

An optimal XBT-based monitoring system for the South Atlantic Meridional Overturning Circulation at 34S

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The South Atlantic is an important pathway for the inter-basin exchanges of heat and freshwater with strong influence on the global meridional overturning stability and variability. Along the 34°S parallel, a quarterly, high density expendable bathythermograph (XBT) transect (AX18) samples the temperature structure in the upper ocean. The AX18 transect has been shown to be a useful component of a meridional overturning monitoring system of the region. However, a feasible, cost-effective design for an XBT-based system has not yet been developed. Here we use a high-resolution ocean assimilation product to simulate an XBT-based observational system across the South Atlantic.

The sensitivities of the meridional heat transport, meridional overturning circulation, and geostrophic velocities to key observational and methodological assumptions are studied. Key assumptions taken into account are horizontal and temporal sampling of the transect, salinity and deep temperature inference, as well as the level of reference for geostrophic velocities. In addition, the sensitivity of the meridional transports to XBT measurement errors, such as historical fall-rate equation biases and temperature accuracy, are estimated.

With the current sampling strategy, the largest errors in the meridional overturning and heat transport estimations are the reference (barotropic) velocity for geostrophic calculations, and the western boundary resolution. An approach for estimating barotropic velocities using XBT and altimetry data is presented.