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Changes in the temperature tendencies in the upper levels of the subtropical North Atlantic ocean

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The Atlantic Meridional Overturning Circulation contributes to the moderation of the climate in Europe through the northward transport of 25% of the global heat flux, reaching its maximum of 1.5 PW at around 24.5ºN. Consequently, the transatlantic oceanographic sections at this latitude, since the first occupation during the International Geophysical Year in 1957, have become a benchmark to monitor long-term changes in temperatures in the Atlantic, in order to understand the nature and causes of climate change. In this study, Argo data are used to investigate the time variation of temperature at 24.5ºN. The Argo global ocean observing system has evolved to the point that the goal of 3000 autonomous floats, providing temperature and salinity profiles from the surface to 2000 dbar at regular 10 day intervals, has just been achieved. Temperature data from the Argo network and five oceanographic sections at 24.5ºN are used to show here that 1) a mean warming of 0.26 ºC occurred in the upper ocean (600-1800 dbar range) during the 1998-1957 period; 2) a mean cooling of -0.15ºC of the upper ocean is found for the 2005-1998 period and; 3) this cooling significantly decreases the maximum upper-ocean warming found in 1998 to only 0.11ºC for the period 2005-1957, less than half that found during the 1998-1957 period. These results, together with oscillations in mode-water properties, sensitive indicators of ocean climate change, found in the Indian Ocean, and the reverse in the tendency of the deep waters of the Mediterranean Sea, a proxy for climate change, demonstrate that there are still important unknown mechanisms of ocean variability that complicate the understanding of ocean climate change.