Appendix D — CLIMATE FORECASTS (Supplement)

In past years, we have provided information in the main presentation of the Ecosystem Status Report (ESR) based on short-term model forecasts using data and analysis from the JSCOPE project (JISAO Seasonal Coastal Ocean Prediction of the Ecosystem), but have not provided this information in the body of the main report or appendices, as the information is usually not available in time for the briefing book deadline. This year we received the information in time for the supplemental briefing book, and so submit this information here, as a supplement to Appendix D - Climate Forecasts. In future years, if timing allows, we will either include this information directly within Appendix D, or else submit it as a supplement to Appendix D, as done here. This data also provides an example of the kinds of information which may become even more readily available in the future as more modeling forecast data becomes available.

Overview

The J-SCOPE forecast system for Washington and Oregon coastal waters presents preliminary results for the 2025 upwelling season. The forecast system predicts the timing of the spring transition from downwelling to upwelling, the cumulative upwelling index, sea-surface temperature (SST), primary production, chlorophyll stock, dissolved oxygen, and sardine habitat. The forecast for 2025 is composed of three model runs that make up an ensemble. Each model run is initialized at a different time (January 5, January 15, January 25), and has complementary forcing files from the large scale model (https://www.nanoos.org/products/j-scope/about_the_model.php). The details of the wind forcing for each model run can be found on the California Current Indicators tab. For each of the predicted quantities listed above, we report the ensemble average anomaly as well as the relative uncertainty within the ensemble, which is defined as the standard deviation of the ensemble divided by the mean of the ensemble and is reported as a percentage of the mean. All of these quantities are reported as monthly averaged anomalies from our January-initialized re-forecast climatology, which spans 2009 - 2017. An anomaly is an indication of how different conditions are to what they have been in the past. For more information about anomalies, please see the NANOOS Climatology App (http://nvs.nanoos.org/Climatology). These predicted quantities are key indicators for the California Current Integrated Ecosystem Assessment report.

Model Forecasts

La Niña conditions are expected from the Climate Forecast System (CFS) forecast to persist through February-April 2025 (59% chance), with a transition to ENSO-neutral likely during March-May 2025 (60% chance). In comparison to the climatological data, during the summer upwelling season (May - Jun), coastal regions are forecasted to have *near or cooler than climatological* sea surface temperatures (SST) with the warm anomalies developing by the end of the season (July-August, Figure D.1.s). Subsurface anomalies, *colder than climatological,* extend subsurface mid-shelf with bottom temperatures over much of the shelf cooler than climatological along both 47 N and 44 N.

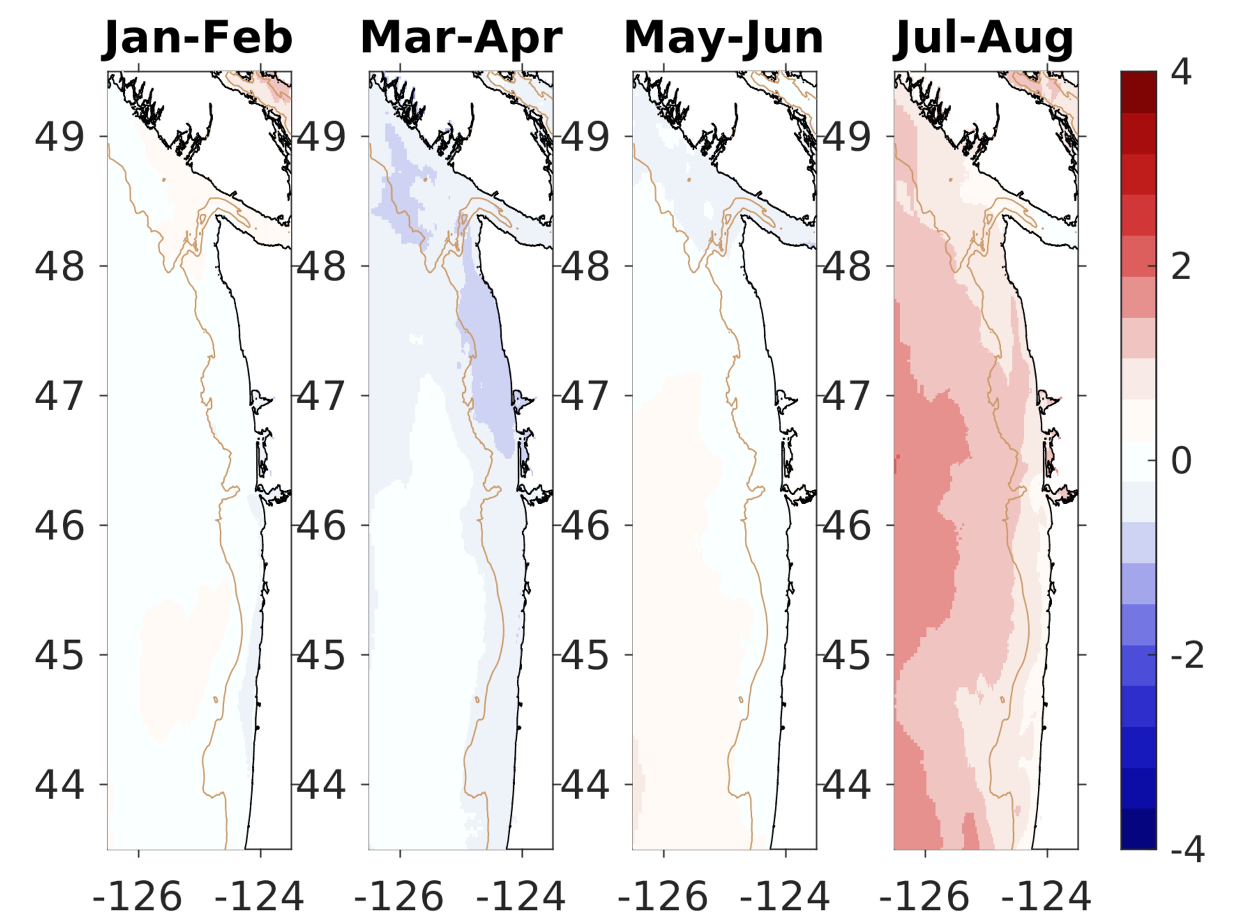


Fig. D.1.s. The modeled region SST anomaly averaged over all three ensemble model runs and in time for (from left to right) January - February, March - April, May - June, July - August.

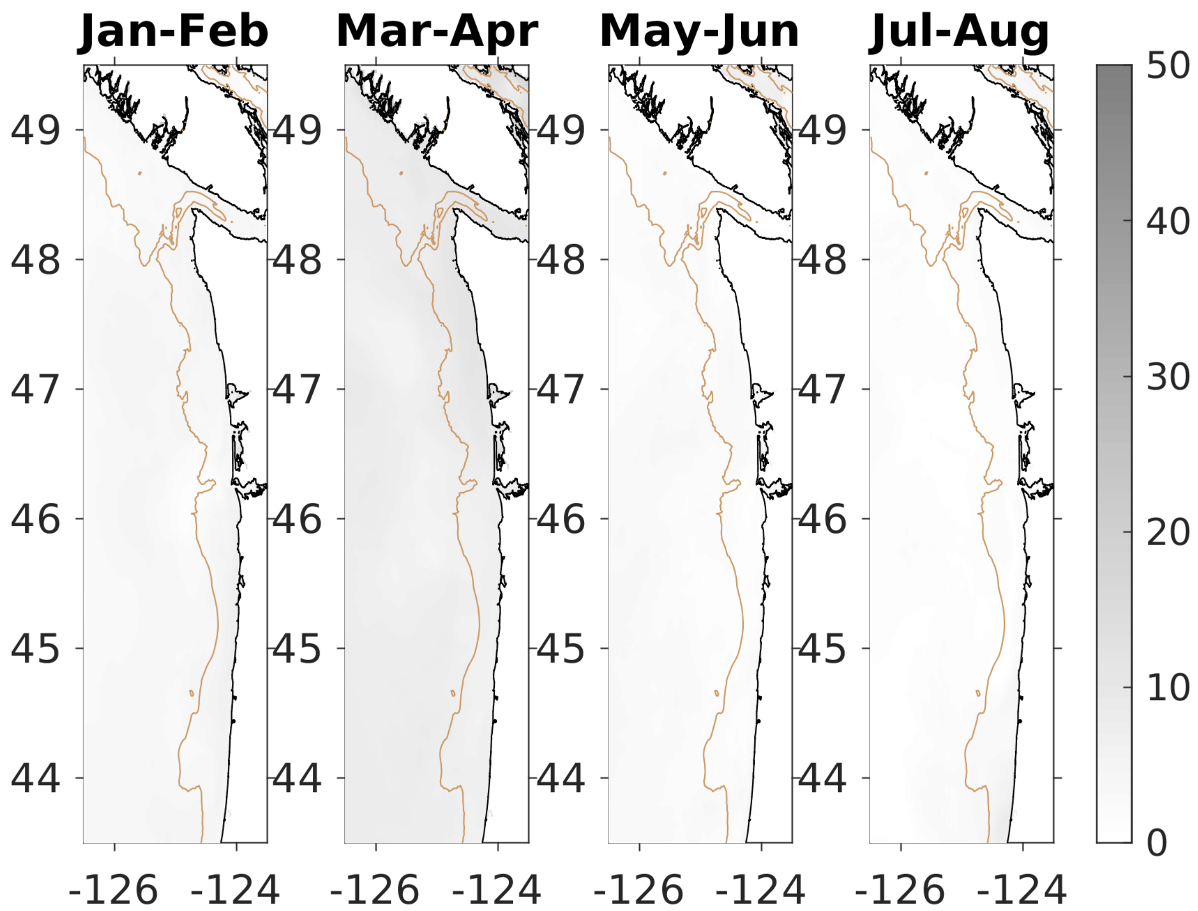


Fig.. D.2.s. The relative uncertainty in percent for the modeled region SST values averaged in time for (from left to right) January - February, March - April, May - June, July - August. The relative uncertainty is defined as the standard deviation of the ensemble divided by the mean of the ensemble and is reported as a percentage of the mean.

Bottom oxygen is forecasted to be *lower* over both the Washington Oregon shelves with high disagreement between ensemble members resulting in high uncertainty in late summer surrounding this forecast throughout the region (Fig. D.3.s, and D.4.s). Subsurface oxygen anomalies extend down the slope regions. Hypoxia is forecasted earlier than climatological (in late May, early June) at both CE042 and NH10, with an earlier onset at NH10*.* Chaba also develops hypoxia in July, which is not typically observed at this location.

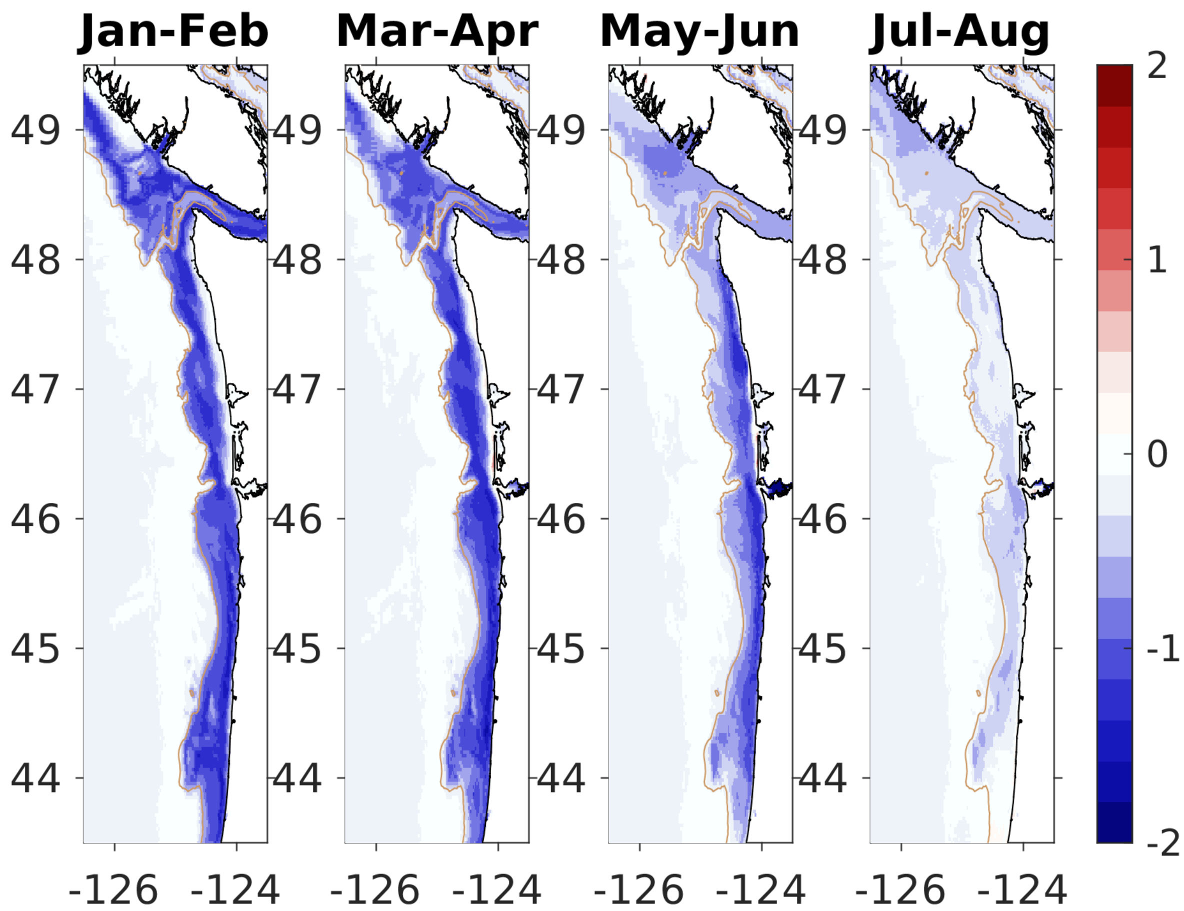


Fig. D.3.s. The modeled region bottom oxygen (ml/l) anomaly averaged over all three ensemble members and in time for (from left to right) January - February, March - April, May - June, July - August.

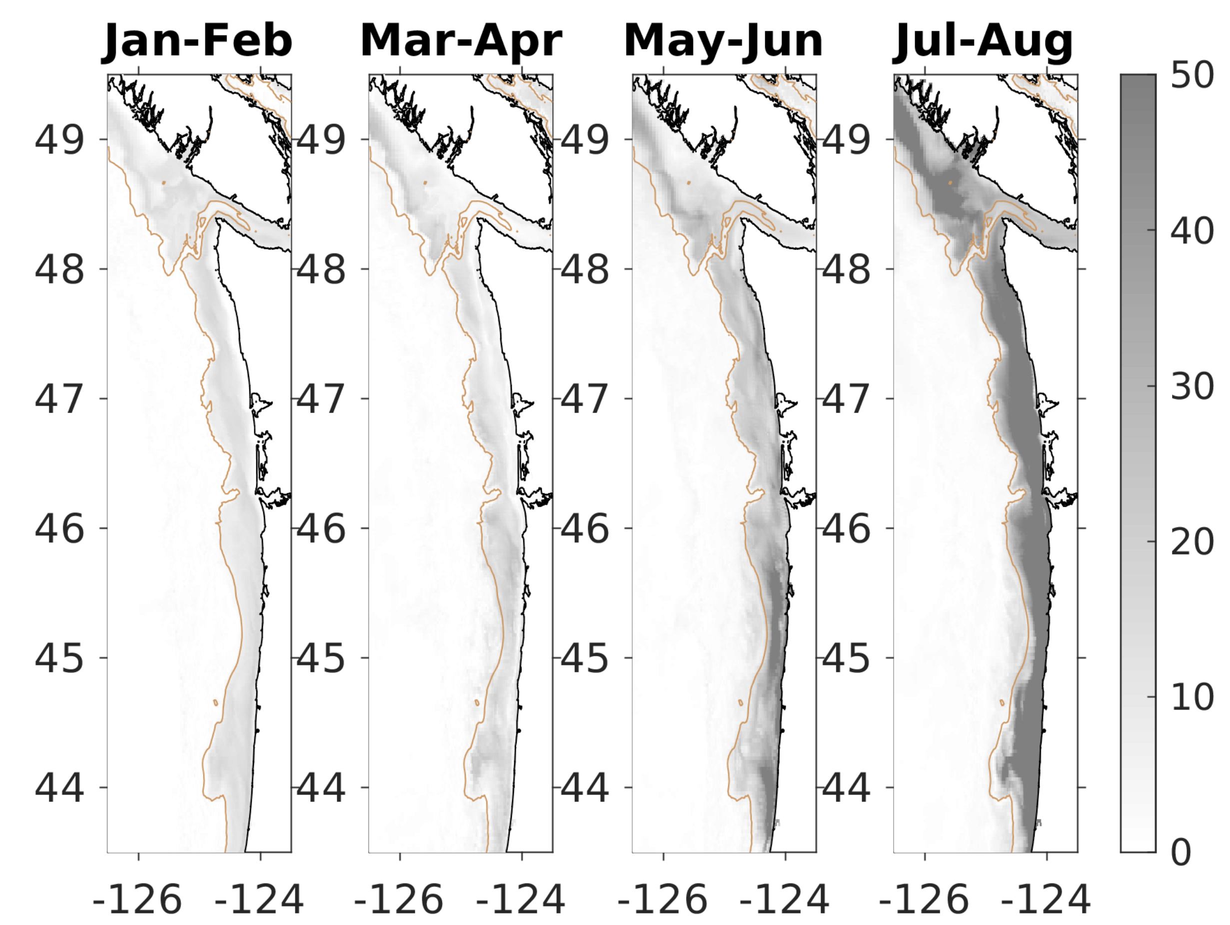


Fig. D.4.s. The relative uncertainty in percent for the modeled region bottom oxygen values averaged in time for (from left to right) January - February, March - April, May - June, July - August. The relative uncertainty is defined as the standard deviation of the ensemble divided by the mean of the ensemble and is reported as a percentage of the mean.

Surface aragonite saturation state (Ω) is forecasted to be supersaturated throughout the upwelling season for all coastal areas (Fig. D.5.s). Bottom Ω is forecasted to be undersaturated throughout the upwelling season, with the exception of supersaturated conditions on shallow nearshore Washington shelves (Fig. D.6.s).

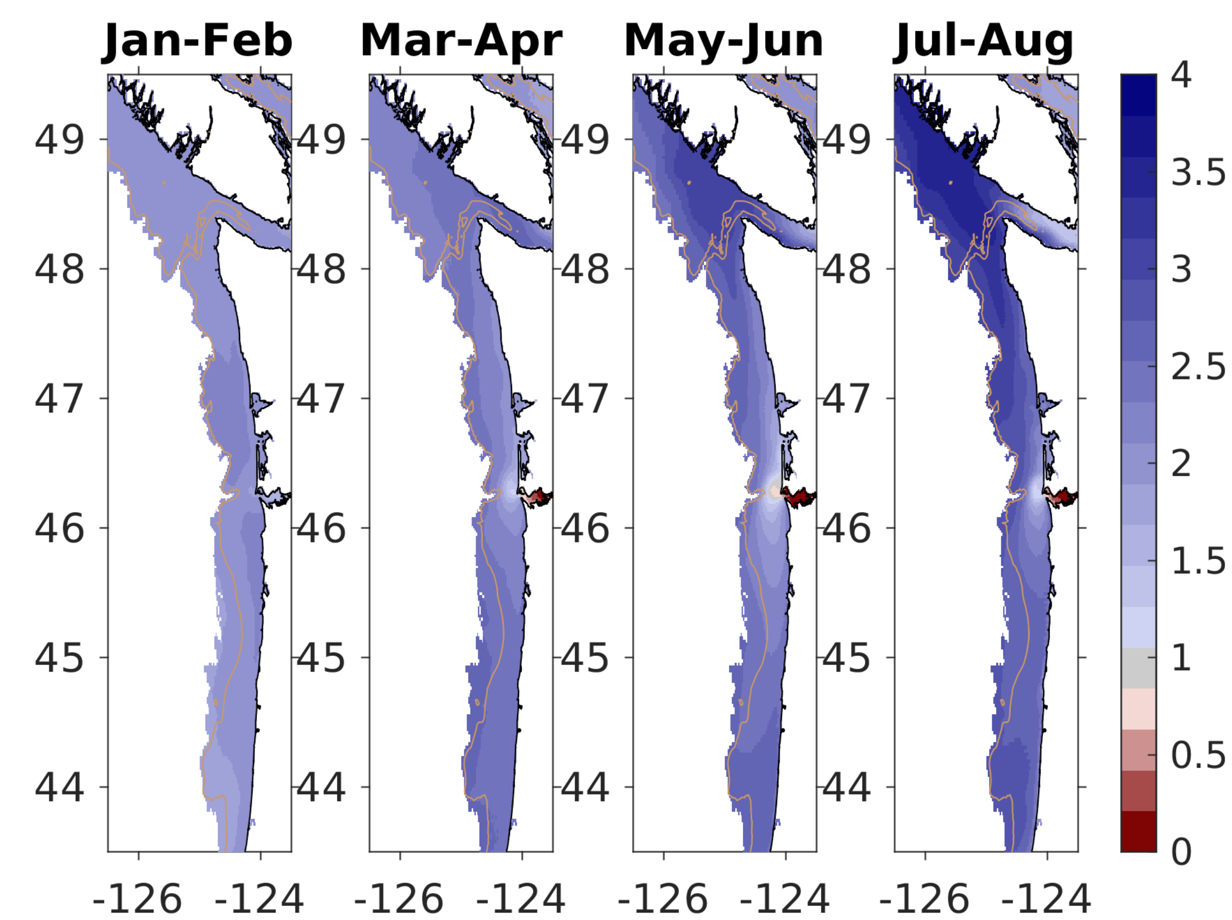


Fig. D.5.s. The modeled region surface aragonite saturation state (Ω) averaged over all three ensemble members and in time for (from left to right) January - February, March - April, May - June, July - August. For reference, Ω = 1 is the physical chemistry defined boundary between undersaturated and saturated conditions, but stressful conditions for juvenile oysters begin to occur before the waters become undersaturated (Ω = 1.3). The 200m isobath is outlined by the beige contour line.

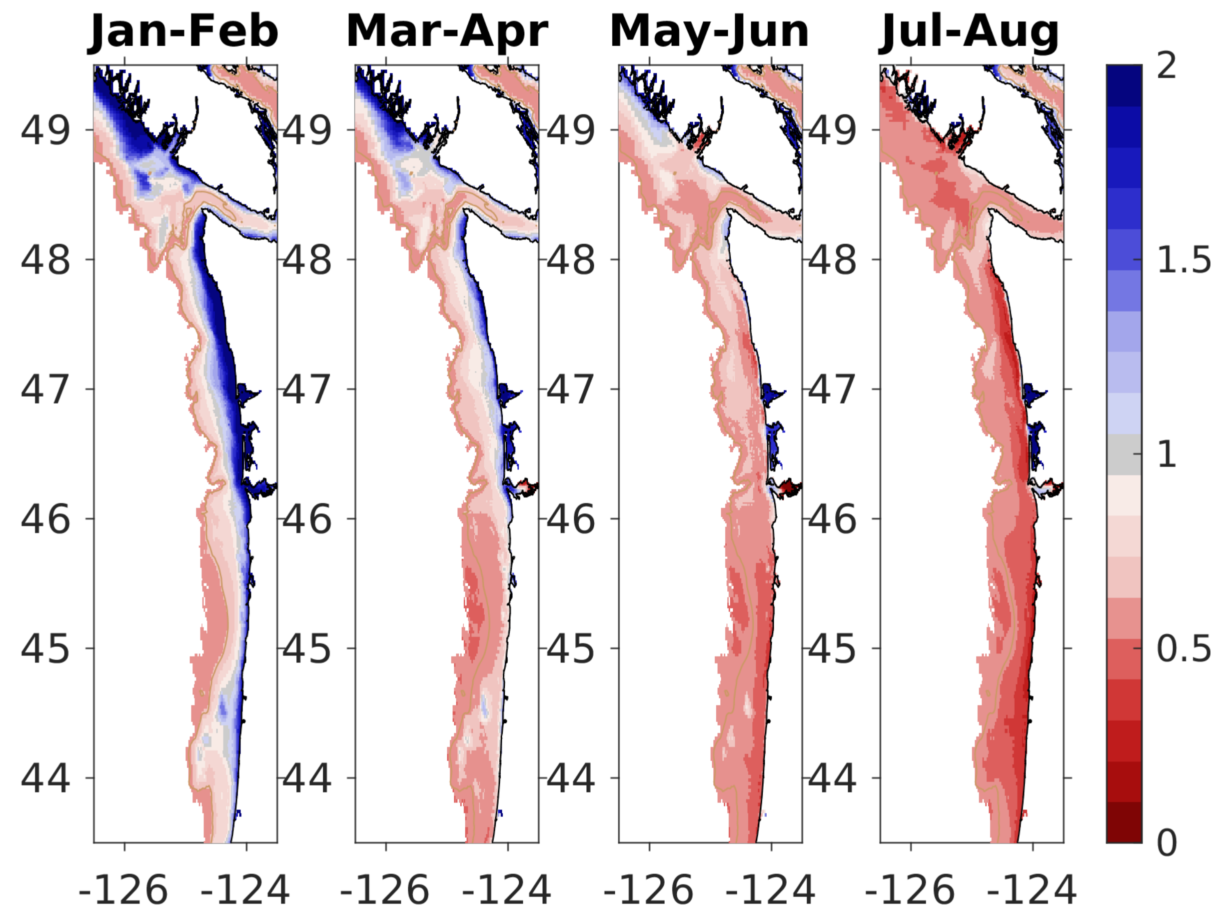
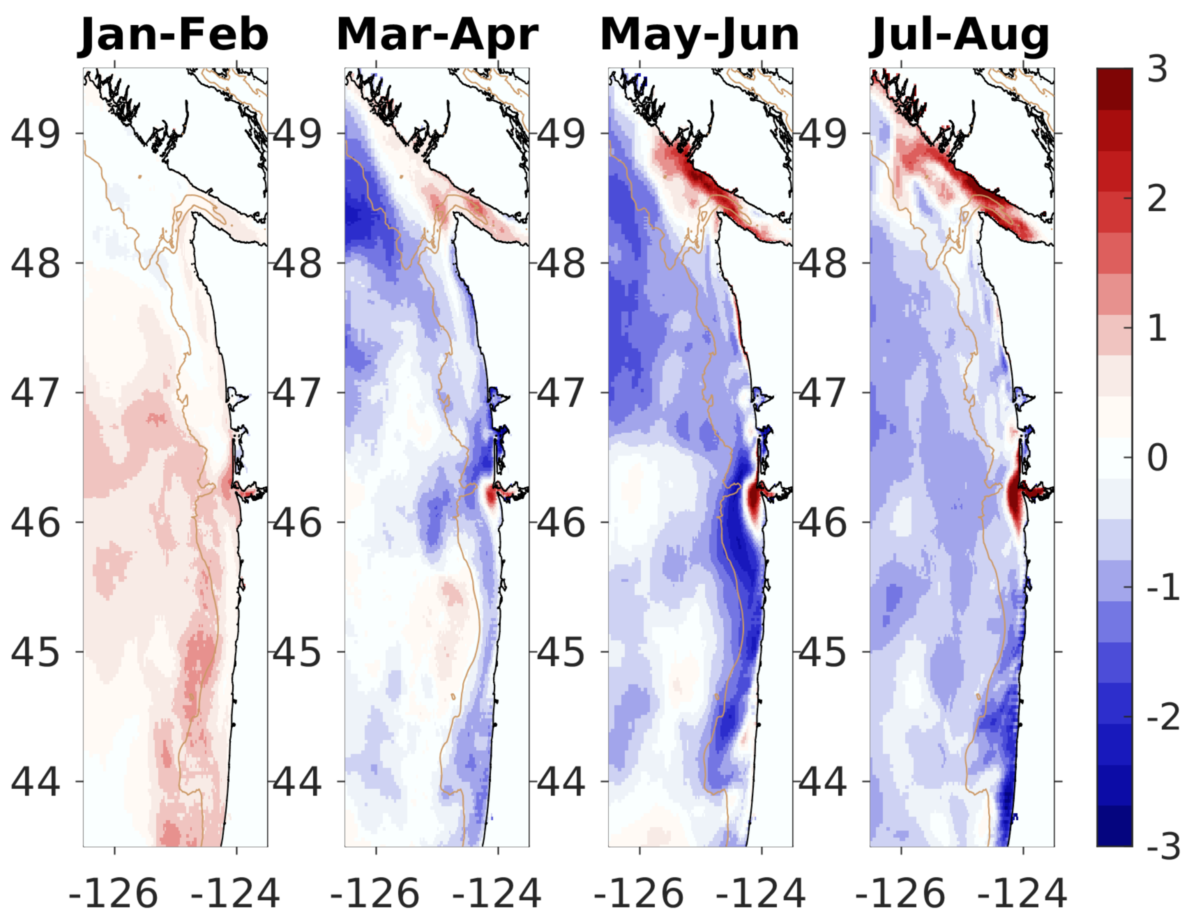


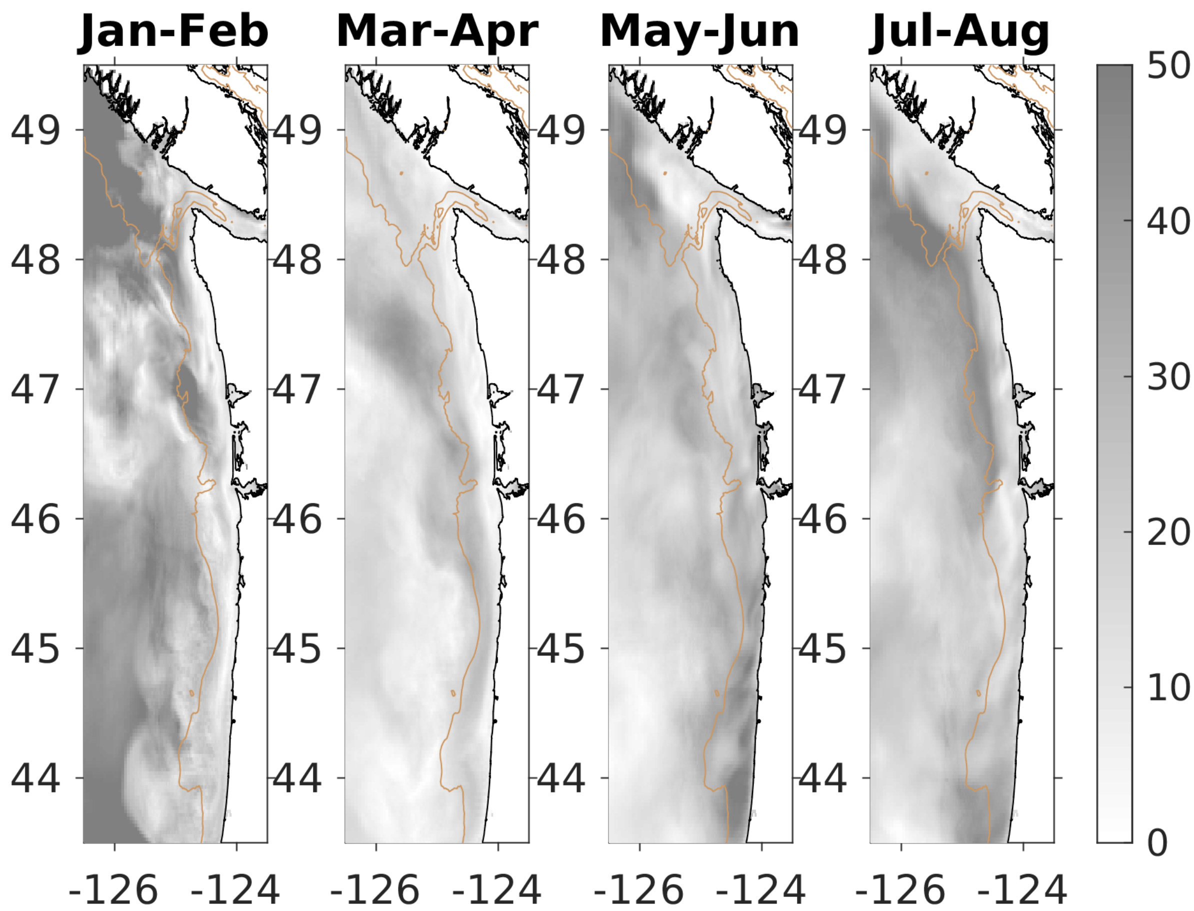
Fig. D.6.s. The modeled region bottom aragonite saturation state (Ω) averaged over all three ensemble members and in time for (from left to right) January - February, March - April, May - June, July - August. For reference, Ω = 1 is the physical chemistry defined boundary between undersaturated and saturated conditions, but stressful conditions for juvenile oysters begin to occur before the waters become undersaturated (Ω = 1.3). The 200m isobath is outlined by the beige contour line.

For waters off the Washington and Oregon coast, the forecast projects that 10-meter integrated chlorophyll will be slightly lower than climatology (Fig. D.7.s.) with the Juan de Fuca Eddy region experiencing a high in the later portion of the upwelling season (Jul-Aug). The relative uncertainty is highest at the beginning of the forecast when chlorophyll levels are low, is minimal around the spring transition (Mar-Apr) and then increases throughout the upwelling season with an uptick in uncertainty in the end (Jul-Aug).

The uncertainty is caused by the differences between the three ensemble members wind forcing (Fig. D.8.s).



D.7.s. The anomaly of the modeled region chlorophyll values integrated over the surface 10 meters (in mg/l), and averaged over all three ensemble members and in time for (from left to right) January - February, March - April, May - June, July - August.



D.8.s. The relative uncertainty in percent for the modeled region chlorophyll values integrated over the surface 10 meters (in mg/l), and averaged in time for (from left to right) January - February, March - April, May - June, July - August. The relative uncertainty is defined as the standard deviation of the ensemble divided by the mean of the ensemble and is reported as a percentage of the mean.

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References

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