EGU2020-6123
https://doi.org/10.5194/egusphere-egu2020-6123
EGU General Assembly 2020

Temporal Variability of the Meridional Overturning Cells in the South Atlantic

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Variations in the Meridional Overturning Circulation (MOC) are known to have important impacts on global scale climate phenomena including precipitation patterns, surface air temperatures, coastal sea level, and extreme weather. The MOC flow structure in the South Atlantic is thought to control the stability of the entire global MOC system. Given this importance, significant resources have been invested on observing the MOC in the South Atlantic over the past decade. Multiple years of full-depth daily observations from moored instruments at 34.5°S are used to calculate the meridional transports near the western and eastern boundaries, as well as the basin-wide interior transports, via geostrophic methods. These transport estimates are combined with Ekman transports derived from satellite wind products to yield daily estimates of the total meridional transports. Analysis of the MOC volume transport using all available moored instruments from 2013 to 2017 allows us to quantify for the first time the daily volume transport of both the upper and abyssal overturning cells at 34.5°S. The structure of these flows is characterized in unprecedented detail; no statistically significant trend is detectable in either cell. Abyssal-cell transport variability is largely independent of the transport variability in the upper-cell. Analysis of this new data set is crucial for improving our understanding of the temporal and spatial scales of variability that governs MOC related flows, and for disentangling their respective roles in modulating its overall variability.