# Meridional Heat Transport Variability in the Atlantic Ocean

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## Project Summary

***Goal:*** To contribute to the assessment of the state of the ocean by providing quarterly reports on the meridional heat transport in the Atlantic Ocean. This heat transport is directly related to the role that this basin plays in the meridional overturning circulation (MOC) and is an important benchmark for integrated air-sea fluxes and numerical model performance. Models indicate that the variability on the MOC has important consequences for the global climate.

***Project Output:*** "State of the ocean" quarterly estimates of meridional oceanic heat transport in the center of the subtropical gyres in the North and South Atlantic. This project funds the development of a methodology to estimate heat transport variability using data collected along two high density Expendable Bathythermograph (XBT) lines operated by AOML, satellite data (altimeter and scatterometer), wind products from the National Center for Environmental Prediction (NCEP) reanalysis and products from general circulation models. These quarterly reports are posted on the AOML web site (http://www.aoml.noaa.gov/phod/soto/mht/index.php). Users of this analysis include modeling centers, climate researchers looking for actual insitu estimates of oceanic heat transport to validate models and assess climate variability. Without these quarterly estimates of heat transport, climate scientists may have to wait on occasional, sporadic publications of scientific analysis in the peer reviewed literature, inherently a slow process.

***General Overview:*** 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. Historical estimates of the net northward heat flux in the vicinity of its maximum, which occurs in the North Atlantic roughly at the latitude of the center of the subtropical gyre, range from 0.9 PW[1] to 1.6 PW, while estimate in the 30°S to 35°S band are even more uncertain, ranging from negative to more than 1 PW. While much of this variability may be a consequence of the different methods used to estimate the heat transport, natural variability cannot be ruled out. The importance of this heat transport to the world climate together with the possibility of monitoring its variability motivates this project.

AOML collects XBT data on two lines spanning the subtropical oceans as part of the NOAA/OCO Ship of Opportunity project: in the North Atlantic since 1995 (quarterly repeats) along AX7 running between Spain and Miami, Florida and in the South Atlantic since 2002 (twice per year until 2004 and quarterly thereafter) along AX18 between Cape Town, South Africa and Buenos Aires, Argentina. These data capture the upper limb of the MOC transport. In the North Atlantic much of the northward transport is confined to a strong boundary current

[1] PW is PetaWatt or $10^{15}$ Watts, a unit of power commonly used for ocean heat transports.

through the Florida Straits, where XBT data can also be usefully augmented with other data from the NOAA/OCO funded Western Boundary Time Series project. In the South Atlantic This project utilizes data collected from these other two funded NOAA programs to provide a product that can be used to assess climate variability.