Atmos. Meas. Tech. Discuss., 7, C3529–C3532, 2014
www.atmos-meas-tech-discuss.net/7/C3529/2014/

Atmospheric Measurement Techniques Discussions

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

A. Lyapustin et al.

Alexei.I.Lyapustin@nasa.gov

Received and published: 5 November 2014

General Comments: The paper "Science impact of MODIS C5 calibration degradation and C6+ improvements" by Lyapustin et al. (2014) performed careful assessment of the impact of MODIS C5 calibration degradation as well as C6 and C6+ calibration improvement on some atmospheric and terrestrial products from the perspective of long-term trend. It is indeed that detection of a sensor calibration trend and its distinction from physical variations is very challenging and the authors' effort in the paper deserves applaud and the results will benefit the user community greatly. The study performed in this paper is generally through and the results are mostly convincing. I only have some minor comments below and hope they can be addressed in a recom-

mended minor revision.

Comment 1: The de-trending coefficients derived in section 5.2 are averaged from the results of 4 selected desert sites. Then, Rn_TOA from one of the four sites (Libya4) is used to check the improvement using the new coefficients as shown in Fig. 11. The improvement is achieved indeed in the Libya4 site which is used as one of the 4 sites deriving the coefficients (in other word, the check is not completely independent). Actually, a more convincing and independent check is to applying the new coefficients to an independent desert site not involved in the derivation of the new coefficients to see the improvement, such as one of the three desert sites excluded from the derivation of coefficients mentioned in the paper.

Reply: We can demonstrate similar improvements for the other 3 (of 4) desert sites used in the analysis. Unfortunately, the three excluded sites cannot be used for this purpose because "Niger showed a factor of 3–5 stronger seasonality resulting in unreliable trend, while Sudan1 and Mali1 produced much larger and opposing trends (p. 7294)." Analysis of what exactly is happening with these sites is a large effort beyond the scope of conducted analysis. Your suggestion is definitely a valid one: overall, CEOS recommended over 11 desert sites for calibration, however MODIS subsets were provided by the MODIS Adaptive Processing System (MODAPS) only for seven sites which we have used in this work.

Comment 2: The BRFn over desert was first used to develop de-trending calibration coefficients, which turns out to be ineffective due to some residual trends. Thus, Rn-TOA was identified as a more proper variable to develop the de-trending coefficients as mentioned/ demonstrated in the paper, which deserves a mention in the abstract.

Reply: Indeed, it would be much easier to do analysis based on BRFn. However, the sensors provide the top-of atmosphere measurements, and for this reason, for example, we can only cross-calibrate different sensors based on the geometry-normalized top-of-atmosphere reflectance to which gain factor can be applied. Regarding your

suggestion, we would rather not change the Abstract because BRFn and Rn_TOA are not easy to explain in 1-2 sentences.

Comment 3: It is nice to use the BRFn of Georgia tile to demonstrate the improvement of C6+ calibration developed from Rn_TOA. I believe more elaboration and discussion are needed to generalize this Georgia tile case to global application.

Reply: This is not easy or straightforward for a number of different reasons including disturbance from human activities, wildfires, La Nina/El Nino cycles, prolonged droughts etc. which create natural trends in the land surface reflectance. On the other hand, MAIAC, which is expected to become an official MODIS algorithm in several months, will produce BRFn values that can be used for the suggested global analysis by interested researchers.

Comment 4 (page 7288, line 3): I am not sure this 0.01 ($\sim$1.5%) NDVI decreasing trend is due to calibration degradation as the 27% AOD and 17% COT decreasing do. One way to check it is using NDVI at TOA without doing atmospheric correction (AC). I suspect this small 1.5% signal is due to the error from AC but I may be wrong.

Reply: The same algorithm is applied to both Terra and Aqua, therefore the trend is not due to the processing algorithm. While 0.01 difference in NDVI may seem a small value, it translates to a very large difference in the gross primary productivity globally, as we mention in the paper. The extensive experience of the land studies shows that atmospheric effects on Top of atmosphere NDVI are not small, therefore a long-term analysis based on TOA NDVI would inherently be much less robust.

Comment 5 (page 7289, line 8): replace “right” in “The right plot: : :” with “bottom” since the two plots are arranged in vertical not in horizontal direction.

Reply: Thank you for this comment. The text was corrected according to your suggestion.

Comment 6 (Fig.9): The plot is somewhat too busy to see the difference. How about

also plot the difference between Aqua_C6 with Terra_C6 and Terra_C6_PC?

Reply: Originally, this Figure also contained the C5 curve which we had to drop for the same reason. The current plots allow to see the difference between the calibration versions and the two MODIS sensors. Because the temporal difference between different curves in not systematic, the suggested difference plots will be very difficult to interpret.

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