



Why is the Ocean so Skinny?

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The ocean hydrography is observed to occupy very little volume in the three-dimensional space defined by salinity-temperature-pressure (S-T-p). While ocean data have previously been analyzed on the two-dimensional temperature-salinity (S-T) diagram and mode waters have been identified on this diagram, the very sparse (skinny) nature of the world ocean in the three dimensional S-T-p space seems not to have been noticed to date. The world's ocean data almost fit on a single surface in this three-dimensional space. A consequence of this observation is that the ambiguity in defining neutral surfaces is quite small. We ask why the ocean chooses to arrange itself so as to have very little volume in this S-T-p, and conclude that if this were not so, the vertical advection achieved by the helical motion along neutral trajectories would be sufficiently large that the ocean could not be steady. We conjecture that if the ocean were forced into a state that occupied significant S-T-p volume, it would be unsteady until another steady state emerged in which the volume of the world ocean in S-T-p space would again be small.