Cloud Optical Properties: MODIS Standard & MODIS-VIIRS Continuity Products

Algorithm Development Team: S. Platnick[1], K. Meyer[1], G. Wind[2,1], C. Wang[3,1], N. Amarasinghe[2,1], B. Marchant[4,1], P. Hubanks[5,1], R. Holz[6]

MODAPS/LAADS: S. Manoharan[3,1], S. Bhoi[3,1]

Atmosphere SIPS: S. Dutcher[6], P. Veglio[6], D. Botambekov[6], L. Gumley[6]

[1]NASA GSFC; [2]SSAI; [3]JCET/UMBC; [4]USRA; [5]Adnet; [6]U. Wisc./CIMSS/SSEC

MODIS/VIIRS Atmosphere Discipline Breakout Meeting
WebEx, The Internet
16 November 2020

Topics

- MODIS standard cloud products (**MOD06, MOD08**)
  - C7 major activities (*supported under ROSES-17 A.37 TASNPP*)
- MODIS-VIIRS continuity cloud products (**CLDPROP**)
  - Continuity paradigm refresher
  - Example results
  - Product status and ongoing efforts
- Other cloud team updates of interest

MODIS Standard Cloud Products

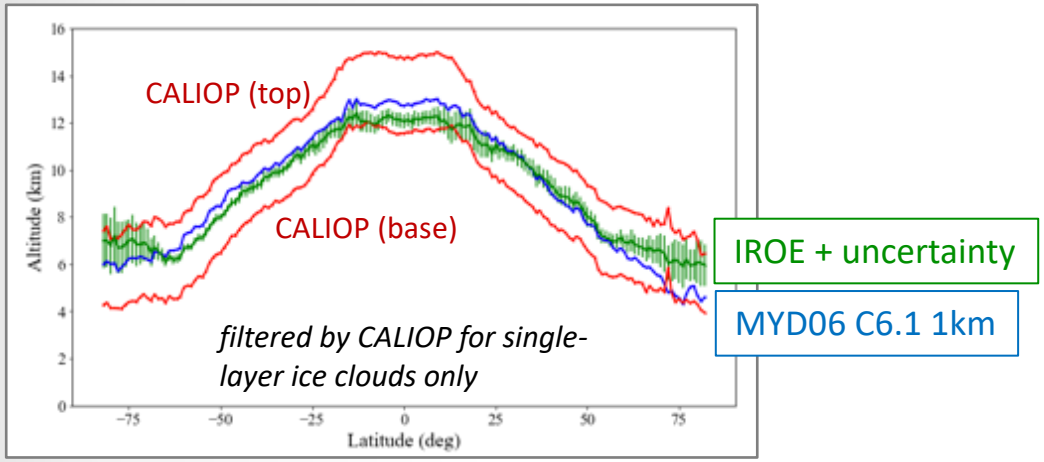
MOD06 (Terra), MYD06 (Aqua)

C7 Major Activities

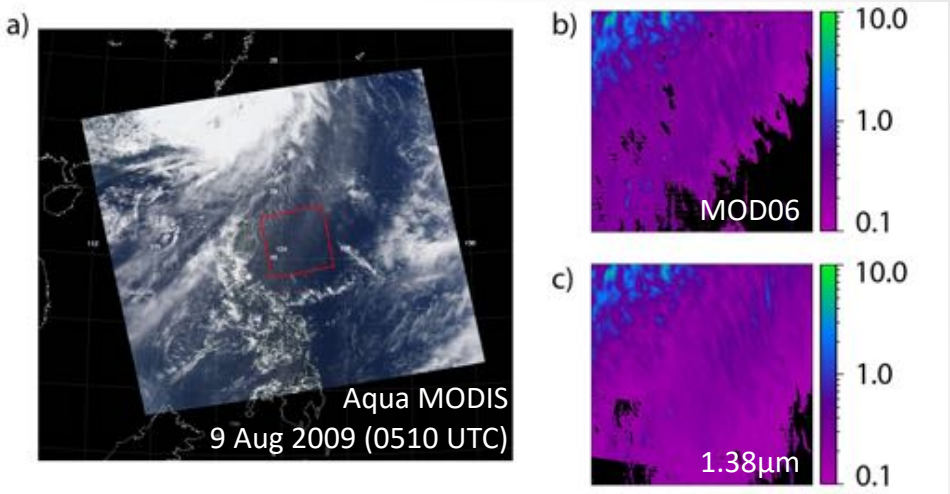
- MOD06 product and algorithm updates
  - Currently in science testing at MODAPS:
    - Pixel-level radiative flux calculations (RRTMG implementation)
    - IR Optimal Estimation (IROE) for 1km cloud-top height and ice cloud optical thickness/particle effective size retrievals [*Wang et al.*, 2016a,b]
    - 1.38µm cirrus cloud optical thickness retrievals [*Meyer & Platnick*, 2010]
  - Experimental efforts under evaluation:
    - High-resolution 500m optical property retrievals
    - Improved retrieval failure metric (RFM): extended liquid CER valid range (4 – 50µm)
    - Optical property thermodynamic phase algorithm based on machine learning [e.g., *Wang et al.*, 2020]
  - Cloud forward radiative model updates
    - Assess updated liquid (and ice?) refractive index datasets for consistency with CLDPROP [*Platnick et al.*, 2020a]
- MOD08 level-3 product and algorithm updates
  - New algorithm based on A-SIPS Yori software package to improve flexibility and support netCDF-4 (consistent with CLDPROP L3 products)

C7 Major Activities

April 2015 Zonal Mean Ice Cloud Top Height



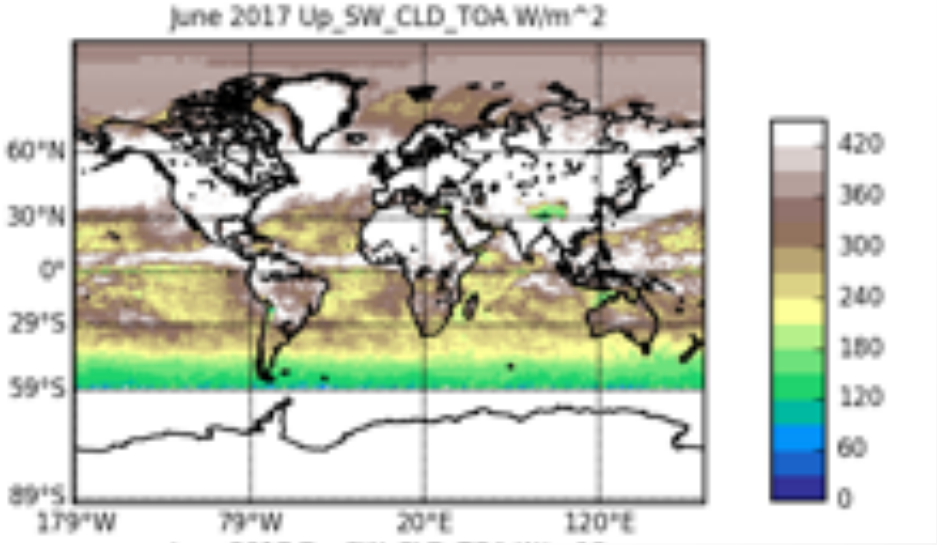
1.38µm Cirrus Retrievals



from *Meyer et al.* [2010]

Aggregated Cloudy SW TOA Flux from Aqua MODIS MYD06 Cloud Optical Property Retrievals (June 2017)

Note: Data from initial science test



C7 Miscellaneous Activities

- Other product and algorithm updates
  - NetCDF-4 file format
  - Improved pixel-level uncertainties
  - Updated atmospheric correction
  - Transition to GEOS-FPIT atmospheric profile and snow cover ancillary dataset
  - Various QA updates:
    - Clear sky restoral and multilayer flag algorithm updates
    - Improved metadata descriptions and status flags

MODIS-VIIRS Continuity Cloud Products

CLDPROP_MODIS_Aqua, CLDPROP_VIIRS_SNPP/NOAA20

CLDPROP Paradigm Refresher

MODIS Aqua L1B + Geolocation
MYD02, **MYD03**
(channel subset common w/VIIRS)

NASA VIIRS L1B intermediate product*
(w/restored bow-tie pixel deletions +
VNIR/SWIR radiometric adjustments) +
Geolocation
VNP02MOD, **VGEOM**

U. Wisconsin A-SIPS processing

Cloud Mask: MOD35 heritage
Cloud-Top: NOAA AWG heritage
Cloud Optical Properties: MOD06 heritage

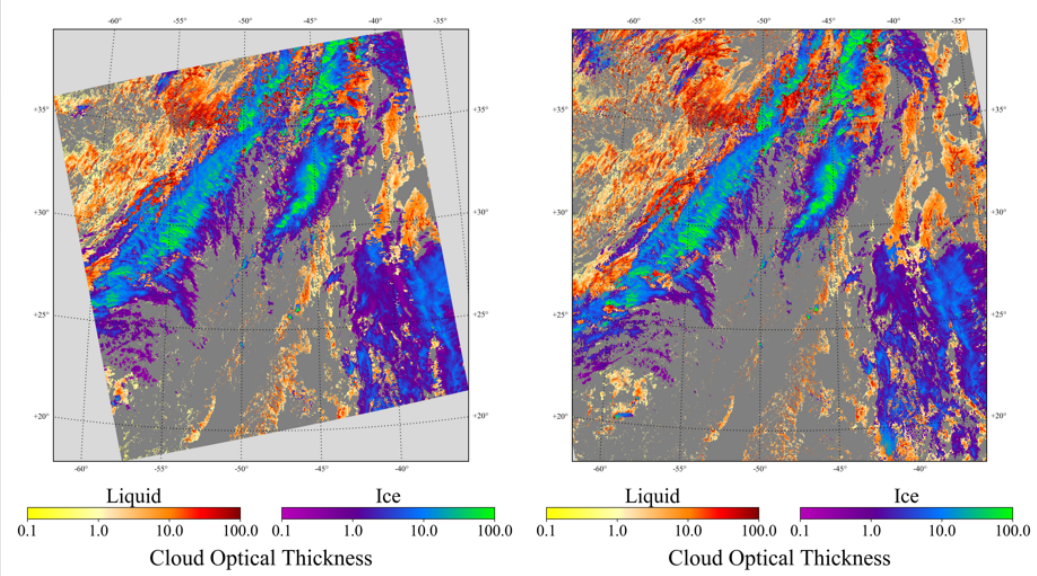
MODIS Continuity Products
CLDMSK_L2_MODIS_Aqua
CLDPROP_L2_MODIS_Aqua

VIIRS Continuity Products
CLDMSK_L2_VIIRS_SNPP
CLDPROP_L2_VIIRS_SNPP

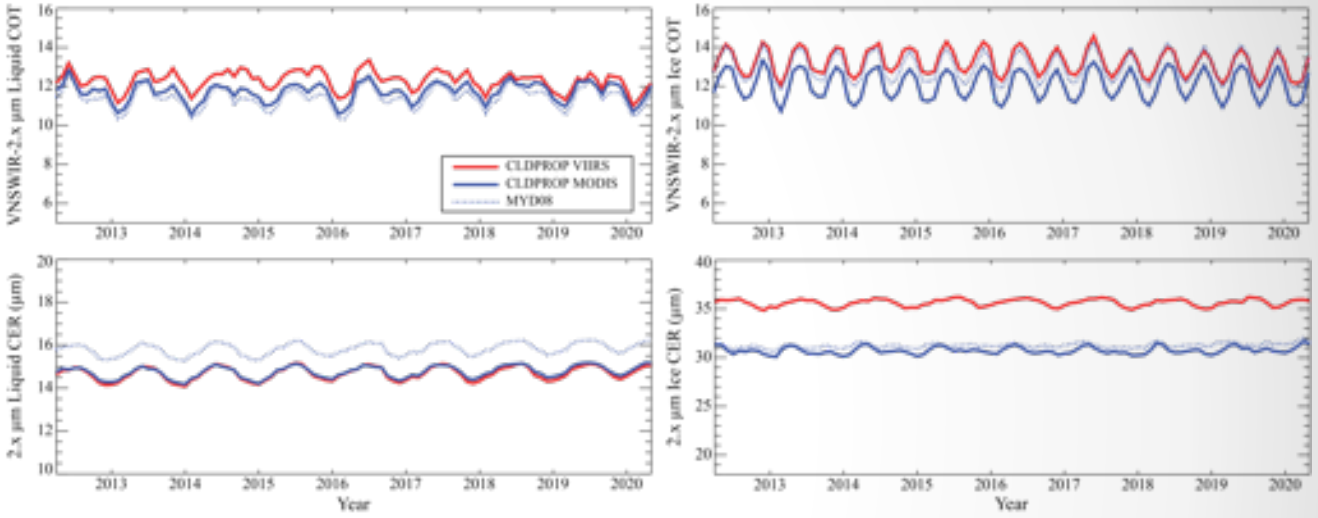
L3 Continuity Products ("Yori")
CLDPROP_D/M3_VIIRS_SNPP
CLDPROP_D/M3_MODIS_Aqua

** Atmosphere SIPS*

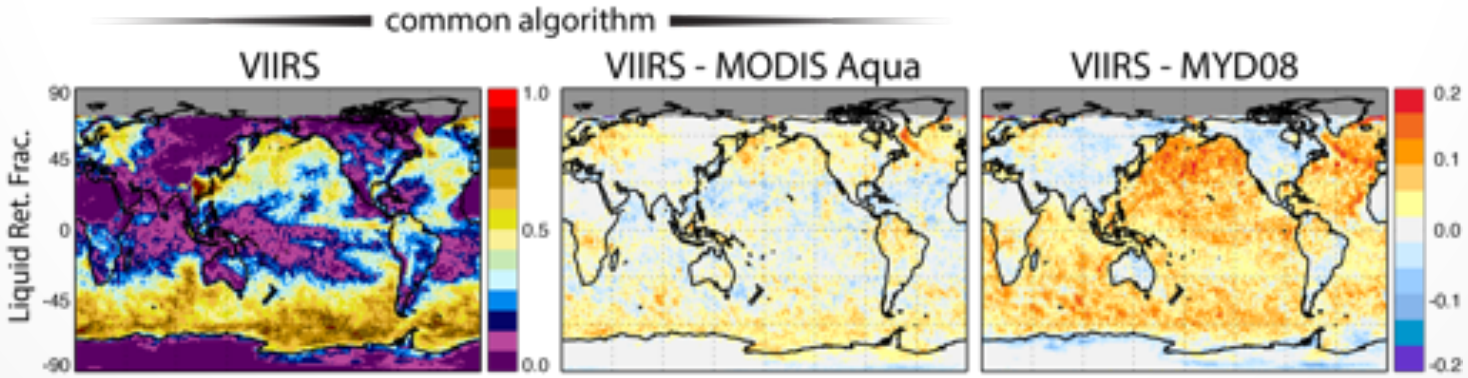
CLDPROP Optical Properties Examples



Granule Example, 29 Nov 2014
1630 UTC (Aqua MODIS), 1624 UTC (SNPP VIIRS)



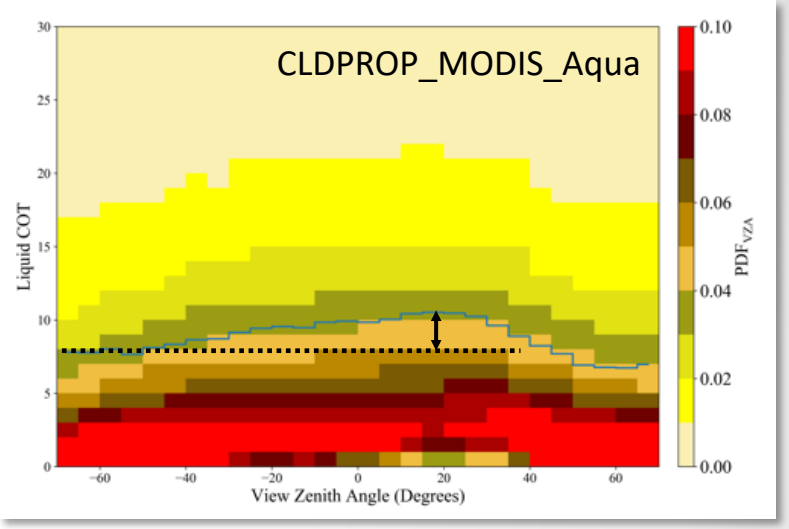
Multi-Year Time Series Example (±60° Latitude)
COT (Top) and CER (Bottom)

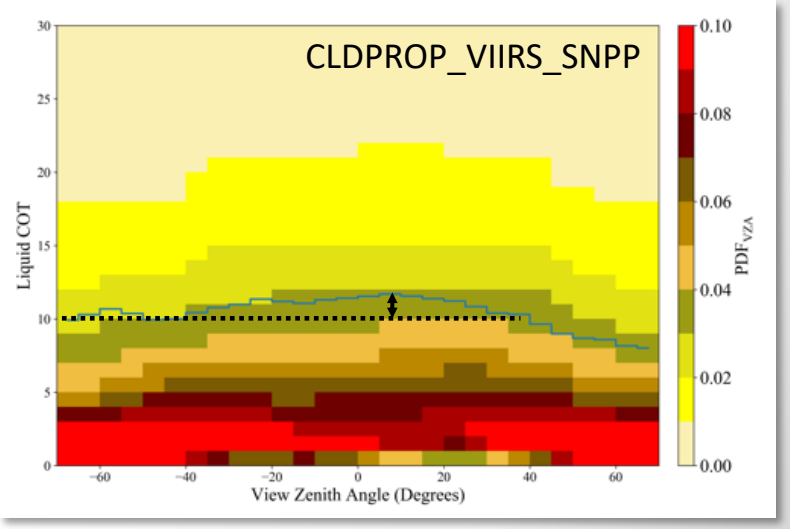


Monthly Aggregated Example: February 2014 Liquid Cloud Retrieval Fraction

CLDPROP Status and Ongoing Efforts

- NOAA-20 VIIRS processing
  - Completed, delivery to LAADS pending final OK
    - Includes NOAA-20 VIIRS shortwave radiometric corrections
- Aqua MODIS – SNPP VIIRS continuity analysis
  - Spatial resolution differences (sub-pixel heterogeneity impacts and overcast/PCL sampling differences), temporal sampling differences, etc.
- Three papers describing CLDPROP development efforts submitted to Remote Sensing special issue
  - Algorithm description [*Platnick/Meyer et al.*, 2020]
  - SWIR liquid index of refraction update [*Platnick et al.*, 2020]
  - MODIS-VIIRS (SNPP and NOAA-20) shortwave intercalibration [*Meyer et al.*, 2020]



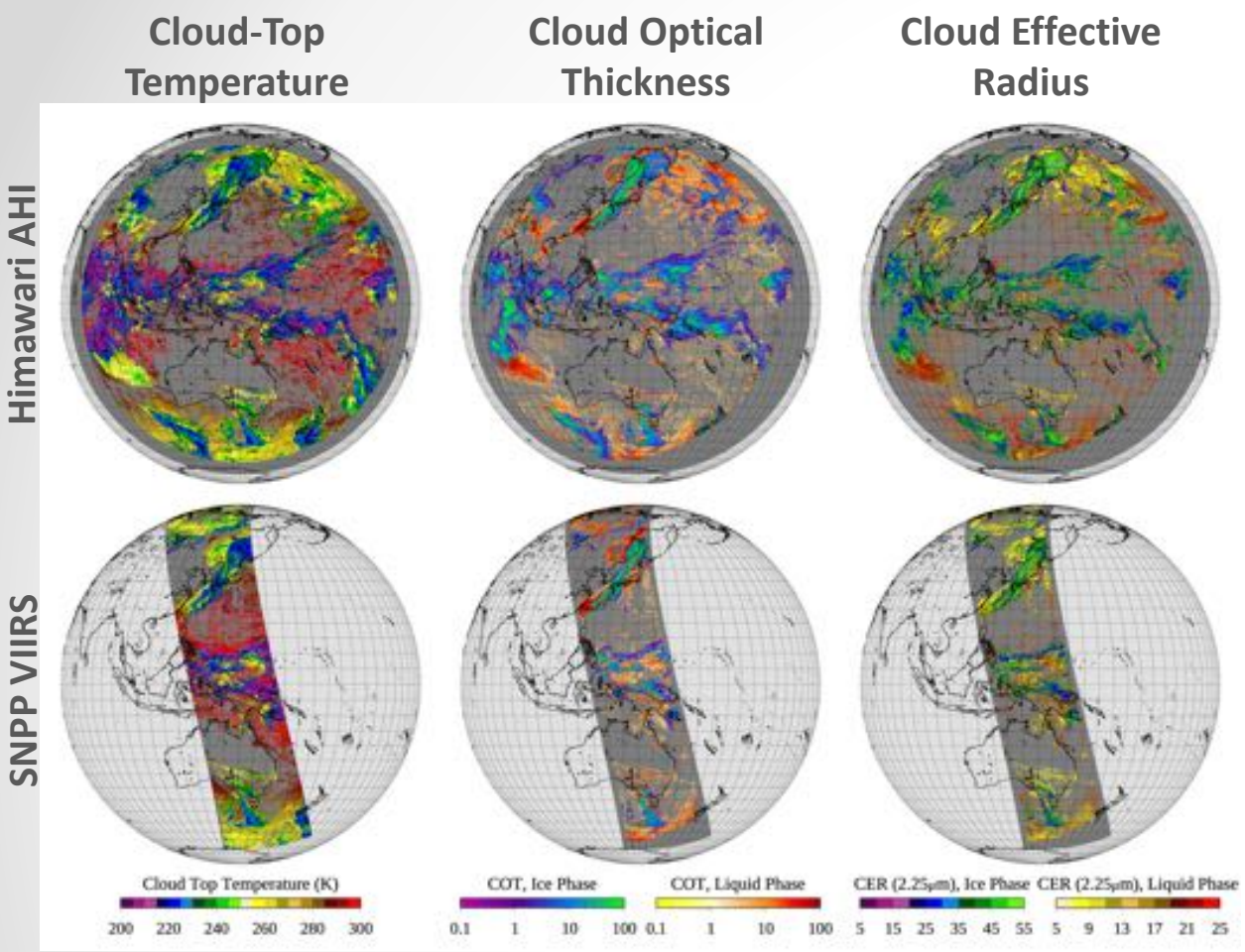


Spatial resolution differences evident in across-swath liquid COT retrieval statistics

Cloud Team Updates

Other Team Activities

- Standard (MOD/MYD06) and continuity (CLDPROP) CFMIP Observation Simulation Package (COSP) products
  - Subset of key L3 cloud parameters geared for climate modelers
    - NetCDF-4 files, based on A-SIPS Yori aggregation software package
  - Terra + Aqua merged standard product (MCD06COSP) available now in LAADS; continuity products (CLDPROPCOSP_MODIS/VIIRS) delivered and available soon
- You will be assimilated into CHIMAERA. Resistance is futile.
  - New generation advanced GEO imager (GOES-ABI, Himawari AHI, GEO-KOMPSAT AMI, MSG SEVIRI) products funded under ROSES-19 ESROGSS
  - DSCOVR EPIC (ROSES-14/18); Landsat OLI/TIRS, Sentinel-2 MSI, RSP (CAMP^{2}Ex support); ASTER, CAVIS, eMAS, AVIRIS,…
  - Cloud + above-cloud aerosols: MOD06ACAERO [*Meyer et al.*, 2015]
  - Capabilities enabled by CHIMAERA shared-core architecture [*Wind et al.*, 2020]



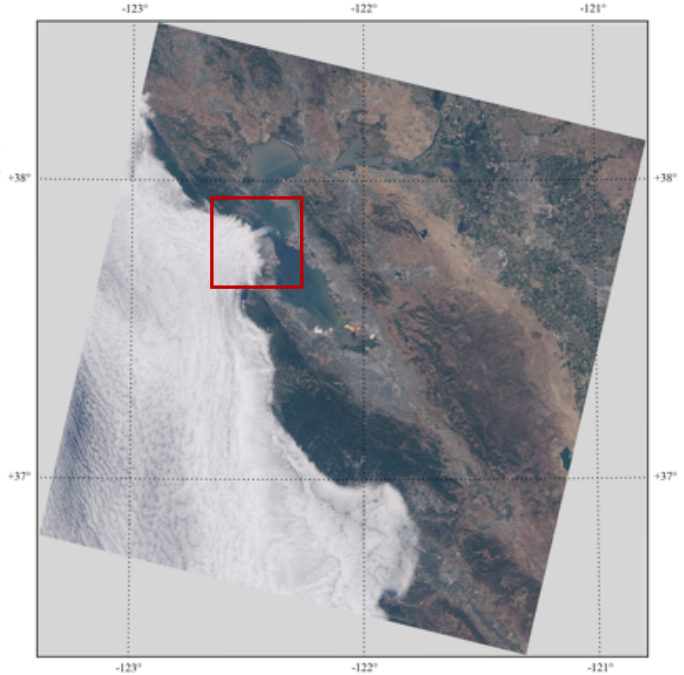
Himawari AHI and SNPP VIIRS CLDPROP

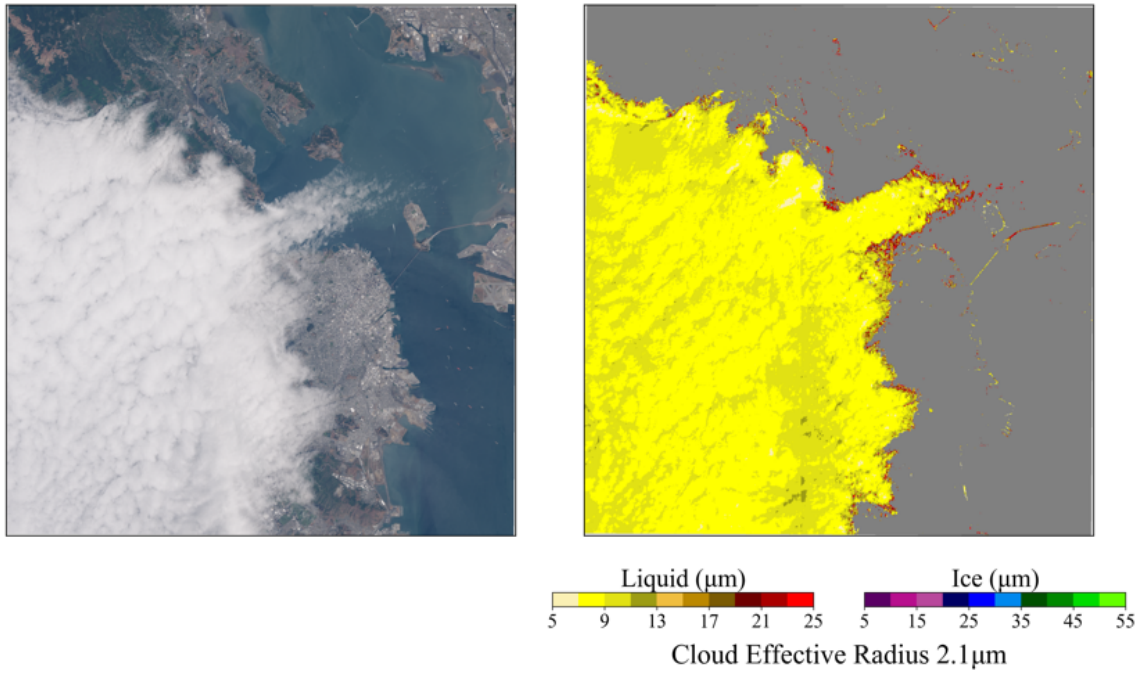
16 May 2016, 0410 UTC

Landsat-8 OLI/TIRS

San Francisco Bay Area

22 July 2019, 1846 UTC





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