

## Comment on acp-2022-604

Anonymous Referee #2

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Referee comment on "Meteorological export and deposition fluxes of black carbon on glaciers of the central Chilean Andes" by Rémy Lapere et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-604-RC2>, 2022

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Lapere et al., estimate the seasonal and spatial variability of black carbon deposition fluxes in the Central Andes using chemistry-transport modeling. The drivers of urban BC export towards the Andes Cordillera are also presented. As an important short-lived climate forcer, BC can also reduce the albedo of snow/glaciers when it is deposited on them. Due to the limited observations of BC in atmospheric aerosols and snow/glaciers over Chilean Andes, the simulation of BC deposition is useful for reference for its impact assessment (radiative forcing and snow water equivalent of glacier melting) in this region. However, the significance of your study is a little weak, I strongly recommend the authors to add more emphasis to the MS. But for the section 3, 4 and 5, they are too redundant, try to make them clear and concise, especially for 3.1 and 4. I suggest to move section 4 to section 2, or to the supporting information. Overall, I recommend the current MS to be constructed better and discussed more robust. Thus, the current MS need a major review and a second critical review. The major and specific comments are as followed:

- You compare the results with the studies on the Tibetan Plateau, however, it is too general. Though, they are glacier regions, but the area, length, volume, and complicated topography, atmospheric circulation, BC sources, and background of BC of the glaciers are different. It is better to add some information, or add the comparison with other glacier regions. There is both atmospheric BC concentrations of and BC depositions over Tibetan Plateau. Does the magnitudes of BC depositions are similar? □
- Rowe et al., 2019 pointed that dust was dominated the albedo reductions in snow rather than BC in northern Chile. Is there possible for you to compare the dust and BC deposition via modelling in your MS?
- Line 70, I'm puzzled on "Anthropogenic emissions only are considered for BC (i.e., wildfire events, which can be a large BC source, are ignored)", what do you mean?
- Lines 77-88, You used the aerosol dry deposition scheme from Zhang et al., (2001), according to the better results over the investigation over the Arabian Peninsula. However, you mentioned that "despite a seasonal variability in performance", does it mean that it is not good for the seasonal variability based on Zhang et al., (2001)? The seasonal variability of BC depositions is the key for your MS. How about to do a

comparison based on Wesely (1989) and Zhang et al., (2001)?

- In current MS, you only compare the influence of BC emissions from and without Santiago city, how about the influence of emissions from a large sale via long-range transport?
- You focus on the comparison of January and July 2015, but for the meteorological export influence, you use the meteorological parameters during 2010-2020, 2004-2019, 2004-2011, 2009-2019, 2013-2020, they are not coherent.
- Due to there is no observation data for modelling validation, how about to try to check the MODIS or reanalysis data?
- You pointed out the future wind speed increase of  $+0.02 \text{ m s}^{-1}$ , and decrease of  $-0.03 \text{ m s}^{-1}$  in January and July, respectively, does the slight variation will really make a big difference under the unclear uncertainties of your current modeling. More importantly, you haven't simulated the radiative forcing caused by BC on glacier on Central Andes.
- L99, "0.350 nm"? It should be "350 nm", right?

Please also note the supplement to this comment:

<https://acp.copernicus.org/preprints/acp-2022-604/acp-2022-604-RC2-supplement.pdf>