

# Atlantic Multidecadal Variability from a stochastic dynamical systems point of view

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If the North Atlantic ocean is described using a simple primitive equation ocean model then variability arises through a normal mode which destabilises the background state through a Hopf bifurcation. This internal ocean mode has a multidecadal time scale, westward propagating temperature anomalies, and a spatial pattern at the surface which resembles observations of the Atlantic Multidecadal Oscillation. The variability, although damped when using realistic surface boundary conditions in the ocean model, can be excited by noise.

When comparing this normal mode to the AMO as it is found in climate models as well as in observations, two main time scales emerge. A 20-30 year time scale is found several long observational and proxy records around the North Atlantic such as the Central England Temperature record, tide gauges along the European and North American coasts, and ice cores from Greenland. This time scale is also found in westward propagating temperature anomalies in the North Atlantic, leading to the hypothesis that the normal mode from the minimal model is associated with this time scale. The longer 50-70 year time scale of variability which is also found in both observations and climate models may then be associated with variability in the Arctic, where a different internal mode with a multidecadal time scale has also been found in an idealised model.