

Interactive comment on “The subtropical Deacon cells” by J. A. Polton and D. P. Marshall

J. A. Polton and D. P. Marshall

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This comment was chiefly about the use of the term “Deacon cell” in the manuscript. The intention was to appeal to Speer’s (2000) work entitled “The Diabatic Deacon cell” and demonstrate similarities between time-mean and quasi-along-stream averaged quantities in the Southern Ocean and subtropical gyre. These averages reveal an overturning circulation that has a component which is fictitious, “the Deacon cell”, and a component that is real and diabatic. My reading of Speer’s paper was that the phrase “diabatic Deacon cell” was coined to emphasize the role of a diabatic component to the overturning in the Southern Ocean. We intended to use this label to emphasize the similarities with subtropical gyre overturning cells. However we agree that there is merit in preserving the term “Deacon cell” to refer specifically to the adiabatic component of the Southern Ocean’s overturning cell in order to prevent further confusion in the literature. So we adopt an alternative title: “Overturning cells in the Southern Ocean and subtropical gyres” and amend the text accordingly.

In light of the specific comments further modifications were also needed to present a clearer introduction.

Paragraph 1: We briefly describe the nature of the adiabatic Deacon cell at the outset. The role of standing eddies, which was previously absent from the discussion, appears in paragraphs 2 and 3.

Paragraph 2: We removed erroneous reference to Deacon cell in paragraph 2 where it was formerly used as a label for the meridional overturning that was not zonally averaged. I have removed the reference to Danabasglu et al (1994) since their different spatial averaging makes the text confusing.

Paragraph 3 is extended, and split in two, to more rigorously link the subtropical gyre's adiabatic overturning with the ACC's Deacon cell. In particular, the special role of the ACC's Deacon cell in transmitting momentum from the surface to the bathymetry is contrasted with wind stress being supported by meridional boundaries in subtropical gyre latitudes. Paragraph 5 is also adjusted to point out whilst the ACC flow can be isopycnal (below the mixed layer) the subtropical gyre overturning must have a diapycnal component. Despite these important differences the same framework can be taken to diagnose the balance of terms in the PV flux budget.

Paragraph 5 (formerly 4) includes the effect of the thermohaline circulation without confusing it with the Deacon cell, with additional references to Rintoul (2001) and Schmitz (1996).

Paragraph 6: Includes the distinction that the subtropical gyre overturning must have a diapycnal component. This is not so for the ACC.

Paragraph 7: typo corrected (include)

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