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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantification of waves in lidar observations of noctilucent clouds at scales from seconds to minutes" *by* N. Kaifler et al.

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General Comments

In my opinion, this manuscript contains an impressive amount of good, new results. The results are presented with text and figures of excellent quality. New analysis methods have been developed in this paper. They are described with sufficient detail that I can recommend using them with data from other, similar lidar instruments and from PMSE observations with VHF radars. The section "Discussion" covers many different important aspects.

Specific Comments

I am most interested in the following conclusions:

- fluctuations on scales of 1 minute and convincing spectral signatures down to periods of about 10 s - the spectral slopes found - the maximum and average amplitudes of variations found - the typical vertical elocities found

I am intrigued by the different spectral slopes found in the different parameters. This is worth studying theoretically and observing in more detail in the future. For simple velocity fluctuations in a Lagrangean observation, we would expect slopes of -5/3. Any real observation will no doubt deviate from this value because an actual realization of turbulence in nature is usually not well-developed and not strictly homogeneous and isotropic. However, the differences found in the observations published here seem to differ from each other in a systematic way. Presumably this is because the parameters measured are much more complex than simple velocity fluctuations. Another important difference is that this lidar observation is a Eulerian observation.

Variations with shorter periods than the Brunt-Wäisälä period (BW-period) have been observed in this part of the atmosphere before, but convincing signatures with periods between 1 minute and 10 s have to my knowledge not been published before. I commend the authors for not jumping to the conclusion that these short-period variations were acoustic waves as opposed to gravity waves. Depending on the propagation direction and the background wind, apparent periods shorter than the BW-period in the lidar's frame of reference are entirely possible. However, some of the high-frequency variations may well be acoustic waves. This is certainly worth studying more with the instrumental and analysis tools presented in this paper. I recommend looking for the signatures in several parameters (e.g., temperature, wind, vertical displacement, density) in the same volume if possible, and checking the results agains the polarization relations and the dispersion relation.

The upper two panels in Fig. 2 demonstrate well how much more detail becomes visible

at 30 s resolution compared with 10 minute resolution.

Technical recommendations

I propose that the authors consider using the SI unit m/s instead of km/h in their Figures 5 and 6.

Figure 9 shows a most interesting result and one of the central results in this paper. Unfortunately, the top panel comes out almost completely black when I print out the paper with my pdf-viewer (other programs may do a better job), and this panel looks only a little better on screen. Perhaps the authors can find a way of suppressing the dark blue background of no data, thus making their interesting result much better visible.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 7397, 2013.