



Decadal Variability in the North Atlantic Ocean as a Bifurcation of the Subpolar Gyre

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Numerous lines of evidence point to the Atlantic subpolar gyre as a major source of North Atlantic climate variability on a wide range of time scales. The nonlinear nature of the underlying dynamics is most strikingly illustrated by the lack of warming in this region in climate projections.

Using reanalyzed observational data, here we show that a substantial part of decadal variability in the subpolar gyre follows a hysteresis with two stable modes. This behavior is predicted by a box model based on first physical principles. In the highly complex region of the North Atlantic, this simplified model helps to highlight relevant processes of decadal climate variability and allows to constrain the response of the subpolar gyre to past and future changes in atmospheric temperatures. The robust and (in itself) comprehensive description of key dynamics might be used to detect biases in more complex modeling approaches and thereby guide research in the field of decadal predictions.