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Trends Observed in Multidecadal Subsurface Temperature Measurements from the Drake Passage

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Since the early 1970's, the Drake Passage has been the site of various intensive oceanographic field programs to study Southern Ocean dynamics. This is primarily because at 700 km wide, the Drake Passage is the narrowest constriction through which the Antarctic Circumpolar Current must pass through on its global journey, and therefore provides a convenient choke-point where the variability in mass and property fluxes can be readily measured and studied. In this analysis, we use the temperature data from the nearly 7500 XBT casts that have been deployed in the Drake Passage over the last 35 years (1969-2004) to examine interannual temperature variation of the surface layer (0-700 m). To reduce the effect of variation from different sampling locations and temporal variability introduced by meridional shifts in the Polar Front, the region was divided into two subregions north (˜3650 XBT casts) and south (˜3850 XBT casts) of the front, and temperature anomalies were formed by removing a temporal mean field for each cast in each subregion. Error analysis associated with choice of the mean front location and the temporal mean field will be discussed. North of the mean Polar Front, statistically significant warming trends were observed increasing with depth from about 0.005 deg C/year at 300 m, to 0.01 deg C/year at 600 m. Slightly lower warming trends were observed south of the Polar Front from 200-400 m depth. In the upper layer (0-100 m), a statistically significant cooling trend (˜-0.006 deg C/year) was observed in both subregions, which was only slightly lower when only summer XBT casts were considered. We relate the observed temperature trends in Drake Passage to long-term variability in sea-ice, and also in response to climate variability from the Antarctic Oscillation, the Antarctic Circumpolar Wave and the El Nino-Southern Oscillation.