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Atmospheric Chemistry and Physics
Discussions
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Interactive comment on "Vertical aerosol distribution in the Southern hemispheric Midlatitudes as observed with lidar at Punta Arenas, Chile (53.2° S and 70.9° W) during ALPACA" *by* Andreas Foth et al.

Anonymous Referee #1

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This paper presents the first results regarding aerosol research in an almost pristine atmosphere over a Southern hemisphere site. Due to the lack of knowledge in such regions, this kind of papers are relevant, event if the involved databases are not large enough. The authors present their study in a proper, robust way. The topic fits in this journal, but my recommendation is to improve the aspects listed as follows before publication:

Page 2, lines 21-22: Consider to review all the lidar-related papers regarding aerosol and cloud profiling from ground. I suggest to start with LALINET (lalinet.org), and then

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you should review other papers developed by indidivual stations and/or during special campaign. Here some of them are listed:

Carmen Córdoba-Jabonero, Fabio J.S.Lopes, Eduardo Landulfo, Emilio Cuevas, Héctor Ochoa, Manuel Gil-Ojeda, Diversity on subtropical and polar cirrus clouds properties as derived from both ground-based lidars and CALIPSO/CALIOP measurements, Atmospheric Research Volume 183, 1 January 2017, Pages 151-165.

Gouveia, D. A., Barja, B., Barbosa, H. M. J., Seifert, P., Baars, H., Pauliquevis, T., and Artaxo, P.: Optical and geometrical properties of cirrus clouds in Amazonia derived from 1 year of ground-based lidar measurements, Atmos. Chem. Phys., 17, 3619-3636, https://doi.org/10.5194/acp-17-3619-2017, 2017.

Guerrero-Rascado, J. L. et al. (2014). Multispectral elastic scanning lidar for flares research: characterizing the electronic subsystem and application Optics Express. OSA. 22-25, pp.31063-31077. ISSN 1094-4087

Lopes, F. J. S., Landulfo, E., and Vaughan, M. A.: Evaluating CALIPSO's 532 nm lidar ratio selection algorithm using AERONET sun photometers in Brazil, Atmos. Meas. Tech., 6, 3281-3299, https://doi.org/10.5194/amt-6-3281-2013, 2013.

Page 2, line 32: replace "lidarÂ" by "lidar".

Page 2, line 33: replace "ALAPACA" by "ALPACA".

Page 3, lines 24-26: Why is it necessary to do this strong assumption? The instrument used here is a Raman lidar system and, therefore, it is possible to apply the method developed in Wandinger and Ansmann (2002) to derive a proper experimental overlap function to correct for this effect.

Wandinger U., Ansmann A., Experimental determination of the lidar overlap profile with Raman lidar, Appl Opt. 2002 Jan 20;41(3):511-4.

Page 3, lines 27-28: The Wavelet method is known to provide reliable results under scenarios with absence of lofted aerosol particles in the free troposphere of decoupled plumes above a well mixed PBL. However, as several works pointed out, such as Granados-Muñoz et al (2012), this method cannot unambiguously identify the PBL top in a stratified PBL. Please consider to apply another more recent approaches, some of them listed below:

Bravo-Aranda, J. A., de Arruda Moreira, G., Navas-Guzmán, F., Granados-Muñoz, M. J., Guerrero-Rascado, J. L., Pozo-Vázquez, D., Arbizu-Barrena, C., Olmo Reyes, F. J., Mallet, M., and Alados Arboledas, L.: A new methodology for PBL height estimations based on lidar depolarization measurements: analysis and comparison against MWR and WRF model-based results, Atmos. Chem. Phys., 17, 6839-6851, https://doi.org/10.5194/acp-17-6839-2017, 2017.

Geiß, A., Wiegner, M., Bonn, B., Schäfer, K., Forkel, R., von Schneidemesser, E., Münkel, C., Chan, K. L., and Nothard, R.: Mixing layer height as an indicator for urban air quality?, Atmos. Meas. Tech., 10, 2969-2988, https://doi.org/10.5194/amt-10-2969-2017, 2017.

Poltera, Y., Martucci, G., Collaud Coen, M., Hervo, M., Emmenegger, L., Henne, S., Brunner, D., and Haefele, A.: PathfinderTURB: an automatic boundary layer algorithm. Development, validation and application to study the impact on in situ measurements at the Jungfraujoch, Atmos. Chem. Phys., 17, 10051-10070, https://doi.org/10.5194/acp-17-10051-2017, 2017.

Pal, S., Haeffelin, M., & Batchvarova, E. (2013). Exploring a geophysical process-based attribution technique for the determination of the atmospheric boundary layer depth using aerosol lidar and near-surface meteorological measurements. Journal of Geophysical Research: Atmospheres, 118(16), 9277-9295.

Granados-Muñoz, M. J., Navas-Guzmán, F., Bravo-Aranda, J. A., Guerrero-Rascado, J. L., Lyamani, H., Fernández-Gálvez, J., Alados-Arboledas, L. (2012). Automatic determination of the planetary boundary layer height using lidar: One-year analysis over

southeastern Spain. Journal of Geophysical Research: Atmospheres, 117(D18).

Page 3, lines 29-31: Authors say that the low signal-to-noise ratio of the Raman signals prevented the determination independent particle extinction coefficients. I wonder if they try to increase the spatial smooth and/or the integration time.

Page 4, lines 21-25: Why is it necessary to use two different models for air mass transport analysis? What is the actual advantage of using both?

Page 4, line 32: Be carefull with the use of mixing depth. I guess that the authors refers to PBL top height. Mixing depth refers to PBL top height only under convective scenarios. In my opinion this ambiguous term must be replaced. Moreover, I'm curious about how this values is computed from the GDAS data.

Page 5, lines 5-6: Please, consider to add information on other models such as CAMS (https://atmosphere.copernicus.eu/charts/cams/aerosol-forecasts?facets=undefined&time=2019010500,3,2019010503&projection=classical_global&layer_name=composition_ao and/or NMMB/BSC-Dust model (https://dust.aemet.es/methods/the-nmmb-bsc-dust-model)

Page 5, lines 23-25: Uncertainties in determing backtrajectories increase with duration of the computed backtrajectories. In my opinion trajectories with a duration as high as 13 days have large uncertainties. How can you guarantee that the computed backtrajectories overpassed regions with active fires?

Page 6, lines 1-3: Did the mentioned particle lidar ratio values apply to both 532 and 1064 nm? Provide explicitaly this information.

Page 6, lines 5-11: Were thess Angstrom exponents computed over backscatter or over extinction? Please, especify it.

Page 7, line 1, and page 8, lines 1-5: Especify in the text the wavelength for these AOT values.

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Page 7, line 30: Provide the distance between Punta Arenas and Rio Gallegos.

Page 8, line 24: To be comparable with previous syudies, I recommend to perform the analysis on 1h basis.

Page 8, lines 26-27: I lot of studies on PBL height have been conducted in the framework of EARLINET. Please, include some of them, in particular with similar latitude and another sites with similar distance to ocean/sea.

Page 8, line 34: Include distance to the lidar site.

Page 9, lines 21-22: Consider my previous comment on the overlap function.

Page 9, lines 31-32: I don't understand the concept "integrated backscatter-related Angström Exponent". Backscatter-related Angström exponent is an intensive property, therefore its integration doesn't make sense. Maybe you were referring to vertically averaged backscatter-related Angström exponent.

Figure 11: why do the standard deviation for Rio Gallegos is too high in March 2009 and July 2010 (Fig. 11a)?. I recommend to include labels on x-axis in Figure 11b and 11c, not only in figure 11d.

Figure 13 and 15: what is the horizontal error bar?

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