2nd review of the manuscript by Tan et al. submitted to ACPD.

The authors have been able to clarify the manuscript and improve the section regarding lidar validation. However, there are still number of points that have to be improved before this manuscript can be published.

First of all, the link between the aerosol typing and the AOD prediction model is still missing. In section 3.5 the authors speculate on the effect of aerosol types on the performance of the prediction model but in my opinion the discussion is not convincing (see specific comments for more details). Especially, when the authors claim that the best model version is the "overall" version which is not season/aerosol type dependent.

Secondly, there are still too many confusing parts which need to be clarified. If the reviewers are not able to follow the story, then other scientist that read the paper quickly won't have a chance. It's hard to follow which data set is used where and how the different numbers relate. For example, the authors mention in the abstract that the R^2 value is 0.68 but in the conclusions they mention that R^2 values are < 0.72.

Thirdly, the lidar part has to be explained better. Now, a lot of information is missing (e.g. how the lidar profiles were calculated) and there are strange gaps in the data presented in figure 10. Furthermore, the figures should be presented in the same time format.

Finally, the motivation of the study is a bit fuzzy. In the abstract the authors mention atmospheric correction (for what do you need this in cloudy cases?) and in the introduction they mention air quality (which is redundant because you have the API data). There is also more meaningful motivation discussed in the introduction and these should be mentioned in the abstract and conclusions.

I also think that there are too many figures and some of them do not bring much to the discussion, thus, they could be left out.

Specific comments:

p1, l19: usually references are not given in the abstract.

P1, l26: the R^2 value is different than in the conclusions or the tables. What value this is?

p1, l30: "atmospheric correction": for what? If you are providing AOD values for cloudy cases, they are not much use for satellite products such as surface albedo because the measurements can not be made in cloudy cases.

p1, l33: "human anthropogenic": human is redundant

p1, l35: "right circumstances": which are what?

P1, l38: "small scale studies": give references

p2, l4: "sufficient measurements": measurements of what?

P2, l15: combine → be mixed

p2, l17-18: You are using air quality index in your prediction. Isn't that a better metric for for air quality than AOD?

P2, l41: Mention here that you are using direct sun data.

P3, l16: Use the same format for coordinates throughout the paper. (see p2, l41)

p3, l34: give reference for Hysplit.

P3, l40: AERONET → the AERONET web page

p4, l5: explain the calculation of API in more detail because this is an important parameter for the model and its link to PM is not straightforward. If I have understood correctly, the reported API value is the maximum of the individual indicies for different pollutants. This means that the conversion of API to PM10 could be overestimated at some occasions.

P4, l22: calculation of %MRE: you call this parameter mean relative error but isn't this actually relative error of the mean? They sound the same but they are slightly different. Based on the presented equation the difference is calculated from the averaged AOD values. In my view, you should first calculate the difference between each individual comparison and then calculate the average from them to be more exact. I would suggest you calculate the %MRE like this
%MRE= $\sum \left|(AOD_{p,i} - AOD_{m,i})/AOD_{m,i}\right| / N * 100$,
where the subscript *p* refers to predicted, *m* to measured and *i* to individual measurements. N is the total number of measurements. I would also encourage to do the comparison with absolute values because the comparisons can result in positive and negative values which could improve the statistics by canceling out big differences. For example, if you have two measurements and the first measurement is overestimated by 0.6 and the second underestimated by the same amount that would give a %MRE of 0 with the current method and 0.6 with the method I'm proposing. If you think that absolute values are not suitable here, at least, calculate the average from the differences and not the difference from the averages.

P5, l12: “the measured counterpart”: measurement of what done with what? AERONET AOD?

P5, l13: give reference for the lidar system.

P5, l15-16: This sounds suspicious. Why didn't you just use all the available lidar data? That would give more reliable results.

P5, l21: “values so obtained” → values obtained

p5, l27: is → are

p5, l35: clarify the sentence. Why are Angstrom exponent and precipitable water related in this sentence?

P6, l9-15: use the same nomenclature in the text and in the figure: October-November → post-monsoon

p6, l40: “frequency data” → data
p7, l13-15: What does turbidity have to do with this study? This sentence could be removed.

P7, l17: This information was already mentioned on rows 9 and 10. Remove the sentence.

P7, l30: This statement underlines my question: why are you doing aerosol typing in this way if it is so uncertain?

P8, l16: “reach in” → reach

p9, l8-9: This sentence needs rewording.

P9, l14: If you are talking about the figure 1, mention it in the text.

P9, l14-15: This sentence needs rewording.

P9, l16: Same model for all seasons or different models for different seasons.

P9, l24: “<” → values were smaller than

P9, l26: “vice versa”, do you mean that predicted AOD increased atmospheric AOD? Reword.

P9, l30: How well does the overall version perform at different seasons? Is it better or worse than the seasonal models? You would assume that the seasonal models are better there if the seasons/aerosol types have some effect to the results.

P9, 31: Why the R^2 values are different for northeast monsoon and pre-monsoon while the mean AODs, RMSE's and %MRE's are almost identical? I would argue that the better correlation is caused by a wider distribution of AOD values for the pre-monsoon and southwest monsoon and not the flow patterns.

P9, l41: “broad region”: isn't this range same for all seasons?

P10, l1-11: I'm not convinced by this discussion. I think more important than the aerosol types is the distribution of AOD values. The wider spread of AOD you have in the training of your model, the better performance it will have. This is in line with the fact that you got the best performance with the overall model which does not depend on aerosol types. How does that fit in with this discussion about aerosol types?

P10, l9: “air quality”: do you mean PM10?

P10, l10: “environmental factors”: chemical composition and aerosol size distribution are not environmental factors. They are aerosol properties that are embedded in the AOD values.

P10, l13-35: This is the most confusing part of the paper. It is not clear where all these values are coming from (what are the different versions of the predictions) and how do they relate to the previous values. For example, what is this R^2 value of 0.68? How does it differ from 0.72 that was given in the previous section? Are these values compared to the same AERONET data as in the previous section or

not? State clearly that which values are coming from which version of the model and what kind of AERONET data is used. I would suggest that you put all these values in a table so it will be easier to compare them.

P10, l26: Here you say that R^2 was not improved but on line 23 you mentioned that R^2 was enhanced. This is a really confusing part.

P10, l42-43: The sentence about underprediction is not clear.

P11, l4-5: Are you saying that overprediction in your estimates is caused by local fires?

P11, l11-14: This information is not needed and figure 6b could be left out. Instead, you should tell more about the lidar system. For example, how was overlap dealt with and what is the lowest usable altitude? Did you use single profiles in the analysis or did you use time-averages of the lidar data?

P11, l16-19: I still don't understand this sentence. Do you mean that the predicted AOD was overestimated by 0.04 at 10:00 and underestimated by 0.04 at 11:00? If so, you have to reword the sentence. What are the measured AODs at these times?

P11, l38-39: I don't understand this sentence.

P11, l41: “examine into” → examine

P11, l41: Why were these windows selected? Why didn't you use all the available lidar data? It would be better to use all data available because then the validation is more comprehensive and more reliable.

P11, l43: “CIMEL sun photometer” → AERONET

p12, l3: You just show that the model gives values for each hour. This is quite evident so I don't think you need a figure to show this. It would be more interesting to see a day when you have a lot of AERONET measurements. Then you could see how well the predictions match with the measurements.

P12, l7-16: This part could be left out because it doesn't bring much to the analysis. It's hard to compare backscatter profiles with AOD time series. Figure 10 is much more informative.

P12, l17 – p13, l12: This part should go to the method section. Define equations before referring to them (e.g. Eq. 5)

p13, l13: Do you have to remote the lidar profile if it has a cloud? Couldn't you just mask the cloud and calculate the AOD?

P13, l21: Explain the hypothesis also here.

P14, l19-20: What do you mean by optical properties here?

Table 1: Month → Number of months

Table 3: Add the number of measurements and mean AOD for each season to the table.

Figure 4: I still think that this figure should be redone. The scales and regions are different which makes comparison between the plots difficult. If the scales do not provide any information why are they shown?

Figure 5 and 7: Still don't understand what is the difference between these two figures. Explain the difference more clearly in the text.

Figure 6: Plot a) is confusing because you mention in the caption that there is a gap in the lidar data but it is not shown in the plot. Clarify the plot. As I already mentioned, b) is not necessary because you are showing backscatter profiles.

Figure 8: This figure could be left out because it shows an evident thing.

Figure 9: This figure could be left out because Figure 10 is more informative. Maybe you could combine 9a with Figure 10. Why are there gaps in the time series shown in 9a? Now the plot is a bit misleading because the gaps are not shown.