Sea surface salinity validation using gridded observations from WOA

Baseline climatologies of sea surface salinity

Climatologies of model and observational sea surface salinity are shown in the figures below. The model climatology is calculated using the year **2005**.

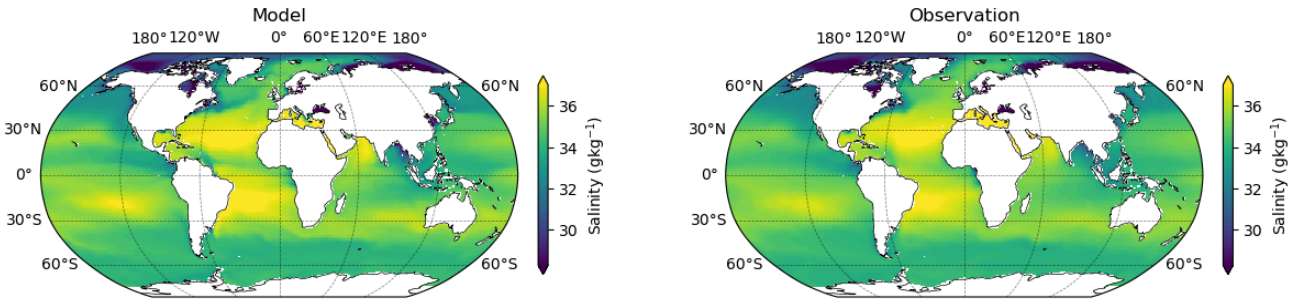

Figure 1: Annual average surface salinity from the model (2005) and observations. Data is limited to the 2nd and 98th percentile of the combined model and observational data. Arrows indicate that values can exceed the colourbar limits.

Assessing model bias for surface salinity

Figure 2 shows the average bias of surface salinity simulated by the model. A positive bias indicates that the model overestimates the observation, while a negative bias indicates that the model overpredicts the observation.

The spatial average bias of surface salinity is 0.10 g kg^{-1}. Overall, the model overestimates the observations in 72.2% of the model domain.

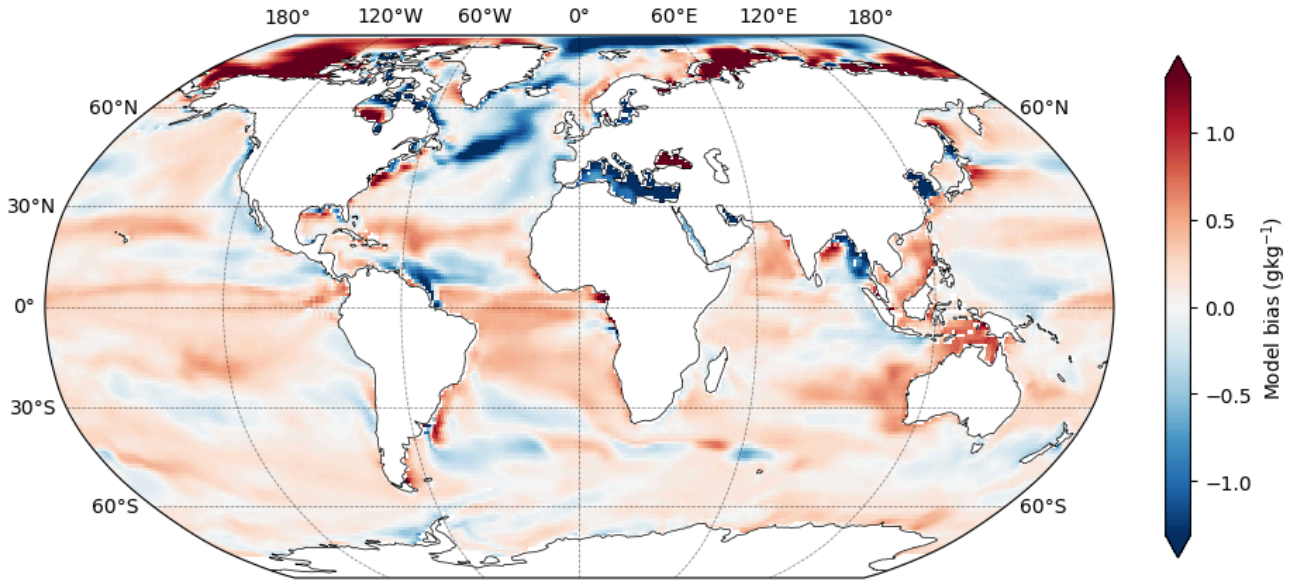

Figure 2: Bias of surface salinity from the model. A positive bias indicates that the model overestimates the observation. For clarity, the colourbar is limited to the 2nd and 98th percentile of the data.

Can the model reproduce seasonality of sea surface salinity?

The ability of the model to reproduce seasonality of sea surface salinity was assessed by comparing the modelled and observed seasonal cycle of salinity. First, we derive a monthly climatology for the model data. Then, we calculate the Pearson correlation coefficient between the modelled and observed salinity at each grid cell.

Note: we are only assessing the ability of the model to reproduce the ability of the model to reproduce seasonal changes, not long-term trends.

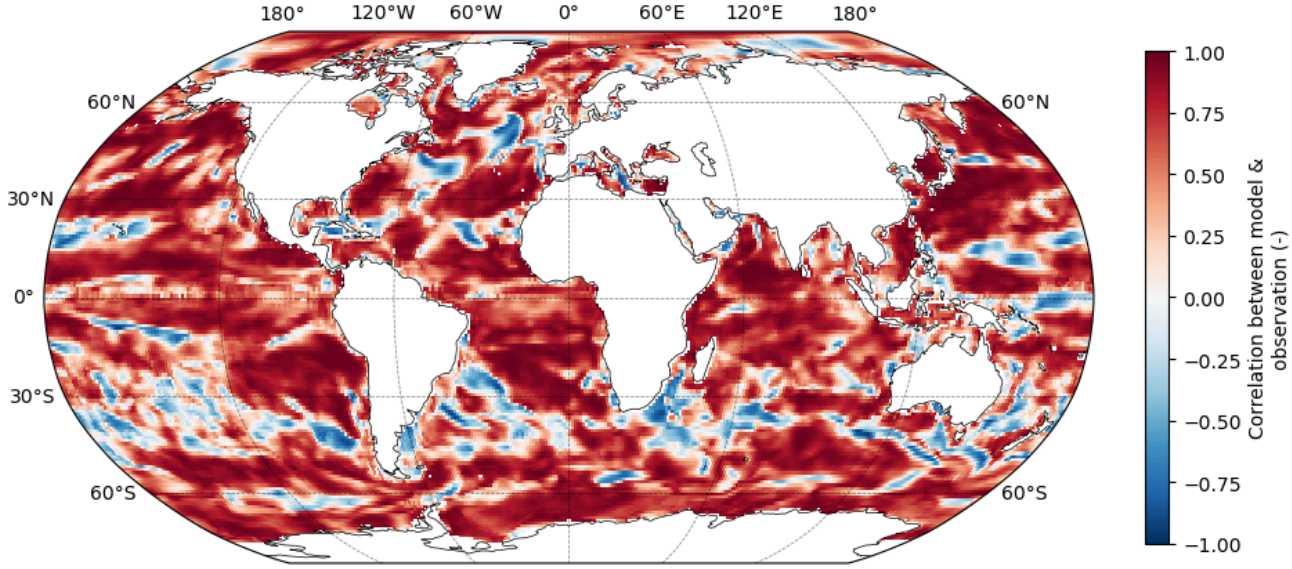

Figure 3: Seasonal temporal correlation between model and observations for surface salinity. This is the Pearson correlation coefficient between climatology monthly mean values in the model and observations.

Can the model reproduce spatial patterns of sea surface salinity?

The ability of the model to reproduce spatial patterns of sea surface salinity was assessed by comparing the modelled and observed salinity at each grid cell. We calculated the Pearson correlation coefficient between the modelled and observed salinity at each grid cell.

This was carried out monthly and using the annual mean in each grid cell

Time period	*r*
Annual mean	0.95
Jan	0.93
Feb	0.93
Mar	0.92
Apr	0.93
May	0.93
Jun	0.92
Jul	0.92
Aug	0.93
Sep	0.94
Oct	0.94
Nov	0.93
Dec	0.94

Table 1: Pearson correlation coefficient between modelled and observed sea surface salinity at each grid cell. The correlation was calculated monthly and using the annual mean in each grid cell.

Data Sources for validation of salinity

Reagan, James R.; Boyer, Tim P.; García, Hernán E.; Locarnini, Ricardo A.; Baranova, Olga K.; Bouchard, Courtney; Cross, Scott L.; Mishonov, Alexey V.; Paver, Christopher R.; Seidov, Dan; Wang, Zhankun; Dukhovskoy, Dmitry (2023). World Ocean Atlas 2023 (NCEI Accession 0270533). [indicate subset used]. NOAA National Centers for Environmental Information. Dataset. https://www.ncei.noaa.gov/archive/accession/0270533. Accessed 13/05/2024.