



Surprising return of deep convection to the subpolar North Atlantic Ocean in winter 2007-2008

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Deep open-ocean convection in the subpolar North Atlantic Ocean, which impacts the meridional overturning circulation and oceanic heat flux, has been largely absent since the mid-1990s. In the winter of 2007-2008 convection returned suddenly in both the Labrador and Irminger Seas. Here we document this return, and address the reasons why it happened. Profiling float data from the Argo program are used to characterize the deep mixing. Analysis of a variety of in situ, satellite, and reanalysis data shows that, contrary to expectations, the transition to a convective state took place abruptly, without going through a phase of preconditioning. Changes in hemispheric air temperature, storm tracks, the flux of fresh water to the Labrador Sea, and the distribution of pack ice all contributed to an enhanced flux of heat from the sea to the air, making the surface water sufficiently cold and dense to initiate deep convection. Given this complexity, we conclude that it will be difficult to predict when deep mixing may occur again.