Cloud product (CLMSK, CLDPROP) team's efforts towards monitoring inter-sensor shortwave radiometry

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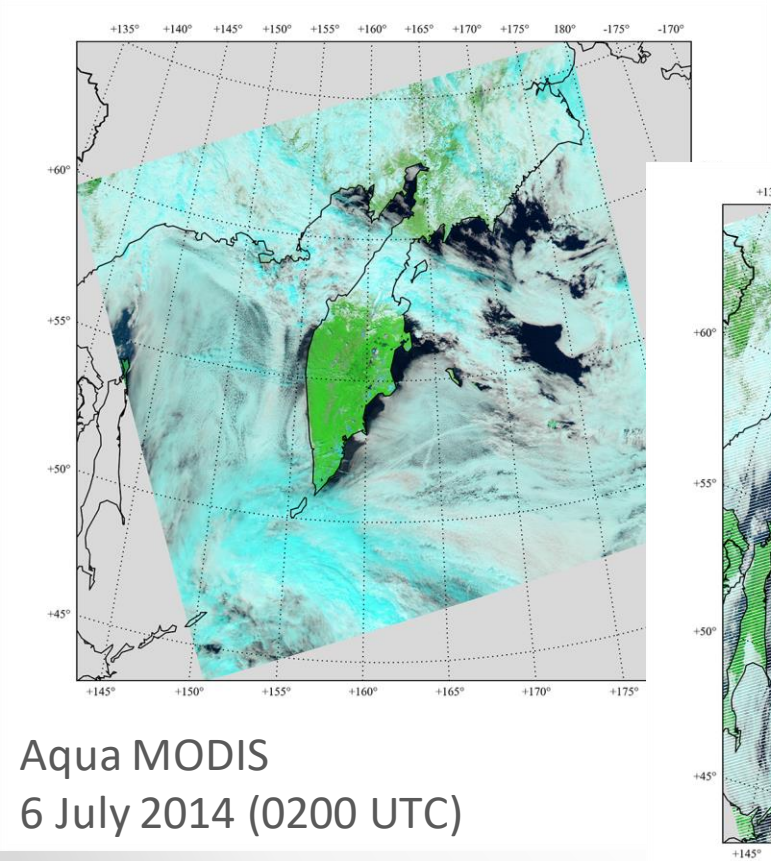
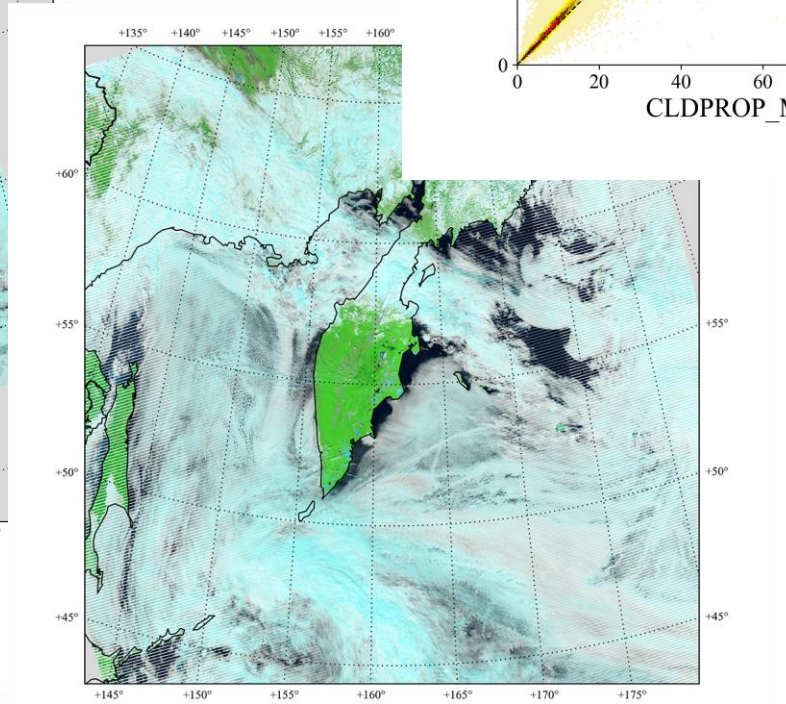
Background

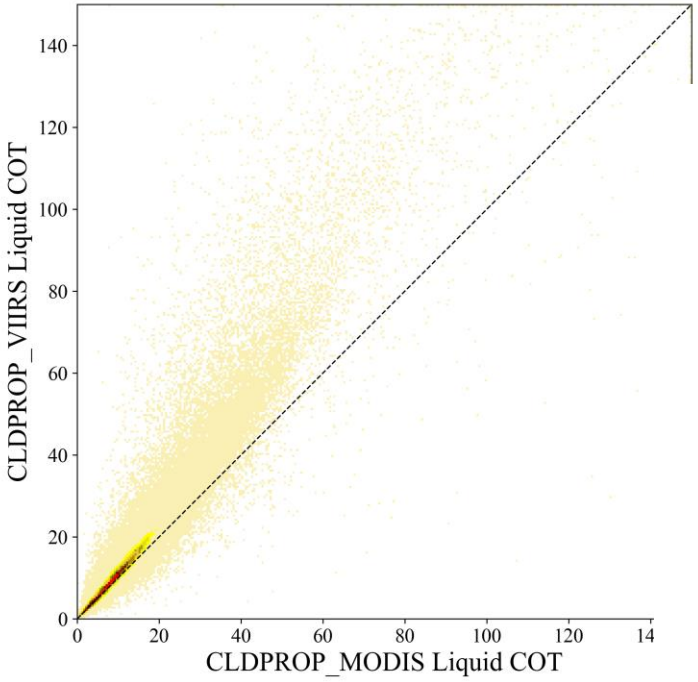
- Initial implementation of continuity cloud optical properties algorithm (CLDPROP) showed large differences between Aqua MODIS and SNPP VIIRS cloud optical thickness (COT) retrievals

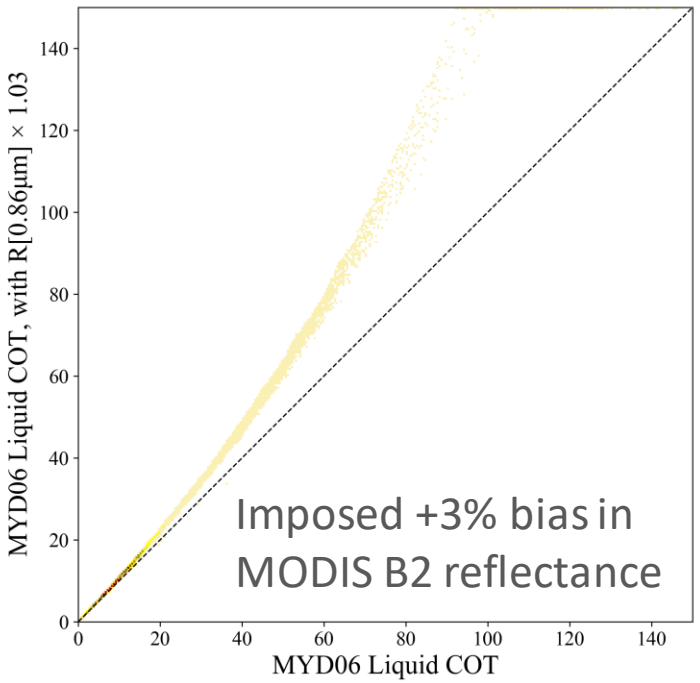


Aqua MODIS
6 July 2014 (0200 UTC)



SNPP VIIRS
6 July 2014 (0154, 0200 UTC)





- Retrieval differences linked to radiometric differences in analogous Aqua MODIS and SNPP VIIRS spectral channels
  - Above: Liquid COT retrievals from 0.87μm channel (MODIS B2, VIIRS M7)

Starting Point: Radiometric Match Files

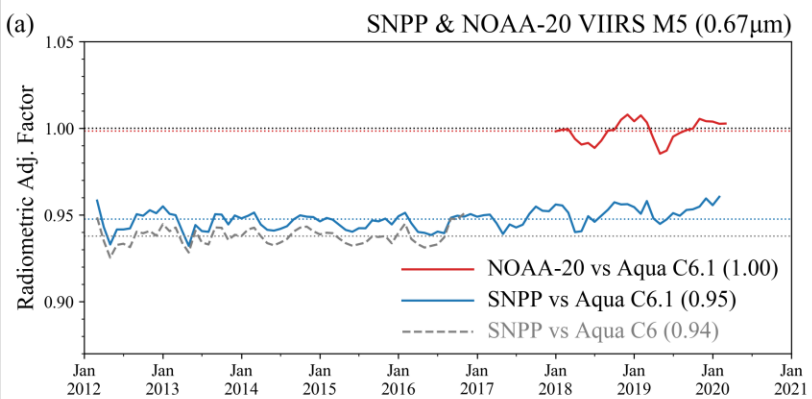
- Developed and processed by Atmosphere SIPS
- Co-located Aqua MODIS and SNPP/NOAA-20 VIIRS data
  - MYD02 L1B vs NASA VIIRS L1B (all M-band spectral channels)
    - Aqua MODIS C6.1; SNPP VIIRS v2.0.2 and NOAA-20 VIIRS v3.0.0 (both "Collection" 1)
  - Key MYD35 and MYD06 geophysical datasets (cloud mask, cloud-top/optical)
- Analysis approach
  - Homogeneous liquid phase clouds over oceans, ±60° latitude
  - Temporal matching: $\Delta t < 10$min
  - Strict angle matching: view zenith and scattering angle differences < 1°
  - Use Aqua MODIS as the benchmark, i.e., scale VIIRS to match MODIS

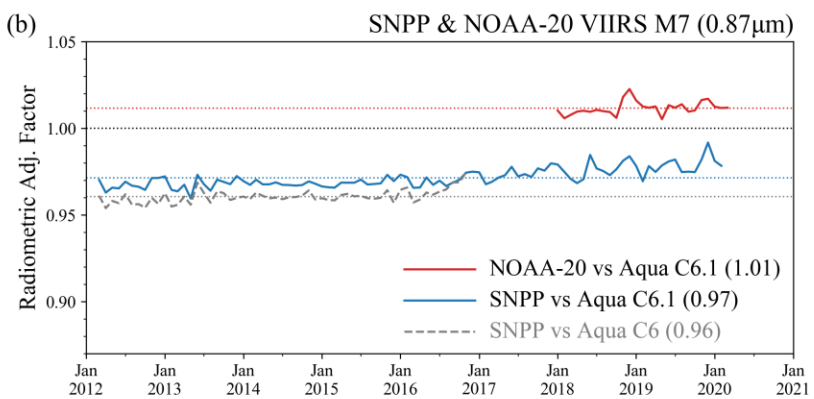
Methodology

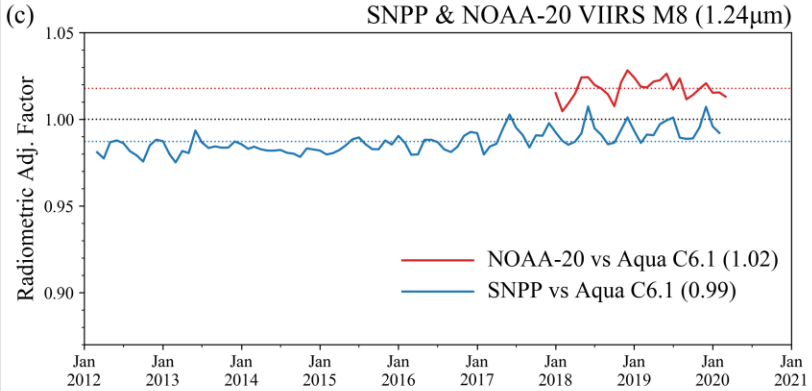
- MODIS COT,CER + VIIRS reflectance LUT => **VIIRS expected top-of-cloud reflectance at pixel level**
- MODIS (MYD06) CTP + VIIRS L1B + atmospheric correction => **VIIRS observed top-of-cloud reflectance at pixel level**
- Aggregate pixel-level expected/observed reflectance into monthly joint histograms => monthly VIIRS radiometric adjustment factors
- Final VIIRS (SNPP or NOAA-20) radiometric adjustment factors derived from time series of monthly values

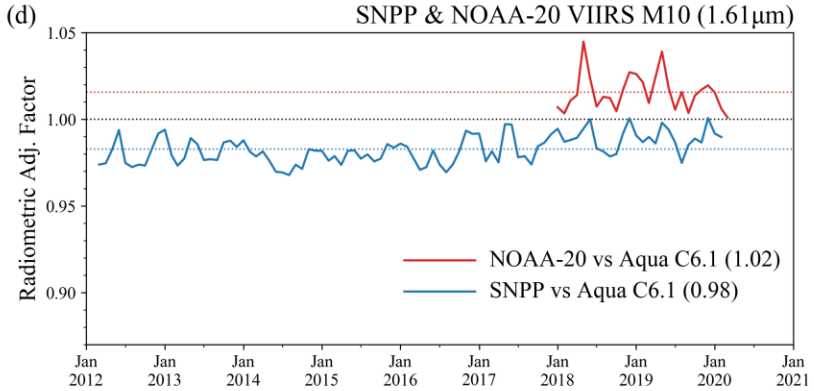
$$\boldsymbol{VIIRS\ Radiometric\ Adjustment(\lambda) = \frac{VIIRS\ Expected\ TOC\ Refl.(\lambda)}{VIIRS\ Observed\ TOC\ Refl.(\lambda)}}$$

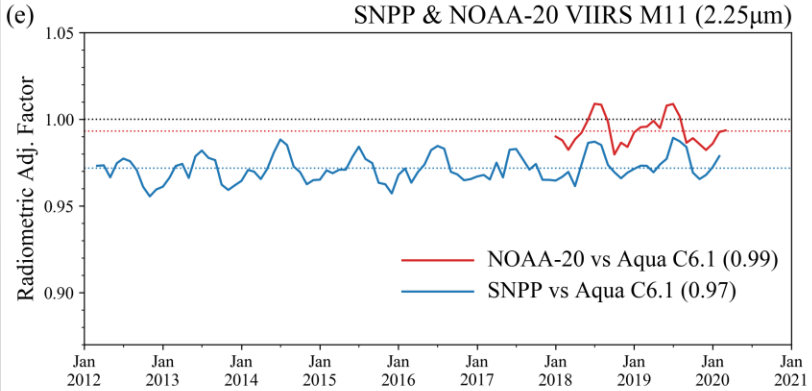
$$\boldsymbol{\lambda = [0.67\mu m\ (M5), 0.87\mu m\ (M7), 1.24\mu m\ (M8), 1.61\mu m\ (M10), 2.25\mu m\ (M11)]}$$









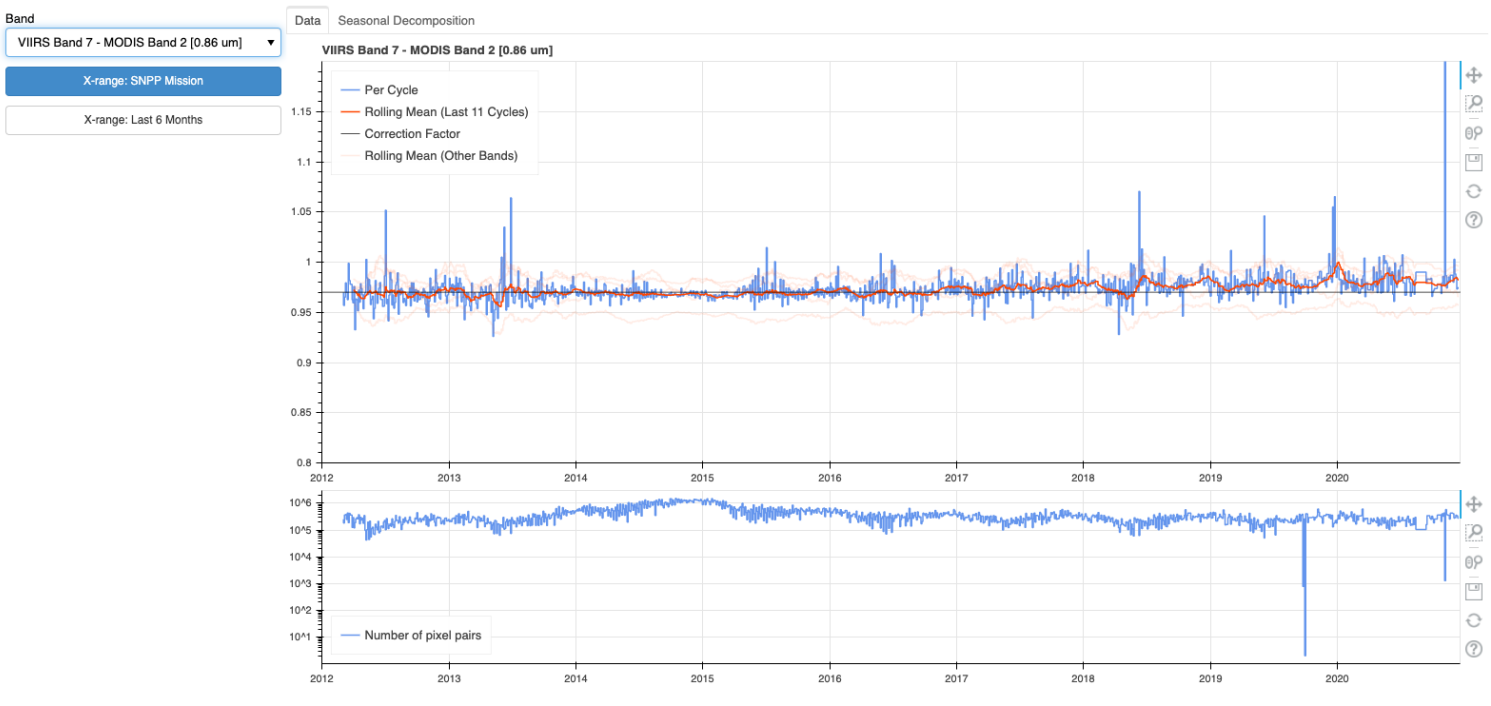


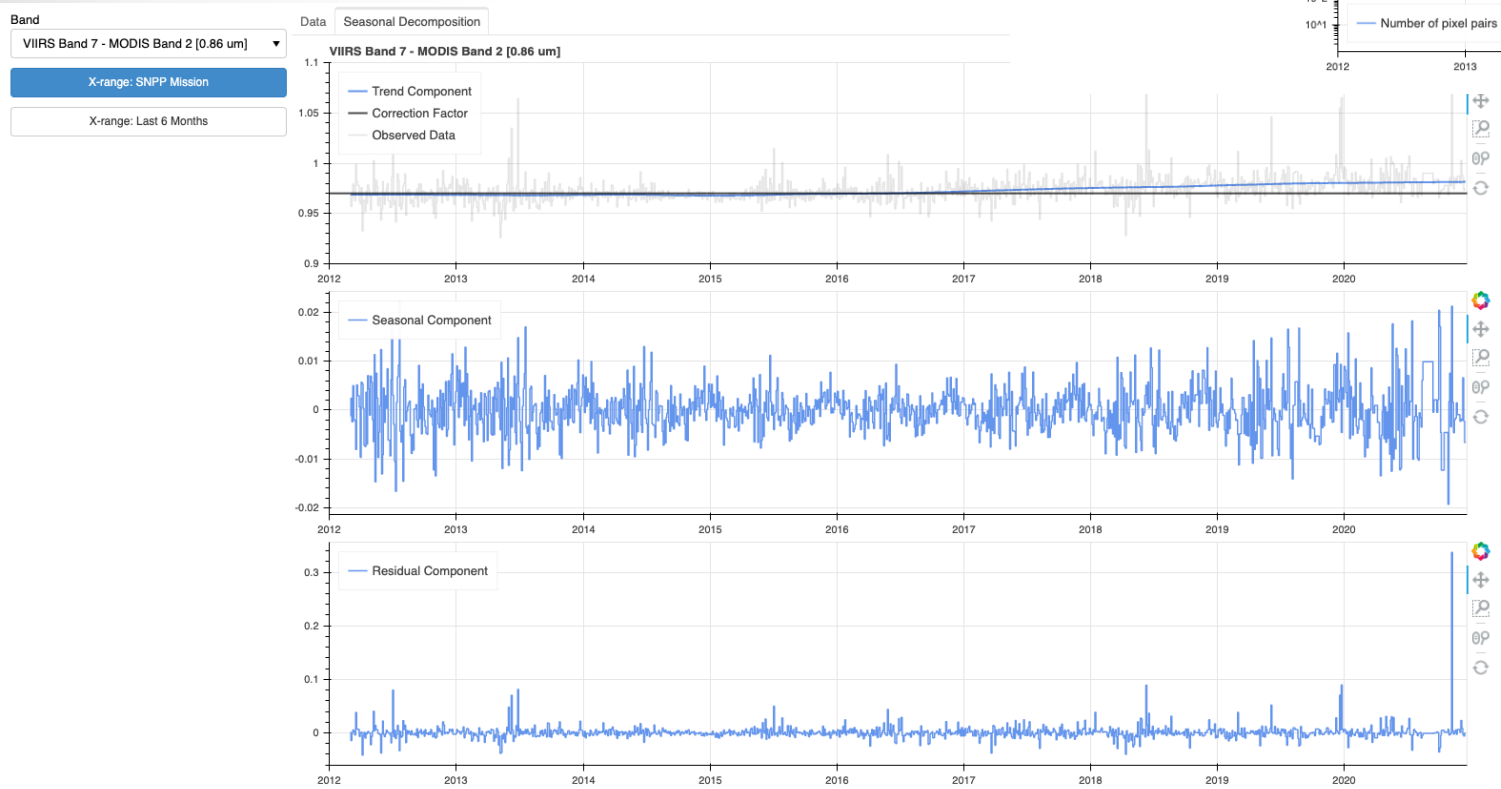
- Radiometric adjustments applied to VIIRS L1B prior to ingestion into CLDMSK and CLDPROP algorithms.
  - Both SNPP and NOAA-20
  - Defined as time series (left) means
- Values are reported in CLDPROP L2 global metadata

VIIRS Wavelength (Band Designation)			0.67 µm (M5)	0.87 µm (M7)	1.24 µm (M8)	1.61 µm (M10)	2.25 µm (M11)
Radiometric Adjustment Factor	NOAA-20	**vs MODIS C6.1**	**1.0**	**1.01**	**1.02**	**1.02**	**0.99**
	SNPP	**vs MODIS C6.1**	**0.95**	**0.97**	**0.99**	**0.98**	**0.97**
		vs MODIS C6	0.94	0.96	0.98	0.98	0.97
		Deep Blue Gain Factors	*0.941*	*0.963*	*1.011*	*0.981*	*0.931*

Ongoing Efforts

- Aqua MODIS – VIIRS (SNPP and NOAA-20) radiometric analysis code implemented at A-SIPS and running in NRT
- Web "dashboard" developed by A-SIPS (Z. Griffith) to facilitate monitoring by team
  - "Per cycle" (64 hrs) and rolling (~monthly) means
  - seasonal decomposition for trends





Open Access Article

Derivation of Shortwave Radiometric Adjustments for SNPP and NOAA-20 VIIRS for the NASA MODIS-VIIRS Continuity Cloud Products

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