The authors would like to thank the reviewer for his/her valuable comments and suggestions. We have modified the manuscript with the proposed changes along with step-by-step answers to the suggestions. Please note that changes have been highlighted (in bold or 'track changes') in the manuscript and the corresponding answers to the reviewer by text below. The original comments are presented in bold letters.

Reviewer #1

Today it is well accepted that the pollen play an important role in the process of aerosol cloud interaction. Still, the pollen optical properties, as well as the dynamic of their spatio – temporal variations are not studied sufficiently. One of the reasons is that pollen are normally mixed with other types of aerosol, and it is difficult to characterize the properties of "pure" pollen. From this point of view, the study presented is very important. The authors use three remote sensing instruments and provide the particle depolarization ratios at four wavelengths, from UV to IR. It is also important that authors consider numerous measurement cases, accumulated during field campaigns, thus allowing to estimate the depolarization ratio of pure birch and pine pollen. The paper is well and clearly written and is suitable for ACP. I have just several technical notes.

Notes:

Decrease of depolarization at 900 nm looks unexpected. But considering uncertainty of the measurements, may be this decrease is inside the uncertainty interval.

Thank you for the comment. Indeed, there is a slight decrease observed at 910nm wavelength under the assumption that the theoretical molecular depolarization ratio is 0.0038. Unfortunately, limitations in the signal-to-noise ratio (SNR) did not allow us to retrieve the experimental molecular depolarization ratio in clean atmosphere thus the assumption of a 100% departure was used as an alternative. Under this scenario the particle depolarization ratio was 3% higher which was added on top of the standard deviation of the observations themselves. We do plan to fully characterize the noise in CL61 instruments and proceed with the uncertainty calculation of the depolarization retrievals thus reduce the PDR uncertainty, but this is the scope of a forthcoming paper.

I wonder, why in Fig.2a pollen concentration is shown in logarithmic scale. Probably variations would be better seen in linear scale. But this is up to authors.

We agree with the reviewer that the linear scale depicts the daily variation better, but we have chosen the logarithmic scale since the 'rest' category presented very low concentrations and therefor was only visible with the logarithmic scale. For clarification, below is the same figure with linear scale. Nevertheless, we prefer the logarithmic scale for the reason mentioned above.

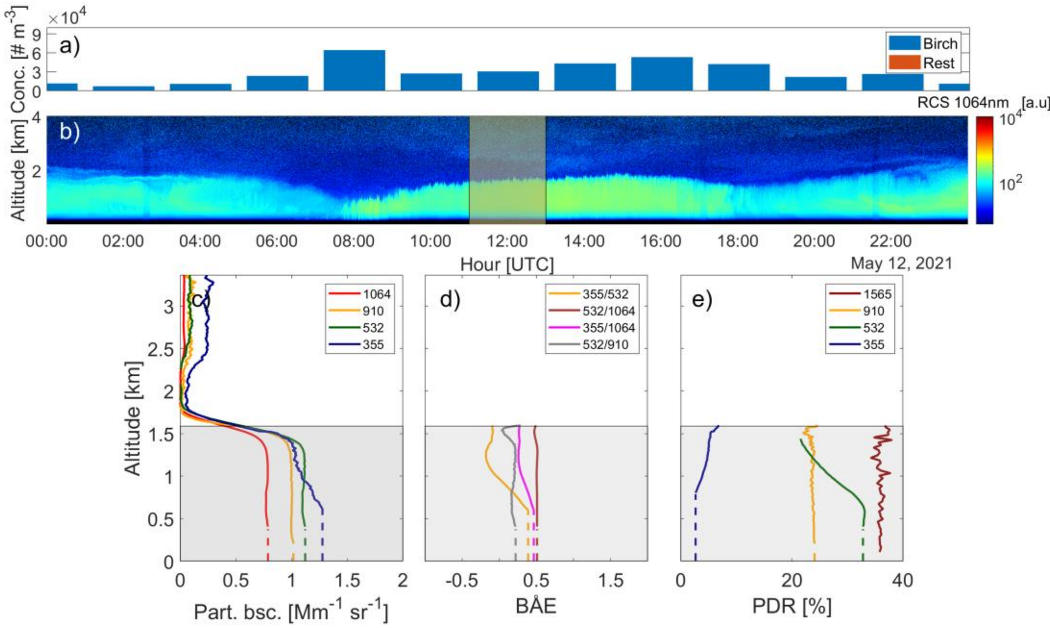

Fig.2b. I would change scale of backscattering to 0 - 2 Mm-1sr-1, to see details of profiles. The layer looks to be well mixed and backscattering at 532, 910, 1064 does not change with height, while at 355 nm it increases below 1 km. Can it be effect of overlap? This increase correlates with drop of particle depolarization at 355.

We have updated Figure 2c to reviewer's suggestion. Regarding the profile of the backscatter coefficient at 355nm, that is a product of the combination of particle backscatters between the far field and the near field channels. This means that we perform the Klett solution independently at both channels and then merge the products. The merging region in this case realized at 1500m. Below this height the particle backscatter comes from the near field signal alone while above this height the far field observations were used. This is our standardized solution to correct for the overlap at the far field channel. The near field channel has an overlap of about 120m. At the moment, we do not perform an overlap correction in the near field channels as we consider observations starting a few hundred meters above the full overlap of the near field. This is not the case for the retrieval of the particle depolarization ratio (PDR). For the PDR we use the merged particle backscatter and since the depolarization channel is only present at the far field, the volume depolarization ratio (VDR) is affected by the different overlaps of the 355nm near-far field channels limiting the usefulness of the signal in the lowest part.

Fig.2c. I would change scale of BAE also: -1 – 2.

We have updated Figure 2d to reviewer's suggestion.

Fig.3. If dust contribution increase, it should increase also depolarization at 355 nm. Was it observed?

Due to the lower limit restriction at 355nm wavelength, the particle depolarization ratio is available at 800m above ground level. Below that height, we assume well mixed conditions and the value at 800m is assumed to be indicative all the way down to the surface. This assumption may be valid during well mixed conditions under a convective boundary layer, but it is not necessarily valid at other times. Therefore, we didn’t observe an increase at 355nm particle depolarization ratio (PDR) in the first layer. Given the low aerosol optical depth (AOD) projected by the models, mineral dust may have a minute contribution, if at all, to the AOD of the first layer. If mineral dust is present, it is certainly mixed with birch pollen and smoke as indicated by the in-situ observations.

Line 333. Did authors estimate the EAE value?

Given the location of the measurement site and the time of the year, the solar background radiation restricts Raman retrievals and therefore the independent estimation of the extinction coefficient is not widely available. We have only a few Raman cases during this period thus a statistical approach similar to what we have done is not feasible. Accounting for the lower boundary top heights during nighttime, the overlap limitation of the instrument and the aerosol conditions which might not be the same as during daytime (see Fig.3) a straightforward connection is therefore not necessarily valid.