Interior Wave Pathways for Propagation of the Atlantic Meridional Overturning Circulation (AMOC) Variability

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There are two mechanisms that high-latitude forcing of the AMOC can affect the whole Atlantic basin: slow advection and fast waves. The western boundary has been considered as the predominant pathway - along which advection and wave influence the lower latitudes in the Atlantic Ocean. The concept that the deep western boundary current (DWBC) is the predominant advection pathway, however, has been challenged. There is compelling evidence to support the existence of interior advection pathways. This study examinea whether interior pathways also exist for topographic Rossby waves and whether they play any significant role in communicating forcing between the subpolar and subtropic basins. We analyzed outputs of ECCO 4 State and observations from GRACE, RAPID-MOCHA, Line W, etc., and use a two-layer model to diagnose mechanisms. There is an obvious discrepancy between the DWBC transport and the AMOC transport on seasonal and interannual time scales. For instance, the overall AMOC transport was weakened in 2009-2010 at 40N. But the transport of the DWBC was actually higher according to Line W data. Both observations (GRACE) and model simulations (ECCO 4 and two-layer model) showed that there was an anomalous northward flow of the NADW along the mid-ocean ridge. This resulted in a net reduction of the southward transport and a weaker AMOC. The interior meridional transport away from the western boundary is related to topographic Rossby wave propagations. Their contributions to seasonal-to-decadal variability of AMOC transport will be discussed.