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Compensation between meridional flow components of the AMOC at 26°N

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Abstract. From ten years of observations of the Atlantic meridional overturning circulation at 26°N (MOC, 2004-2014), we revisit the question of flow compensation between components of the circulation. Contrasting with early results from the observations, transport variations of the Florida Current (FC) and upper mid-ocean transports (UMO, top 1000 m east of the Bahamas) are now found to compensate on sub-annual timescales. A deep baroclinic response to wind-forcing (Ekman transport) is also found in the lower North Atlantic Deep Water (LNADW, 3000-5000 m). The observed compensation between the FC and UMO transports is associated with horizontal circulation and means that their individual variability does not project onto the MOC. In contrast, covariability between Ekman and the LNADW transports does contribute to overturning. On longer timescales, the southward UMO transport has continued to strengthen, resulting in a continued decline of the MOC. Most of this interannual variability of the MOC can be traced to changes in isopycnal displacements on the western boundary, within the top 1000 m and below 2000 m. Substantial trends are observed in isopycnal displacements in the deep ocean, underscoring the importance of deep boundary measurements to capture the variability of the Atlantic MOC.

1 Introduction

The Atlantic meridional overturning circulation (MOC) is a key part of the global ocean circulation, redistributing heat and properties around the globe. The continuous daily time-series observations at 26°N are the first of their kind, capturing the transbasin circulation variability on timescales of days to—now—a decade.