Insight into the improvement of PARASOL Radiometric In-flight Calibration

The PARASOL mission was launched in December 2004 and was a member of the A-train up to end of 2009. The mission was definitively stopped in December 2013 after 9 years of operation. A temporal decrease of the radiometric sensitivity of PARASOL occurred with a complex signature within the field-of-view. Using several calibration techniques, all based on the use of natural targets, it was possible **to derive an efficient set of new calibration parameters,** which includes now the absolute calibration, and the temporal evolution characterized by a mean decrease plus a variation within the field-of-view. The updated calibration, based on a synergy between various calibration methods, has significantly improved the radiometric consistency for all spectral bands of the PARASOL data archive which represents nearly 9 years of acquisitions. The full PARASOL level-1 archive was reprocessed in 2014 in order to implement these corrections.

The latest version of the PARASOL Level-1 products (ICARE collection 3) includes the following radiometric improvements:

- Correction of an anomaly on the dark current correction. This anomaly was due to a variation of dark current with integration time badly implemented leading to a dark current residual more or less important depending on latitude and time. This error was small but became significant for dark targets, e.g. large enough to partly explain some abnormal background residues on the aerosol retrieval over ocean;
- Improvement of the mean instrumental drift correction as historically described in Fougnie and Bach (2009). The end-of-life reevaluation of the drift is now based on a multi-methods calibration approach using the whole available time series and leading to a more robust estimation. As a result, the drift was slightly adjusted by 0.5% for all bands except bands 443 and 1020nm for which a very significant adjustment by about 5% after 8 years was necessary (these bands were previously overcorrected). Considering the consistency observed between all methods, the drift can now be considered as being corrected to an accuracy close to 0.5% over the full archive (Fougnie, 2013 and 2015).
- In Fougnie and Bach (2009) the ageing was corrected assuming a constant value for the whole field-of-view of the instrument. However, it was detected (see for instance Fougnie; 2011) that the ageing cannot be considered as identical for all viewing directions. Consequently, a differential ageing has to be considered for each viewing directions of the field-of-view. The variation with viewing direction was large for short wavelengths (up to +/-4% for 490nm) and small in the near infrared (less than +/-1% for 865nm). These variations were modelled based on a multi-method calibration approach as described in Fougnie (2013 and 2015) and the correction was implemented for the new level-1 processing;

For all other performances, the level-1 archive can be considered as consistent with results described in Fougnie et al. (2007).

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