

Interactive comment on “The Ekman spiral for piecewise-uniform diffusivity” by David G. Dritschel et al.

Anonymous Referee #2

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This paper examines the Ekman theory of wind driven ocean currents, in particular considering the angle of deflection of the surface currents which Ekman predicted would be 45 degrees to the right (in Northern hemisphere) of the wind direction when assuming the vertical eddy viscosity is constant. In this paper the authors show that one obtains a range of deflection angles by considering a piecewise constant vertical viscosity with two layers, leading to analytical solutions showing that the deflection angle depends only on two parameters, the ratio of viscous lengths in the two layers, and the depth of the upper layer. This work is well written and using simple analysis provides great insight into the central problem. I believe it is worthy of publication as is, though I would ask the authors to consider the minor comments below which may clarify the manuscript.

C1

line 90: Change "on" to "by"

line 93: Though perhaps obvious it might be useful for clarity if you note that superscript ' indicates derivative with respect to z .

line 168: The authors state that "in fact the results also apply when the two regions have different densities". Is this true? Would this not affect the scaling factor used to non-dimensionalise the equations, adding the density ratio as another parameter?

Final paragraph: Can the results in figure 1 be verified by observational study. While the studies outlined in the final paragraph give some qualitative sense to the results, is it possible measurements already obtained relating to the two parameters, i.e. a mixed layer depth and vertical eddy viscosity, could be collected and plotted as in figure 1 in order to quantitatively verify the results. The authors may want to comment on this or about the utility of potential new observations to clarify the deflection angles dependence on these parameters.

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