

## ***Interactive comment on “Method to calculate the aerosol asymmetry factor based on measurements from the humidified nephelometer system” by Gang Zhao et al.***

**Anonymous Referee #1**

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The paper 'Method to calculate the aerosol asymmetry factor based on measurements from the humidified nephelometer system' offers a new method for determining the ambient aerosol asymmetry factor. I believe that aerosol asymmetry factor is clearly of real importance. The proposed method has advantages over the traditional methods as it can measure the aerosol asymmetry factor in real time. I am glad to see the results of the effects of aerosol hygroscopic growth on the variation in aerosol asymmetry factor, which is rarely discussed in previous studies. Overall, the paper is clearly written and contains originality. I recommend that the paper be accepted for publication in ACP after some minor work to be done for its improvements. I have the following suggestions to further improve this work: (1) The authors should highlight the novel

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and original aspects of the work. More discussions should be added in the text, mostly the introduction section. (2) To my knowledge, the aerosol asymmetry factor is highly related to the aerosol particle number size distribution, the aerosol mixing states, the ambient relative humidity (RH) and the aerosol complex refractive index. The first three parameters are discussed in this work, I suggest that the authors add some work on the sensitivities of the aerosol asymmetry factor on complex refractive index. The uncertainties due to complex refractive index should be well discussed in this paper. (3) The method of training the machine learning model should be reconstructed. There are large uncertainties for measurements of particle number size distribution. I suggest that it would be better if the authors use all of the training data from the calculations of the Mie scattering model with measured particle number size distributions. In this way, the aerosol scattering coefficient, aerosol backscattering coefficient and the aerosol asymmetry factor under different RH can be calculated using the measurements of particle number size distributions, the mass concentration of the black carbon and aerosol hygroscopic growth factor,  $\kappa$ . This can avoid the uncertainties in measurements of the aerosol particle number size distributions. (4) In section 3.3, parameterization of the aerosol vertical profiles of the aerosol optical properties should be discussed in detail. (5) Section 4.4 gives the validation of the random forest machine model, it should be placed after section 4.2. (6) I suggest that figure 6 re-plotted and be presented in a clearer way. (7) Line 114 : What is the meaning of UCAS? Please describe it. (8) Line 312: 'to' should be changed to 'in'

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