Ocean and atmosphere changes in the North Atlantic over the last millennium

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During the last millennium, climate in the North Atlantic region has been characterised by multidecadal oscillations, which, despite their small magnitude, had important societal and economic impacts. The most favoured explanations for this variability invoke external forcing related to variable solar activity and explosive volcanism, with changes amplified by ocean and atmosphere feedbacks, mainly involving the Atlantic Meridional Overturning Circulation (AMOC) and the North Atlantic Oscillation. However, the scarcity of highly resolved archives has hampered our understanding of the role that ocean-atmosphere interactions played in these climate oscillations. Here, results from a very highly resolved (sub-decadal) sediment core, in conjunction with model simulations, show coherent multidecadal to centennial-scale abrupt changes in the properties of the upper limb of the AMOC and subpolar gyre strength between 700-1750 years AD. Surface ocean changes were likely driven by the frequency and persistence of atmospheric blocking events in the eastern North Atlantic as a response to solar irradiance variability. Similarly, we suggest that this coupled ocean-atmosphere response to solar irradiance minima was the likely cause for some of the consecutive cold winters documented in Western Europe during the Little Ice Age.