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North Atlantic SST anomaly patterns and NW European winter climate in the past 2000 years - colder in the coming 2-3 decades?

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It is well-known that since the late 19th century major regional climatic variations have occurred at multi-annual to multi-decadal time scales. Part of these variations can be linked to multi-decadal changes in Atlantic Sea Surface Temperature (SST) anomaly patterns ('Atlantic Multidecadal Oscillation', AMO) observed in the 20th century, a feature which probably persisted during most of the Holocene.

Marine sediment core records from the NE Caribbean and West Greenland Current region covering the past 1500-2000 years show centennial-scale SST fluctuations with warming anomalies marking here the termination of the Medieval Climate Anomaly about AD1200. Ensemble simulations with an atmospheric GCM forced with reconstructed SST data for the period 1871-1999* confirm linkage between a warm North Atlantic subpolar gyre and weakening of both the westerly winds around 60o N and subtropical NE trade winds. Weaker North Atlantic trade winds and associated tropical North Atlantic positive SST anomalies are likewise typical features of a negative North Atlantic Oscillation index. Considering the actual AMO status characterised by North Atlantic SST warming since 1997, we may infer similar climate development as after the 1930's (positive AMO started late 1920's), with more common cold winters in the coming 2-3 decades. Presumed AMO development in the mid 21th century, possibly enhanced by a global warming trend, may lead to fast and significant (winter) warming.

*)Sutton, R.T., Hodson, P.L.R. 2003. Influence of the ocean on North Atlantic climate variability 1871-1999. Journal of Climate 16, 3296-3313