

***Interactive comment on “A study on aerosol extinction-to-backscatter ratio with combination of micro-pulse lidar and MODIS over Hong Kong” by Q. S. He et al.***

**Anonymous Referee #1**

Received and published: 2 May 2006

**General Comments:**

The authors present extended measurements of the lidar ratio (LR) retrieved using MODIS optical depth measurements in Hong Kong, and analyze this parameter with respect to a ground based measurement. Seasonal variations in LR are explained using knowledge of local meteorology. The paper presents information that is valuable to the scientific community, and therefore should be published with some corrections/improvements. Some significant deficiencies of this paper are found in the analysis of the visibility sensor data. Here the authors should consider in more detail,

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why the scattering coefficient differs from the extinction coefficient. The paper also lacks references to published measurements of aerosol size distribution and chemical composition. Grammar corrections are also needed. Reviewer #2's comments are quite valid and a detailed discussion of the overlap effect should be included before publication.

**Specific comments**

If the authors use a visibility sensor, the experimental details of this instrument should be included in the measurements section. Some details to include would be spectral range and angular range, in addition to the normal inclusions that belong in this part of the paper.

Line 18, p3013: this reviewer does not understand the convention  $\Delta AOD = +/- 0.05 +/- 0.2 AOD$ . please clarify.

P. 3105: The authors use the NASA standard atmosphere. The authors should comment on the magnitude and sources of error by assuming the standard atmosphere. For example, if the vertical profile of relative humidity is significantly different than the standard atmosphere, how does this affect the results? What sorts of deviations from the standard atmosphere are expected from Hong Kong.

Section 4.1, first paragraph: The details of the visibility sensor should be moved to the "measurements" section. More detail can be included regarding the spectral response and angular range.

Lines 11-12, p3108: are sulfate particles implied to be large in this sentence? Most commonly, sulfate mainly occurs from 10nm to 1000nm. Are the sulfate aerosols in Hong Kong expected to be different? Why? Please comment

Lines 1-5, p3109: When discussing particle size the authors should reference direct measurements rather than those obtained via retrieval.

Lines 13-30, p3109: A comment on the reason why the scattering coefficient measured

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with the visibility sensor is different from the extinction coefficient measured with MPL: Firstly, there are no nephelometers or visibility sensors that measure the scattering coefficient exactly. This is because these integrating measurements do not cover the entire phase function - there will be some scattered light that is not collected. Obviously this changes with particle size. Typically if particle size is larger the measured scattering coefficient will be lower. Secondly, the authors are correct in reason 3 that the visibility sensor does not measure absorption. The authors are comparing an EXTINCTION coefficient with a convoluted SCATTERING coefficient. The authors have stated repeatedly that the visibility sensor is measuring extinction, which is incorrect. It is the reviewer's belief that these two reasons are the most probable explanations for the difference between extinction and scattering coefficients.

It might be interesting to take the difference between extinction and scattering coefficients to derive absorption. Maybe this will correlate well with the urban air masses?

If the authors wish for the readers to think quantitatively about the scattering coefficient and how it differs from the extinction coefficient, it would be useful to list the angular range of the instrument in the "measurements" section.

Line 7, p3111: are the trends really considered to be significant if the error bars overlap? Looking at the number of observations for some of the months, one can see why some of the errors are so large. The error bars for Jun should be 100%. How was the error calculated here? It should also include an analysis any systematic errors.

Line 1, p3112: the authors should be careful when stating that soot is the major pollutant in Asia. I'm sure a significant amount of organic carbon, dust and others contribute to the Asian pollution. If the authors state that soot is the major component, they should find a reference from the area that quotes soot number or mass concentrations.

Line 20, p3114: sentence should read: "(b) large particles contribute more to the extinction coefficient". A comment on this statement: Sure, larger particles extinguish more light, but it also depends on concentration. Typically the mode in the surface area

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distribution is larger than that in the coarse mode. The extinction efficiencies may be similar; therefore the fine mode would contribute more to scattering. Before making these statements, it would be nice to compare to direct ambient size distribution measurements (previously published) and microphysical properties. If chemical information is available this would be an even more robust argument.

#### Technical Corrections

Line 4, p 3105: There should be a period in place of the comma after “C”.

Line 6, p3103: “Detail” should be changed to “detailed”

Line 9, p3103: “describes” should be changed to “describe”

Lines 15-16, p3103: “continuously” should be changed to “continuous”, and “products” should be “product”.

Line 2, p3106: “separated” should be “separate”.

Line 25, p3106: “monotonously” should be “monotonically”.

Line 3, p3107: “separated” should be “separate”

Line 5-6, p3108: “extinction” should be changed to “scattering”

Line 26, p3108: “extinction” should be changed to “scattering”.

Line 6, p3109: “extinction” should be changed to “scattering” in the case of the visibility sensor.

Line 13, p3109: “related” should be changed to “due to”

Line 8, p3110: should read “absorption contributes more to”

Line 9, p3110: “companied” should read “accompanied”

Line 16, p3111: “precipitations” should read “precipitation” and “rich oceanic aerosol” should read “air masses rich in oceanic aerosol”.

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Line 27, p3111: “find” should read “found”

Line 28, p3111: “is” should read “are”

Lines 18-19, p3112: should read “easterly and southerly flows”

Line 10, p3113: “constitute” should read “composed of”

Line 18, p3113: “dense-populated” should read “densely-populated”.

Line 27, p3115: “aerosols” should read “aerosol”.

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 6, 3099, 2006.

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