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Atmospheric multidecadal variations in the North Atlantic realm: proxy data, observations, and atmospheric circulation model studies

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Abstract. We investigate the spatial and temporal characteristics of multidecadal climate variability in the North Atlantic realm, using observational data, proxy data and model results. The dominant pattern of multidecadal variability of SST depicts a monopolar structure in the North Atlantic during the instrumental period with cold (warm) phases during 1900–1925 and 1970–1990 (1870–1890 and 1940–1960). Two atmospheric general circulation models of different complexity forced with global SST over the last century show SLP anomaly patterns from the warm and cold phases of the North Atlantic similar to the corresponding observed patterns. The analysis of a sediment core from Cariaco Basin, a coral record from the northern Red Sea, and a long-term sea level pressure (SLP) reconstruction reveals that the multidecadal mode of the atmospheric circulation characterizes climate variability also in the pre-industrial era. The analyses of SLP reconstruction and proxy data depict a persistent atmospheric mode at least over the last 300 years, where SLP shows a dipolar structure in response to monopolar North Atlantic SST, in a similar way as the models' responses do. The combined analysis of observational and proxy data with model experiments provides an understanding of multidecadal climate modes during the late Holocene. The related patterns are useful for the interpretation of proxy data in the North Atlantic realm.

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