A Consistent EPIC Visible Channel Calibration using VIIRS and MODIS as a Reference

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Introduction
• EPIC onboard the DISCOVER satellite at L1 lacks onboard calibration
• Filter wheel radiometrically calibrated at TDR to monitor to measure stability
• EPIC’s constant view of Earth provides unique opportunity for inter-calibration of EPIC channels using well-calibrated instruments on low Earth orbit (LEO) satellites
• Inter-calibration is performed by ray-matching with MODIS on Aqua satellites and VIRIS on NPP-Suomi
• EPIC bands 1-4 are in the ultraviolet wavelengths and have no MODIS/VIIRS channel counterparts, and therefore are not considered here

Data
• EPIC-L.B bands 5-8
  - Version V01 is used for most of this study
  - Version V01 is briefly used for navigation analysis
  - Aqua-MODIS Collection 6 L2B
  - NPP-VIIRS Land PEATE L1 theoretical version 001
  - Aqua-MODIS Collection 6 L1B
  - EPIC’s constant view of the sunlit-disk of Earth provides unique opportunity for inter-calibration of EPIC channels using well-calibrated instruments on low Earth orbit (LEO) satellites

EPIC Navigation Correction using MODIS or VIIRS Images

EPIC's constant view of the sunlit-disk of Earth provides unique opportunity for inter-calibration of EPIC channels using well-calibrated instruments on low Earth orbit (LEO) satellites.

Comparison of ATO and DCC Ray-matched Calibration

- All-sky tropical ocean (ATO) gridded (0.5º x 0.5º) ray-matching, linearly regressed E7/B1 radiance pairs over tropical oceans
- Deep convective cloud (DCC) (0.25º x 0.25º) ray-matching, linearly regressed E7/B1 radiance pairs that have BT ~ 220K
- The DCC and ATO have their own unique SBAFs

Version 01 to 02: Stray-light Improvement

- All bands appear to be very stable, with the largest degradation only being 0.014%/year.
- The DCC and ATO temporal trends for all non-absorption band pairings are very similar, with their mean gains within 1%
- The absorption to bands 15 and 16 get worse due to differences in absolute calibration

Version 01 to 02: Navigation Improvement

- Image shift analysis indicates that navigation could still be improved, although in V02 it does appear more consistent than in V01.
- The most common shift seems to be +1 East and +1 North, with +2E/+1N also in high frequency
- All other channel channel pairings show similar 1st shift frequency
- Shifts using both MODIS and VIIRS show similar results

Conclusions
• EPIC Version 02 shows navigation improvement over version 01, but still could be further improved
• SBAF accounts for spectral differences and brings the offsets closer to zero
• The stray-light improvements in V02 also bring the offsets closer to zero
• ATO on DCC temporal trends for non-absorption band pairings are within 1% of each other
- All bands appear to be very stable, which is expected since the distance between Earth and DISCOVER is so vast