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Estimating the Meridional Ekman Transport at 14.5 N in the Atlantic Ocean

Yao Fu, Johannes Karstensen, and Peter Brandt
GEOMAR Helmholz Centre for Ocean Research Kiel, Germany (yfu@geomar.de)

The meridional Ekman transport across a transatlantic section at 14.5 N is estimated from different wind products and in-situ observational data. As a well-established method, the wind-based approach gives a meridional Ekman transport of 5.8 $\pm$ 0.4 Sv (ship-board wind observation), and 6.2 $\pm$ 0.4 Sv (ASCAT/OSCAT satellite wind data). From the in-situ observational data, an ageostrophic velocity is derived by subtracting the geostrophic velocity (CTD) from the total velocity (ADCP). Interpreting the ageostrophic velocity to be an imprint of the Ekman spiral, its vertical and zonal integration results in a direct estimate of the meridional Ekman transport. Applying a constant integral depth of 85 m, and excluding the western boundary current region, the ageostrophic transport is 6.0 $\pm$ 1.9 Sv, consistent with the wind-derived transport. When integrating to the mixed layer base (roughly 40 m), the transport is only 4.0 $\pm$ 1.9 Sv. Despite the overall consistency between the wind-based calculation and direct measurement, more mesoscale variability can be detected in the ageostrophic transport than in the wind-derived transport. The section-averaged ageostrophic velocity profile also shows distinct vertical structure that is different from a typical Ekman spiral. Therefore, further attempt will focus on analysing the mesoscale processes, such as inertial oscillation and eddies, which may potentially contribute to the ageostrophic velocity. The associated meridional heat and freshwater transport will be quantified in combination with CTD, high-resolution underway CTD, and satellite-only data, respectively.