

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-990

Anonymous Referee #1

Referee comment on "Measurement report: Spectral and statistical analysis of aerosol hygroscopic growth from multi-wavelength lidar measurements in Barcelona, Spain" by Michaël Sicard et al., Atmos. Chem. Phys. Discuss.,
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Manuscript analyzes hygroscopic growth parameter based on collocated radiosonde and multiwavelength lidar measurements. Hygroscopic growth parameter and enhancements factors are derived at three laser wavelengths for different types of aerosols and seasons. Paper is clearly and well written and authors provide very complete review of previous studies in this field. The results presented are new and original and manuscript is appropriate for publishing.

I have just several technical comments.

Authors consider two parameters: hygroscopic growth parameter and enhancements factor, which are recalculated to each other via a simplified scheme. May be it is worth to mention, that these parameters are not really independent.

Simplified parameterization may not work for deliquescent aerosols and sea salt particles are often occur in cases presented. Probably, corresponding comment id needed.

Are backscattering coefficients calculated by Raman or Klett method? For Klett method lidar ratio may vary with RH.

It is a pity, that depolarization measurements are not presented. These could help in particle identification. Besides dependence of depolarization on RH is also interesting. Hope the authors will include it in their future studies.

Ln 46. "Atmospheric aerosols can be classified as hydrophobic (e.g. dust) or hydrophilic with monotonic (smoothly varying, e.g. volcanic) or deliquescent (step change, e.g. marine) growth (Carrico et al., 2003)". I think "growth" should be changed for something else. "Types"?

Ln 310. "Hygroscopic layers". I am confused, because probably authors mean layers where hygroscopic growth was calculated? Because most part of aerosol is hygroscopic everywhere...

Fig.8a. Hygroscopic growth is calculated for low RH (below 55%) and then extrapolated to RH=85%. Uncertainty can be high.

Ln.439. "This behavior could be attributed to the aerosol size: the smaller the aerosol, the more hygroscopic". Can it be explained? For spectral dependence, it is explained by the presence of the coarse mode particles. But if we have only fine particles, how hygroscopicity depends on size?