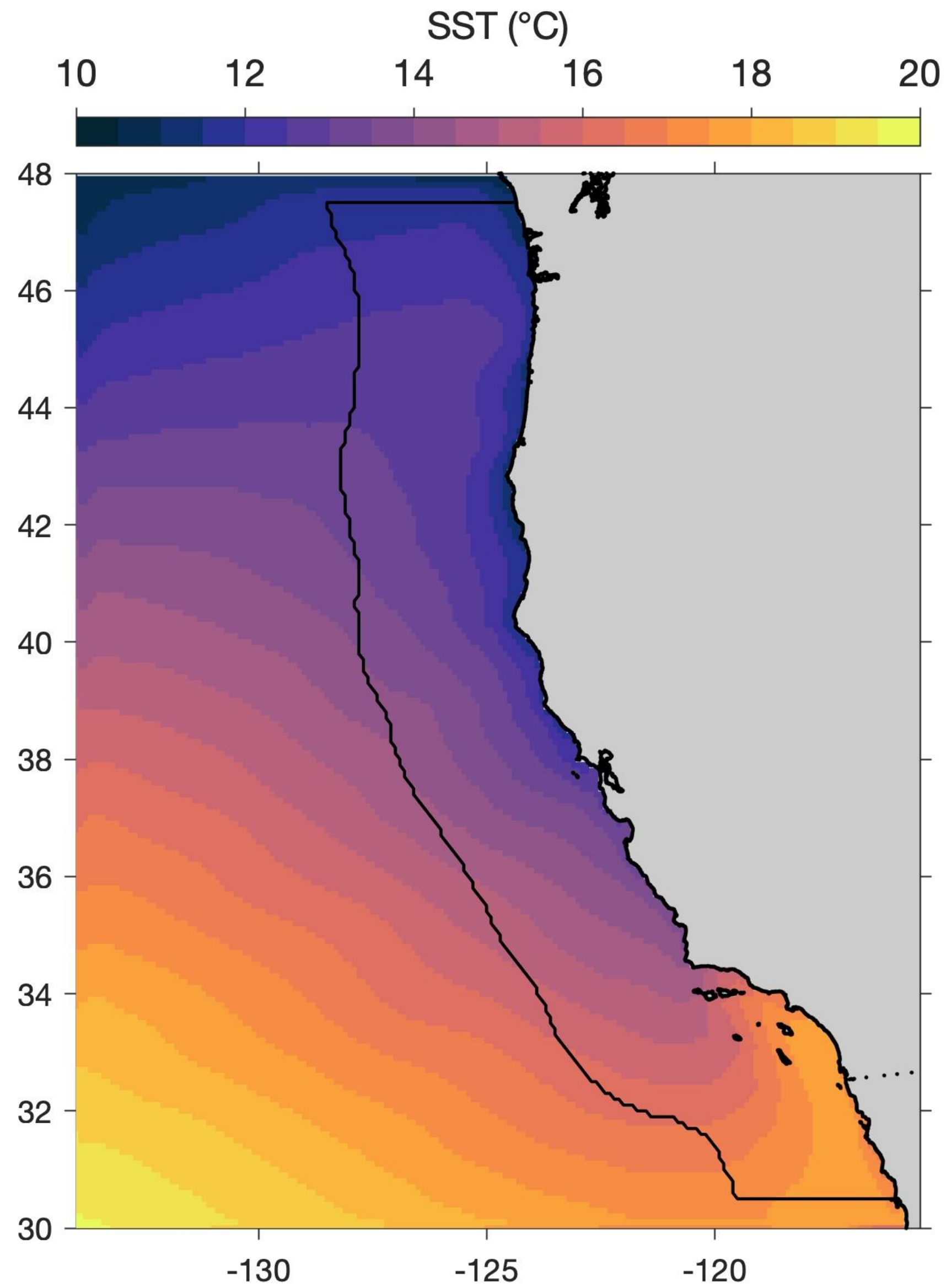
Forecasts initialized twice per year (January and July)

1982 to 2010

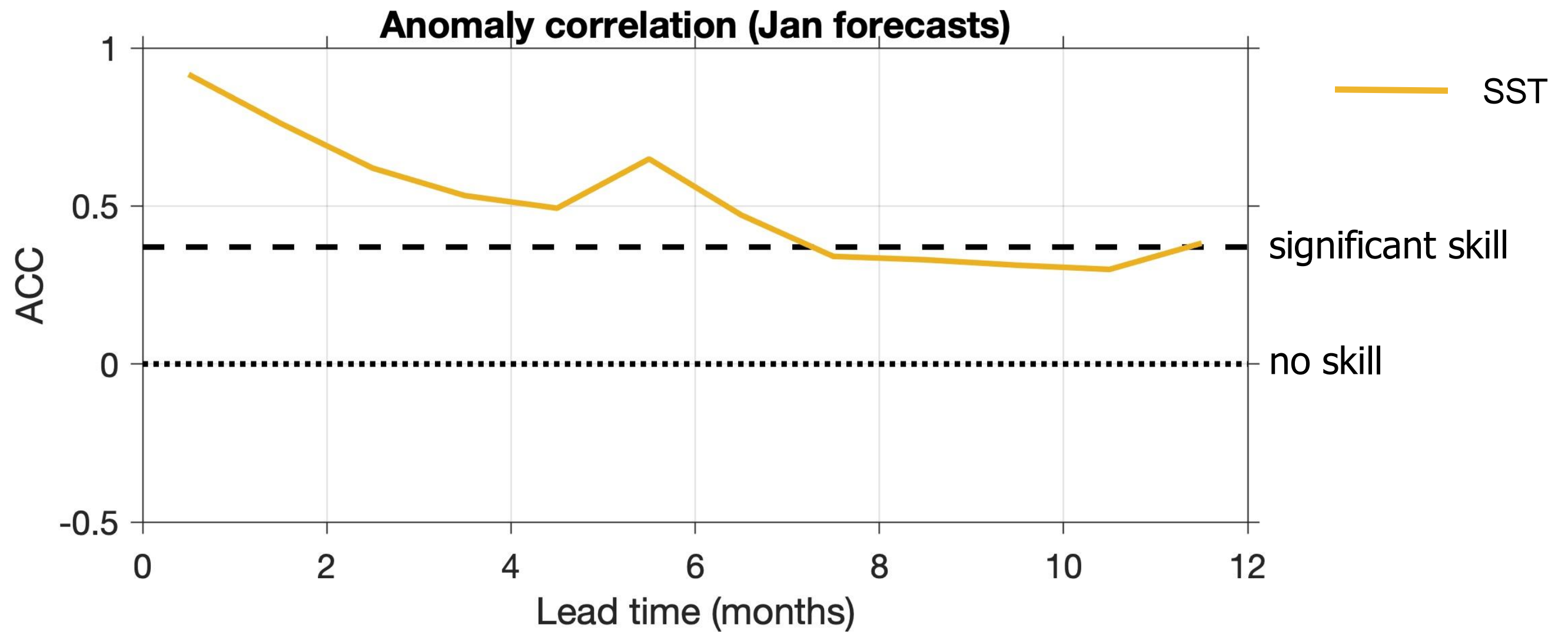
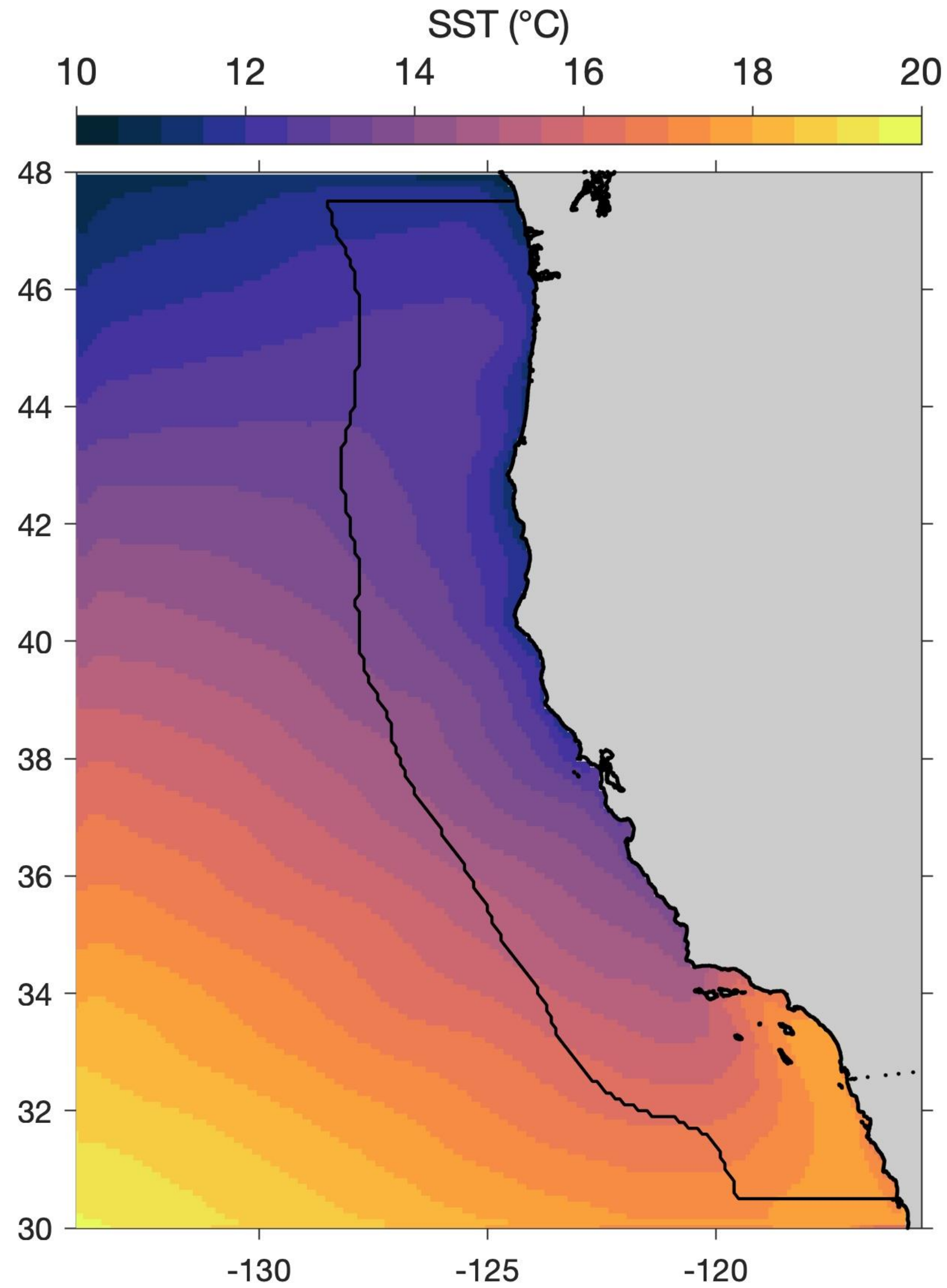
12-month forecasts

Three ensemble members

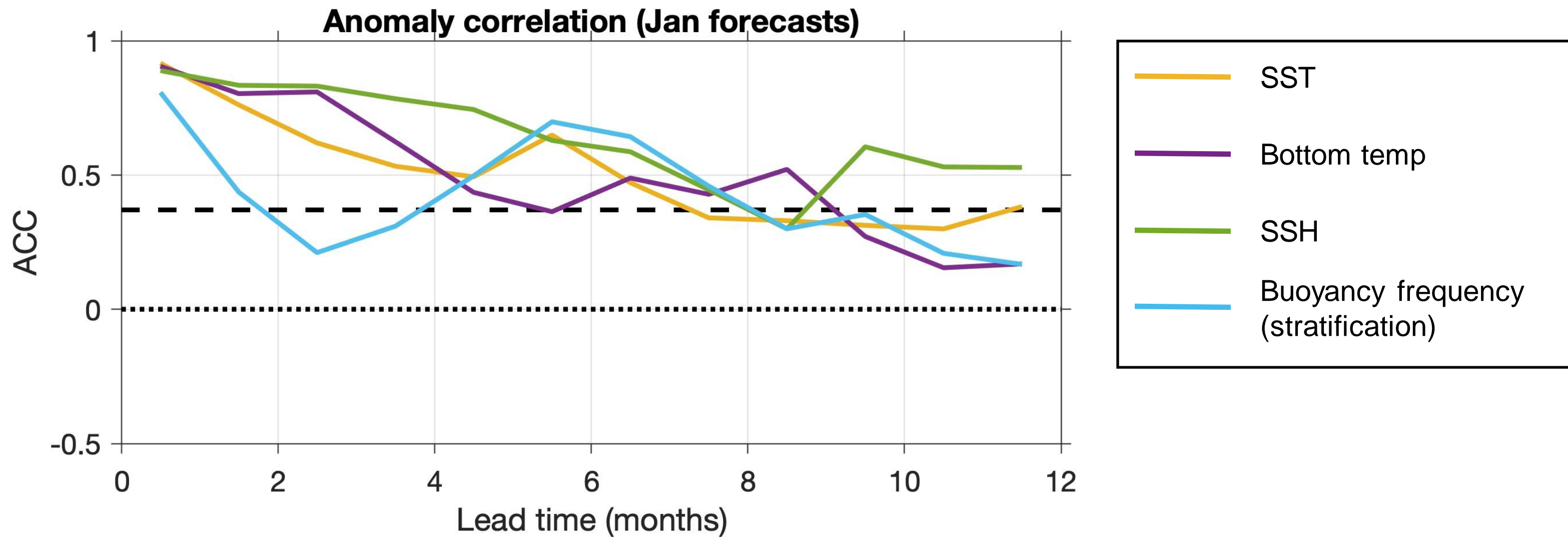
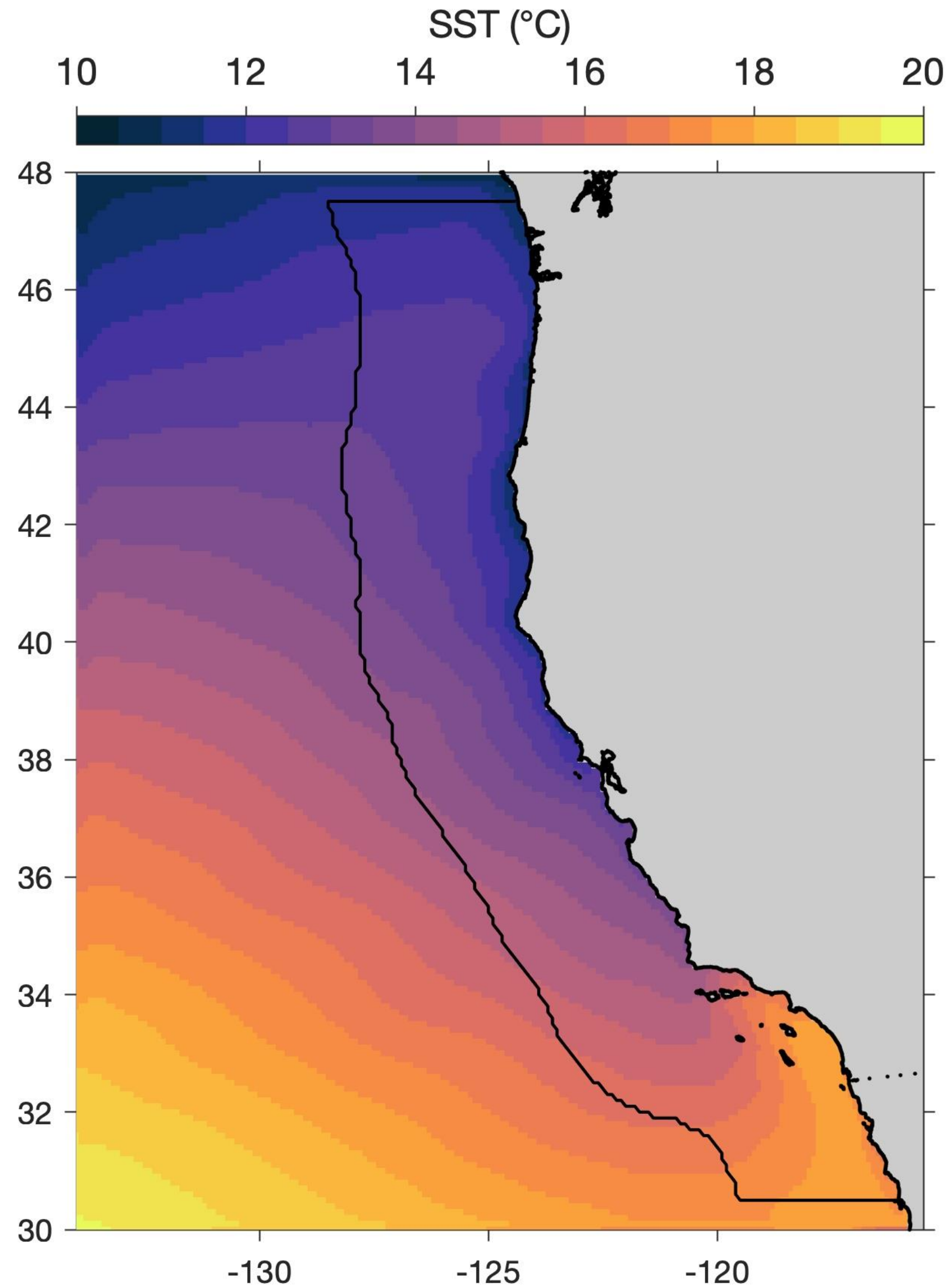
Regional downscaling for the U.S. west coast



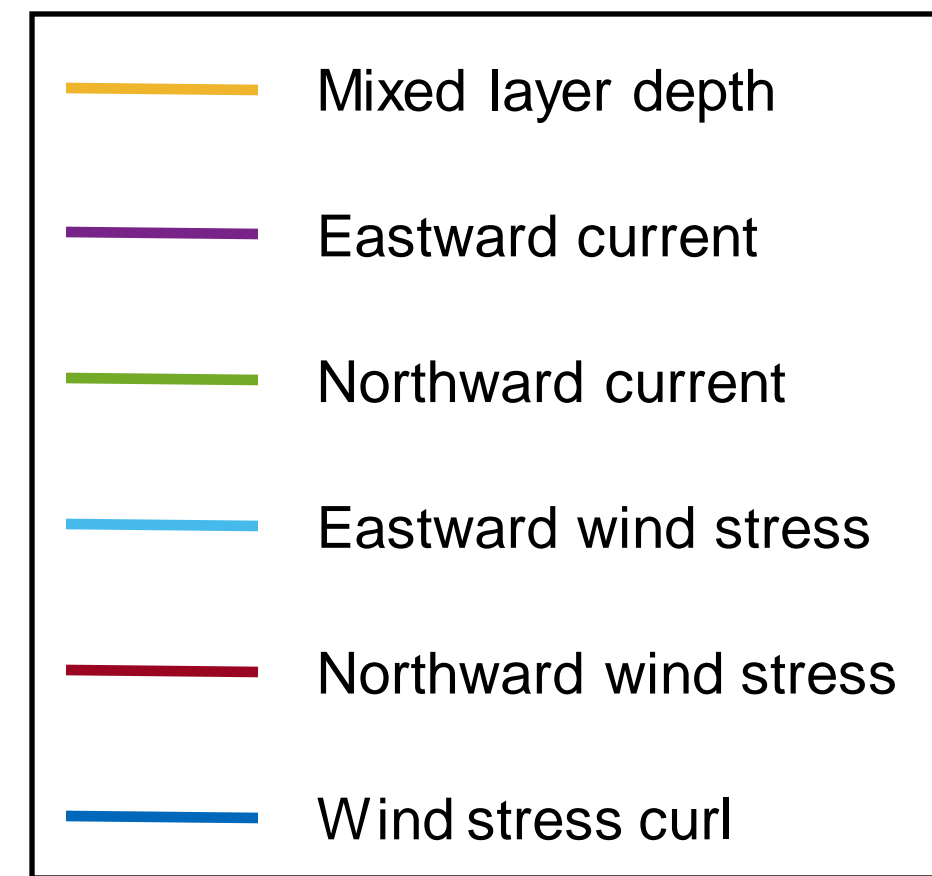
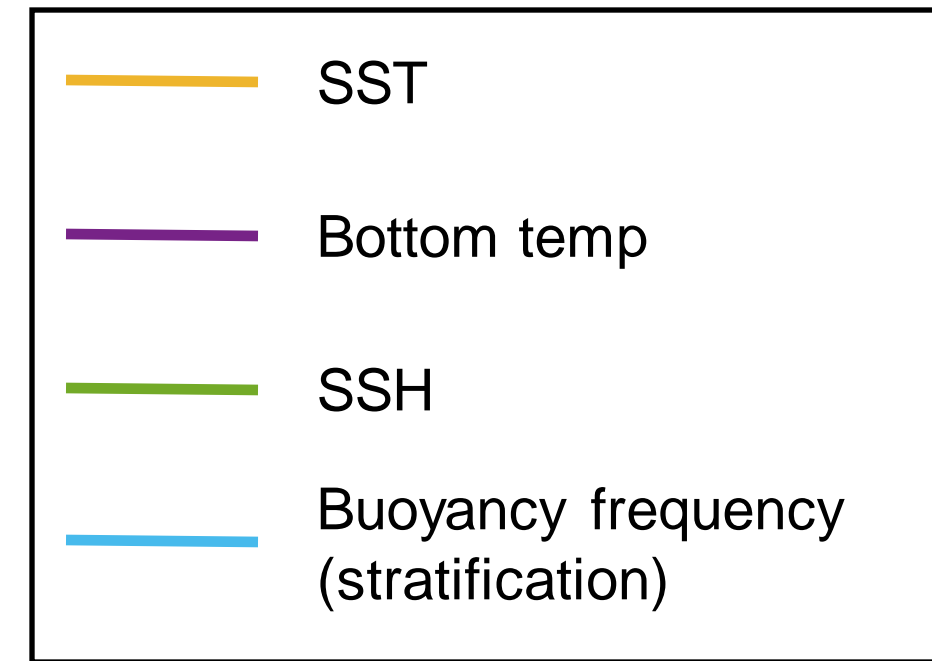
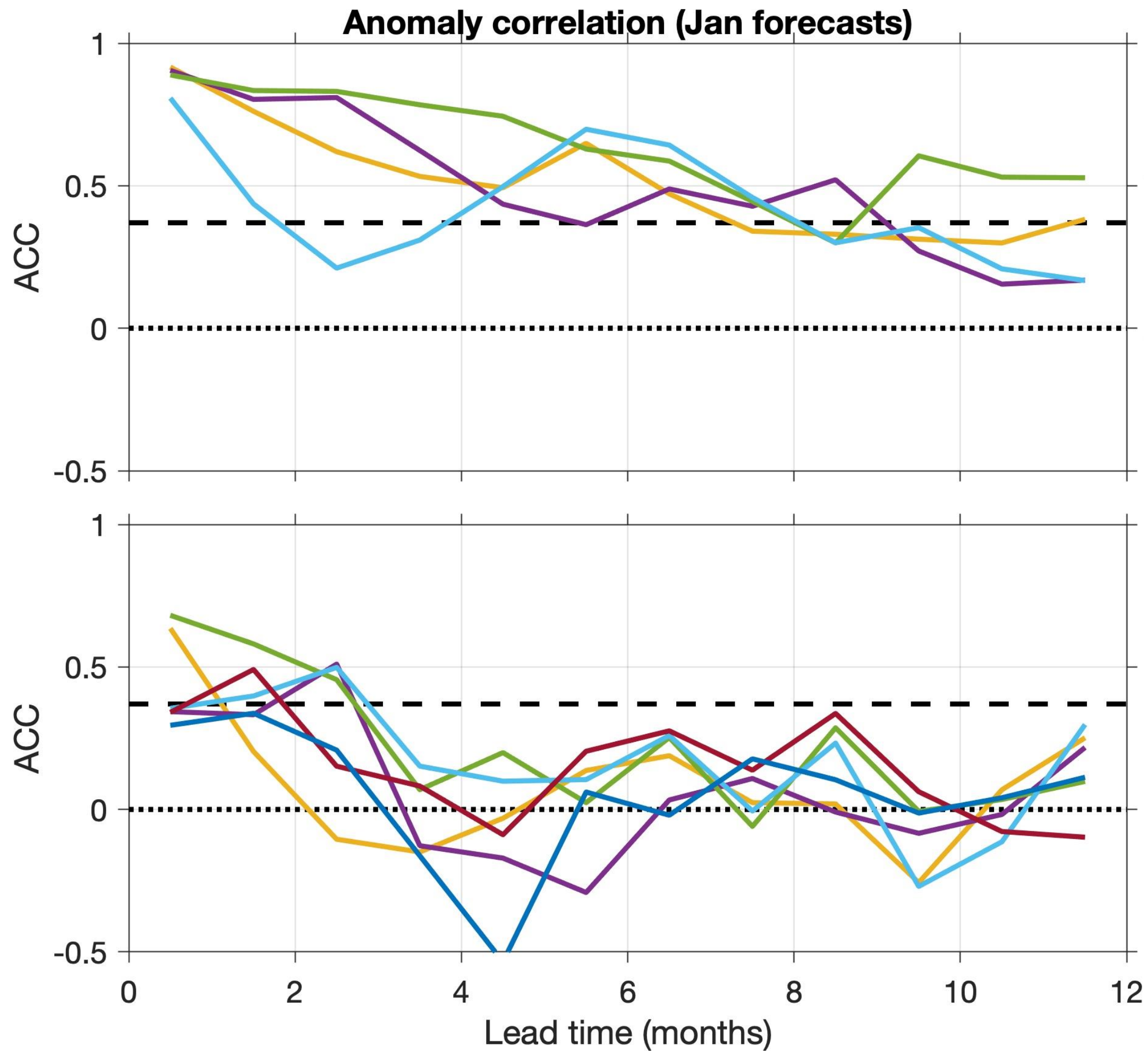
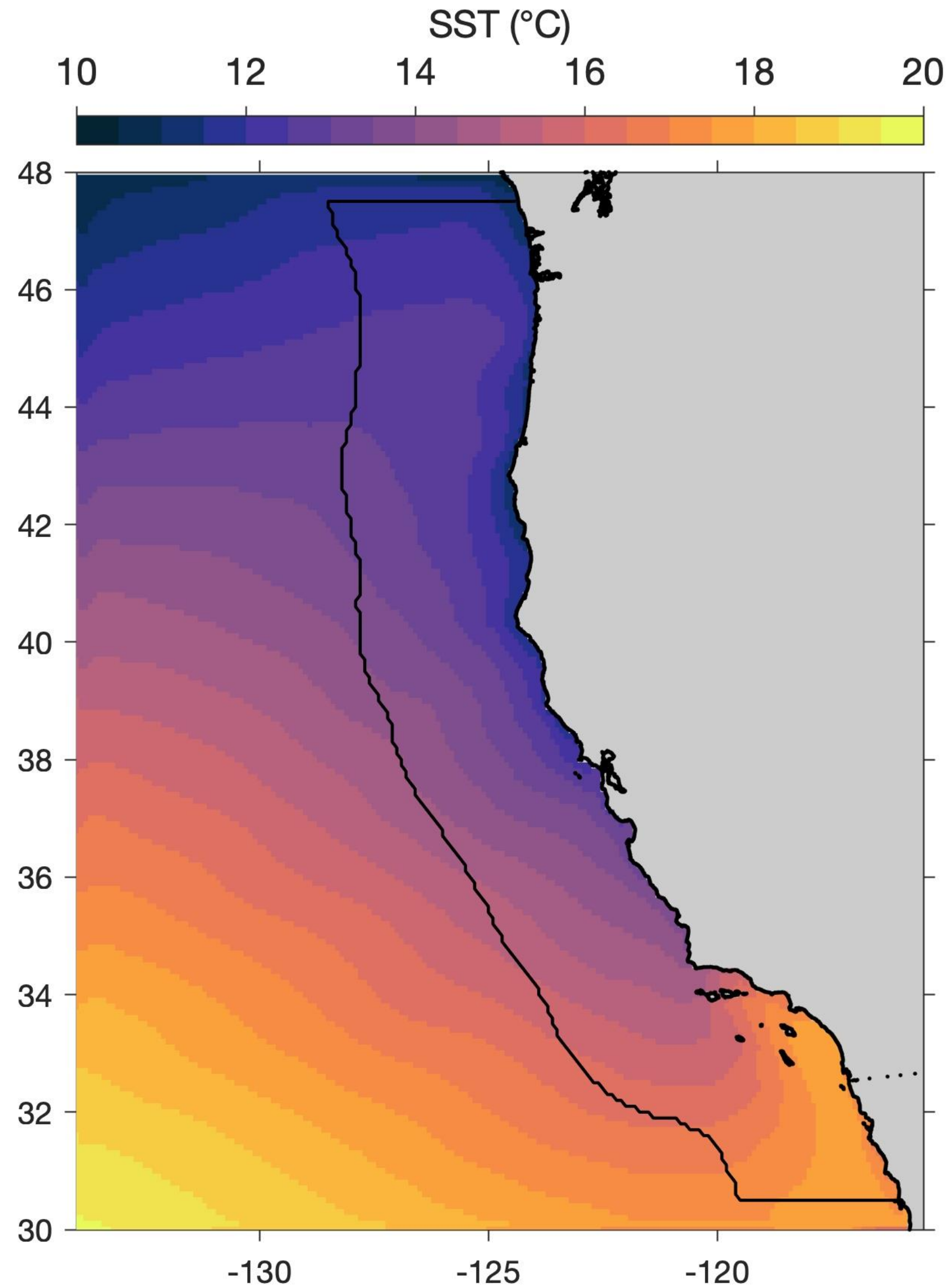
Regional downscaling for the U.S. west coast



Regional downscaling for the U.S. west coast

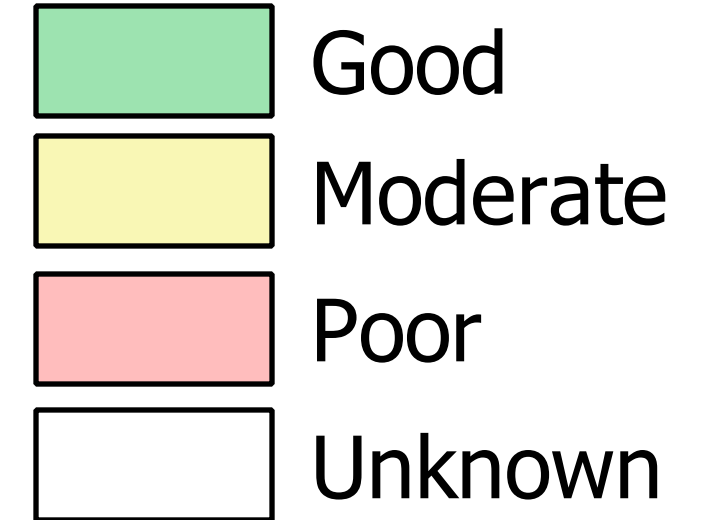


Regional downscaling for the U.S. west coast



Summarizing predictability across timescales

Variable	Past (hindcast/reanalysis)	(Sub)Seasonal (up to 1 year)	Multi-annual (2-10 years)	Long term (multi-decadal to century)
Sea surface temperature	Good	Good	Poor	Good
Sea surface height	Good	Good	Unknown	Good
Bottom temperature	Good	Good	Unknown	Good
Upwelling	Good	Moderate	Unknown	Moderate
Transport	Moderate	Poor	Unknown	Unknown
Stratification	Moderate	Moderate	Unknown	Good
Mixed layer depth	Moderate	Poor	Unknown	Good
Oxygen	Moderate	Moderate	Moderate	Good
pH	Moderate	Moderate	Moderate	Good
Nutrients / Chlorophyll / Primary Production	Moderate	Moderate	Moderate	Poor



*This is a somewhat subjective, qualitative attempt, based on the work of many, to classify our confidence in estimating various ocean parameters.

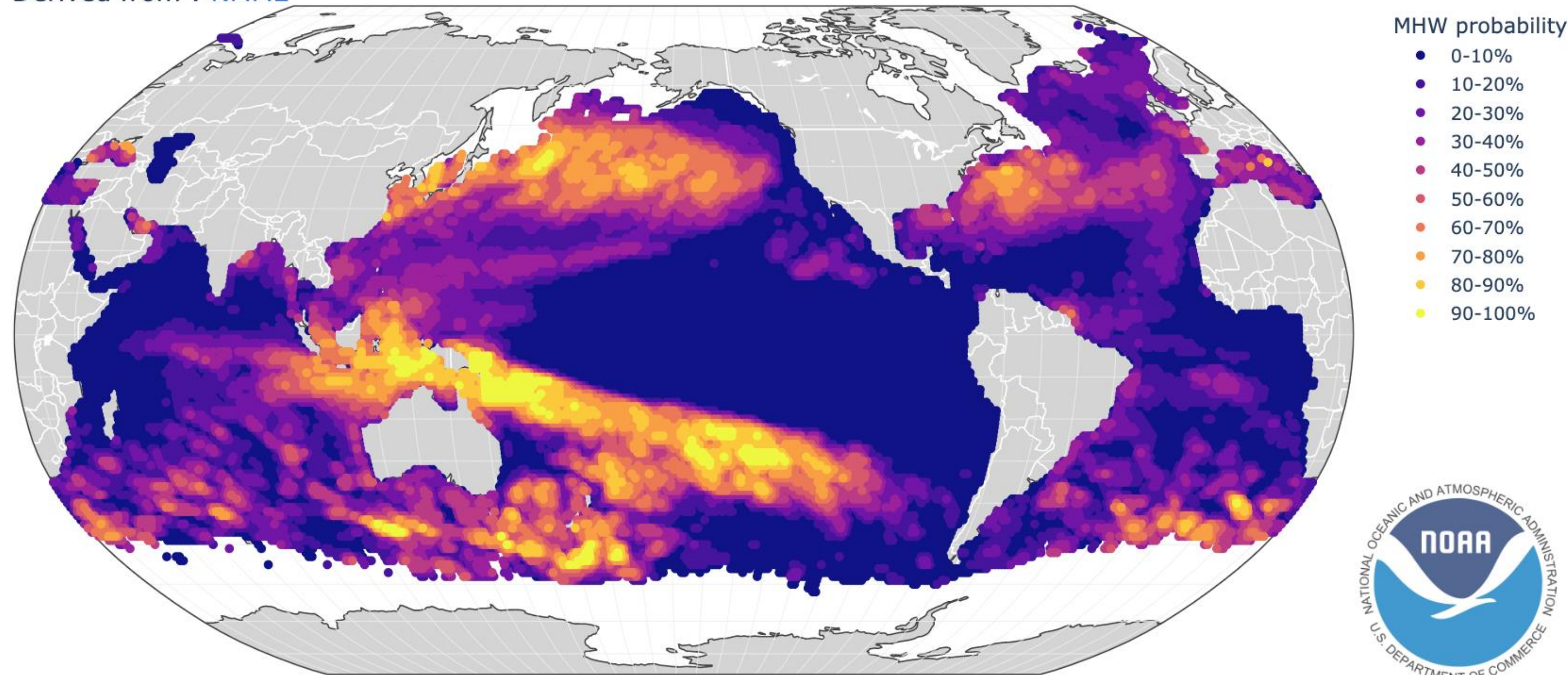
*For long-term, color simply denotes our confidence in the direction of change, while for other timescales it denotes our ability to predict the actual conditions at a given time.

Facilitating uptake of climate information - Global forecasts of marine heatwaves

Overview Current **Forecasts** Explore PSL Papers Data News Links

Initial year: 2022 Initial month: Apr Projection: robinson Remove long-term temperature trends? No Yes

Marine Heatwave (MHW) Forecast
Derived from : [NMME](#)



Lead time = 3.5 months (07/2022)



Built on output from existing global climate models (GCMs)

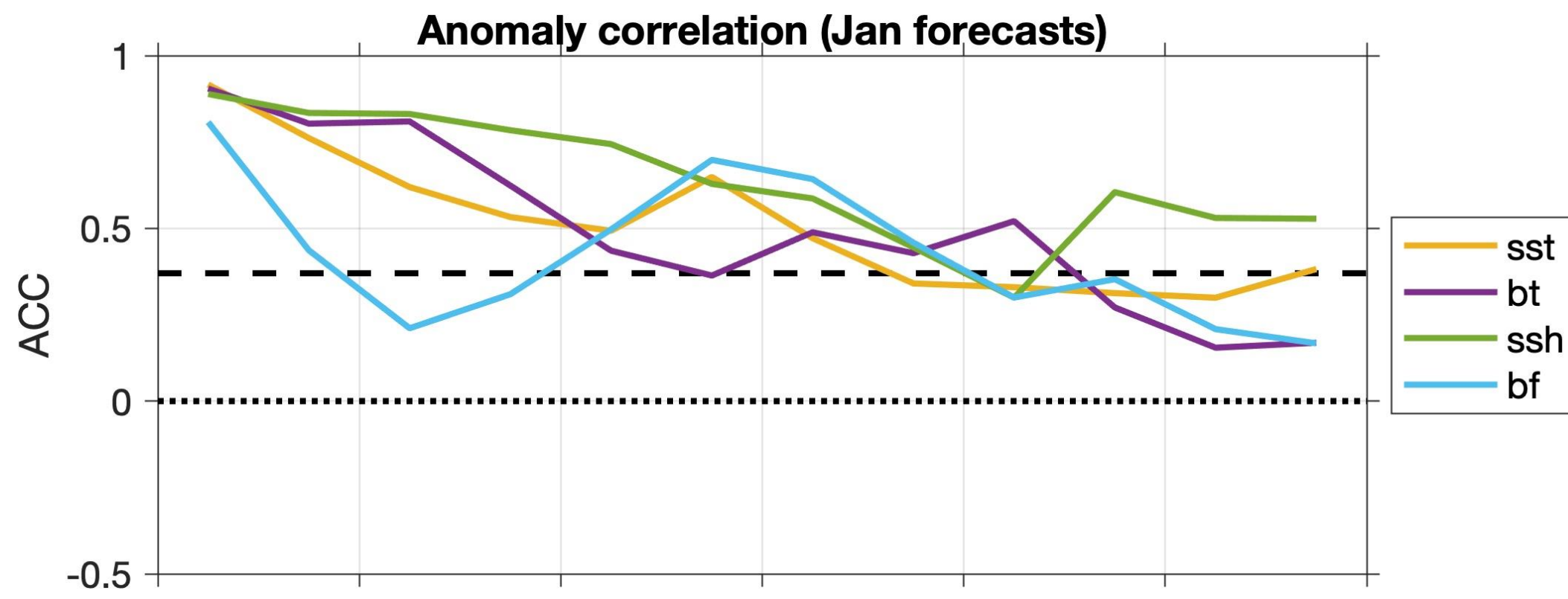
Large forecast ensemble (>70-members) from six GCMs

New forecasts produced monthly and readily available online

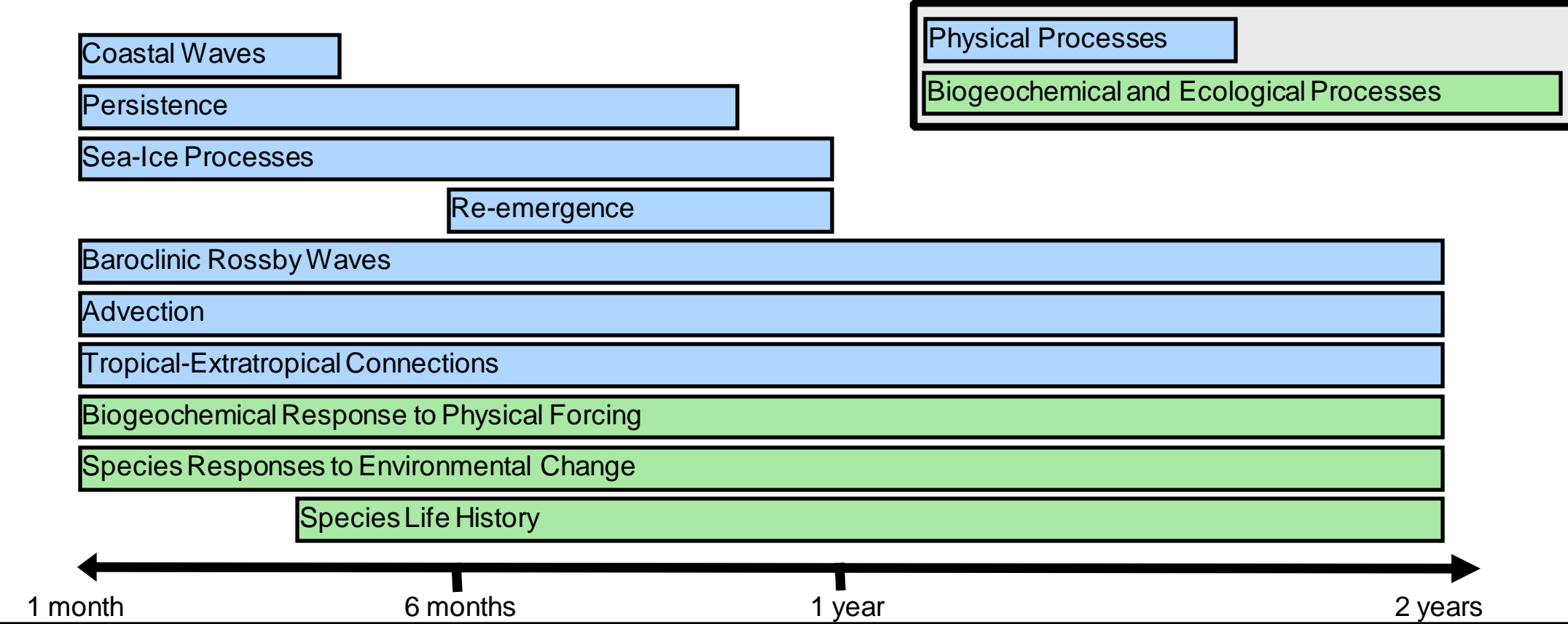
<https://psl.noaa.gov/marine-heatwaves>

Suggested pathways to forecast improvements

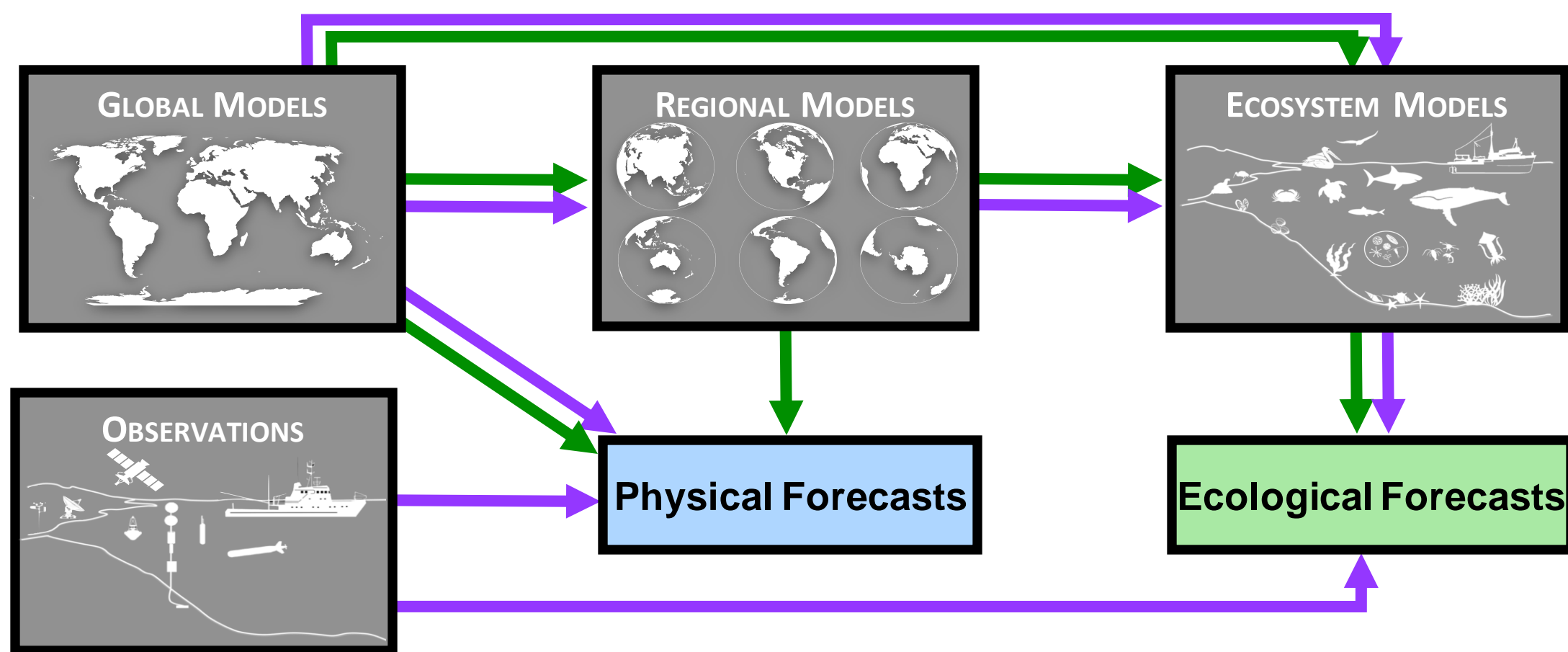
Evaluate forecast skill and uncertainty



Improve mechanistic understanding



Improve models



Facilitate uptake of climate information

