

Review of “A technical description of the Balloon Lidar Experiment BOLIDE” by Kaifler et al.

The paper give an excellent overview of the design and development of a novel Rayleigh lidar system operated on broad a NASA high altitude balloon mission. This includes the choice of laser system and telescope, especially the team’s work on reducing the optical background noise. The match of FOV between the telescope and the laser beam diameter seems to be the critical part of reducing the background. The lidar data prove the system achieved its major capabilities and worked during the flight as designed, although there is room to improve the system in the future mission. The documented experience in this paper is extremely valuable for future balloon or spaceborne lidar design work.

I would appreciate the author to clarify on the FOV technique, which I do not fully understand. The fiber is 200 μm , 0.22 NA and the focal length of the telescope is $f=2.4*0.5=1.2$ m. If we reverse the ray tracing, the only return signals that can be reflected into the fiber are those centered within 265.6 mm diameter disk of the telescope. If this is the case, there would be no need to use 0.5 diameter telescope. From another perspective, the conservation of etendue, if we assume the divergence of the laser beam is 70 μrad , the etendue of the object illuminated atmosphere at 70 km by the laser and received by the 0.5 m telescope is about $(0.5/70,000)^2*(5\text{ m})^2$. The etendue of the fiber is $(0.22\text{ rad})^2*(200\times 10^{-6}\text{ m})^2$, which is much less. Am I missing something here?

Could the author also please explain why three detectors (two APDs and one PMT) are set up in the receiver?

Minor comments:

Line 20, please consider to replace “wanted” with “desired”

Line 23, please consider to replace the reference Wickwar et al., 2016 with Sox et al., 2018 (a JRG paper for the same topic).

Line 27, please consider to add “Krueger et al., 2015” as the reference on Na Doppler lidar.

Line 35, One of the other advantage of the balloon lidar is that The high altitude flying lidar also avoids the scarified laser power and return signal due to strong scattering in the troposphere, suffered by the ground-based lidar system.

Line 129, please consider to replace “Not converted” with “The residual”.

Line 258, please consider to change the phrase “worst case estimated” to “worst case scenario estimation”.

Line 262-263, the last sentence of the paragraph “Therefore, we defer the discussion to the discussion” sounds a little strange, please consider to rephrase.

Line 277-278, please explain the underline motivation to choose these two factors, 38% and 280%

Line 324, please consider to delete “due to”