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Atmospheric Measurement Techniques Discussions

Interactive comment on "Impact of pitch angle fluctuations on airborne lidar sensing ahead along the flight direction" *by* Alexander Sergeevich Gurvich and Victor Alexeevich Kulikov

V. Banakh (Referee)

banakh@iao.ru

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The paper is devoted to analysis of the variations of airborne lidar echo signal power when probing the atmosphere ahead along the flight direction to detect the areas of high intensity of the turbulence (clear air turbulence (CAT)). Starting from the detailed review of possible sources of the errors, the authors conclude that uncompensated pitch angle variations in the presence of aerosol thin clusters can lead to noticeable echo signal power changes which can be mistakenly interpreted as the impact of turbulence or fast variations of aerosol concentration. Based on the performed analysis the authors formulate the criteria for distinguishing the pitch effect from the temporal

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evolution of atmospheric aerosol concentration. The obtained theoretical and computer simulation results are applied to interpretation of the airborne lidar experimental observations. There are few notations to the manuscript material. 1. As the authors formulate, the reason for the considered in the paper task is revealing the possible errors in airborne lidar detection of CAT. At the same time there is no information in the manuscript which method is used for recognition of the CAT areas. There is no analysis of expected variations of lidar echo signal power caused by CAT in comparison with the variations of that because of the pitch effect. It is not clear what is comparative contribution of the CAT and pitch effect to the total echo signal power variations. 2. Strong inhomogeneity of aerosol concentration is serious problem in interpretation of results of lidar remote sensing the turbulent atmosphere. To exclude the uncertainty in lidar determination of intensity of turbulence caused by variations of aerosol concentration along probing path, two equivalent receiver channels are used [1-5], for example. Some comment on possibility of application of similar approach to avoid impact of pitch effect in airborne lidar detection of CAT may be useful in the paper. 3. It is known (see works by A.S. Gurvich) that at the heights of about 10 km and above the refractive turbulence is strongly anisotropic one and turbulent inhomogeneities have vertical dimensions much less than horizontal ones similar to thin aerosol clusters considered in the paper. These inhomigeneities can cause the refraction of probing beam. Estimation of impact of atmospheric optical refraction on probing beam propagation direction as compared to the pitch angle variations may be useful. 4. There is very detailed introduction in the manuscript which contains a lot of information in the paper subject. But part of them is not necessary. For example, it is obviously that nonlinear effects (filamentation) can not be expected for probing nano pulses with pulse energy about hundred of mJs used in typical lidars. Conclusion: the manuscript contains very useful results which can find the application in interpretation of the experiments in airborne lidar probing the atmosphere. The manuscript can be published in the AMT with taking into account the listed notations above. 1. Banakh V.A., Razenkov I.A., Smalikho I.N. Aerosol lidar for study of the backscatter amplification in the atmosphere. Part I.

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