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Strong-mixing induced deep ocean heat uptake events in the North Atlantic.

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The deceleration of the upper ocean heat storage during the last decade has resulted in an active search for the 'missing heat' in the deep ocean. Modeling work has provided new insights into the role of the central Pacific Ocean on the present hiatus in global warming and the efficient transfer of heat to the deep ocean, but recent studies have highlighted also the large contribution of the North Atlantic basin to these processes, mainly based on ocean observations. The deep ocean heat uptake (below 300 m) in the North Atlantic is not confined to the subpolar gyre region but extends to mid-latitudes of the Eastern North Atlantic (ENA), requiring an additional process for its explanation other than deep convection considered until now. Here, using oceanographic in-situ data, we describe a mechanism of heat and salt injection to the deep ocean after years of warming and saltening at the surface occurred both in regions of mode (43º-48ºN) and deep water (74º-76ºN) formation in the ENA. The mechanism, although punctual meditated by strong winter mixing events, is between 2 and 6 times higher than the 2000-2010 ocean heat uptake at depths of mode (300-700m) and deep water (>2000m) formation, contributing significantly to the observed deep ocean heat uptake in the North Atlantic. Nutrient, hydrographic and reanalysis data indicate that the strong mixing-induced deep ocean heat uptake events at areas of mode and deep water formation in the North Atlantic are connected through the northward propagation of salty ENA mode waters triggered by the contraction of the subpolar gyre reinforced by the occurrences of blocking anomalies in the ENA. Such connection is not unique of the last decade but observed also during the 1960s. Natural climate variability seems the ultimate driver of the strong mixing-induced deep ocean heat uptake events, although the anthropogenic global warming and its forcing on the Arctic sea-ice retreat and frequency of extreme weather events could modify their effects.