Absolute Calibration Correction Coefficients of GOES Imager Visible Channel: DCC Reference Reflectance with Aqua MODIS C6 Data

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Outlines

- DCC reference reflectance
  - Mode vs. median reflectance
- DCC and Sonoran desert-based calibration coefficients
- Impact on the integrated calibration method
- Summary

DCC Reference Reflectance: Introduction

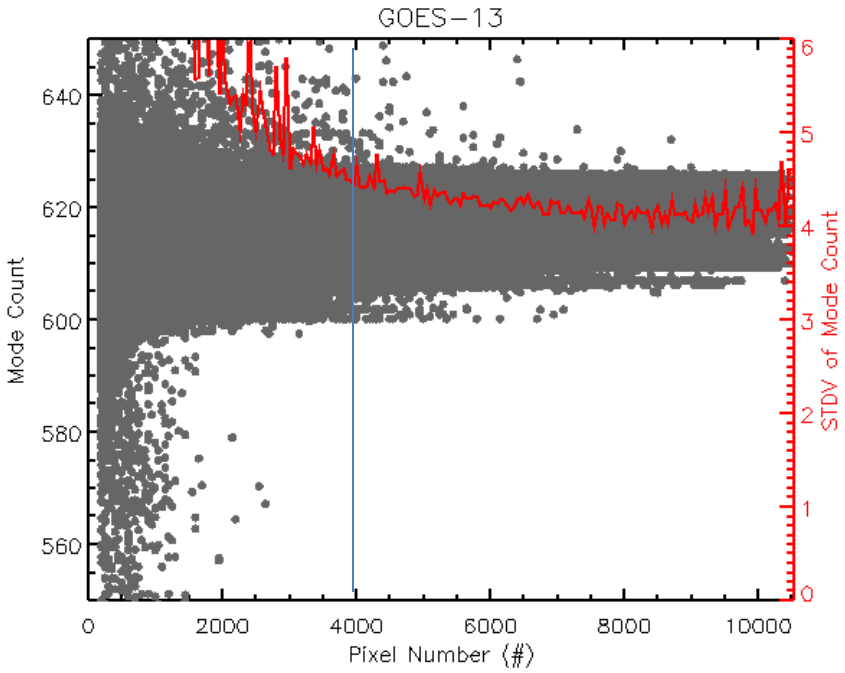
- **It is established that the DCC reflectance can be used for the trending of visible channels**
  - **Community criteria: spatial location, viewing/illumination and temporal thresholds**
  - **Need to apply BRDF correction: ADM models**
  - **Some GEO visible channels may show seasonal variations**

- **Mode or median reflectance**
  - **Comparable simulation results**
  - **At least thousands of accumulated monthly DCC pixels needed for a reliable result**
  - **Median reflectance is relatively easy to generate**

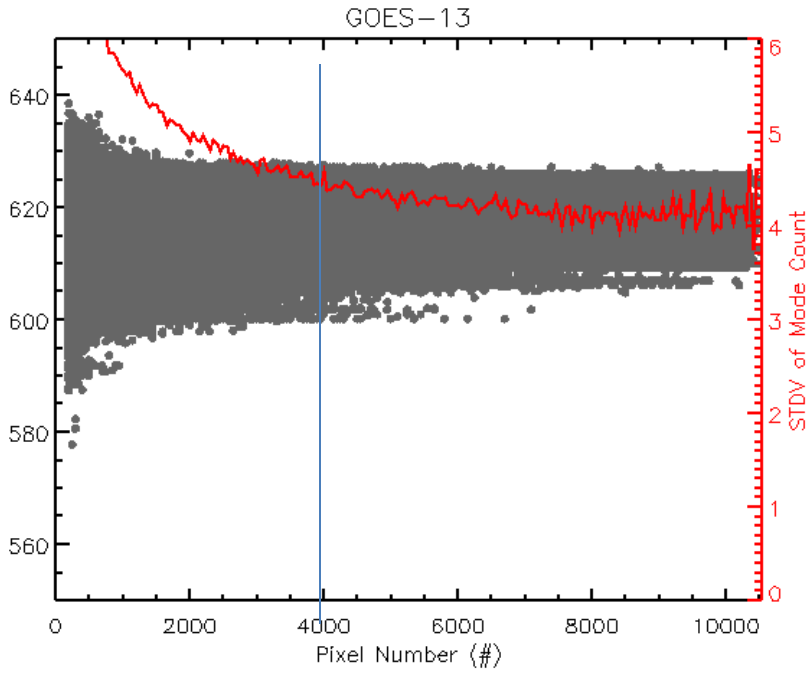
- **Reference reflectance is needed for the absolute calibration**
  - **Long-term stability**
  - **Variability: the uncertainty**

Minimum DCC pixels for a robust mode reflectance

Polynomial fitting of bi-mode



Mode without any fitting

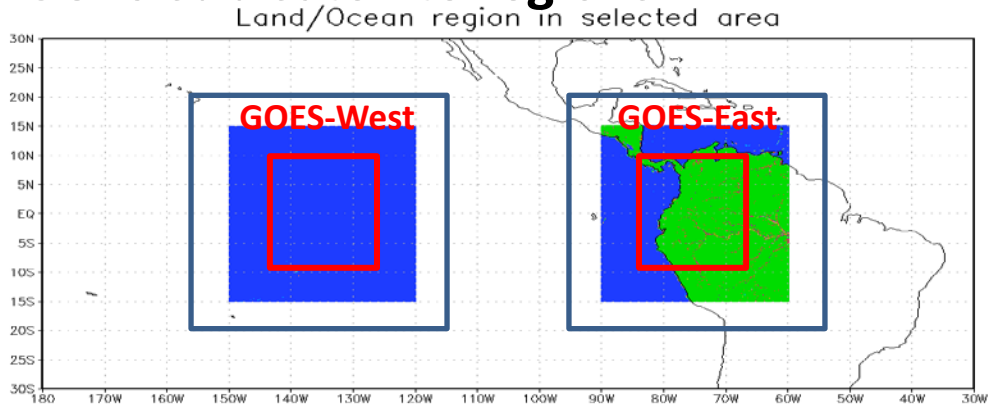


DCC#>4,000, 1-sigma stdv = 0.5%

DCC Reference Reflectance

- **Ideally, the DCC reflectance should be characterized with long-term reference instrument measurements at the monitored instrument viewing condition**
  - **Requires large computer resource and computing time**

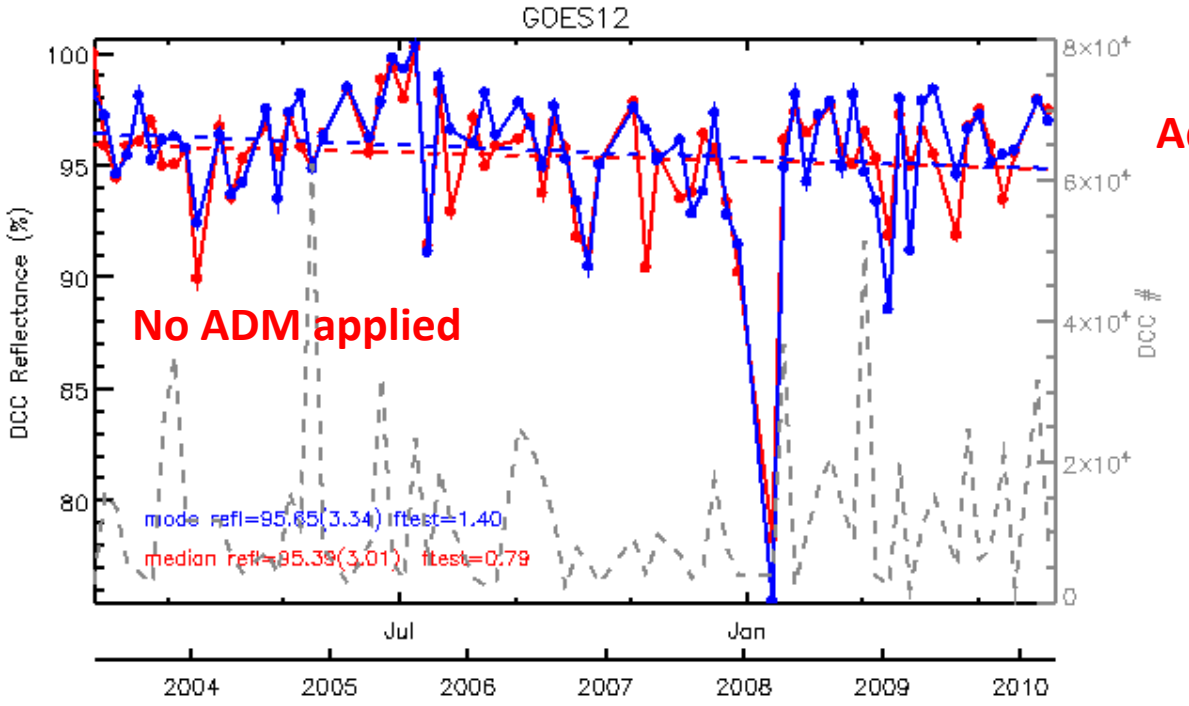
- **Ray-matching DCC pixels near GOES sub-satellite regions**
  - **±8.11**



- **Assuming the ADM correction works well to correct the viewing zenith angle dependent reflectance**
  - **Hu's ADM applied in this study**

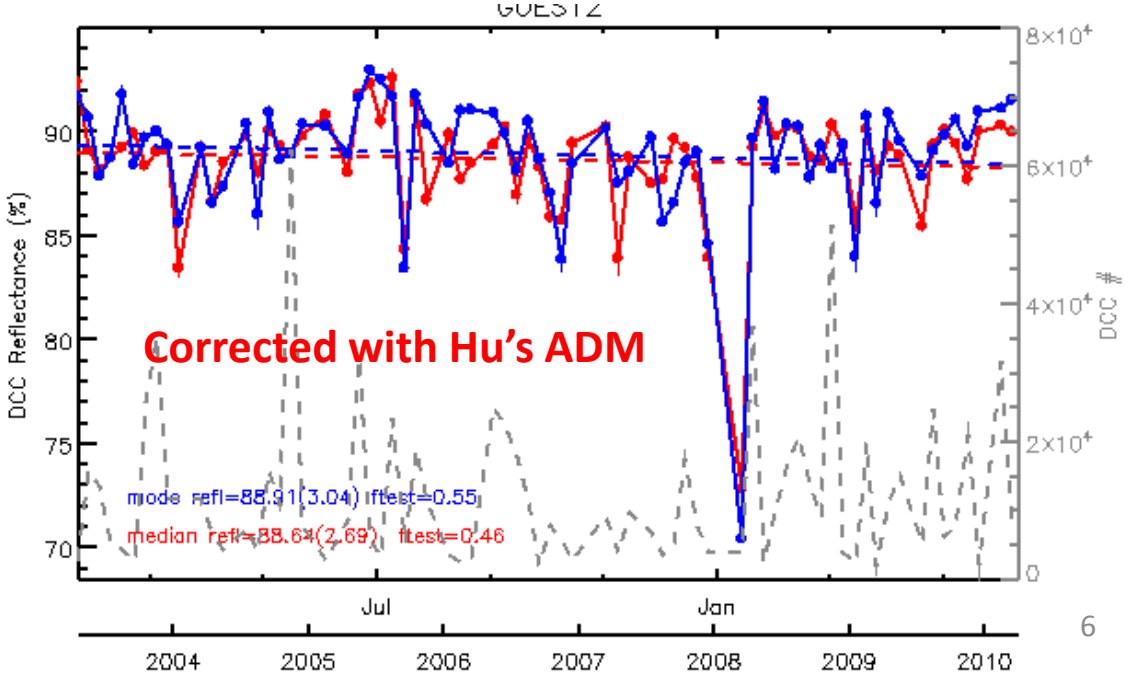
- **GOES-12 as the example**

Aqua/MODIS DCC Reflectance



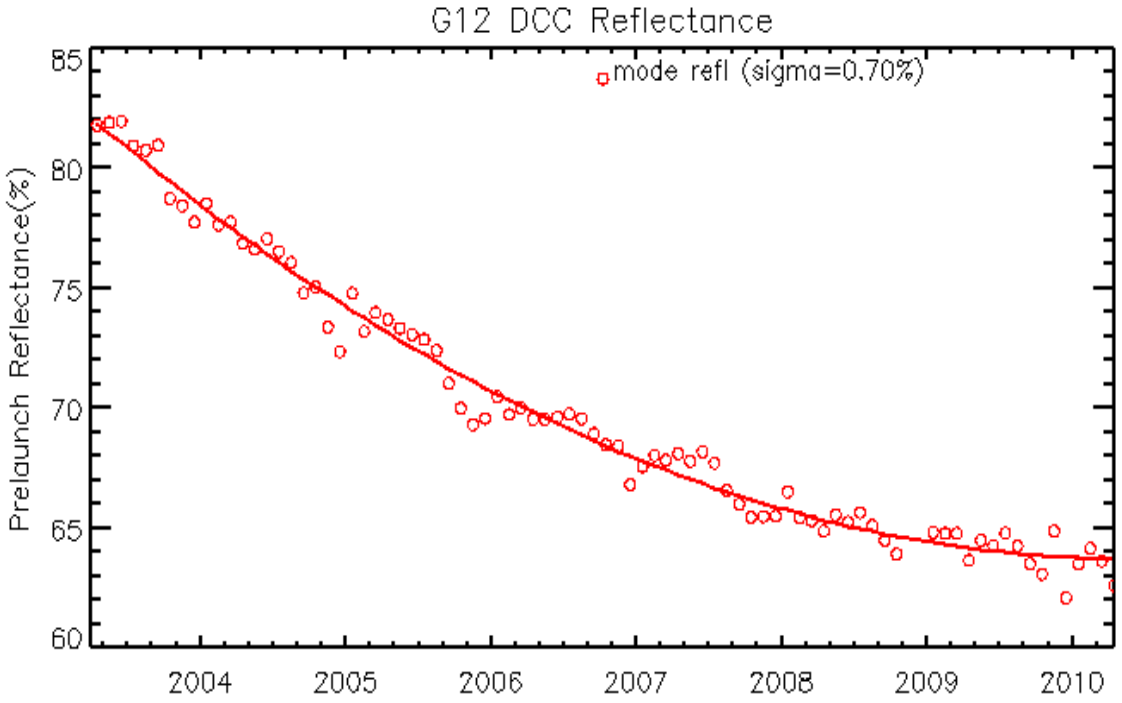
- minimum dcc# = 2000
- the anomaly around Feb 2008 is unknown
- No significant trending for both mode and median refl.
- median reflectance has slightly low standard deviation and slope values

- the seasonal variation observed at GOES-12 DCC trending is not apparent here. This may be because the ray-matching area is mainly over land.
- ADM correction reduces the reference reflectance, therefore need to be consistent with the ADM application



Calibration Coefficients Reference to Aqua MODIS C6

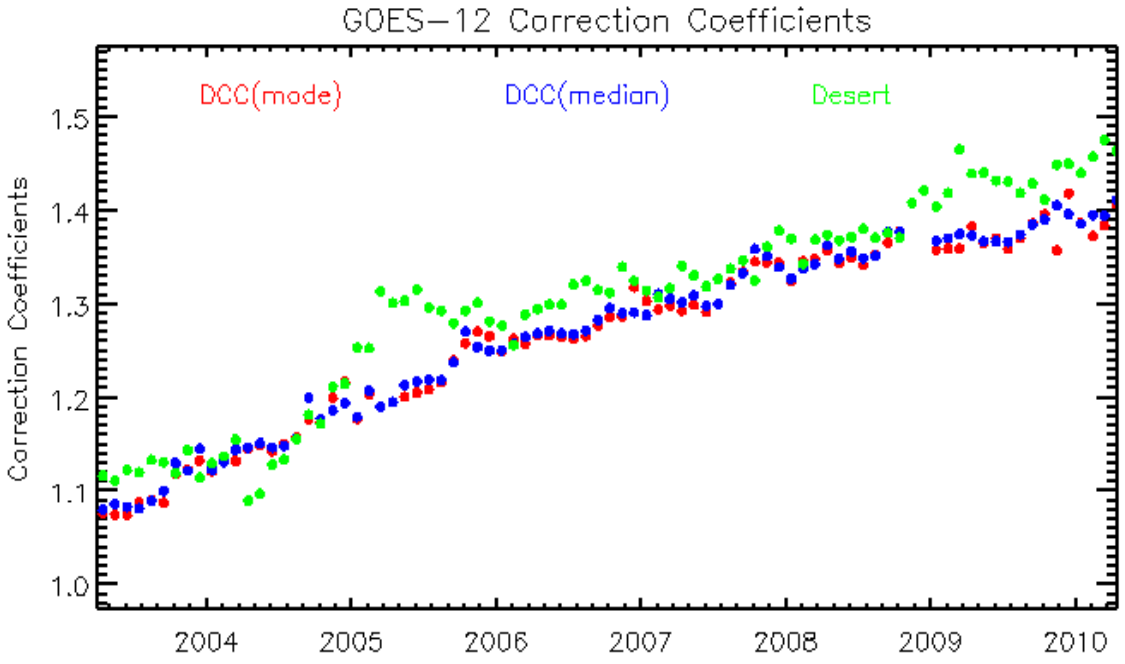
$$Cal\_correction\_Coeff = \frac{\mathrm{Re}\, f\_reflec\tan ce}{prelaunch\_calibrated\_reflec\tan ce}$$



GOES DCC reflectance is corrected with Hu's ADM model

Sonoran Desert vs. DCC Cal. Coeff.

GOES-12	MODIS measurement (%)	Band Correction	Uncertainty
DCC(mode)	88.91	0.99	-
DCC(median)	88.64	0.99	-
Sonoran Desert	32.51	0.97	-



Possible causes of the difference:

- bias in the reference reflectance
- variations in the reference target
- Change in the instrument which can only be detected with certain method

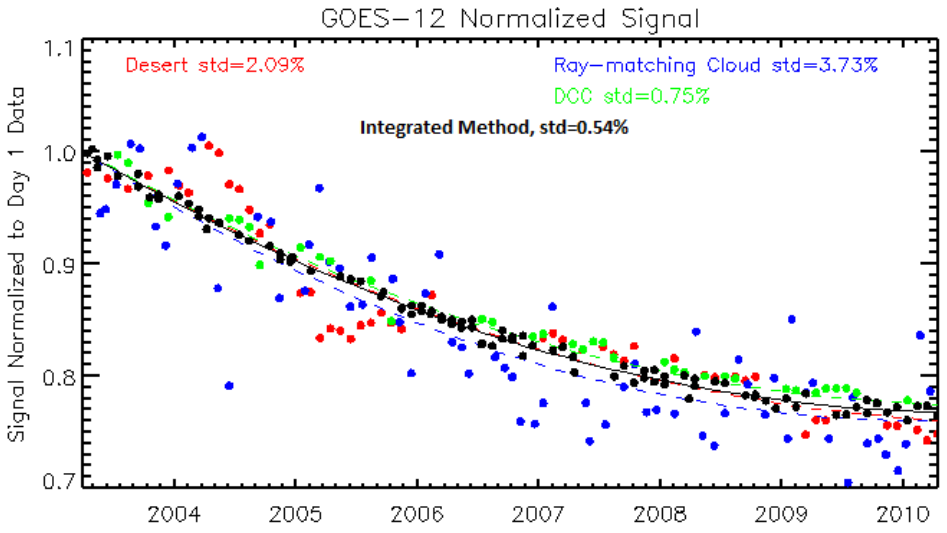
Yu et al. 2014, Inter-Calibration of GOES Visible Imager Data using the Sonoran Desert, JGR, revised and resubmitted.

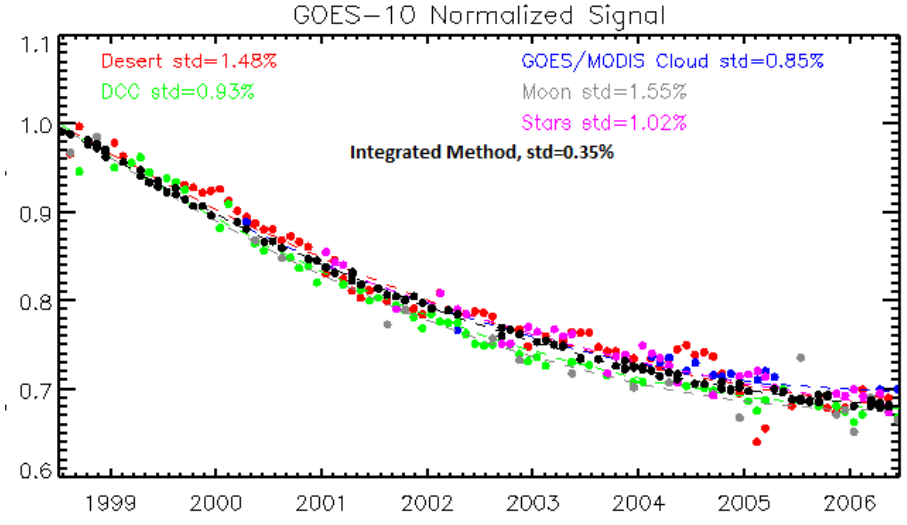
Integrated Vicarious Calibration for GOES Imager Visible Channel

Where is the truth of sensor degradation?

–The truth should have higher possibility of observations

Recursive filtering to remove the observations away from the "truth" - the fitting curve

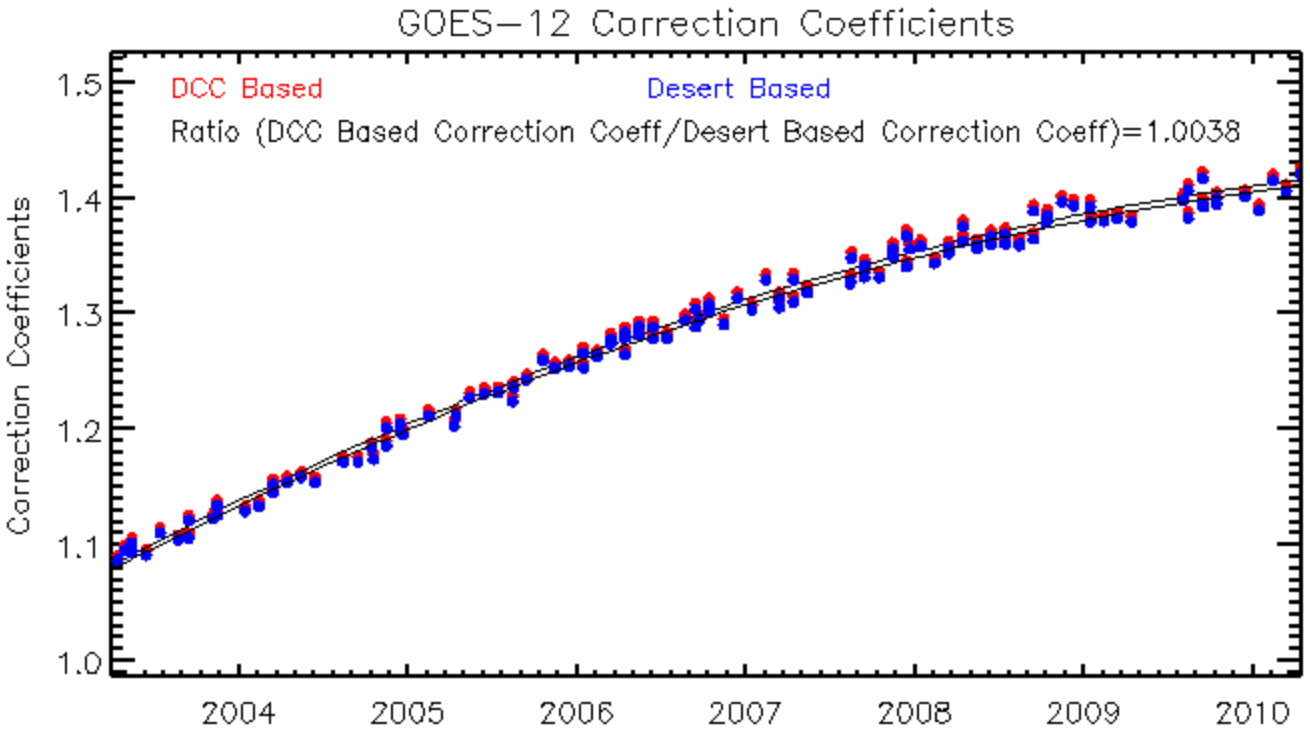




Yu and Wu, 2013: Vicarious Calibration of GOES Imager Visible Channel, 2013 EUMETSAT and 76th AMS Joint Conference, Vienna, Austria, Sept. 16-20, 2013.

Impact on the integrated calibration accuracy

- **The bias between DCC (median reflectance) and Desert method is <0.5%!**



Conclusions

- **The result with the Mode and Median DCC reflectance values are very similar with difference <0.5%**
  - **As median reflectance is relatively easy to generate with slightly lower uncertainty, recommend using the median reflectance**
- **DCC derived calibration correction coefficients agree well with those derived from the Sonoran-desert method**
- **The bias caused by the difference of DCC and desert reference reflectance is less than 0.5% for the integrated method.**
- **All the results indicates that DCC reference reflectance determined with near sub-satellite region has very small systematic error**
  - **Analysis consistent with the Hu's ADM model**
- **Uncertainty assessment is still undergoing.**