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Observations for climate: Multi-decadal warming and shoaling of Antarctic Intermediate Water

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Antarctic Intermediate Water (AAIW) is a dominant Southern Hemisphere water mass that spreads from just north of the Antarctic Circumpolar Current (ACC) to at least 20oS in all oceans. This study uses an isopycnal climatology constructed from Argo float Conductivity-Temperature-Depth (CTD) profile data to define the current state of the AAIW salinity minimum (its core) and thence compute AAIW core pressure, potential temperature, salinity, and potential density anomalies since the mid 1970s from ship-based CTD profiles. The results are used to calculate maps of temporal property trends at the AAIW core, where statistically significant strong circumpolar shoaling (30 - 40 dbar per decade), warming (0.10 - 0.16^{o}C per decade), and density reductions (up to -0.03 kg per meter cubed per decade) are found. These trends are strongest just north of the ACC in the southeast Pacific and Atlantic oceans and decrease equatorward. Salinity trends are generally small, with their sign varying regionally. Bottle data are used to extend the AAIW core potential temperature anomaly analysis back to the mid 1920s, primarily in the Atlantic Ocean in the earliest decades, suggesting a zonally averaged decadal variability of order 0.2^{o}C. The modern warm AAIW core conditions appear unprecedented in the historical record: Biennially and zonally binned median AAIW core potential temperatures in the first half of the 20th Century are 0.2 - 1^{o}C colder than modern values, with even most of their third quartiles colder than modern conditions.