

**Editor Initial Decision: Reconsider after minor revisions (Editor review)**

(25 Feb 2015) by Patricia Quinn

Comments to the Author:

The paper has been significantly improved. The authors have done a commendable job of addressing the reviewers' comments. However, there are many grammatical errors that need to be corrected to improve the readability of the paper. Please make the following corrections listed below and re-submit.

Dear Editor,

We greatly appreciate the editor's effort to correct our grammatical errors and refine the content to improve the readability of the manuscript. Now, the revised manuscript should be more lucid and reader-friendly.

For the sake of your convenience, we have highlighted the modified sections in different colors:

**Yellow** → Grammatical problems. Sentences are replaced by more suitable words suggested by the editor.

**Green** → Restructuring of sentences or amendments for better clarification.

**Grey** → Added reference (for HYSPLIT\_4) for Figure 4.

p. 1

line 13: Omit “pragmatically”

**Response:** The word of “pragmatically” has been omitted.

line 30: Replace “prediction” with “performance”

**Response:** Modified as suggested.

line 31: Change to “The predicted AOD can enhance measured short- and term-term AOD and....”

**Response:** Changed.

p. 2

line 3: Omit “However”

**Response:** The word of “However” has been omitted.

line 33: Change to “especially WITH THE OCCURRENCE OF and elevated...”

**Response:** Changed as suggested. We suppose what the editor meant was “especially WITH THE OCCURRENCE OF an elevated...”.

line 37: Define “Vis”

**Response:** “Vis” was defined at p. 2 line 30.

p. 3

line 13: Change to (i) under- and overprediction of AOD were not ASSESSED because of...”

**Response:** Changed.

line 16: Change to “WAS considered”

**Response:** Changed.

line 17: “Omit “efficiently”

**Response:** The word of “efficiently” has been omitted.

line 38: change to “model ARE used to”

**Response:** Changed.

p.4

line 10: change to “due to PM10 ARE used”

**Response:** Changed.

line 19: Omit “Say”

**Response:** The word of “Say” has been omitted.

line 33-34: Change to “these properties can have a non-trivial impact on the magnitude of the retrieved AOD.”

**Response:** Changed.

Line 36: should be “additional”

**Response:** Modified as suggested.

Line 42 – 43: change to “exerts less influence”

**Response:** Changed.

p. 5:

Lines 14 – 15: change to “using the RESULTING data FROM subset 1”

**Response:** Changed.

Line 20: Change to “LIDAR system is co-located with the”

**Response:** Changed.

Line 27: Glued→combined

**Response:** Modified as suggested.

Line 30: decimated→determined

**Response:** Modified as suggested.

p. 6:

Lines 1 – 2: change to “as described in Eq. (3) using the Angstrom power law (Angstrom, 1929).”

**Response:** Changed.

Lines 13 – 14: Omit “of the aerosols in the atmosphere.”

**Response:** The words of “of the aerosols in the atmosphere” have been omitted.

Lines 16 – 18: As written, it is difficult to tell which L values go with which type of aerosol. Please clarify.

**Response:** To clarify how the value of L is chosen for calculating  $\alpha_a$ , we have modified the relevant paragraph to read as follows:

The value of L to be adopted for calculating  $\alpha_a$  depends on which dominant aerosol type is in the atmosphere. To arrive at a specific value for L is somewhat arbitrary. Different authors adopt different strategies to fix the value of L. In this study, the following strategy is adopted: the aerosol type is first identified by using a scatter plot of the Angstrom exponent against the AOD (from AERONET data). Once the dominant aerosol type is determined the corresponding L value is set to be the mean value of the range suggested by Chew et al. (2013) for that particular aerosol type. Specifically, for clean and polluted marine aerosol particles or dust, L=30 sr; for urban aerosols, L=50 sr; for biomass burning aerosols, L=70 sr.

Line 20: change to “The assumed value of L ADDS TO THE UNCERTAINTY in the AOD estimation.”

**Response:** Changed.

Line 21: change to “without the need to make AN assumption ABOUT the value of L.”

**Response:** Changed.

Line 23 – 24: change “THIS approach”

**Response:** Changed.

Line 25: change to “maximum height of THE aerosol”

**Response:** Changed.

Line 26: change to “Ro is THE height”

**Response:** Changed.

p. 7

Line 18: should be Angstrom exponent in the text and figure captions.

**Response:** We suppose the editor want us to replace the term “Angstrom<sub>440-870</sub>” by “Angstrom exponent” in line 18 of p.7 and Figure 1. However, the term “Angstrom<sub>440-870</sub>” has been defined as “Angstrom exponent” in the previous paragraph (line 11 – 14, p. 7 in the original manuscript.).To avoid the ambiguity, we have modified the sentence as follow:

“Small aerosol particles contribute primarily to the air pollution in Penang, as the average Angstrom exponent for wavelength between 440 nm and 870 nm (referred to as Angstrom<sub>440-870</sub>) is higher than 1.1.” (p. 7 and lines 13-15 in the revised manuscript).

So, we will retain the term of Angstrom<sub>440-870</sub> in the text and captions.

Line 20: change to “in THE ATMOSPHERIC column”

**Response:** Changed.

Line 34: change to “FALLS within”

**Response:** Changed.

Lines 37 – 38: change to “sometimes dust PARTICLE CONCENTRATIONS CAN BE ENHANCED above THE boundary”

**Response:** Changed.

p. 8

Line 10: Omit “Although”

**Response:** The word of “Although” has been omitted.

Line 10: change to “driest season in Malaysia. PW frequency was approximately 20% lower than that of the northeast monsoon period WITH PW < 4.0”

**Response:** Changed.

Line 19: change to “SIMILAR studies have performed THIS analysis”

**Response:** Changed.

Line 28: change to “DIAGRAMS”

**Response:** Changed.

Line 36 fail→failed

**Response:** Modified as suggested.

Line 38: change to “ARE dominant”

**Response:** Changed.

Line 40: fails→failed

**Response:** Modified as suggested.

p. 9

Line 11: change to “in THE overall”

**Response:** Changed.

Lines 17 – 18: change to “BMA ARE likely the most common AEROSOL TYPES”

**Response:** Changed.

Line 25: seasonal → seasonally

**Response:** Modified as suggested.

Line 26: change to “PARCELS”

**Response:** Changed.

Line 29: solved→determined

**Response:** Modified as suggested.

Line 34: omit “transported”

**Response:** The word of “transported” has been omitted.

Line 37: change to “AND Sumatra”

**Response:** Changed.

P. 10

Line 5: “similarities BETWEEN the air”

**Response:** Modified as suggested.

Line 21: “of THE Angstrom exponent”

**Response:** Modified as suggested.

Line 25: “that FOR Penang”

**Response:** Modified as suggested.

Lines 31 – 32: What is the point of the sentence starting with “The relative...”? It seems out of place here.

**Response:** Yes, we agree that this sentence is of no direct relevance in the present context. It is a redundant information that should be omitted for better conciseness. We happily removed the sentence as suggested.

Lines 35 – 38: This is confusing. It is stated that the sensitivity of AOD prediction is affected when AOD values are low. Yet the next sentence says that aerosol models are insensitive during clear (low AOD) conditions. Please clarify in the text.

**Response:** The confusion is remedied by replacing the word “affected” by “low”. We have also included a bracket “(e.g. when AOD is low)” after the description “clear atmospheric conditions”. The relevant sentences now read:

“The sensitivity of AOD prediction is low when the major occurrence frequency is clustered around small AOD values. The insensitivity of the aerosol models to clear atmospheric conditions (e.g., when AOD is low) was also previously observed (Zhong et al., 2007).”

These modifications should now make the two sentences consistent with each other.

Lines 42 – 43: Change to “The accuracy of AOD prediction is improved for cases with higher aerosol concentrations.”

**Response:** Changed.

p. 11

Line 2: “of twenty two months OF data”

**Response:** Modified as suggested.

Line 7: “twenty two months OF data”

**Response:** Modified as suggested.

Line 15: “WHEN scrutinizing”

**Response:** Modified as suggested.

Line 35: “have A narrower”

**Response:** Modified as suggested.

p. 12

Line 8: “exhibits A high”

**Response:** Modified as suggested.

Line 13: “less THAN 1.0% in TERMS of”

**Response:** Modified as suggested.

Lines 13 – 14: clarify what is meant by “so is for the calibration data”

**Response:** To remove the ambiguity raised by the sentence, we have replaced “so is for the calibration data” by “similar accuracy was obtained for the calibration data”.

Line 20: Omit “which outliers are not removed”

**Response:** The words of “which outliers are not removed” have been omitted.

Line 23: “Thus, BY filtering”

**Response:** Modified as suggested.

Line 24: “but wMAPE ONLY SLIGHTLY INCREASED from”

**Response:** Modified as suggested.

Lines 37 – 42: These two sentences needs to be re-worked for grammar and meaning.

**Response:** We have re-worked and replaced the original sentences by the following:

“The proposed model uses ground-based sources as input. It assumes (1) the aerosols are well-mixed, and (2) the air above the planetary boundary layer (PBL) is aerosol free. Any aerosol, if present, above the PBL is not taken into account by the model. If these assumptions are true, the model can then be correctly compared to the columnar measurement of the sun photometer. However, in reality, aerosol could be present above the PBL, or not always well-mixed, giving rise to some uncertainties in the AOD predicted by the model. These uncertainties are quantified in terms of RMSE.”

p. 13

line 6: “above THE boundary layer”

**Response:** Modified as suggested.

line 9: “of aerosol residual LAYERS ABOVE the PBL”

**Response:** Modified as suggested.

Line 29: change to “Particles TRANSPORTED within the free”

**Response:** Changed.

Line 39: “potential OUTLIERS removed”

**Response:** Modified as suggested.

p. 14:

Line 29: “the result of THE comparison”

**Response:** Modified as suggested.

Line 34 – 37: Omit last two sentences of paragraph.

**Response:** The last two sentences of paragraph have been omitted.

p. 15

Line 36: “in analyzing THE proposed model”

**Response:** Modified as suggested.

Line 41: “in THE current study”

**Response:** Modified as suggested.

p. 16

Line 2: “which MAKES sense”

**Response:** Modified as suggested.

Line 13: “stress-TESTED”

**Response:** Modified as suggested.

Line 14: “using A higher”

**Response:** Modified as suggested.

p. 30

Line 11: “using A moving”

**Response:** Modified as suggested.

Figure 4 caption: add a reference to HYSPLIT.

**Response:** We have added in the reference (Draxler and Hess, 1998) to the caption in Figure 4. In fact the reference to HYSPLIT has been already mentioned in the text in the methodology section.

Figure 5 caption: “500 nm FOR 2012 and 2013”. The figure x-axis should have a label of “Julian Days”.

**Response:** We have modified the caption to read

“Figure 5. Predicted and measured AOD at 500 nm for 2012 and 2013 for validation dataset (subset 2, with 395 data points) ...”.

The label “Julian days” has also been added to the x-axis.