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Corrigendum to Diffusivity and viscosity dependence in the linear thermocline (J. Mar. Res., *62,* 743–769)

by J. H. LaCasce[1]

The statement in LaCasce (2004) that the amplitude, A, of the western boundary layer solution (Eq. 25 in the article) is determined by matching at the northern wall to the streamfunction from the northern boundary inner layer solution, ϕ_{in}, is incorrect. The correct procedure is to match to the full boundary layer solution at the northern wall, with contributions from both the inner and outer layers. Doing this ensures that the full transport in the northern layer is fed into the western layer.

Correcting the boundary condition, we obtain the solution in Figure 1 (to be compared with Fig. 1 in the article). Now there is southward flow in the northern half of the western boundary layer, where before that flow was purely northward. Indeed, the incorrect boundary condition required an inflow from the west to satisfy a net eastward flow in the northern inner boundary layer. But the transport in the northern outer layer is westward and stronger, so including it causes the flow reversal in the northwest. In addition, the vertical flow in the western layer is also altered. While previously there was upwelling along the entire western wall, now there is downwelling in the northern half of the boundary layer (with upwelling offshore, as discussed previously).

Similar alterations occur with the solution in the boundary-intensified mixing case with Ekman damping (shown in Fig. 6 in the article). However, the error only affected the western boundary layer flow; the solution elsewhere was correct. Moreover, the conclusions of the article, that upwelling occurs primarily in the boundary layers and is thus affected by the choice of viscosity, are unchanged.

There is a second aspect which is also worth pointing out. In the article I stated that the boundary layers at the southern boundary are like those found in the north (the same point is made by Pedlosky, 1969). However, this need not be the case if the Coriolis parameter there is small, because this will alter the balance of terms (discussed in Section 3c). In particular, a small f favors a balance between the first and fourth terms in Eq. (11), yielding a single southern layer rather than the nested double layer structure seen in the north. This

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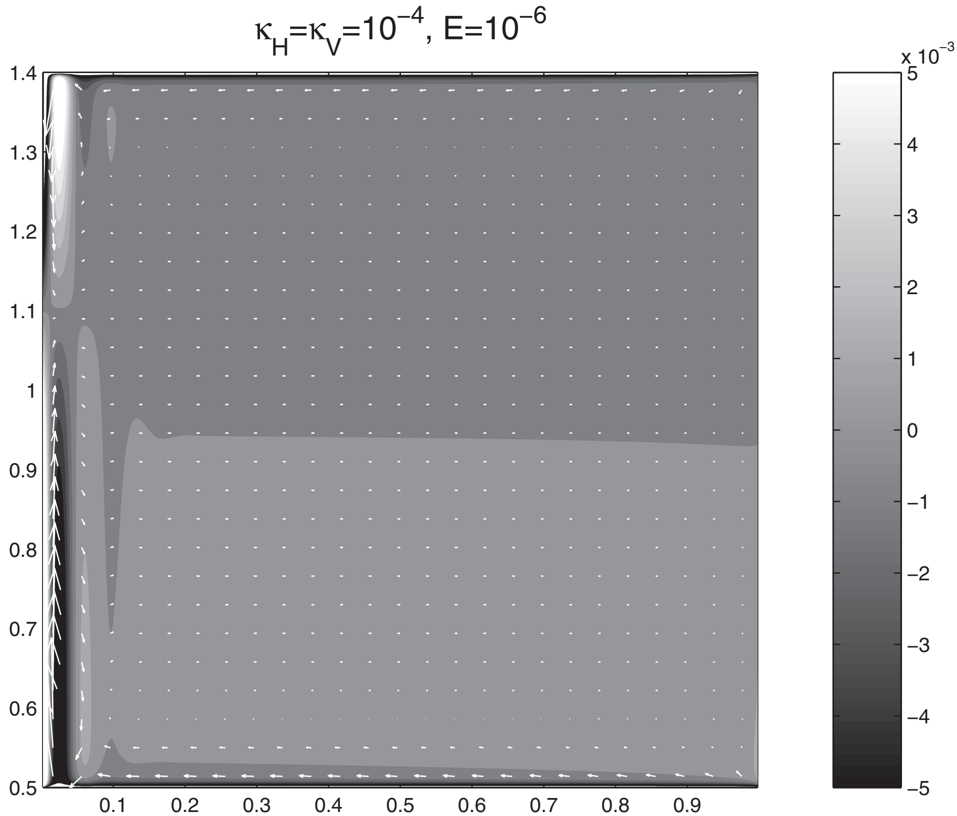

Figure 1. The vertically-averaged vertical velocities for the diffusive viscosity case, with the corrected matching condition at $y = 1$. The diffusivities and the horizontal Ekman number are as shown. Superimposed are the surface velocities, with an arbitrary scale.

boundary layer involves solving a fourth-order diffusion equation. If, however, the basin is confined to mid-latitudes, this is not an issue. It is for this reason that the basin is shifted northward in the present Figure 1 and a smaller Ekman coefficient is used.

Interestingly, both the corrected solution with Ekman damping and that with Rayleigh damping (see Fig. 3 in the article) exhibit two surface gyres, with westward flow along both the southern and northern boundaries, and convergent flow along the western boundary. The solutions are thus qualitatively similar. But both differ from comparable numerical simulations of thermally-forced flow, where the sinking occurs in the east or north and the surface flow manifests as a single gyre (e.g. Martozke, 1997; Huck *et al.,* 1999). We are currently exploring the reasons for this difference. However, we note a recent study which suggests that sinking at the eastern wall is suppressed with progressively higher numerical resolution (Park, 2006). In such cases, the surface flow veers to the north, yielding two gyres, as in these linear solutions.

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