

# The Variability of Deep Ocean Convection and Subpolar Gyre in the North Atlantic

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The variability of deep ocean convection in the North Atlantic Subpolar Gyre (SPG) relates to atmospheric and oceanic changes at a wide range of temporal scales. Atmospheric forcing serves to trigger deep convective process and set its variability at especially interannual timescales. As comparison, recent warming trend in the SPG has minor influence on the deep convection variability. An enhanced deep convection event occurred in the winter of 2008 after years of weak occurrence, and disrupted the ongoing warming trend in this region. However, the impact of the 2008 deep convection on the water properties was quickly removed in the SPG. The sea surface height anomaly (SSHA) in the SPG also reflects a limited impact of deep convection activities in the 2000s. The reduction in overall sea level rise rate, accompanied by an energy regain, is associated with changes in low-frequency SSHA oscillations, which might be related to both deep convective process and the propagation of the Atlantic Meridional Overturning Circulation variations. The asymmetrical sea level changes in the western and the eastern SPG may be associated with different underlying mechanisms at the interannual timescales. Moreover, the estimation of the heat flux based on the air-sea temperature difference is in good agreement with the atmospheric reanalysis data, especially for the harsh winter of 2008. This indicates the dominant role of sensible heat flux in initiating deep convection and the importance of using surface observations as potential predictors of the onset of deep ocean convection at high latitudes.