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## Observations for climate: The contribution of the XBT network to climate studies

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The international community maintains a global eXpendable BathyThermograph (XBT) network of 51 transects that utilizes approximately 50 ships of opportunity. One primary objective of this network component is to provide oceanographic data needed to initialize the operational climate forecasts. Data from XBT transects have been used extensively in ocean analysis to estimate and monitor the variability of ocean heat storage, western boundary currents, global heat and freshwater transport. In particular, two zonal XBT transects in the Atlantic Ocean have been used to estimate the strength of the meridional overturning circulation (MOC) and the meridional heat transport (MHT). It is important to monitor the MHT in the Atlantic Ocean in order to diagnose and understand ocean circulation variability, identify changes in the MOC and to monitor for indications of possible abrupt climate change. Studies using XBTs deployed along a zonal transect at nominally 35oS in the South Atlantic since 2002 have shown that the geostrophic component of the circulation dominates the net MHT and that, at the seasonal time scale, the geostrophic and Ekman components of the circulation are out of phase. Further analysis of these data has shown that the variability of the MOC is similarly very weak on seasonal time scales. Separation of transport into western and eastern boundaries and interior indicates that it is critical to monitor all three regions in order to quantify changes in the MOC and MHT. Those results have been used to evaluate model performance in simulating MOC processes. Analysis of an eddy-resolving ocean simulation also suggests that the MOC and MHT in the South Atlantic have important contributions not only from the boundaries (Agulhas and Brazil-Malvinas Confluence regions) but also in the ocean interior. Model simulations also point out the critical role of the inter-ocean exchanges in the South Atlantic in long-term changes of the MHT, suggesting that it is important to monitor the exchanges of the South Atlantic with Pacific and Indian Oceans. XBT observations can be used with data from other observational platforms, such as blended satellite altimetry observations and Argo profiling floats, to investigate the year-to-year variability of the MOC and MHT along 35oS since 1993 and to assess the contribution of the barotropic and baroclinic components to these transports. The barotropic and baroclinic components of sea height can be extracted from co-located altimetric and hydrographic data using a methodology demonstrated previously in the Brazil-Malvinas Confluence region. The barotropic contribution to the MOC and MHT are validated using the pressure records of four pressure-equipped inverted echo sounders (PIES) deployed in the South Atlantic at 35oS in 2009, while the baroclinic components are validated by the XBT derived MOC and MHT estimates.