Review of the Ocean Science submission "Isoneutral control of effective diapycnal mixing in numerical ocean models with neutral rotated diffusion tensors" by Antoine Hochet, Remi Tailleux, David Ferreira and Till Kuhlbrodt.

This paper quantifies the extent of non-neutrality for a few candidate density variables. This paper has some interesting things to say and it should be published in Ocean Science.

Throughout the paper it would be more convincing if Conservative Temperature, Θ, and Absolute Salinity, S_A, were used in place of potential temperature and Practical Salinity, since these are the variables that have been adopted by IOC under TEOS-10 and because (1) Conservative Temperature Θ is many times more conservative than is potential temperature, and (2) Absolute Salinity S_A takes into account the varying seawater composition, and in particular, the effect of this varying composition on the specific volume of seawater.

Just below Equation (7), and throughout the following equations (particularly Equation (11)), the small-scale turbulent mixing coefficient is not represented correctly. Small-scale mixing is isotropic. It does not diffuse stuff only in the diapycnal direction, but rather it diffuses stuff isotropically. McDougall et al (2014) (JPO) discuss this. The equations in this paper should be changed accordingly, in keeping with how mixing actually works in the real ocean.

Figure 2. I think that the x-axis of this figure is correctly labelled, but the caption and its description in the text (line 4 of page 9) is not correct. That is, is this axis the log of the square of the sine, or is it half this? Also, please check this issue for what is plotted in Figure 4; is it the square or not.

Page 8, Line 11. Here it says "has a gradient much smaller than all …". I think that this should read "has a gradient much larger than all …".

Page 13, line 3. "depths deeper than -2000 meters." This negative depth would be 2000 m above the sea surface, in the atmosphere. So I think what is meant is "depths deeper than 2000 meters."