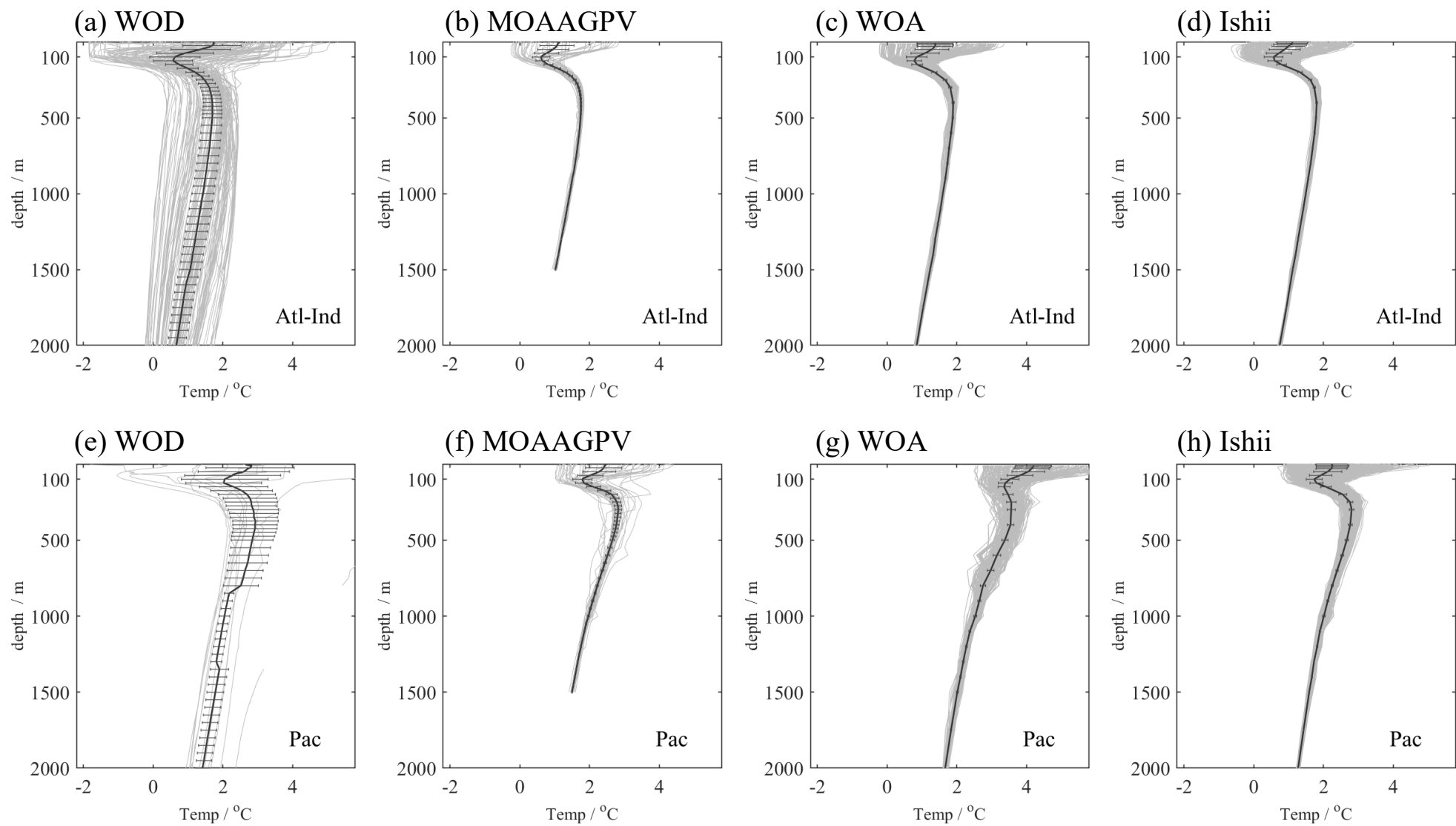
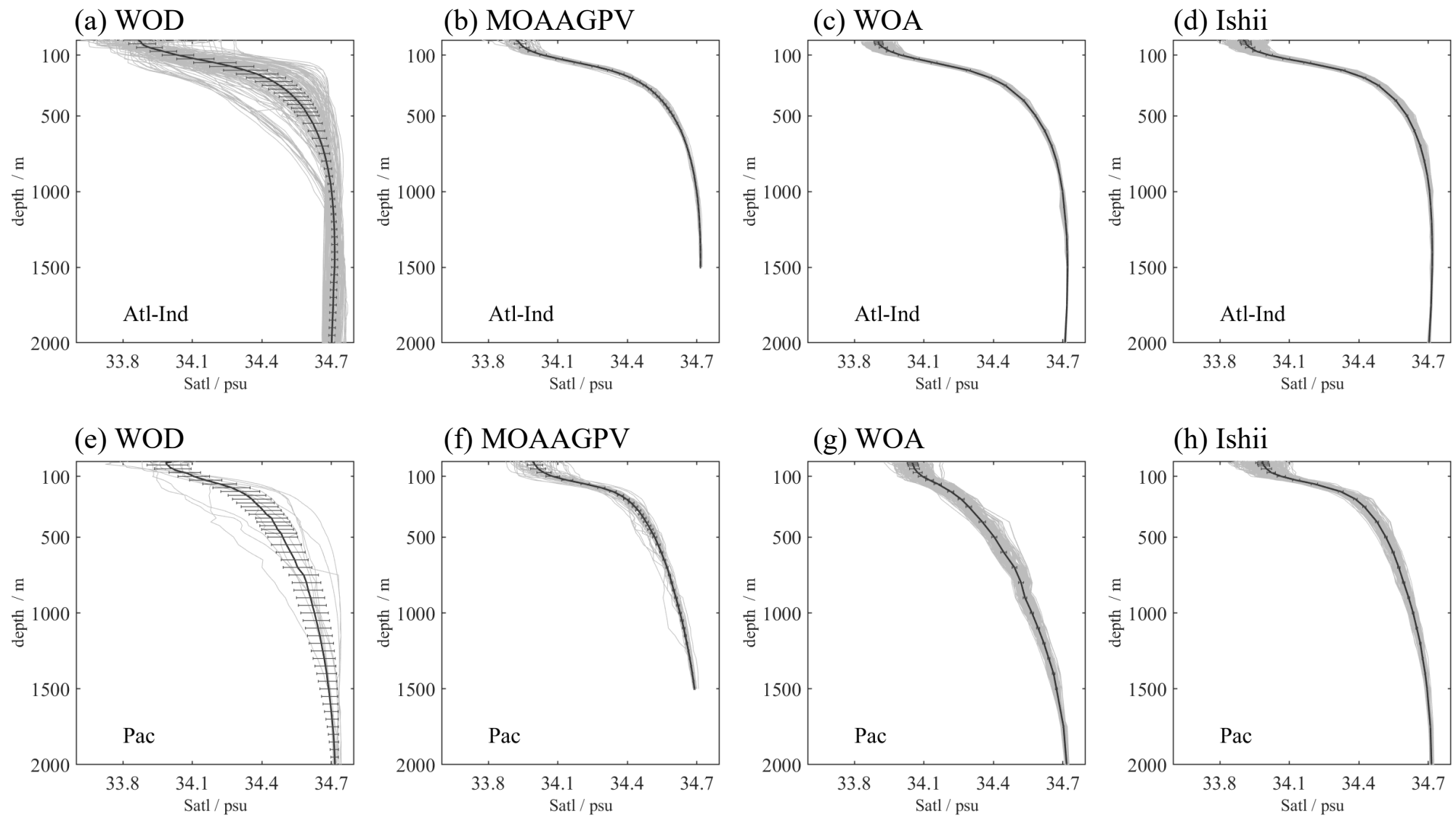
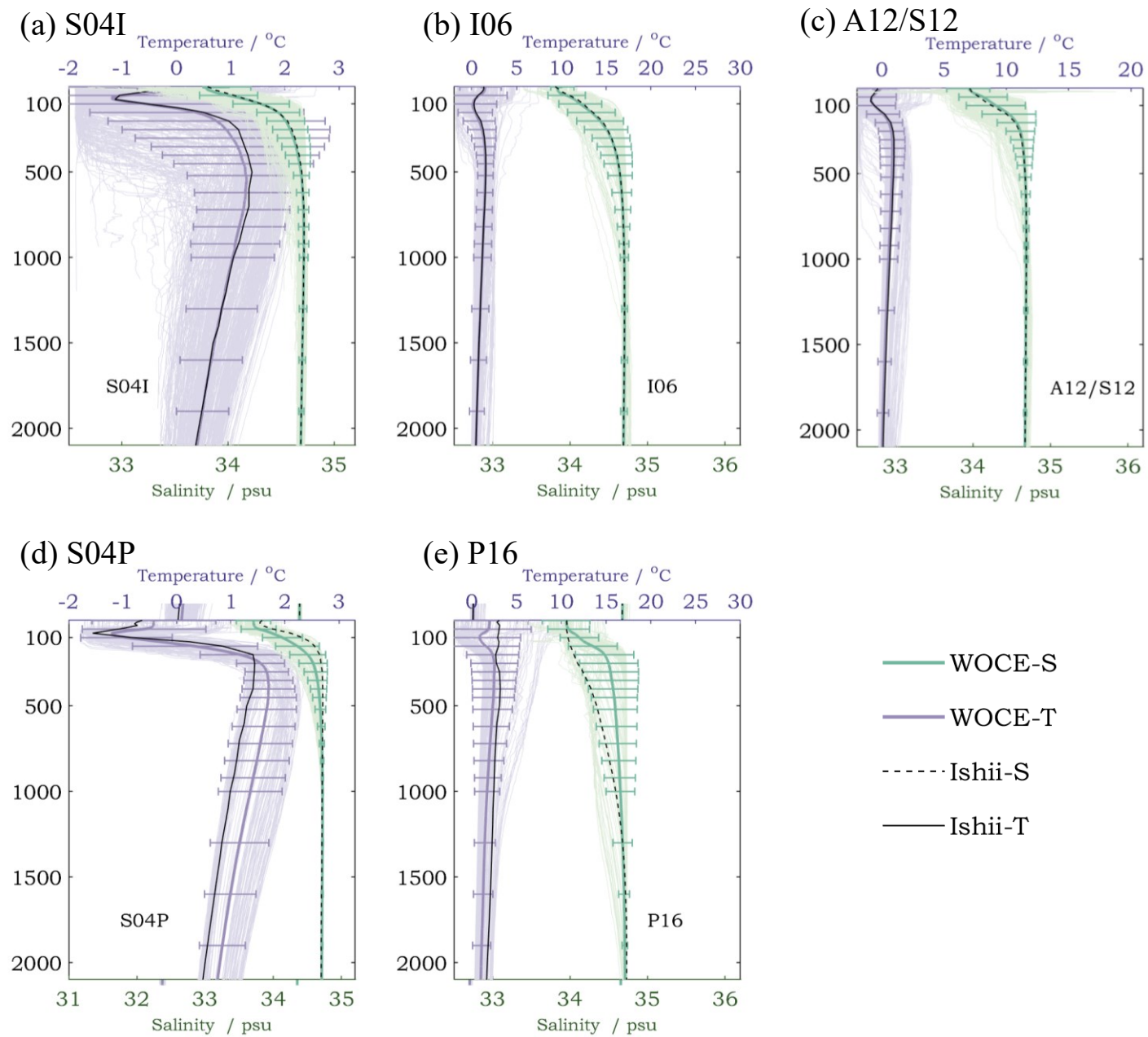
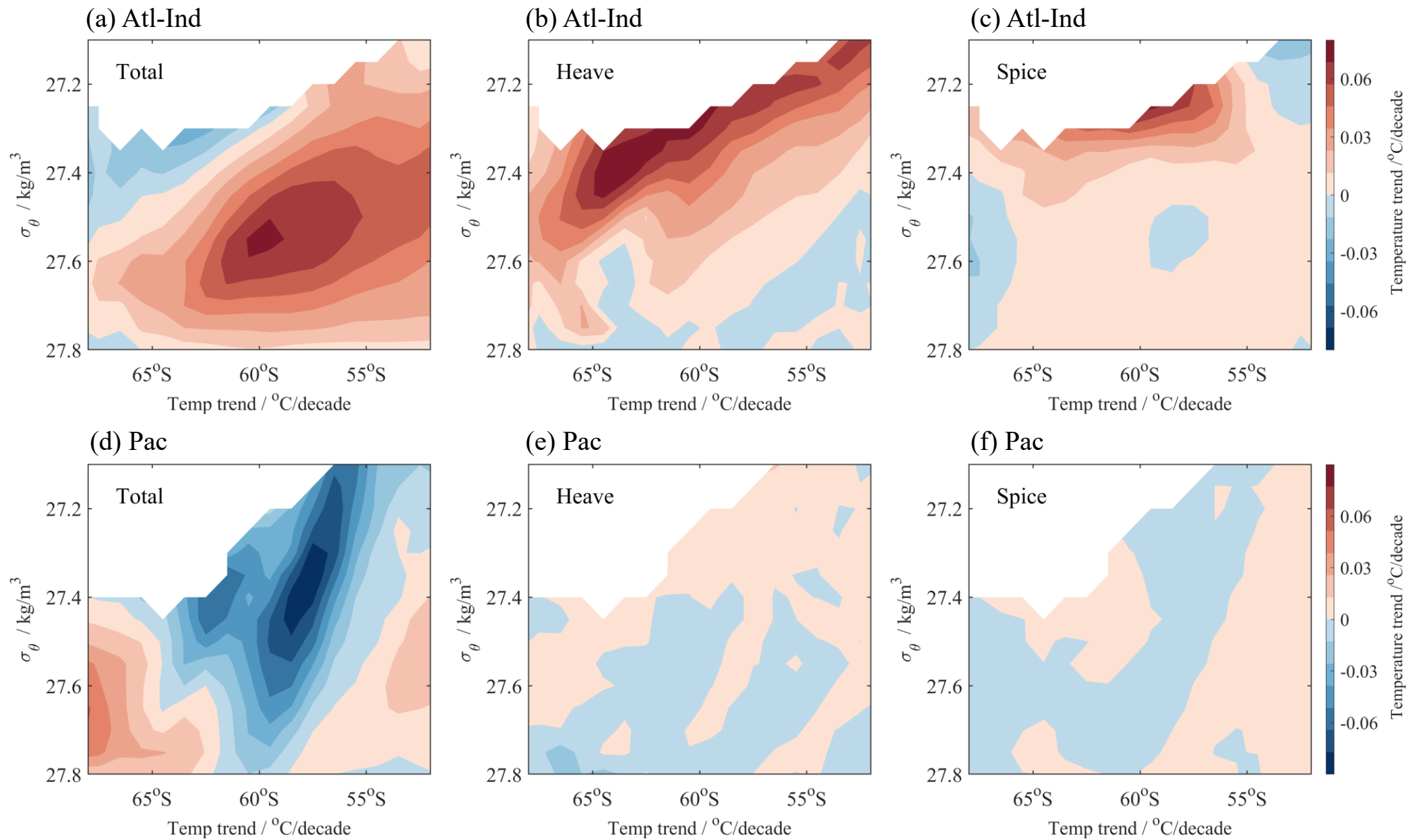
Supplementary figure.1. The OHC changes. The left column, a), b) and c) derived from Ishii are the OHC trends of the upper–2000m, AAIW and CDW during 1979–2019, respectively. The middle column, d), d) and f) same to the left column, but derived from MOAA GPV during 2001–2019. The right column, g), h) and i) derived from WOA are the OHC changes from pre–1993 to the past–2005.

Supplementary figure.2. The temperature profiles. The top panel, a), b), c) and d) in the Atl–Ind sector and are derived from WOD, MOAA GPV, WOA and Ishii, respectively. The error bars are the half standard deviation at each depth. The bottom panel is same to the top panel but in the Pac sector. The profiles of WOD in Pac sector are less than those in the Atl–Ind sector since there are some profiles removed with abrupt amplitudes compared to the regional mean.

Supplementary figure.3. same to Supplementary figure.2 but for the salinity profiles.

Supplementary figure.4. Comparison of temperature/salinity sections from WOCE and Ishii. The black solid line and black dashed line represent the regional mean temperature and salinity profile from Ishii data, respectively. The light purple and green lines denote the temperature and salinity profiles of WOCE sections, respectively. The dark purple and green lines are the mean the temperature and salinity profiles of WOCE sections, respectively. The horizontal beards are 1.5 standard deviation.

Supplementary figure.5. The temperature trend during 1979–2019. a) the total temperature trend in the Atl–Ind sector. b) and c) are the temperature trend in the Atl–Ind sector by the heave and the spice component, respectively. The bottom panel, d), e) and f) are the same to the top panel, but in the Pac sector.

Supplementary Table.1. Five repeated observed WOCE sections with inconsistent gap years.

	Section	Location	Time
Atlantic	A12/S2	34ºS – 69ºS, 0º	1992–05; 1999–01; 2000–12; 2002–11; 2005–01; 2007–11; 2008–02; 2010–11; 2014–12
Pacific	P16	150ºW, 15º S –71ºS	1992–10; 2005–01; 2014–03
	S04P	67ºS, 173ºE–70ºW	1992–02; 2011–02; 2018–03
Indian	I06	32ºS – 69ºS, 30ºE	1993–01; 1996–02; 2008–02; 2019–04
	S04I	58º S, 30ºE–170ºE	1994–12; 1996–01; 1996–05; 2006–01; 2012–11; 2013–01; 2018–12