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The Bolus Component of the Deacon Cell

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The bolus effect in the Southern Ocean is investigated by using overturning stream functions. The bolus component is defined as the eddy induced part of the stream function due to the time correlation between the velocity and the density fields. The amplitude of the zonally averaged meridional overturning circulation in depth level around the Antarctic Circumpolar Current (ACC), known as the Deacon cell, is estimated at 20 Sv. The purpose of this study is to hunt the features of the eddy-induced circulations in the Deacon Cell, and evaluate the spatial and temporal characteristic scales of these "eddies". Based on an eddy permitting and a coarse resolution ocean numerical model, the bolus effect of the Deacon Cell is calculated from different temporal and spatial averaging of the meridional overturning stream function as a function of potential density σ_2. Only 4 - 10 Sv out of the 20 Sv of the Deacon Cell is true diapycnal. The rest can be explained by the fact that the temporal variability of the density field and the velocity field is not in "phase". This so called bolus effect arises when the overturning stream function as a function of density is calculated from the zonal integration of the time averaged velocity field along the time averaged density layers. Most of the Deacon Cell vanishes when the time average is instead made over the all ready calculated stream function for the individual "snap shots". The time scale of the Bolus effect of the Deacon Cell is estimated by making time average over time periods from 5 days to 12 years. The spatial scale of the Bolus effect of the Deacon Cell is estimated by making spatial averages over the entire domain.