Abstract View

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On the Estimation of Absolute Geostrophic Volume Transport Applied to the Antarctic Circumpolar Current

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ABSTRACT

An objective method of estimating the geostrophic barotropic volume transport across an oceanographic section is developed and applied to the transport of the Antarctic Circumpolar Current through the Drake Passage. The total geostrophic transport through a passage can be broken up into a baroclinic component, calculable from hydrographic data, and a barotropic component which is calculated objectively using direct current meter measurements at some fixed level. The influence of measurement noise is incorporated into the calculation of the rms error in the objective estimate of barotropic transport which depends on the number of current meters at the fixed level, the "correlation length" of the through passage velocity component, the noise variance and noise scale. For measurement noise variance not exceeding 10% it is shown that an accurate estimate (rms error $\leq$ 20%) of the barotropic transport can be made when the spacing of the current meters is less than or equal to the correlation length.

Using six long-term (35 weeks) current meter measurements at 2700 m in the Drake Passage, it is found that the baroclinic geostrophic transport of 100 Sv relative to 2700 m (Nowlin *et al.,* 1977) should be corrected by an average of 27 Sv which is the contribution from the geostrophic barotropic transport. The total range of the 35 weekly estimates is 220 Sv and the rms error of the estimates due to insufficient spatial coverage is ±14 Sv. Two weekly estimates of the barotropic transport were made from 12 current meters all al approximately 2700 m across the passage, and varied considerably from the corresponding estimates made with only six current meters. The rms error for 12 current meters is only ±4.5 Sv assuming the rms through passage speed to be 3 cm s^{-1}.

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