

## Experimental Modelling of the Atlantic Multidecadal Variability

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Atlantic Multidecadal Variability (AMV) is a signal in the sea-surface temperature (SST) field of the Northern Atlantic, with a characteristic period of 20 to 70 years. Paleoclimatic evidence reaching back to 500 AD and instrumental observations since the 1850s (see Figure) suggest that a certain variability in this spectral range has been persistently present throughout the centuries and has considerably contributed to the climate variability of the Northern Hemisphere. A spatial pattern of the AMV can also be found, associated with the temporal behaviour. Averaging over the “warm” intervals, one can observe positive SST anomalies all over the North Atlantic basin, except for the coast of Newfoundland, where a localized negative anomaly is present. During the “cold” phases, the basin exhibits a similar pattern with the opposite sign: an overall cold anomaly, accompanied by a warm “patch” around Newfoundland.

According to the minimal numerical sector model introduced by te Raa and Dijkstra (2002), the three key components to excite such a low frequency variability in the North Atlantic are rotation, meridional temperature gradient and additive thermal noise in the surface heat forcing. If these components are present, periodic perturbations of the overturning background flow are excited, leading to thermal Rossby mode like propagation of anomalous patches in the SST field.

Our tabletop scale laboratory setup at the von Kármán Laboratory for Environmental Flows was built to capture this phenomenon, and to test whether the aforementioned three components are indeed sufficient to generate a low frequency variability in the system. The results are compared to those of the numerical models, as well as to oceanic SST reanalysis records. To our best knowledge, the experiment described here is the very first to investigate the dynamics of the North Atlantic multidecadal variability in a laboratory-scale setup.

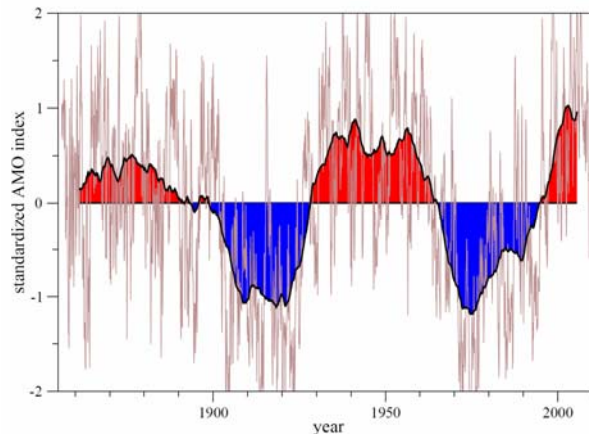


Figure: Standardized monthly mean SST anomalies averaged over the Northe Atlantic basin (thin line), and its ten-year running mean (thick line with red and blue colors).