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Observed and simulated variability of the Atlantic meridional overturning circulation and the deep western boundary current

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Despite the importance of Atlantic meridional overturnig circulation (AMOC) for the climate of Africa, America and Europe, continuous AMOC observations are at present restricted to two latitudes, and are available for less than ten years. We therefore investigate whether the AMOC's variability can be inferred from measurements of the deep western boundary current (DWBC), which are already available at several locations.

To that end, we jointly analyze the available $26°\mathrm{N}$ RAPID and the $41°\mathrm{N}$ Argo-based AMOC estimates with RAPID and line W ($40°\mathrm{N}$) DWBC estimates. We also compare them to a 60-year simulation with a high-resolution NCEP-forced ocean model. The DWBC and its layers are defined dynamically in the model based on a comparison of temperature-versus-salinity data in model and observations and the time-dependent velocity field. On the timescales where observations are available, the model is able to reproduce the variability of the DWBC and its individual layers at both locations.

Our preliminary analysis of the observational data and model results suggests that different mechanisms dominate the DWBC's variability at different timescales. On sub-seasonal to seasonal timescales, the DWBC is mostly barotropic, and its variability is linked to local processes. Thus, the DWBC has a well-defined seasonal cycle which is opposite to the seasonal cycle of the non-Ekman component of the AMOC seasonal cycle. On interannual timescales, there is no obvious relation between AMOC and DWBC. However, on decadal timescales, our analysis indicates covariability between AMOC and DWBC. We conclude that although caution should be exercised on interannual timescales, the DWBC might be used as a proxy for long-term AMOC trends and possibly modulations of the AMOC's seasonal cycle.