Response to Review 2
We thank Dr. Lahoz for his thorough review and thoughtful suggestions.

Question: *P. 2, L. 3: There seems to be a bracket missing.*
Answer: We made the change.

Question: *P. 4, L. 7: Could you provide an indication of the percentage error associated with a value of 0.015?*
Answer: 0.015 is the instrumental error and does not vary as a function of AOD, as suggested by Holben et al., 1998. For example, for two AEROENT AOD values of 0.1 and 1.0, the uncertainties are both 0.015, and therefore, an error represented by a percentage is not appropriate. However, we modified the text to avoid the confusion. We changed the text to: "a reported uncertainty of approximately 0.01 - 0.02 in AOD (wavelength dependent) due to calibration"

Question: *P. 4, L. 15: I suggest replace "blur" with "overcome".*
Answer: Done

Question: *P. 4, L. 19: Is it not the case that a height-resolved satellite retrieval represents a 3-d spatial observation (2-d in the horizontal plus a vertical range). Could you clarify this?*
Answer: Thank you very much for the suggestion. 3-D structures of aerosol plumes can be resolved by active sensors such as CALIPSO. However, passive sensors such as MODIS provide measurements that can only be converted to column integrated values such as AOD currently. We modified the text to clarify the issue. We changed from" a satellite retrieval is a two dimensional spatial observation at a given time" to "a satellite retrieval from passive sensors such as MODIS represents a column integrated two-dimensional spatial observation at a given time"

Question: *P. 5, L. 16 and elsewhere: Do you mean "over water" (to include ocean and lakes) or "over ocean"? You use the term "over ocean" almost elsewhere in the paper.*
Answer: We changed "over-water" to "over-ocean" throughout the paper to be consistent.

Question: *P. 6, L. 17: "refer" -> "referred".*
Answer: Done.

Question: P. *6, L. 20: "on MODIS retrieved" (replace "to" with "on").*
Answer: Done.

Question: *P. 7, L. 3: "year" -> "year's".*
Answer: Done.

Question: *P. 7, L. 8: "however, this is beyond".*
Answer: Done.

Question: *P. 7, L. 17: I suggest: "Following improvements made to the MODIS C5 aerosol product (Remer et al., 2008), a nine-year analysis was performed and compared with the one year of analysis from Zhang and Reid (2006)."*
Answer: Done. Many thanks for your suggestion.

Question: *P. 9, L. 25: Is Eq. (5) a fit? What is the (typical) residual given the parameters calculated?*
Answer: Eq. (5) is a regression. It was used to correct the original MODIS C5 AOD (for AOD less than 0.2) based on the near surface wind speed and the cloud fraction. The detailed error budget of the modified AOD is analyzed in the validation section.

Question: P. *10, L. 6: I suggest: "Both Zhang and Reid (200?6) and this study suggest that biases in the over water MODIS AOD data can be characterized by cloud fraction and the 'nu' value."*
Answer: Done. Many thanks for your suggestion.

Question: *P. 10, L. 21: Is Eq. (6) a fit? What is the (typical) residual given the parameters calculated?*
Answer: Eq. (6) is also a regression. It was used to correct the original MODIS C5 AOD (for AOD greater than 0.2) based on fine mode ratio and cloud fraction. The detailed error budget of the modified AOD is analyzed in the validation section.

Question: *P. 10, L. 27: "details of the".*
Answer: Done.

Question: *P. 11, L. 21: "Figure" -> "Figures".*
Answer: Done.

Question: P. *11, L. 24: "decreases for all". For all what?*
Answer: Changed to "decreases for all AOD cases".

Question: *P. 12, L. 15: I suggest: "Terra C5 and the data produced in this study." And I suggest a similar change in L. 17 and in P. 13.*
Answer: Done.

Question: *P. 12, L. 18: "noises"-> "noise".*
Answer: Done.

Question: *P. 13: Kindly reword: "The cloud contamination introduced fluctuations of RMSE are weakened, indicated that the cloud introduced uncertainties and noises are reduced."*
Answer: Done. We changed to: "The noise floor values decrease as the percentage of cloud fraction decreases indicating that the cloud-induced uncertainties are reduced for retrievals with less cloudiness."

Question: P. 13, L. 15: I suggest "As discussed above". Unless you mean something else by "before".
Answer: Done. We change to "As discussed above".

Question: P. *13, L. 16: I suggest "troublesome"-> "problematic".*
Answer: Done.

Question: *P. 13, L. 20: I suggest: "we estimate that over the southern oceans the corrected MODIS AOD data have 30–35% of RMSE reduction compared with the original MODIS AOD."*
Answer: Done.

Question: *P. 14, L. 1-2: Is there a pattern in the improvement? Is this better over particular areas?*
Answer: Yes. As pointed out by several studies (e.g. Smirnov et al., AEROCOM, 2010; Gao Bocai, personal communication), the aerosol band over high latitude southern oceans could be an artifact due to cloud (especially cirrus cloud) contamination. Our study also suggested that we could reduce the suspicious aerosol band over southern oceans by applying stringent cloud screening criteria. The details are discussed in Page 12 "Again, the primary patterns are preserved and the suspiciously high AOD band over the southern oceans is removed, suggesting that the potential cloud contamination issue exists in both Terra and Aqua aerosol products."

Question: *P. 14, L. 12: Define 'nu' to aid the reader.*
Answer: 'nu' is defined at P6 L16. We added "fine mode AOD fraction" here to remind readers. Many thanks for the suggestion.

Question: *P. 14, L. 19: "over the southern oceans".*
Answer: Done.

Question: *P. 15, Hogan et al. reference: Check the style, should all text (e.g. TDOTNO) be there?*
Answer: Done.

Question: *P. 20, Fig. 2 caption: I do not understand the comment of "large AOD cases" after "red lines". The red lines go down to zero, albeit with a break. Please clarify.*
Answer: We changed from "large AOD cases" to "for AOD > 0.2 only".

Question: *P. 24, Fig. 6 caption: I would say the black color represents land, so no data (as only the ocean is considered). Otherwise your statement suggests that there are areas over the ocean without data. Is this the case?*
Answer: Thanks for your suggestion. We added the following discussion: "black color represents land".

Question: *P. 25, Fig. 7 caption: "comparing" -> "compared".*
Answer: Done.

Question: *P. 26, Fig. 8 caption: “comparing” -> “compared”.*
Answer: Done.