Thermobaricity in the transition zone between alpha and beta oceans.

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The oceanic stratifying property (heat or salt) plays a fundamental role in climate dynamics. Three classes are defined on the basis of the stratifying property: alpha, beta and transition zone oceans. Alpha and beta oceans are regions where the stratification is *permanently* set by heat and salt, respectively. A surface beta ocean is required for the existence of sea ice (but not vice versa). Transition zone oceans exist where the stratification is not permanently set by heat or salt. Transition zone oceans are the most weakly stratified regions of the upper oceans, making them ideal locations for thermobaric effects arising from the nonlinear equation of state of seawater. Two types of thermobaric instability are defined and identified in the hydrographic data. The first type arises from the vertical relocation of individual water parcels. The second type is novel and depends on the effect of pressure on the stratification via the pressure dependence of the thermal expansion coefficient. In this type of thermobaric instability, water that is statically stable at one pressure can be unstable at other pressures. We analyze four years (2010–2013) of hydrographic data from the Argo profiling float array. The upper 1500m of the global ocean is comprised of 67% alpha, 15% beta, and 18% transition zone oceans: 5.7% of the global ocean is thermobarically-unstable and 2.3% is statically unstable. Of these thermobarically-unstable waters, 63% exist in transition zone oceans, suggesting that these are important locations for efficient vertical transport of water mass properties. Moreover, alpha, beta, and transition zone oceans likely respond differently to changes in air/sea buoyancy forcing. Alpha, beta, and transition zone oceans are all important to ASOF science for reasons that are discussed.