Estimating the Meridional Heat Transport and Overturning Circulation from XBTs

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The Atlantic Ocean Heat Transport is estimated and monitored to diagnose and understand ocean circulation variability, identify changes in the Meridional overturning circulation and to monitor for indications of possible abrupt climate change. The Atlantic Ocean is the major ocean basin involved in large-scale northward transports of heat typically associated with the meridional overturning circulation (MOC) where warm upper layer water flows northwards, and is compensated for by southward flowing North Atlantic Deep Water. This large-scale circulation is responsible for the northward heat flux through the entire Atlantic Ocean. This presentation summarizes estimates of the heat transport and meridional overturning transport from the two zonal sections AX07 and AX18 that AOML maintains in the Atlantic Ocean. As shown below (Figure 1), the heat transport in the North Atlantic was found to vary on inter-annual time scales from 0.8 ± 0.2 PW in 2003 to 1.2 ± 0.2 PW in 1996 and again in 2007, with instantaneous estimates ranging from 0.6 to 1.6 PW. Heat transport due to Ekman layer flow computed from annual Hellerman winds was relatively small (only 0.1 PW). This variability is entirely driven by changes in the interior density field; the barotropic Florida Current transport was kept fixed (32 Sv). At low frequencies, North Atlantic heat transport variations were found to weakly correlate with the Atlantic Multidecadal Oscillation (AMO).

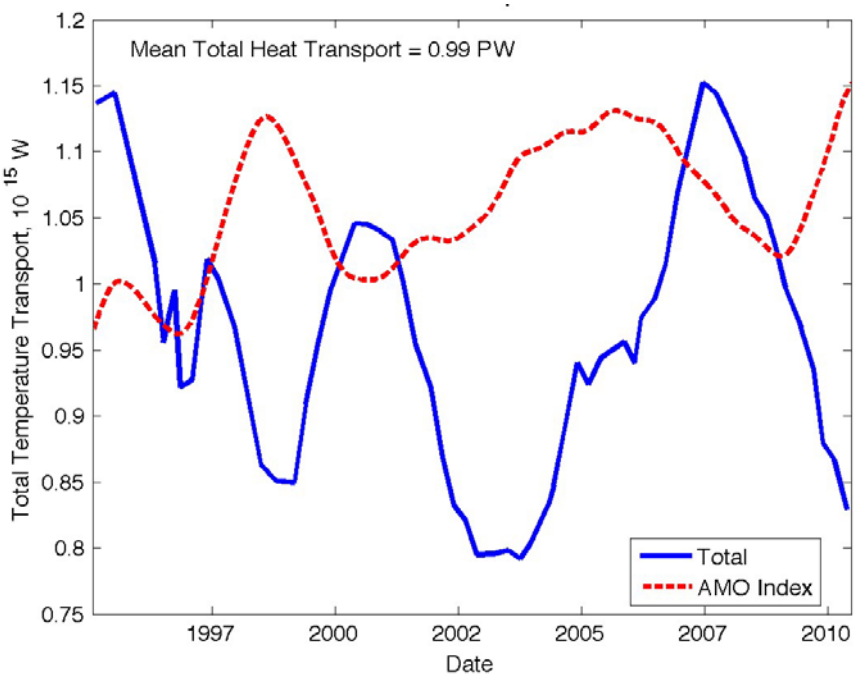

Figure 1: Meridional heat transport from the high density XBT transect AX7 that cuts through the North Atlantic Subtropical Gyre (blue line) compared to the Atlantic multidecadal oscillation index (AMO: red-dashed line).