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Atmospheric Measurement Techniques Discussions

Interactive comment on "Science impact of MODIS C5 calibration degradation and C6+ improvements" *by* A. Lyapustin et al.

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We would like to thank all the Reviewers for providing thoughtful comments and questions that lead to improvement of the manuscript.

Anonymous Referee #1 General Comments: Based on MODIS level 3 data and MAIAC analysis, this paper presented that (1) due to on-orbit degradation, the MODIS on Terra showed systematic calibration trends, which can be seen from the C5 MODIS Terra datasets in the visible and near-infrared bands; (2) a majority of the C5 calibration trends are removed with the MODIS C6 calibration; (3) some residual errors are resulted from the change of polarization sensitivity of the sensor and the polarization correction approach is introduced to remove them; and (4) a MAIAC-based de-trending

and cross-calibration method is developed to account for the residual Terra-Aqua bias, which leads to the C6+ dataset that brings the trends in Terra and Aqua MODIS together (almost indistinguishable) and shows promises in future science analysis. The logic flow of the article is clear and the analysis is very much needed by the community. I recommend publication of the paper after some minor revisions. Specific comments are listed below.

Specific Comments: 1) Page 7286 and Figure 1-middle: why does the AOD from Terra have a consistent positive bias compared to Aqua? If the retrieval algorithms for Terra and Aqua are the same, since the Terra TOA reflectance has a downward calibration trend, shouldn't the Terra AOD be biased low?

Reply: The strong downward calibration trend was observed in MODIS Terra Blue band (B3) which is used for the DT aerosol retrievals over land. The DT ocean aerosol algorithm uses a different set of bands (p. 7286, Ln. 11-14). The primary band for retrieving AOD over ocean is B2 (0.87 mkm) which did not have a strong downward trend in C5. The most probable cause for the B2 bias between the two sensors is the difference in the pre-launch calibration. Since the on-orbit calibration is tied to the pre-launch calibration, this difference remained for the duration of MODIS Collection 5.

2) Page 7288: regarding the MCST C6 calibration, it appears to me that using moon view and Earth view ratio (Moon/EV) as the normalization coefficient would only make the trends in Earth view and Moon view consistent with each other. It isn't clear to me how this procedure can also remove a large portion of the calibration trend (Figure 5). More explanation would be helpful.

Reply: Since the Moon reflectance is stable, the Moon view provides de-trending for the SV angle of RVS (AOI=11.5 deg.). Therefore, the ratio (Moon/Earth_view) at AOI=11.5 deg. will help remove the major calibration trend (to the accuracy of procedure) at AOI=11.5 deg. At other angles of RVS, the de-trending coefficients obtained over stable desert sites should be normalized by the ratio (Moon/Earth_view) at AOI=11.5deg. to

obtain the final calibration for the full RVS. More details can be found in the references to the C6 calibration procedure provided in the paper.

3) Page 7293, first sentence from the top: does the author mean to say ": : :., while it almost removes the entire trend : : :"?

Reply: Correct. To make the sentence clear, it was changed as follows: "Thus, while the MCST C6 L1B calibration removed most of sensor degradation trends . . ."

4) Page 7294 (regarding Figure 10): "blue color shows C6 Aqua data", please make the description and the figure match.

Thank you for this comment. The typo was corrected as follows: ". . .Fig. 10, where the left plots show C6 Terra (with PC for B3) and the right plots show C6 Aqua data."

5) Section 5: from the context, the justification for the MAIAC-based de-trending procedure is that trends existed in the selected desert sites are non-physical, but is this true? Additional justification would be helpful.

Reply: You are correct, of course. However, these sites were carefully selected and recommended for satellite calibration by CEOS based on multiple criteria, including the long-term stability. This is a practical approach given the lack of continuous observations of Moon in every calibration cycle by MODIS.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 7281, 2014.