Ocean Science Discussions

Ocean Sci. Discuss., referee comment RC5
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Comment on os-2022-12

Anonymous Referee #3

Referee comment on "Gravity disturbance driven ocean circulation" by Peter C. Chu, Ocean Sci. Discuss., https://doi.org/10.5194/os-2022-12-RC5, 2022

I have read the first several pages of this manuscript and I think it is incorrect and cannot be published. The author uses an oblate ellipsoidal coordinate system and takes into account the variations of the gravitational potential along a surface of constant height in this coodinate system. This then allows the calculation of the GDF which depends also on the gradients of in situ density along this same coodinate ellipsoidal surface.

I ask the author to consider the following situation where the planet is an aqua planet, and the ocean is not in motion. This requires that in situ density is constant at each point on the real geoid surface (not the ellipsoidal approximation to it). The author's GFD is however non-zero and large in this situation; that is, his equation (22). But this turns out only to be that he has not chosen his vertical distance to be measured from the real geoptential. Rather he has chosen the zero of his height to be in an ellipsoidal surface. So his equations show substantial motion, but we know that there should be no motion.

This siimple thought experiment shows that the manuscript is flawed.

The development of the equations with respect to the geoid is done in textbooks, for example in the early pages of the text "Fundamentals of Ocean Climate Models" by S. M. Griffies, published in 2004. These ocean models do not put the ocean in motion if the in situ density is constant on geoptential surfaces.