Review of acp-2016-897
"Case study of wave breaking with high-resolution turbulence measurements with LITOS and WRF simulations" by A. Schneider et al.

Submitted to Atmospheric Chemistry and Physics

This paper describes the results of high-resolution atmospheric turbulence measurements using LITOS, which are complemented by WRF simulations of gravity waves breaking in similar atmospheric conditions. I found the analysis of the experimental part of the study carefully done and potentially useful to modelers trying to fit simulation parameters (e.g. eddy dissipation rate) to real observational data for benchmarking or validation purposes. On the other hand, I do not believe that WRF (especially in the chosen simulations set-up) is an adequate tool to carry out equivalent "high-resolution" turbulence simulations for the reasons explained below. In order to publish the paper, the authors should justify their modeling choice clearly stating the limitations of the model, and better explain the numerical set-up of the simulations. This will help the reader to better judge the analysis of the simulations and to put this part of the study into the right perspective.

Major Comments

- The main point made by the authors is that an increase in GW breaking is associated to the increase in turbulence dissipation. If the authors mean that high GW *leads* to stronger turbulence, I agree. But the I would be cautious to generalize this statement implying (as the authors say at the end of Conclusions), that turbulence in the atmosphere is generated by continuous GW activity because the latter is only *one* of the causes triggering turbulence in the atmosphere (other drivers are large-scale convention, shear instabilities, etc. which do not necessarily involve GW).

- I do not believe that WRF can provide reliable information on turbulence characteristics in the chosen simulation set-up, at least the authors didn't show substantial evidence it can. The main is reasons is of course the coarse resolution: 2km is not even close to resolve eddies in a substantial (and potentially relevant to observational data) portion of the inertial range, should turbulence develop following GW breaking. Indeed, the discussion on the simulation results rely entirely on the supposed correctness of the modeled TKE transport rather than the resolution of turbulent scales! In addition, there are no details on the TKE parameterization used in the runs so it is not clear whether such parametrizing is correctly tailored to the cases analyzed. There's a huge literature on DNS/LES modeling of turbulent stratified flows -which apply to atmospheric turbulence as wll- discussing these issues. You can refer to the review study by Brethauwer et al, JFM 2007 and to more recent works such as Kani and Waite, JFM 2014, and Paoli et al, ACP 2014 in addition to the work by Fritts and coworkers on GW breaking that you cited.

- I agree with your consideration on Richardson number and the difficulty to match the theoretical Ri=0.25 threshold for shear instability in real atmospheric situations. To support your discussion, you may also refer to the work by Paoli et al, ACP 2014 where they used high-resolution LES (with grid sizes of order of meters) to study atmospheric turbulence at the tropopause level. They observed similar trend of Ri as a function of altitude (ex their Figs. 9-10), and discussed the impact of turbulence intensity and the sensitivity to resolution, which can also apply to the measured profiles shown in your Fig 1c, 3c etc.

- It would very much benefit to the paper showing turbulence spectra or structure functions, particularly in the inertial range, and especially for the cases of developed turbulence where an inertial range should be neatly detected.

Minor comments

- What is the reason for adding a legend of K/d in addition to W/kg in the dissipation profiles of Figures 1d, 3d, etc? In fact, I also found a little weird to label the units of dissipation rate as W/kg instead of m^2/s^3 or cm^2/s^3 which is more customary in turbulence literature.

Literature added:

- Brethouwer et al, 2007: "Scaling analysis and simulation of strongly stratified turbulent flows", Journal of Fluid Mechanics. vol. 585, pp. 343-368.
- Khani and Waite, 2014: "Buoyancy scale effects in large-eddy simulations of stratified turbulence", Journal of Fluid Mechanics. vol. 754, pp. 75-97.
- Paoli et al, 2014: "High-resolution large-eddy simulations of stably stratified flows: application to subkilometer-scale turbulence in the upper troposphere–lower stratosphere", Atmospheric Chemistry and Physics, vol. 14, pp. 5037-5055.