SNPP OMPS-NM Spectral Measurements: Calibration and Comparison

Kai Yang – UMCP

OMPS Science Team Meeting, Dec 3, 2015

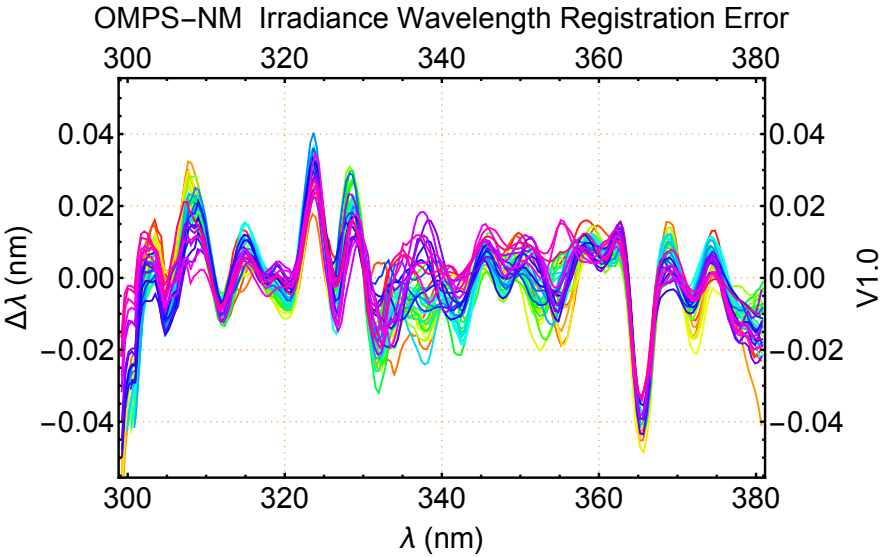
OMPS-NM L1B Measurements

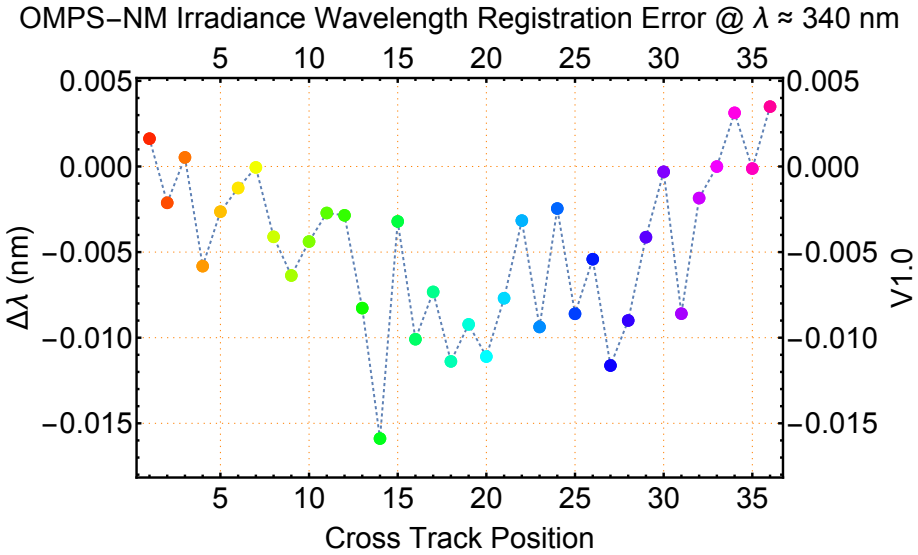
V1.0 vs. V1.8

- Wavelength Registration
- Spectral Response Function
- Soft Calibration
- Impacts on L2 retrievals

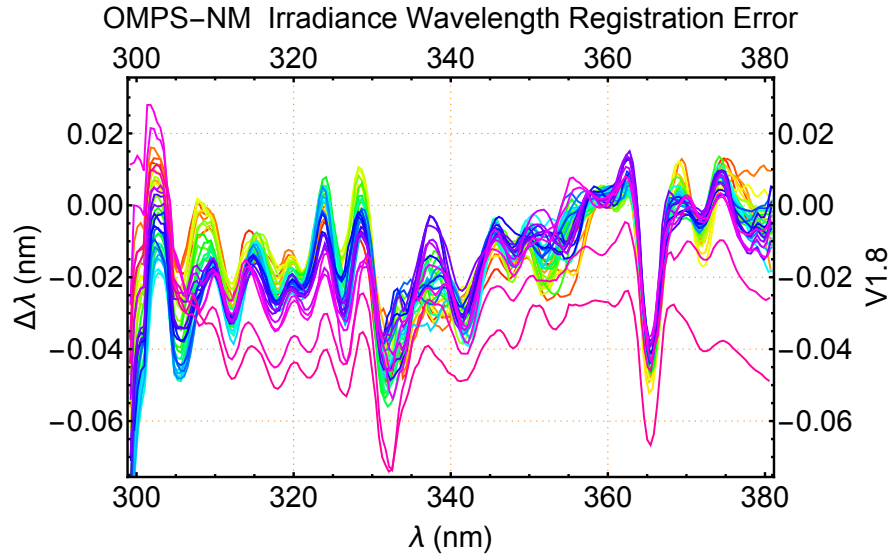
Irradiance Wavelength Registration

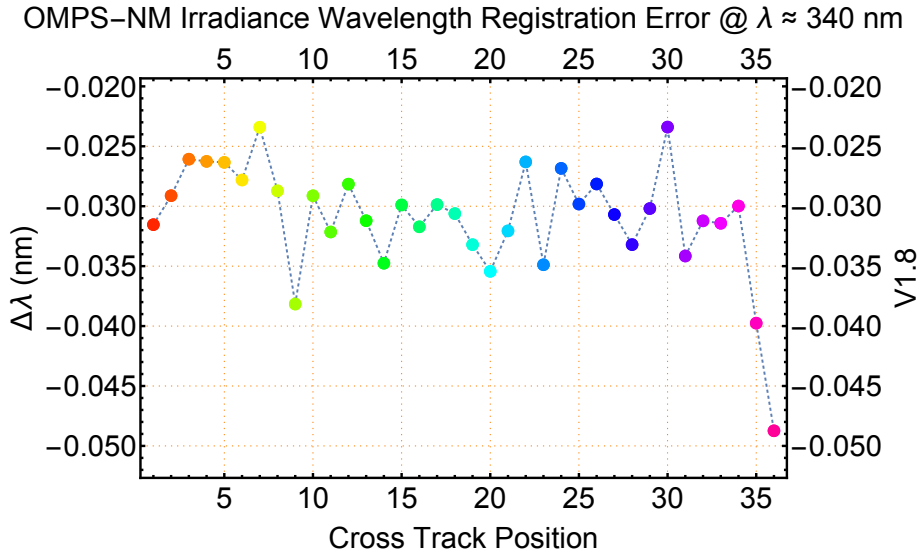
V1.0





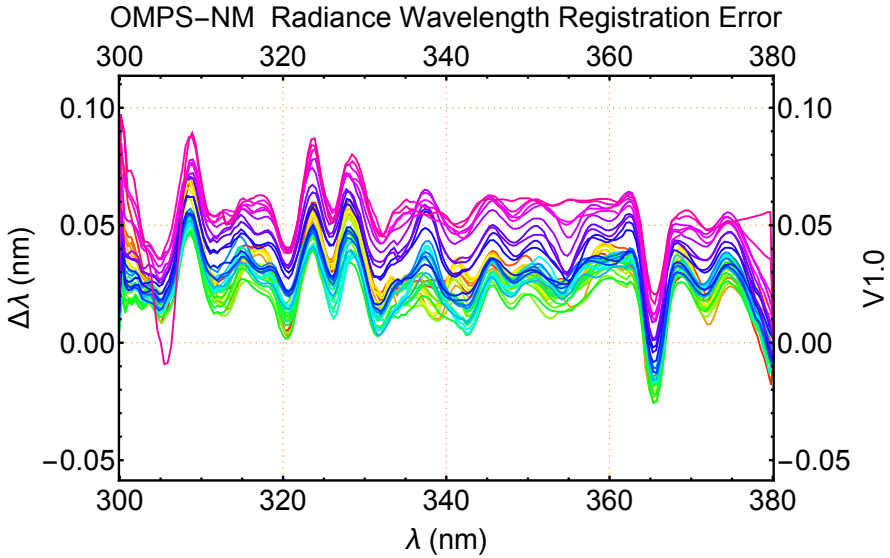
V1.8

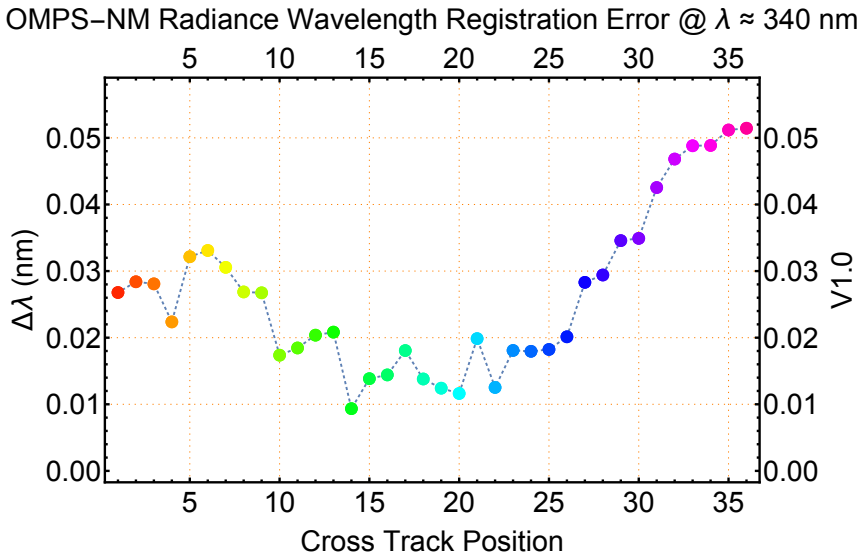




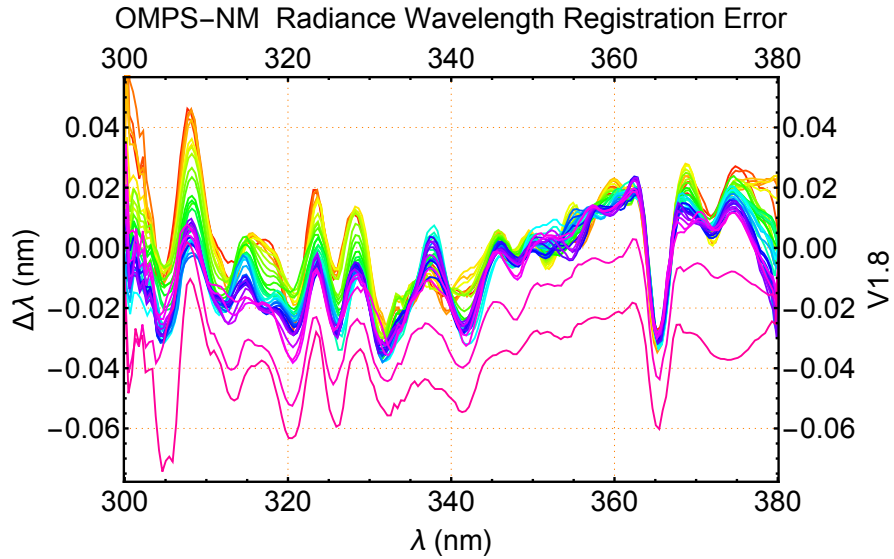
Radiance Wavelength Registration

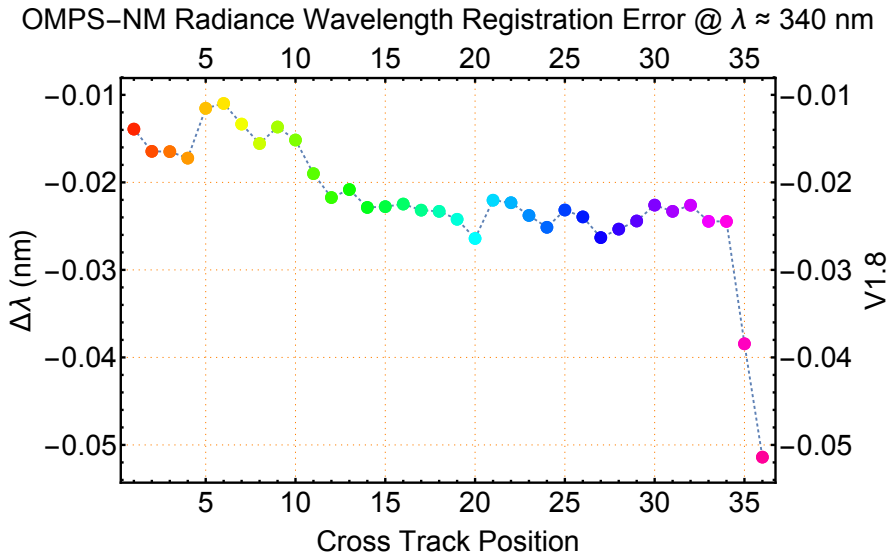
V1.0



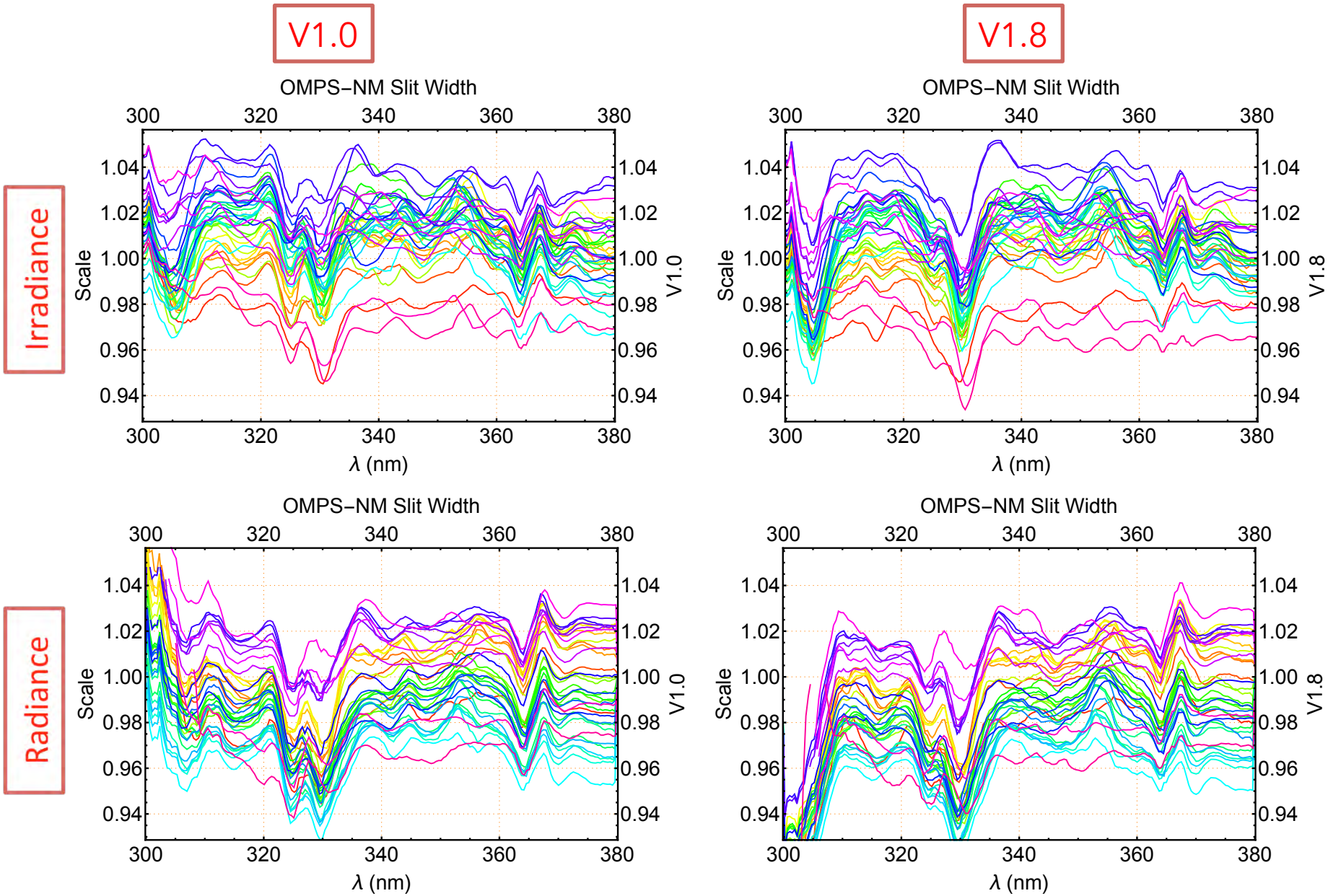


V1.8



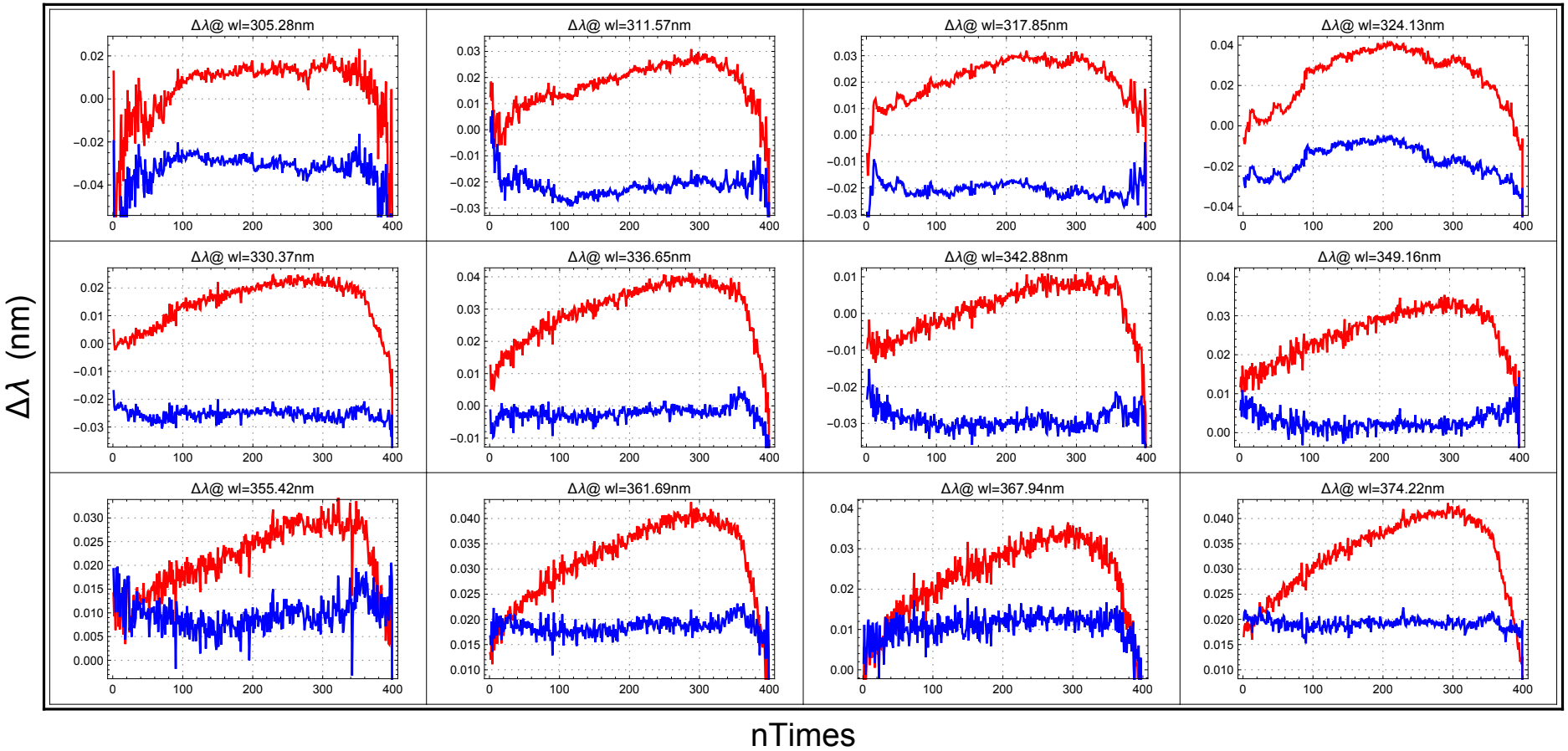


Irradiance and Radiance Spectral Response



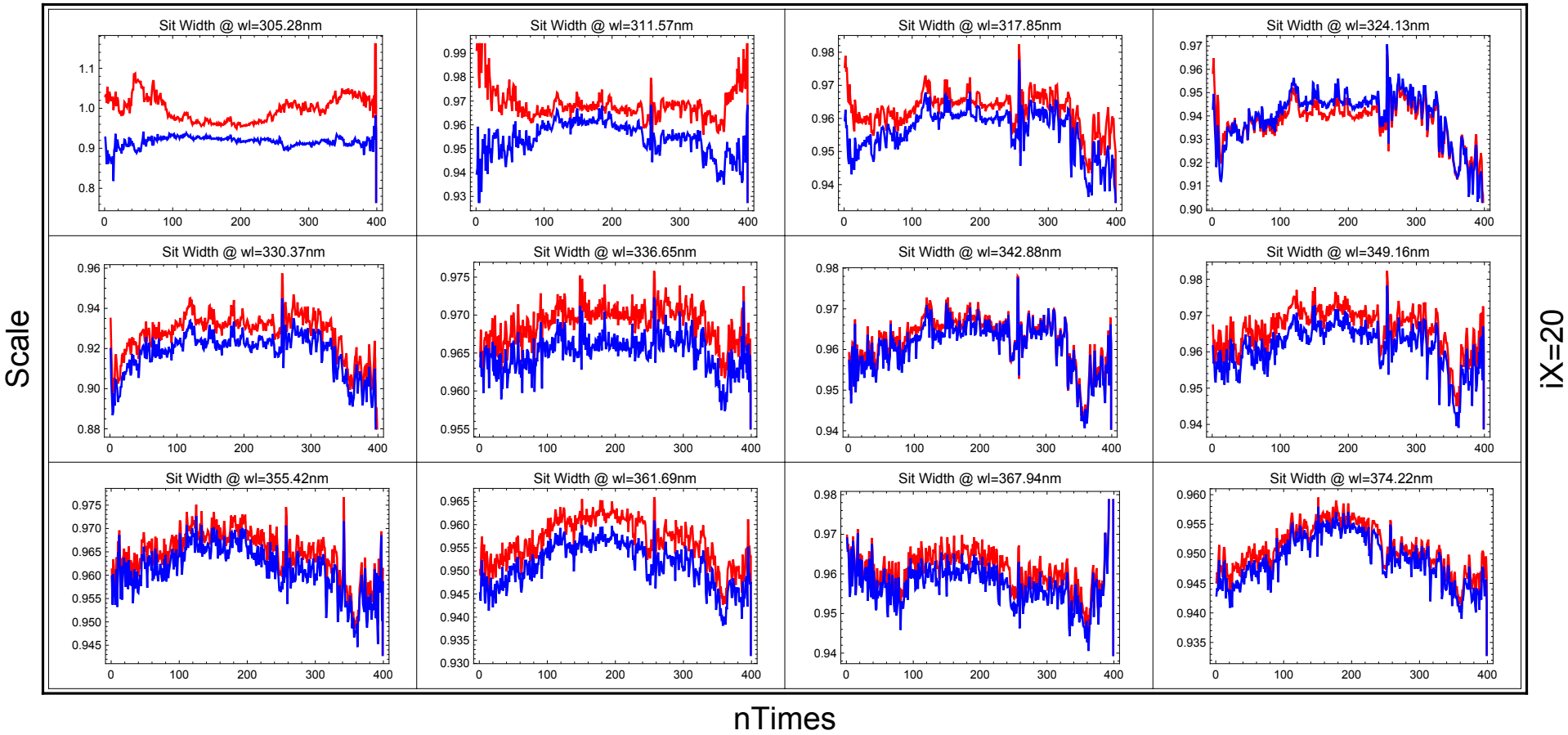
Along-Track Radiance Wavelength Registration

Along Track Wavelength Error: RED: V10, BLUE: V18



Along-Track Radiance Spectral Response

Slit Width Scale: Along Track Changes RED: V10, BLUE: V18



Summary of L1B Characterization

V1.8 vs. V10

- Wavelength errors (mostly) smaller (V1.8 < V1.0)
- Wavelength errors at cross-track positions 35 and 36 are way-off for both radiance and irradiance compared to other positions (V1.8)
- Wavelength errors roughly stable along track, but biases remain (V1.8)
- Stray light significantly broaden the apparent spectral response in the short wavelength region (< ~318 nm, V1.0)
- Correction seems overdone in the short wavelength region: apparent spectral response mostly too narrow in short wavelength region (< ~315 nm, V1.8).

L1B Radiance Adjustment: aka Soft Calibration

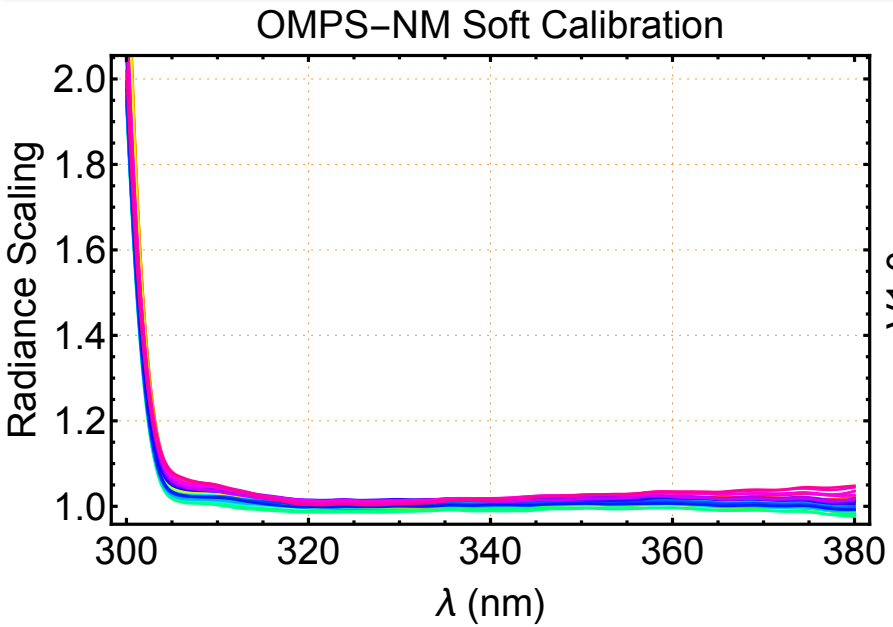
Objectives

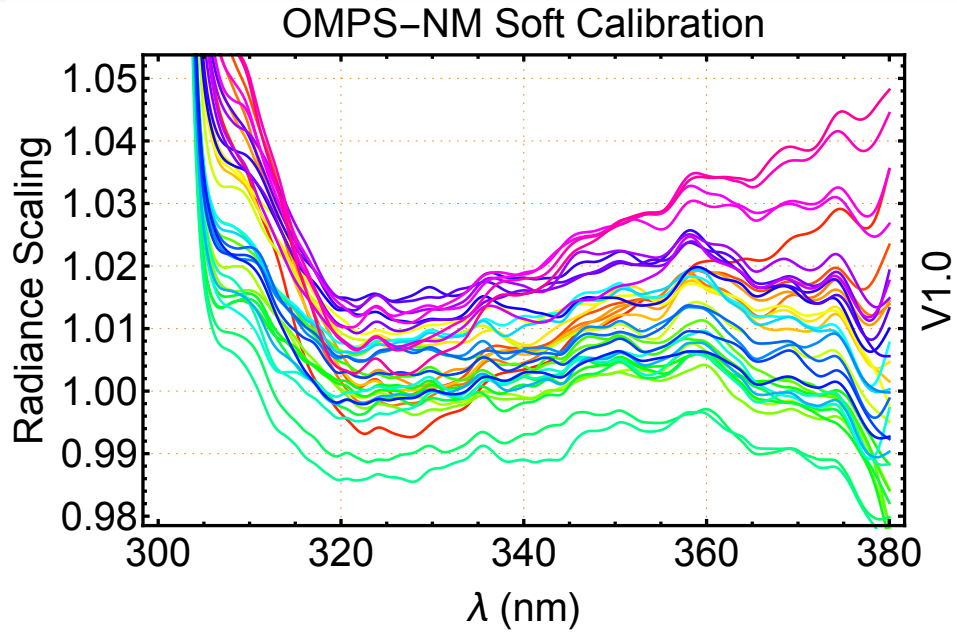
- Reduce calibration biases, achieve internal consistency among measurements at different wavelengths

Approach

- Determine radiance adjustments so that measured and modeled radiances agree for a set reference targets.

Soft Calibration: V1.0

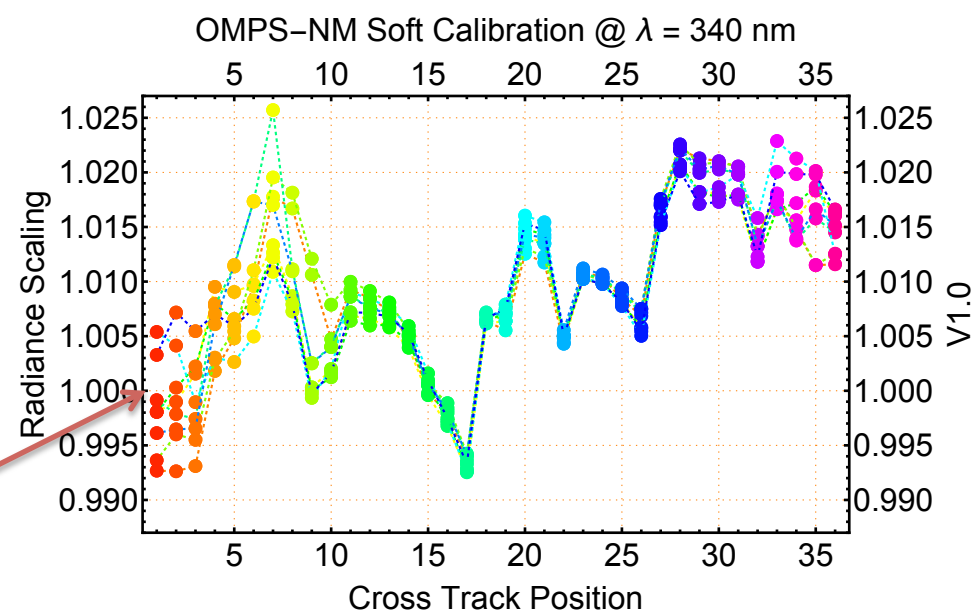




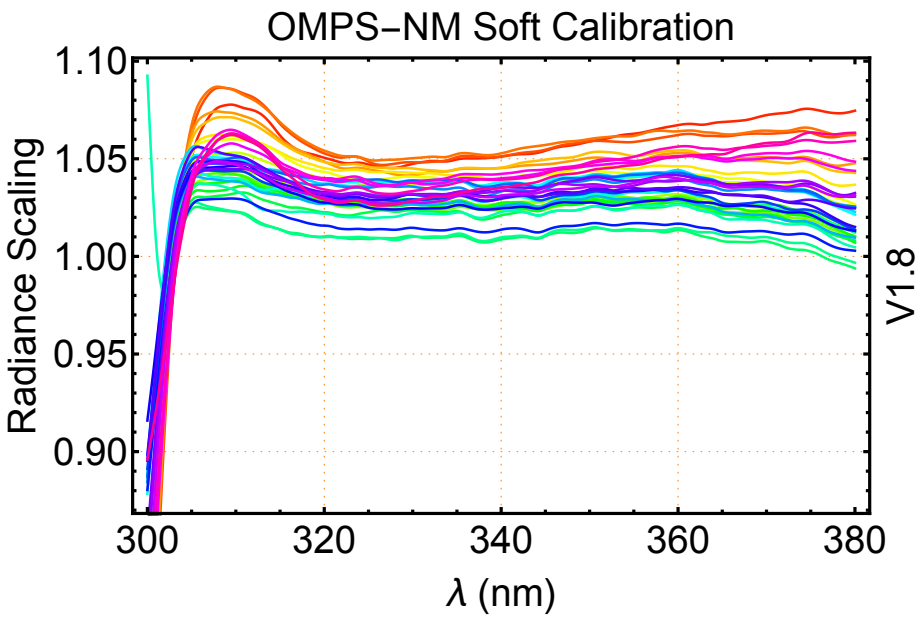
Radiance Adjustment Dependence

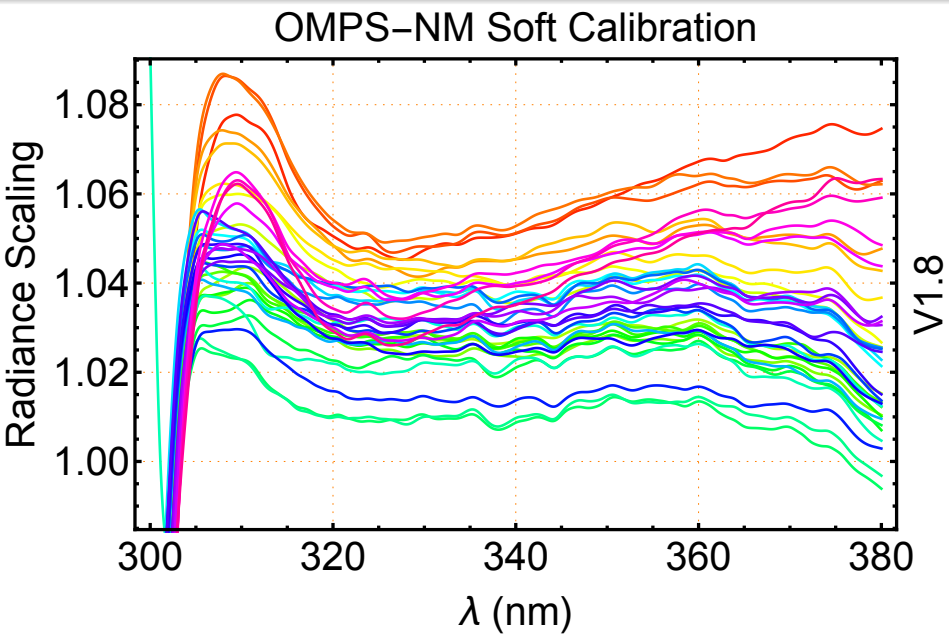
- Wavelength
- Cross-track
- Time

03/2012 – 09/2015 by 6 months



Soft Calibration: V1.8

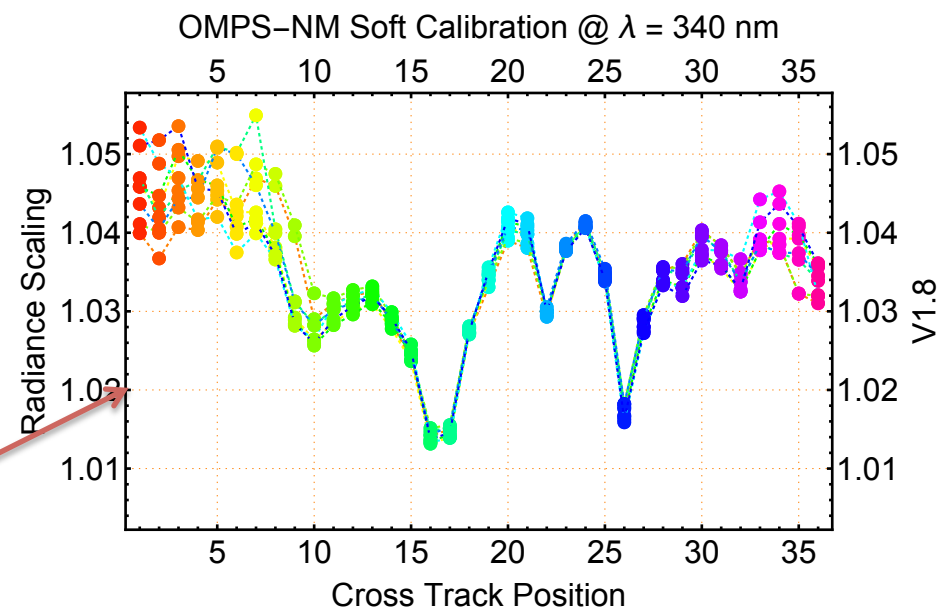




Radiance Adjustment Dependence

- Wavelength
- Cross track (or viewing angle)
- Time

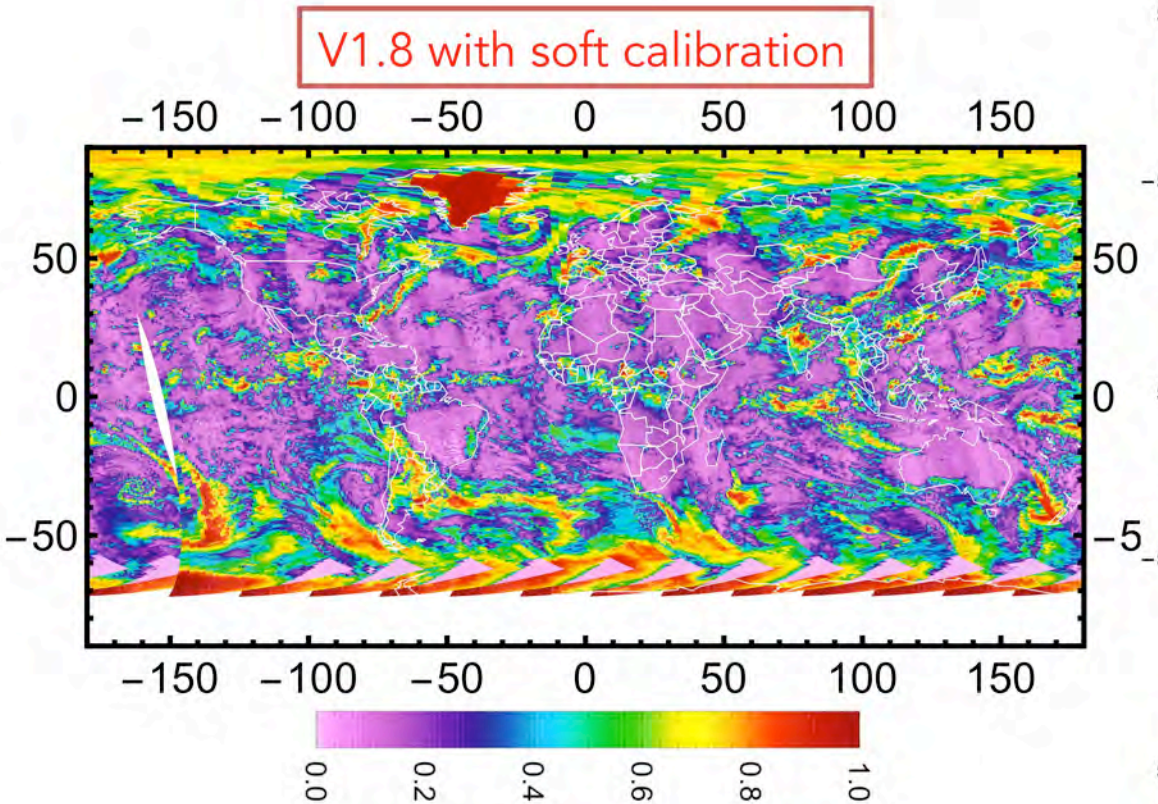
03/2012 – 09/2015 by 6 months

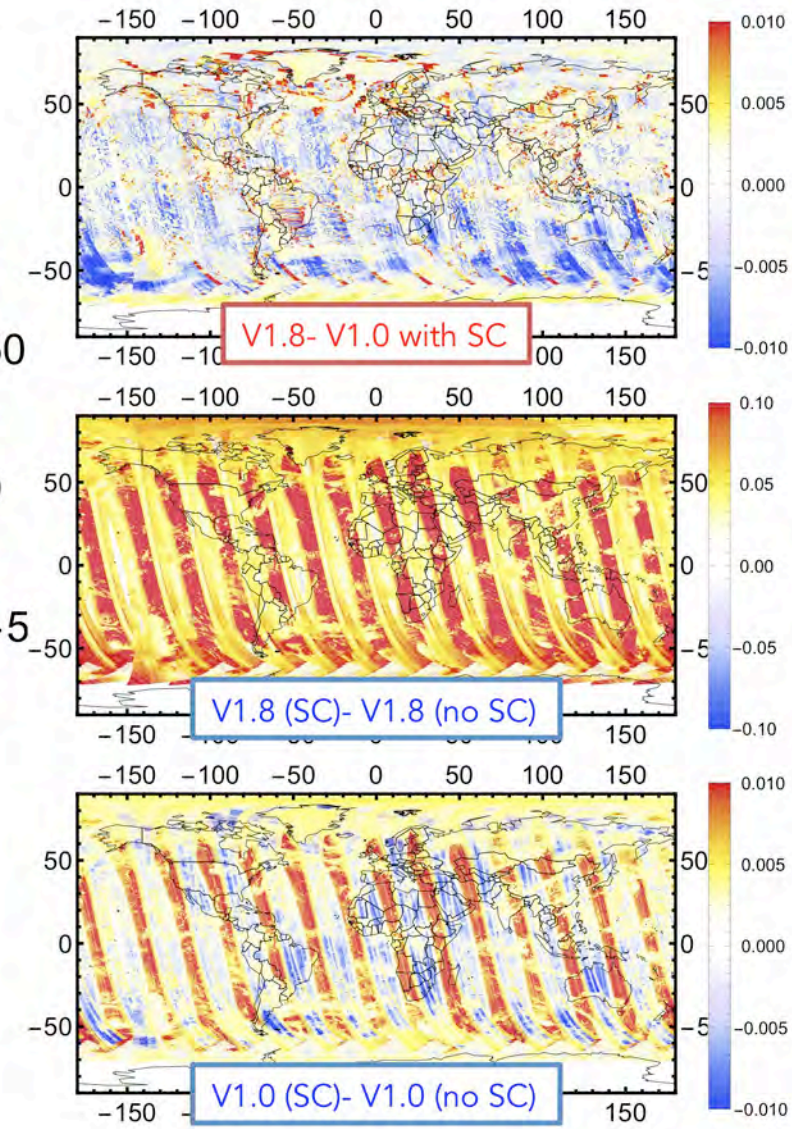


Impacts of Soft Calibrations

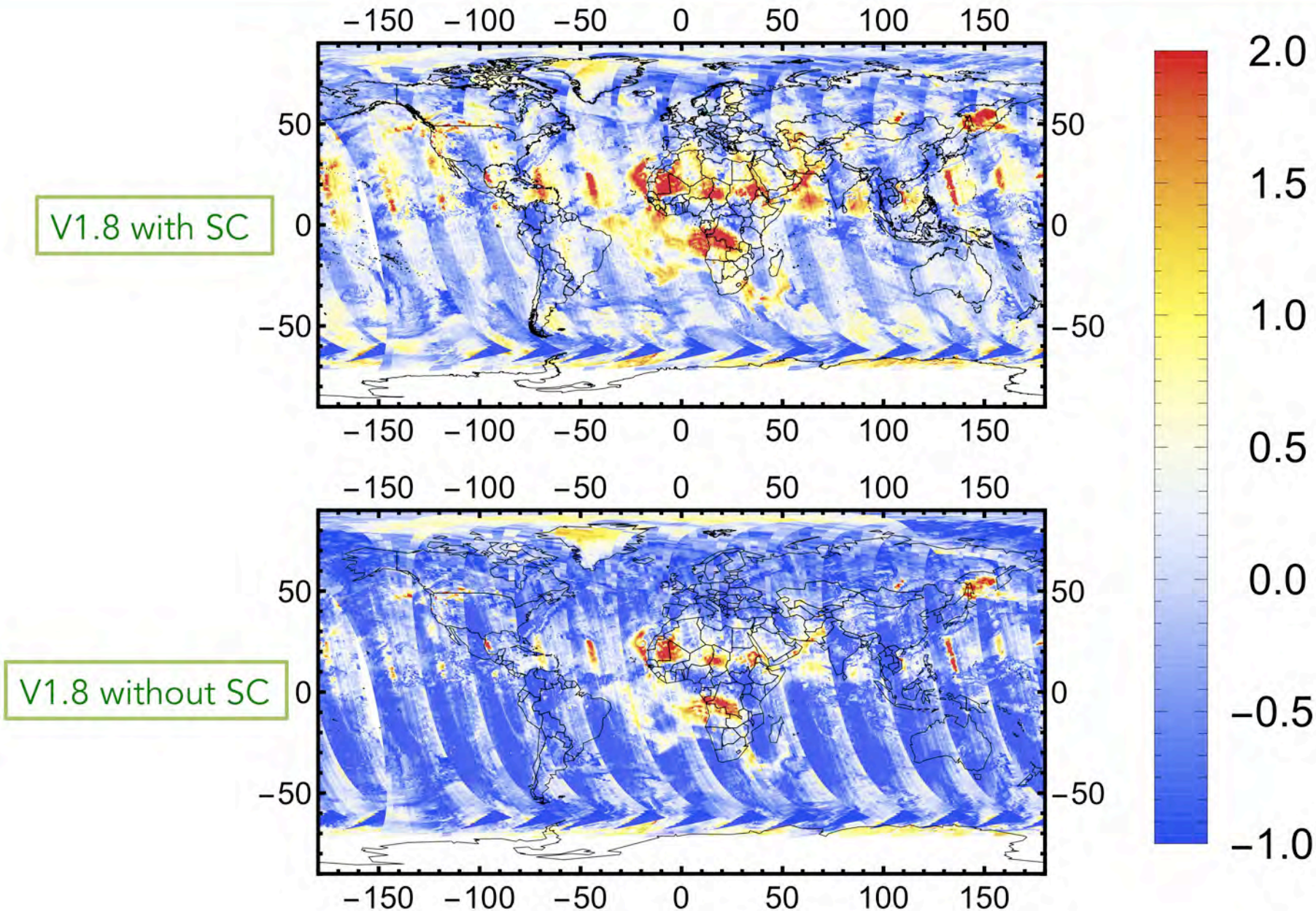
- Quantification of the amounts of trace gases (SO_2, NO_2, and other ones) needs accurate modeling of average photon paths
- Photon paths may be well characterized by vertical ozone column, surface reflectivity and its spectral dependence (i.e. aerosol Index), and ground and cloud pressures.
- Examples of radiance adjustments on these critical parameters for trace gas quantifications.

LER @ 340 nm

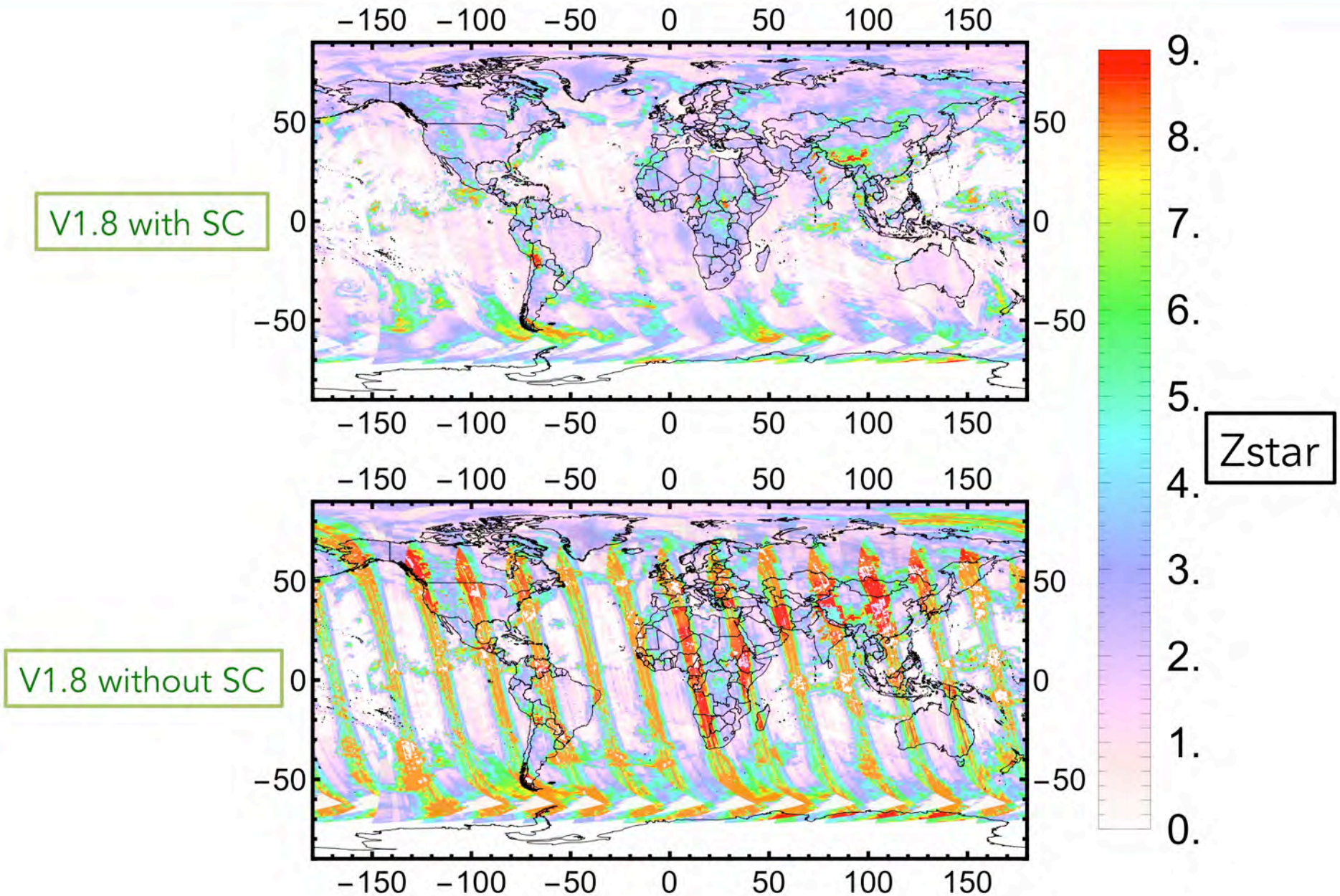

V1.8 with soft calibration
−150 −100 −50 0 50 100 150
50
0
−50
0.0 0.2 0.4 0.6 0.8 1.0


V1.8- V1.0 with SC
V1.8 (SC)- V1.8 (no SC)
V1.0 (SC)- V1.0 (no SC)
−150 −100 −50 0 50 100 150
0.010 0.005 0.000 −0.005 −0.010
0.10 0.05 0.00 −0.05 −0.10

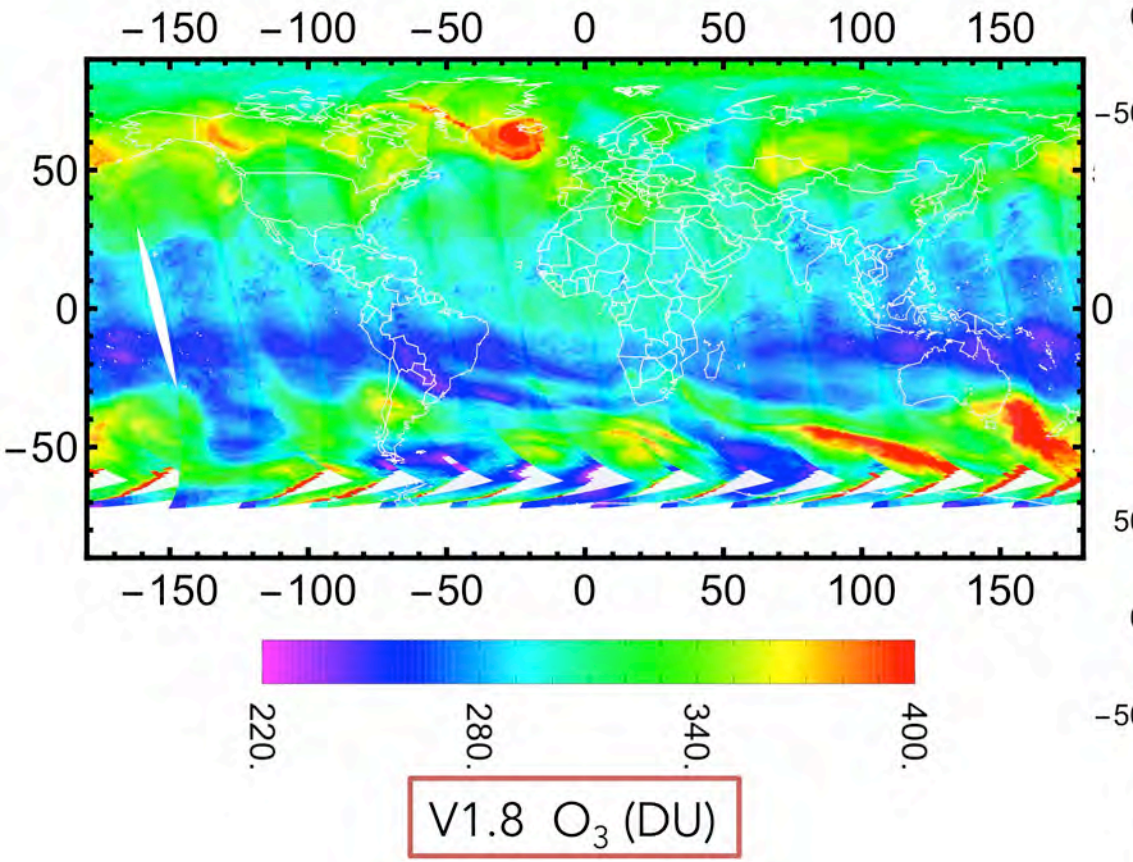
Aerosol Index (345 – 375 nm)

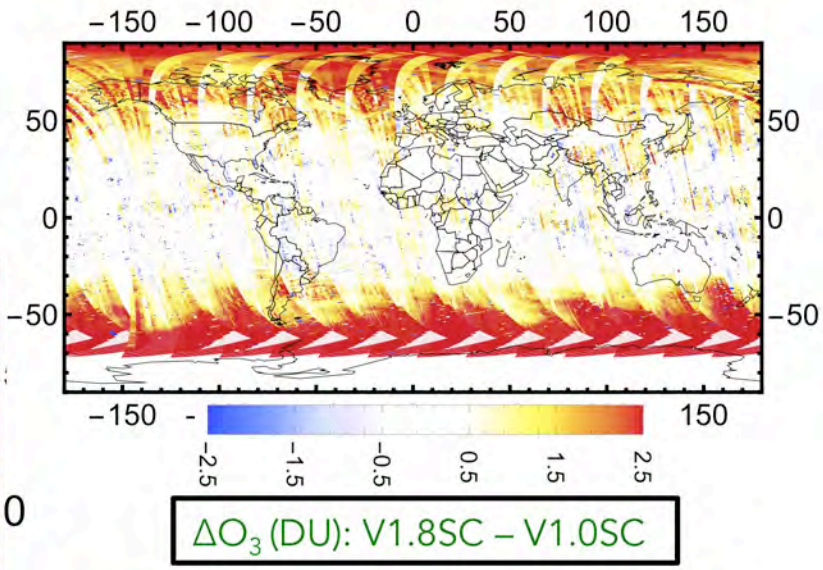


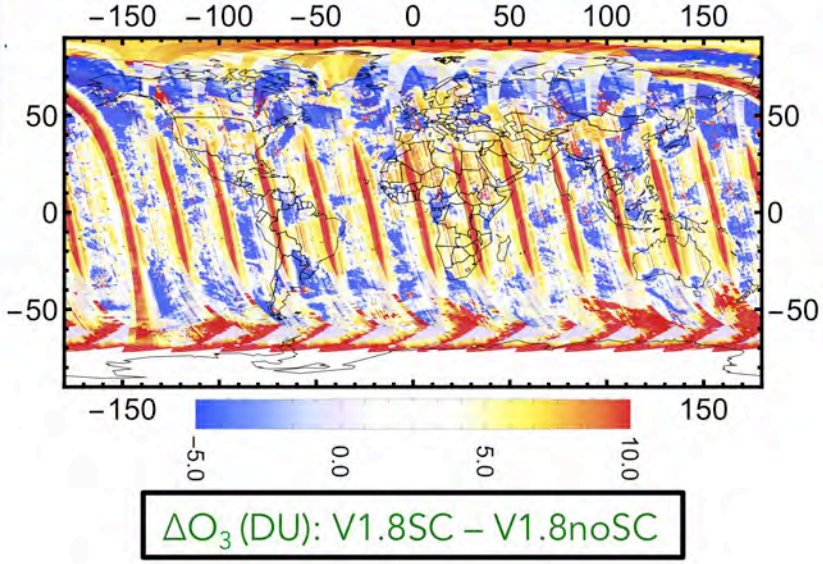
LER Scene Pressure (350 – 374 nm)



Total Ozone (317.5 & 325.0 nm ~ DSCOVR/EPIC)







Summary

L1B V1.8 vs. V1.0

- Analysis and soft-calibration results suggest that L1B adjustments in V1.8 may be over-estimated (too large) in the short wavelength range (< 315 nm), but under-estimated (too small) between 315 – 320 nm.
- V1.8 and V1.0 L1B yield near identical results for retrievals using longer wavelengths (> 320nm) after soft calibrations are applied.

Soft Calibration

- Soft calibration approach is quite general and can be applied to UV-VIS measurements, to facilitate consistent data records (of O_3 and other trace gases) from different instruments.