Review of Suchánková et al., *An innovative approach to measuring hygroscopic light scattering enhancement using a humidified single-nephelometer system*

This work presented a novel, cost-effective approach to investigate aerosol hygroscopicity using a single-nephelometer set-up with an automatically controlled switching valve alternating between humidified and dried sample branches. The authors provide a succinct introduction to the single nephelometer system used to measure particle light scattering and backscattering enhancement factors f(RH), although I document some perceived issues with this design (see Suggestions 1&2 below). Results of f(RH) from Nov 2022-July 2023 were presented in the context of seasonal variability, aerosol optical properties (single scattering albedo, scattering Angstrom exponent, absorption Angstrom exponent), estimated aerosol chemistry (based on aerosol optical properties using a scheme introduced by Cappa et al., 2016), air mass source region, and OC/EC. The paper adds useful climatology of f(RH) in the Prague, Czech Republic area but I recommend some changes to improve the paper before publication, as outlined below.

Suggestions:

1. The authors claim in multiple places that the single-nephelometer aerosol scattering hygroscopicity measurement reduces uncertainties associated with dual-instrument configurations. However, no supporting evidence (error estimates) are provided to support this claim and I would argue that the single nephelometer system could potentially have larger f(RH) uncertainties than the dual nephelometer systems most commonly used. I base my statement on two potential error sources:
   (a) **Non-simultaneous sampling of dried and humidified particle light scattering:** The single nephelometer system used to measure f(RH) can potentially possess smaller uncertainty relative to the traditional dual nephelometer system but switching between dried and humidified particle light scattering at 1-hour intervals can lead to potentially larger (and unknown) uncertainty in f(RH) because one is taking a ratio of measurements taken one hour apart. I should note that the authors acknowledge the limitations of non-simultaneous dry and humidified light scattering and backscattering measurements made using the single nephelometer system (lines 124-125).
   (b) **A well-calibrated dual nephelometer system includes built-in checks of nephelometer performance lacking in the single nephelometer design**. This is achieved by periodically comparing light scattering and backscattering measured by both nephelometers under low RH conditions. A slope close to 1 and intercept close to zero provides high confidence in relative calibration of the nephelometers and small differences from this can be applied to correct the wet nephelometer scattering. Values of f(RH) sometimes in the 0.8-0.9 range (Fig. 8) could potentially signal small calibration drifts or other unknown uncertainties.

2. The calculated f(RH) should be at a stated RH and the humidified (and to less degree dried) RH values used to compute the ratio should be the same for all hours to compute meaningful statistics over the time period . For example, many studies (Burgos, et al. 2019 and some of the references there within) use f(RH)=σ_{sp}(RH=85%) / σ_{sp}(RH=40%). The authors only state that humidified scattering used are when RH≥80%. Particle scattering increases rapidly at RH near and larger than 80% so comparing multiple hours with different RH values or using the hours to calculate statistics can lead to additional, unknown uncertainties.

Minor Suggestions

1. The color-coded plots of particle type versus cluster, SSA, etc. are nicely done and convey a lot of information on single plot (Figs. 8-9).
2. **The statement in lines 58-59 is confusing: "***The comparison of the integrating nephelometer TSI 3563 with AURORA 3000 possessed an overall uncertainty of 2-5 % for σsp and 3-11 % for σbsp in laboratory conditions, respectively (Müller et al., 2011)."* For which instrument is the uncertainty quoted for and (if so) is the other instrument assumed to be the "standard" reference instrument? Please clarify what you mean by these "uncertainties".
3. Corrections to the raw data were mentioned in lines 159-161 but no mention was made of the most important correction, namely the nephelometer angular truncation correction (Anderson and Ogren, 1998). The authors also stated that "Values below the limit of detection (LOD) were replaced by LOD/2 values" but no mention was made as to the value of the LOD.
4. The two wavelength pairs used to calculate ΔSAE should be explicitly stated.
5. The authors state (lines 343-444) that "While we found a larger influence of the chemical composition on light scattering enhancement than the particle size, the seasonal variations in the ratio *b* were linked to changes in aerosol size distributions and sources." However, no data is presented to support this assertion.
6. Figure 6: There is a non-negligible fraction of f(RH) <1 (often for SSA<0.60) with values ~0.80-0.90 for ~5% of whole dataset. In a dual nephelometer system this could perhaps be attributed to relative differences/drifts in nephelometer calibration and this difference could be corrected by inter-comparison of the nephelometers under low RH conditions but it is not obvious to me what the reason could be for a single nephelometer system. Please elaborate on likely sources for this.