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Interactive comment on "Assessment of lidar depolarization uncertainty by means of a polarimetric lidar simulator" *by* J. A. Bravo-Aranda et al.

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Let me please seize the opportunity to participate to the open AMT-discussion on the interesting manuscript proposed by Bravo-Aranda et al.. This manuscript is interesting as it deals with the important concern of performing sensitive and accurate depolarization lidar measurements and proposes to use a simulator to address these concerns. I have several questions on this manuscript, which I hope may benefit to the authors and to potential readers.

1. In their manuscript, Bravo-Aranda et al. indicate that they propose a new tool to assess the lidar polarizing sensitivity and to quantify the error on the depolarization due to the unknown systematic errors. To my knowledge, such a discussion on the

sensitivity and accuracy of polarization lidar measurements was proposed in (G. David et al., Appl. Phys B, 108, 197-216, 2012) through laboratory and field experiments, by quantitatively discussing all possible systematic errors, including the following ones that are here analyzed: a small-unpolarized component in the emitter laser beam, an imperfect separation of polarization components, a misalignment between the transmitter and receiver polarization axes. Could the authors situate their work in regards to other published works and identify the novelty of their work ? I feel quite surprised that this paper is not quoted.

2. As a reader, it seems to me that the term of "polarizing sensitivity ", as proposed all along the manuscript, needs some clarification. Could the authors add precision ?

3. The Stokes-Mueller matrix formalism is here used by introducing the Mueller matrix of the emitter optics and of the receiver optics with reference to Freudenthaler (2016a) all along the manuscript, a reference that is not yet published and hence not yet reviewed. For the sake of clarity, I propose to the authors to use reference to the publication by G. David et al. (Opt. Exp., 21, 16, 18624-18639, 2013) where with my co-authors, we stated the Stokes-Mueller matrix formalism for a pulsed laser source in the lidar backscattering geometry by introducing the same emitting and receiver optics Mueller matrices and the corresponding formalism. Could the authors situate their work in regards to this published work? I feel quite surprised that this paper be not quoted.

4. When reading the manuscript, the reader gets the impression that the approach that is here proposed (the polarization lidar simulator) is the only possible one to address the sensitivity and the accuracy of lidar depolarization measurements. In David et al. (APB, 2012), we used a somewhat different approach by addressing the detector transfer matrix, which allows, as being diagonal, to perform a robust calibration, after minimizing all possible effects on the emitter optics. What additional information(s) do the authors get by introducing the Stokes-Mueller matrix formalism compared to our contribution? Whether this formalism is necessary or not should be clearly stated for

potential readers.

5. The manuscript only deals with 1λ-polarization lidars while many papers have been published with 2λ-polarization lidars such as Shimizu et al., 2004 or Tesche et al., 2009, as well-known. Such polarization lidar stations rely on wavelength-dependent components, that may attenuate the backscattering intensity and also modify the polarization state of the backscattered radiation in agreement with Fresnel's formulas. How do the authors account for this important contribution ? Is their conclusion similar to that published in David et al. (APB, 2012) ? Different ?

6. Using a polarization simulator may be interesting but it is not to my knowledge the only possible approach. To address accurate lidar depolarization measurements or to calibrate the lidar depolarization, laboratory experiments at exact 180° are nowadays available and can be used to quantitatively address this quantity, even for non-spherical particles such as mineral dust particles, and at two-wavelengths, as we recently published (Miffre et al., JQSRT 2016). I think adding such information may be useful for potential readers of your manuscript, as it complements your approach. Indeed, a robust calibration has to rely on accurate laboratory measurements. That's why, I am proposing to add this reference that complements your work.

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