



Representativeness of meridional hydrographic sections in the western South Atlantic

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Many studies of the oceanic circulation are based on data collected during quasi-synoptic hydrographic surveys. After spatial averaging, to filter out the effects of mesoscale variability, it is often explicitly or implicitly assumed that the hydrographic fields are representative of a quasi-steady “mean” state. Climatological tracer fields and float data at the depth of North Atlantic Deep Water in the western South Atlantic (Brazil Basin) support the notion of a quasi-steady mean circulation characterized by alternating bands of primarily zonal flow with meridional scales of several hundreds of km. Visually, the mean circulation appears to dominate three samples of the large-scale meridional-density-gradient field taken between 1983 and 1994. A quantitative comparison reveals, however, that the baroclinic temporal variability of the zonal velocities is of the same magnitude as the mean, and is associated with similar spatial scales. The synoptic geostrophic flow field is therefore only marginally representative of the mean state. Thus, the data do not support one of the central assumptions of reference-velocity methods, such as linear box-inverse models and the beta-spiral, because baroclinic temporal variability renders the equation systems underlying these methods inconsistent. A modal decomposition of the temporally varying baroclinic zonal velocity field in the Brazil Basin indicates that the first two dynamical modes dominate, accounting for 90% of the rms velocities. The residual flow field that remains after removing the first two baroclinic modes from the three synoptic samples is dominated by the mean circulation. However, its magnitude is not sufficient to account for the float and tracer observations. Therefore, it is necessary to determine the projection of the mean zonal velocities onto the barotropic and the first two baroclinic modes in order to diagnose fully the mean zonal circulation in the western South Atlantic. There is evidence that the representativeness of synoptic hydrographic sections

in other regions may be similarly marginal.