Lynne D. Talley*, Brendan Carter*&, Teresa Chereskin*, Andrew Dickson*, Rana Fine+, Corinne Hartin+, James Holte* #, and Bernadette Sloyan® (ltalley@ucsd.edu)
*Scripps Institution of Oceanography; &Princeton University; +RSMAS; #WHOI; @CSIRO

WCPR Open Science Conference  Denver, 2011

Abstract (in white boxes)

We highlight results from the 2005-2006 austral winter survey of Subantarctic Intermediate Water and Antarctic Intermediate Water formation in the southeast Pacific. The salinity minimum of the Antarctic Intermediate Water (AAIW) is formed in the southeastern Pacific, as the densest, coldest, and freshest, but not necessarily thickest, Subantarctic Mode Water (SAMW). A wintertime hydrographic survey with follow-on summer survey in 2005-2006 explored the late winter mixed layers and subsequent restratified water column in the southeastern Pacific.

Background

Salinity minimum fills the Southern Hemisphere and tropics.

Hypothesis (McCartney, 1977): AAIW is the densest form of SAMW. Principal source of the salinity minimum is in the Drake Passage region.

SAMW formation experiment goals

Evaluate relative importance of cross-frontal fluxes, Ekman transport, air-sea fluxes, eddy fluxes, diapycnal mixing (wind-driven), possibly upwelling driven by wind stress curl preconditions by higher surface salinity

References to order of publication


Air-sea and cross-frontal fluxes

Air-sea buoyancy fluxes from 5 different products, run with KPP mixed layer model and summer stratification reproduce the observed winter mixed layer depths (ICCEP is best), but not the zonal variation in salinity, temperature. (Holte et al, submitted)

Winter mixed layer properties: two distinct SAMW pools; eastern one is cooler, fresher, denser (Holte et al, submitted)

Enhanced diapycnal diffusivity

Diapycnal diffusivities were enhanced, up to 10^3 to 10^4 m^2/s, near the SAF, north of the subduction front, within the capped SAMW in summer, and below the deep winter mixed layers (proto-SAMW) in winter; the diffusivities decayed rapidly with depth. Associated high rates of mixing within the summer SAMW suggests that the low stratification is partially actively maintained outside the winter (Sloyan et al, 2010).

Origin of SAMW and AAIW; mixed layer gases

The late winter mixed layers within the study region were colder, fresher and denser downstream to the east, the greatest restratified mixed layer depths and hence most well-developed SAMW coincided with higher surface salinity some distance north of the SAF while the freshest deep mixed layers adjacent to the SAF coincide with the new AAIW salinity minimum. Within the region of new SAMW, surface oxygen and chlorofluorocarbon saturations were reduced to ~95%, indicating active entrainment of surface waters in SAMW formation region are much less saturated north of subduction region. (Holte et al., submitted)

SAMW and AAIW formation rates and ages

Southeast Pacific SAMW and AAIW formation rates estimated from chlorofluorocarbon inversions from the 2005-2006 cruises and from WOCE data are 11.7 Sv and at least 5.8 Sv, respectively (Hartin et al., 2011).