



## **Predictable sub-decadal hydrographic pulses in the northeastern Atlantic**

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Pronounced changes in the northeastern Atlantic marine climate and ecosystems have recently been attributed to the dynamics of the subpolar gyre, represented by a so-called gyre index. But uncertainty remains about which aspects of the subpolar gyre, strength or shape, the gyre index represents. We first reveal the presence of traceable hydrographic pulses, introduced at the boundary between the subpolar and subtropical gyres every 5-10 years and which propagate to the Greenland-Scotland ridge after 1-2 years. These sub-decadal hydrographic anomalies are here attributed to the shape of the subpolar gyre, more so than the circulation strength, and the gyre shape is in turn linked to meridional shift of the Gulf Stream/North Atlantic Current (NAC) system. When the NAC is in a northerly position, the gyre has an east-west shape, engulfing the Rockall Plateau, and a fresh anomaly ensues in the Rockall Trough. When the NAC shifts south, the northern part of the subpolar gyre follows suit and the eastern gyre boundary shifts to the west of Rockall. Sub-decadal shifts in the NAC position are furthermore linked to meridional shifts of the zero wind stress curl line 1-2 years before, although the marked southward NAC shift after 1995 only can be explained by an internal reorganization of the subpolar gyre. These detailed linkages provide atmospheric and oceanic metrics, which likely facilitate realistic forecasting of the state of the northeastern Atlantic a few years ahead of time.