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Atlantic Meridional Overturning Circulation: Salinity and water mass transports in the Florida Straits

Zoltan Szuts[†]; Christopher Meinen; Molly Baringer
[†] Max Planck Institute for Meteorology, Germany
Leading author: zoltan.szuts@zmaw.de

As part of calculating the freshwater or salinity flux at 26N from the RAPID/MOCHA moorings, the voltage measured by the Florida Straits submarine cable needs to be calibrated for salinity transport. Since calibration data used to date did not include salinity measurements, we use 31 CTD/LADCP transects collected by NOAA/AOML across the strait over the past decade. These observations allow investigation of salinity transport, as well as temperature and volume transport. Cable calibrations for volume and temperature transports are consistent with previous calculations. Relative to the average mid-ocean salinity at this latitude, the rms error of the cable-derived salinity transport is 2.2 Sv psu out of a signal of 32 ± 2.5 Sv psu (mean ± standard deviation). The correlation between salinity transport and volume transport is found to be weaker than the correlation between temperature transport and volume transport. Empirical modes of variability show that salinity fluctuations are strongest in mid-depth waters of intermediate salinity, where velocity is neither particularly strong nor variable. In contrast, temperature is highly stratified and warm surface temperatures coincide with strong and variable surface velocities. When combined, these factors help explain the lower correlation of salinity transport with cable voltage. The temperature and salinity structure can also be used to deduce the origin of waters in the strait. Based on a rough classification following Schmitz and Richardson (1991), waters of 12-24 C are predominantly of subtropical North Atlantic origin, while warmer and colders waters are predominantly of South Atlantic origin. The transport of North Atlantic waters is 13.3 ± 1.7 Sv (average ± standard deviation), whereas that for South Atlantic waters is 17.1 ± 1.6 Sv. The transport of North Atlantic waters is correlated with the total volume transport in the strait and can be estimated with an rms error of 1 Sv (65% common variance), while the transport of South Atlantic waters is only weakly correlated (rms error of 1.35 Sv, 25% common variance). The predominance of North Atlantic water in fluctuations of the Florida Current transport has important implications for the driving mechanism of the western boundary current, its interactions with the subtropical gyre, and its role in the overturning circulation.