Review of manuscript AMTD-2017-386: Spatial distribution analysis of the OMI aerosol layer height: a pixel-by-pixel comparison to CALIOP observations by Chimot et al.

The paper discusses the application and evaluation of a novel technique to retrieve a measure of aerosol layer height based on a Neural Network based technique. Overall, the paper is well written and should be published after the authors address my, mostly-minor, comments below.

My main comment has to do with the evaluation of retrieved dust layer height and the uncertainty analysis

I do not understand why they have chosen events during periods (post row-anomaly) when the evaluation using CALIOP data is impossible. The authors should re-do their analysis of the OMI NN dust-retrieval method making use of observations between the launch of CALIOP (mid-2006) and the beginning of the OMI row anomaly problem by the end of 2008.

The authors have discussed an uncertainty analysis associated with the assumed values of physical parameters used in the generation of NN training data sets. No error analysis, however, is performed regarding AOD. There seems to be an implicit assumption that the MODIS provided AOD is error-free. There are two ways the uncertainty of the MODIS AOD will propagate to the OMI ALH retrieval:

1) Uncertainty of the MODIS algorithm associated with assumptions on surface albedo, SSA and particle size and shape. Over the oceans, MODIS uncertainties in surface albedo and angstrom exponent are generally very low. The effect of particle shape, however, is non-negligible. Assumed SSA albedo is another source of error. MODIS retrievals over land are subject to uncertainties to all above listed parameters.

2) Even if all internal MODIS algorithm uncertainties are well characterized and propagated to the NN ALH retrieval, there is still the issue of the spectral consistency of the assumed aerosol models. Is the NN algorithm designed to assume the same aerosol type as identified by the MODIS algorithm? There may be cases, particularly over land, when the algorithms select different aerosol types. The use of MODIS-AOD for a particular model may not be reasonable for the OMI NN assumed model. It would therefore be desirable to have a consistent retrieval algorithm providing both the AOD and ALH.

Please elaborate on the above-stated points.

Other comments:

Page 3, line 4 suppress ‘ideally’

Page 3, line 18 add ‘channel’ after O_2-O_2

Page 3, line 19 replace ‘the present’ with ‘the current’

Page 3, line 20-21, last sentence is paragraph is confusing and actually unnecessary. Remove it.

Page 5, line 24, provide a reference (or elaborate on performed sensitivity analyses by the authors) to substantiate the statement that the AMF does not depend on the aerosol scattering phase function.

Page 8, line 12, spectral characterization applies to the radiation not to the particles. Please rephrase.

Page 8, line 26, use the 1064 nm measurement instead of the 532 one. It has been shown by several publications that the CALIOP's 532 attenuated backscatter signal attenuates very rapidly in the presence of smoke layers and, therefore, does not capture the full vertical extent of the layer.

Page 9, lines 28-30 and Page 10, lines 1 to 8. This is not a new finding. Problems with the CALIOP 532 nm measurement have been demonstrated by the quoted literature. The authors should just work with the 1064 channel that works well for all aerosol types.

Page 10, lines 19-27. The poor performance of CALIOP's 532 nm channel is mostly instrumental (i.e., low laser power). As shown by Kacenelenbogen et al. [2011], the HSRL 532 nm channel works equally well for all aerosol types.

Page 10, line 28. CALIOP data should not be used to evaluate the NN OMI ALH product because of the loss of OMI-CALIOP collocation after Dec 2008 due to the onset of the row anomaly. There are however, 30 months of data (July 2006 to Dec 2008) that offer hundreds of dust events when full OMI-CALIOP collocation is possible. The authors should replace the currently used post-2008 case studies, with pre-2009 events. Dust activity is seasonal. Therefore, it is not difficult to find 'good' dust cases in the pre-row anomaly period of OMI observations.