Seasonal cycle of the overturning circulation in the subpolar North Atlantic

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Introduction

Understanding the mechanisms driving variability in the Atlantic Meridional Overturning Circulation (AMOC) on different timescales is essential for better predictions of our evolving climate. The newly updated time series (August 2014 to June 2020) from OSNAP (Overturning in the Subpolar North Atlantic Program) continues to reveal strong intra-annual and interannual variability. In addition, this six-year record allows us, for the first time, to examine the observation-based seasonal variability of the subpolar overturning circulation.

Shading: Climatological surface density derived from EN4
Arrows: Climatological wind from NCEP/CFSR
Cyan dots: positions of OSNAP moorings

MOC

- The MOC peaks in spring and reaches the minimum in winter
- The seasonal change from peak to trough across the full array is about 9.5 Sv
- Winter dense water formation and subsequent export explains the peak in spring
- Ekman transport has a large impact on the MOC at OSNAP East in winter

OSNAP West dominates the total MOC across the entire subpolar North Atlantic
OSNAP West shows stronger overturning in the recent 2 years

MHT

OSNAP East dominates the mean and seasonal variability of total MHT
MHT reaches maxima in spring and fall and minimum in summer
Ekman transport strongly impacts MHT seasonal variability at OSNAP East in winter

MHT seasonal cycle

MFT

The total MFT seasonality is more strongly expressed by OSNAP West
MFT strongest in winter and weakest in spring through summer
Ekman transport has little impact on MFT seasonal variability

Key messages

1. MOC seasonal variability in the Subpolar North Atlantic determined from observation for the first time
2. Dense water formation/export and Ekman transport contributes significantly to the MOC and MHT seasonal variability
3. MFT seasonal variability accounts for more than 55% of the total MFT variability

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