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Interactive comment on "McRALI: a Monte Carlo high spectral resolution lidar and Doppler radar simulator for three-dimensional cloudy atmosphere remote sensing" *by* Frédéric Szczap et al.

Anonymous Referee #2

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Some time ago now, I reviewed an earlier version of this paper for another journal. Now, I find the work and presentation to be much improved ! I have only a few mainly minor comments/concerns.

Page 2: Around line 15:

Aeolus carries a Fizeau spectrometer, which measures the spectrum of the return +/- 0.33 pm around the emitted laser wavelength using 16 different frequency bins. Thus, Aeolus provides spectrally resolved data in the normal sense of the phrase. ATLID

separates the pure so-called "Mie" and Rayleigh backscatter returns. This is not the same as measuring the full spectrum. Please adjust the text accordingly.

Page 2: Line 20:

Simulation tools are steadily advancing thus allowing the exploration of the direct...way. Lidar and/or radar simulators are no exception.

Page 3: Line 5.

This text is not clear. Is DOMUS part of ECSIM or something separate ?

Section 2.2: The modelling of Doppler shifts is well described, however, the treatment of polarization is not described at all (despite the section title of " Modelling of idealized polarized backscattered power spectrum profiles") ! At least short description with references should be given.

Page 14: Lines 10-15. The cross-talk coefficient used in this paper have been apparently derived assuming ideal behavior of the EarthCARE FP element. In practice, the Airy function will be "blurred" due to the effects of non-ideal collimation of the beam, frequency jiter, surface roughness etc.. These factor all act to decrease the peak transmission and lower the FWHM. For a more realistic view on these parameters you should take into account the information in CEAS Space Journal (2019) 11:423–435 https://doi.org/10.1007/s12567-019-00284-6 (See Fig 9).

Looking at the FP characterization curve, it is certain that here will be substantially more Mie to Ray cross-talk than reflected by the present choice of coefficients. This fact will not alter any of the present papers conclusions (the increased X-talk will act mainly to reduce the SNR of the cross-talk corrected observations). Rather than redo the "EarthCARE" cases (which would be ideal but may require too-much time/effort) the authors could instead make it clear that the calculations shown are merely "EarthCARE like" but with an idealized modeled FP etc...

Page 14: Line 21 "(named by abuse of language)" ==> "the so-called"

Page 14: Line 26 "..step a simulated FP interferometer separates the ..."

Page 15: Figure 5 and associated text. It is likely worth pointing out the quasi-exponential decay of the below cloud molecular return towards single scattering return levels. This result is consistent with the cases shown by Donovan 2016.

Page 25: Lines 10-15: Have the the variance reduction techniques described by Buras et al. been employed in these calculations ? If so, it is work some more discussion regarding why these spikes in the spectrum remain. If not, then why were they not used ?