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Interactive comment on "Dynamics of turbulence under the effect of stratification and internal waves" *by* O. A. Druzhinin and L. A. Ostrovsky

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The manuscript "Dynamics of turbulence under the effect of stratification and internal waves" by O. Druzhinin and L. Ostrovsky presents research on the topic of the turbulence decay in a strongly stratified layer with no shear. Two regimes are considered, namely, the free decay regime and the regime with a prescribed monochromatic internal wave propagating along the pycnocline. Authors conducted high quality direct numerical simulations (DNS) to investigate the dynamics and evolution of the imposed turbulent fluctuations within the strongly stably stratified pycnocline.

General comments

The manuscript is clearly written, reasonably well structures and, in general, concise.

The modeling technique is described with all necessary details. The DNS setup and runs are well thought and, to large degree, lead to the derived conclusions. There are however two major and a number of technical difficulties with the manuscript, which need to be addressed in its final version.

One difficulty appears in the discussion of the internal wave generation by the turbulence on the pages 339-340. Figure 3b does not show any internal waves generated by the turbulence. Moreover, the narrative discussion proposed at this place is not convincing. As the authors know, the IW spectrum is limited by the Brunt-Vaisala frequency. This frequency could be translated in certain wavelength at the cut-off scale, which could be larger than the interval of length scales of the turbulence in the DNS run. Thus, the problem of the IW generation requires careful analysis of the spectra of the components of motions. Moreover, it is not obvious why the turbulence should generate a monochromatic wave as Fig 3b seems to suggest.

Another difficulty appears in the wave-turbulence interaction discussion in the pages 342-343. The DNS runs revealed that the turbulence has only weak impact on the IW. It has been explained as the turbulence amplitude is too small to damp the IW. However, it is also clear that the IW and the turbulence have very different scales where the IW are much larger than the typical turbulent motions. Since the most effective interactions are between the motions of the same scale, the weakness of the interactions in the run could be just due to this scale separation. It would be reasonable to have another run with the IW of much shorter wavelength to check the interactions.

Minor comments

The Re definition here (Eq. 4 and below in the text) is rather meaningless as it does not refer to the turbulence features of the fluid and the ability of the DNS to reproduce them. It is wrong to claim that if you double L0, your Re will also double. Traditional estimation, based on Taylor microscale, required L0 to be the integral scale of the turbulence and U0 the scale of TKE fluctuations, roughy it could be approximated as Re $\sim$ Nˆ(4/3),

which place your DNS in the class of Re $\sim$ 300 or even lower as turbulence decay with time, which is normal for such exercises.

Eq. (17) is problematic. Is "j=3"? Otherwise it will will be incompatible with Eq. (16)

Page 343. The interesting discussion point that the turbulence survive longer in the vicinity of the pycnocline centre. Could it be because at this level the stability is the strongest and the turbulence has the largest horizontal scales so that the interactions between the shortest waves and the largest turbulence is more efficient? It would be interesting to have an analysis.

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