

Supplementary Material

1 SUPPLEMENTARY FIGURES

Supplementary Fig. S1: To further support the use of the ORA MMM, we have compared the ORA MMM with hydrographic data from cruises in the Eurasian part of the CAATEX section (cruise data close to the section have been selected; Table 2). We find that the ORA MMM represents well the observed salinity of the Mid Layer (300-700m; upper panel). The cruise data fall within the spread of the six different ocean reanalyses and close to the ORA MMM. Figure S1 also shows the salinity anomaly in the Eurasian part of the CAATEX section (lower panel).

Supplementary Fig. S2: The ORA MMM shows fairly good results for temperature and salinity in the Upper Layer (100-300m). The spread of the different ocean reanalyses is larger for the Upper Layer than for the Mid Layer, but the cruise data still fall within the spread.

Supplementary Fig. S3: We note that if we look at the annual mean temperature in the Polar Layer, NorESM2-MM, GFDL-ESM4, and MRI-ESM2-0 are showing fairly good results, both in terms of the average temperature across the CAATEX section and the spatial pattern (upper panel). The Polar Layer is the uppermost layer and is thus more influenced by the atmosphere and sea ice (polar layer temperatures are generally constrained by the fact that they stay close to freezing temperatures; simulated temperatures are between -1 and -1.8°C). The models that show a more realistic Polar Layer are therefore not necessarily the same models having more realistic results in the Upper and Mid layers. In the deeper layers (below the Mid Layer), the models show a large spread in the average temperature both for the Deep Layer (700-1500m; middle panel) and the Bottom Layer (1500-3000m; lower panel). Overall, the models poorly represent the spatial pattern in the Deep Layer and with various results for the Bottom Layer. This might be due to smaller gradients across the Arctic Ocean in these layers.

Supplementary Fig. S4: Salinity from two CMIP6 models are compared with that from the ORA MMM for the time period 1993-2010 in the Upper Layer and the Mid Layer: CNRM-ESM2-1 and EC-Earth3.

Supplementary Fig. S5: Future projected temperature changes in the Upper Layer and Mid Layer based on the SSP126 scenario. The changes are calculated by subtracting the mean conditions in 1993-2010 from the mean conditions in 2045-2055.

Supplementary Fig. S6: Future projected salinity changes in the Upper Layer and Mid Layer based on the SSP126 scenario. The changes are calculated by subtracting the mean conditions in 1993-2010 from the mean conditions in 2045-2055.

1.1 Figures



Figure S1. Upper panel: Mid Layer salinity from the ORA MMM (black curve) is compared with salinity from the cruise data (blue diamonds) in the Eurasian part of the CAATEX section. See Table 2 for information about the different data sets. All 13 CMIP6 models are included (grey curves). In this study, we use 300-700m to capture the Mid Layer. Lower panel: Same as above, but for the anomalous salinity (the respective long-term mean for the period 1993-2010 has been removed for each data set, whereas the period 1995-2011 is used for the cruise data).



Figure S2. Upper panels: Upper Layer temperature and salinity from the ORA MMM (black curve) is compared with that from the cruise data (light blue symbols) in the Eurasian part of the CAATEX section. See Table 2 for information about the different data sets. All 13 CMIP6 models are included (grey curves). In this study, we use 100-300m to capture the Upper Layer. Lower panels: Same as above, but for the anomalous temperature and salinity (the respective long-term mean for the period 1993-2010 has been removed for each data set, whereas the period 1995-2011 is used for the cruise data).



Figure S3. Correlation of temperature between all CMIP6 models (coloured circles and lines) and that from the ORA MMM (black circle and line) in the Polar Layer (PL; 0-100m), the Deep Layer (DL; 700-1500m), and the Bottom Layer (BL; 1500-3000m). Same as show in Fig. 4.



Figure S4. Salinity from two CMIP6 models (CNRM-ESM2-1 and EC-Earth3) are compared with that from the ORA MMM for the time period 1993-2010 in the Upper Layer (UL; left panel) and the Mid Layer (ML; right panel).



SSP126: projected temperature change for the period 2045-2055

Figure S5. Future projected temperature changes in the Upper Layer (UL; upper plots) and Mid Layer (ML; lower plots) based on the SSP126 scenario. The changes are calculated by subtracting the mean conditions in 1993-2010 from the mean conditions in 2045-2055. The 500m and 2000m isobaths are shown (thin black curves) together with the position of the CAATEX section.



SSP126: projected salinity change for the period 2045-2055

Figure S6. Future projected salinity changes in the Upper Layer (UL; upper plots) and Mid Layer (ML; lower plots) based on the SSP126 scenario. The changes are calculated by subtracting the mean conditions in 1993-2010 from the mean conditions in 2045-2055. The 500m and 2000m isobaths are shown (thin black curves) together with the position of the CAATEX section.