Review of the manuscript 'Sensitivity studies for a space-based lidar mission' by Dr. Kiemle and associates.

This paper presents a very thorough analysis of system performance for the proposed French-German space-based MERLIN mission to map global distributions of methane. The authors present sensitivity study of the proposed system that employs the Integrated Path Differential Absorption (IPDA) lidar technique. A comprehensive study is presented that includes detailed scientific rational for the mission, the technique, a novel selection criterion for the on- and off-lines, computational model for error calculation, and a parametric study of system performance. Formalism for the retrieval of dry-air methane mixing ratio is presented in the appendix along with estimates of uncertainties in measurements resulting from the variability of assumed temperature and water vapor fields. This is an excellent piece of work--it is well written, documented and illustrated and I strongly recommend publication. However I have a couple of suggestions for including a discussion on the impact of uncertainty in the measurement of range and bias due to sequential sampling of on- and off- signals (in case they are not simultaneous measurements). I have also listed some minor corrections for change. I

Include a discussion on the following issues:

1. What is the precision in the measurement of surface range? This is important and related to the impulse response function, electronic pre-digitizer filtering, digitization rate, and accuracy of the digitizer clock. Does this have an impact on the precision of column measurements because the weighting function has limited effective height? Another issue—any assessment of uncertainties related to terrain height changes within the footprint of the laser in forest regions.
2. A biased is introduced, depending on the terrain, if on and off line signals are not measured simultaneously. An earlier study addressed this issue for CO2. Please cite that work if it is applicable to this.

Minor suggested corrections:

1. Page 3551, line 6; define P
2. Page 3551, line 9; change from ' $E_{on,off}$ the laser pulse energy at each wavelength' to '$E_{on/off}$ represents either the on or off laser pulse energy'.
3. Page 3553, discussion on line 3-6 gives the impression that methane lines are present over the entire near IR region, and regions near 1.6 and 2.3 are selected because of the presence of water vapor transmission windows. This is not the case--strong methane absorption lines are present only in these regions in the near IR and it so happens that water vapor lines are weak in these locations.
4. Page 3558, line 25; define 'single-measurement'—what is 'single' about it. Is it 'signal'?
5. Page 3566, line 6; explain what is 'dry-air' volume mixing ratio of water vapor. Delete 'dry-air'?

6. Page 3578, Table 2 detector specifications; provide vendor's name and model number (since these info is based on a commercially available detector).