

CGD Seminar Series

Causal attribution of North Atlantic sector variability using ocean adjoint models

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NCAR

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Time: 11am – 12pm

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*For live stream information, visit the
CGD Seminar Webpage*

ABSTRACT

The unique role of the large-scale ocean circulation in the North Atlantic may offer predictability of climatically important quantities years to decades ahead. Modern observations and models reveal a complex picture of variability in these quantities, however. A particularly useful tool for tracing variability to its origins is the adjoint model, which takes as input a definition of an ocean dynamical quantity (e.g., volume transport, heat content, etc.) and returns as output the sensitivity of that quantity to earlier changes, based on model physics. Here, we present a range of recent work demonstrating the use of these models to address fundamental questions about the ocean's role in North Atlantic climate variability. Firstly, we ask whether heat content variability is a purely passive response to atmospheric forcing, or whether dynamical changes in ocean heat transport have a significant role. We show that surface temperature variations are primarily passive, but that full-depth heat content fluctuations in the North Atlantic reflect large-scale ocean dynamics, in particular the Atlantic Meridional Overturning Circulation (AMOC). We then estimate the proportion of large-scale ocean variability which is forced by chaotic fluctuations at the oceanic mesoscale, using a stochastic representation of eddy buoyancy fluxes. This suggests that year-to-year subtropical AMOC variability is primarily attributable to ocean eddies, but that subpolar variability is predominantly surface forced at all considered timescales. We conclude with an overview of recent work aiming to attribute this subpolar variability to dominant patterns of surface forcing.

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