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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A new parameterization scheme of the real part of the ambient aerosols refractive index" *by* Gang Zhao et al.

Anonymous Referee #2

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General comments:

The real part of the refractive index is surely still uncertain and its impact on the aerosol radiative forcing (ARF) is large. The scope of this manuscript is important. The logic of this manuscript is generally clear, but the following three points should be clarified. Firstly, the title is "A new parameterization scheme of the real part of the ambient aerosols refractive index", so the proposed parameterization must be evaluated in the manuscript, but the evaluation is not enough. The parameterization is based on the measurements at one Chinese site during May-June of the specific year. Generally, the parameterization must be universal, so the proposed one should be tested under various conditions using other measurements at different places and seasons or using a numerical model. Otherwise, I suppose other people do not tend to use the

proposed parameterization. Also, an introduction how to use the parameterization in numerical models, i.e., what is the input and required parameters, may be required. Second, the main conclusion can be led from Figure 4. However, Figure 4 only indicates that Equation (1) is applicable for the effective particle (I understand this is also one of the findings in this study). I expect the clear evidence of the relationship between measured-RRI and calculated-RRI, as shown in Figures S8 and S9. Finally, in the result and discussion of section 3.4, the authors estimated the ARF, but the objectives of this section may be sidetracked. Here, the authors should discuss the impact of the parameterization on the ARF, but the conclusion is "the real-time measured RRI be used rather than a constant RRI when estimating the ambient aerosol optical and radiative properties". This conclusion confuses me. When the proposed parameterization is applied to numerical models, is the real-time measured RRI still required? If so, this parameterization is not attractive to modelers. In addition, the experimental conditions of the ARF calculation is unclear (see the below comment). In overall, the manuscript would be acceptable for publication if these comments can be satisfactorily addressed.

Specific comments:

L23 (and L233): Only correlation coefficient is not enough to evaluate the relation. Please add the other statistical metrics. In abstract, the correlation coefficient is 0.75, but the value is 0.76 in Figure 4. Which is right?

L36: Which wavelengths are used?

L103: Zhao et al. (2018b) seems to be still under discussion. The readers cannot trust the method only from the explanation in this manuscript.

L144-145: RI of BC is set at 1.8+0.54i. Do the authors consider a dependence of RI on wavelength?

L159: Please clarify "parameterization aerosol vertical distributions". This information

is very important to estimate the ARF.

L198-200: The RRI was measured at three different wavelengths (200nm, 300nm and 450nm). Here the measured RR is expressed as “1.34-1.56”. Can the measured RRI at different wavelengths be combined? Do the authors consider the difference of RRI among the different wavelengths? In addition, is the focusing wavelength consistent to those proposed by the previous studies?

L204-205: Can the authors explain the mechanism of the relationship between effective density and particle size?

Figure 5: Is the instant value or mean? Which wavelength do the authors calculate? Please clarify them.

Figure S8 and S9: They are very interesting. I strongly recommend they are moved to the main text. Can the authors show the same figures estimated from the current study?

Technical comments"

L34: prat –> part

L46: It is better to add “n: refractive index” to the explanation of Equation (1).

L52: ne –> neff is suitable.

Figure S1 (a), S4, S5: Better to be moved to the main text.

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