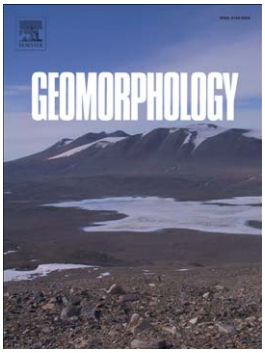

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Decadal changes in North Atlantic atmospheric circulation patterns recorded by sand spits since 1800 AD

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Abstract

Present-day coastal barriers represent around 15% of the world's oceanic shorelines, and play an important role as early warning indicators of environmental change. Among them, wave-dominated barriers are dynamic landforms that tend to migrate landward in response to storms and sea-level change. High rates of sediment supply can locally offset the global retrogradation trend, providing valuable records of past environmental change occurring on transgressive coasts. However, geochronological control limits the temporal resolution of such records to millennial or centennial timescales, and the decadal or even faster response of wave-built barriers to historical climate changes is therefore poorly understood. In this study, we show that shoreline dynamics of sand spits reconstructed from old cartographic documents has been synchronous on both margins of the North Atlantic Ocean since about 1800 AD. Spit growth accelerated drastically during three periods lasting about 15 years, characterised by positive North Atlantic Oscillation (NAO) and negative East Atlantic–West Russia (EA–WR) atmospheric circulation patterns. These changes are in phase with periods of increased volcanic activity. We use a high-resolution wave hindcast (1948–2014 AD) in a reference area to confirm the association between NAO and EA–WR as a proxy for offshore and nearshore wave height and for associated longshore sediment transport (LST) involved in spit growth. A 24-month lagged correlation between

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