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Comment on acp-2021-235

Anonymous Referee #2

Referee comment on "Measurement report: Characterization of the vertical distribution of airborne *Pinus* pollen in the atmosphere with lidar-derived profiles – a modeling case study in the region of Barcelona, NE Spain" by Michaël Sicard et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-235-RC2, 2021

The manuscript presents a comprehensive, state-of-the-art study on pollen in the atmosphere (emission, vertical layering, regional transport) based on surface observation, lidar remote sensing and advanced modelling. The work includes even a detailed study on uncertainties and error sources. The paper is well written, but a bit long. Short, compact paper attract readers, too long papers often cause the opposite.

Minor revisions may further improve the paper.

Some detailed comments:

P3, l3: Please have also a look into the recent paper of Veselovskii, AMT, 2021 (fluorescence lidra, focus on pollen) and also Saito, Rem. Sens., 2018. Could be included in the introduction.

I miss a bit a discussion on: How did the papers of Bohlmann (ACP 2019) and Shang (ACP 2020) contributed to the field, and even improved the knowledge about pollen and lidar measurement approaches (after the pioneering papers of Noh 2013 and Sicard 2016). And what about Veselovskii, AMT 2021? I miss something like a small review (on progress) in the field of pollen and lidar applications by the expert.

P3, l12-13: My request was triggered by the final, not very specific sentence of the paragraph.

P4: Sect. 2.2:

Shang mentioned pollen lidar ratios of 65 sr.

Is your approach (methodology) is in full agreement with latest approaches (Bohlmann 2019, Shang 2020)?

Please check also Veselovskii. You will find some hints to pollen lidar ratios as well.

Concerning depolarization ratios: What about masking effects? Dust or dry-marine-related depolarization enhancements? I think, these effects are negligible. But there are several field sites (cities) close to the Mediterranean Sea (and there will be sea breeze effects,

advecting sea salt particles across the coastal regions…, sometimes up to 10-20 km into the continent). Please, provide a short comment on this.

P7, Figure 1 is very nice and rather helpful. If possible, provide a bar, indicating 10, 20 or 50 km distance…, in the right lower corner… In Figure 1, one can see that sea breeze (and land breeze effects in the night) will affect the pollen transport.

P12, Figure 3b is very convincing, shows excellent agreement! I did not expect such an agreement between a point observation (at ground) and a column observation (lidar). This corroborates that dust and dry sea salt effects are probably negligible. Should be mentioned.

P15, Figure 6: Please mention that the solid line (in each plot) shows the coast line (and not a river…, as I was thinking in the first moment).

P24, Figure 16 is mentioned… To my opinion, the lidar profiles are biased (above 400m) . The profiles are unrealistically smooth. I speculate that the pure Rayleigh depolarization background is varying with time. By using a fixed, but a bit smaller values than the actual (instrument-related) background Rayleigh value, you get such a bias. But in reality, it is the background, and not a pollen depolarization contribution. At least it looks strange.

Appendix B: Comparison of meteorological and pollen surface observations with respective model results…… sounds better…

However, do we need Appendix B?