

Cloud Mask and Cloud-Top/Optical Properties: MODIS Standard & MODIS/VIIRS Continuity Products

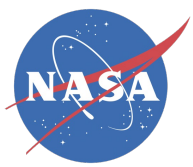
PI: Meyer (cont.), Platnick (standard); Co-Is: Holz, Wang; Team: Amarasinghe, Wind, Miller, Hubanks, Veglio, Dutcher

Multiple Ongoing Efforts

- Trending analysis of MOD/MYD06 C6.1 (Standard) and CLDPROP v1.1 (Continuity)
 - Evaluating algorithm and sensor consistency
 - Evaluating approaches for sensor data record “stitching”
- Science tests for CLDMSK/CLDPROP v2 and MODIS Standard C7 algorithm updates
- Engagement in community efforts:
 - Contributed to GEWEX cloud assessment (CLDMSK/CLDPROP and MODIS Standard)
 - Developed/released new COSP datasets for model evaluation (CLDMSK/CLDPROP; MODIS Standard in prep)
 - Maintain Atmosphere Discipline website (<https://atmosphere-imager.gsfc.nasa.gov/>)

Objectives:

- To continue maintaining the C6.1 MODIS standard cloud optical property products and to prepare and implement key advancements for C7 reprocessing
- To continue advancing the common CLDPROP algorithm designed to provide continuity between EOS MODIS and the VIIRS imagers on SNPP and NOAA-20+
- To coordinate the LEO continuity efforts with parallel advanced Geostationary imager algorithm efforts to achieve an internally consistent NASA Program of Record for clouds that is expected to support upcoming Designated Observables missions (e.g., AOS)



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MODIS Standard C6.1 reprocessing occurred in 2017, forward processing ongoing

MODIS/VIIRS
Continuity processing
history (at right)

Product Name	Description	Latest Version	Sensor	Public Release Date (latest version)
CLDMSK_L2	Cloud Mask	v1.0	VIIRS SNPP	3/2019
			VIIRS NOAA-20	1/2021
CLDPROP_L2	Cloud-Top, Optical, and Microphysical Properties	v1.1	MODIS Aqua	3/2019
			VIIRS SNPP	11/2019
			VIIRS NOAA-20	4/2021
CLDPROP_L3	Daily, Monthly Gridded Aggregations	v1.1	MODIS Aqua	11/2019
			VIIRS SNPP	11/2019
			VIIRS NOAA-20	4/2021

Known Issues or Concerns

<https://atmosphere-imager.gsfc.nasa.gov/continuity/issues>

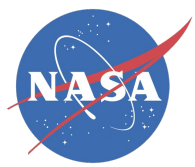
Recent/Relevant Publications

Frey, R. A., et al. (2020), The continuity MODIS-VIIRS cloud mask, *Remote Sens.*, 12, 3334, doi:10.3390/rs12203334.

Meyer, K., et al. (2020), Derivation of shortwave radiometric adjustments for SNPP and NOAA-20 VIIRS for the NASA MODIS-VIIRS continuity cloud products, *Remote Sens.*, 12, 4096, doi:10.3390/rs12244096.

Platnick, S., et al. (2020), Sensitivity of multispectral imager liquid water cloud microphysical retrievals to the index of refraction, *Remote Sens.*, 12, 4165, doi:10.3390/rs12244165.

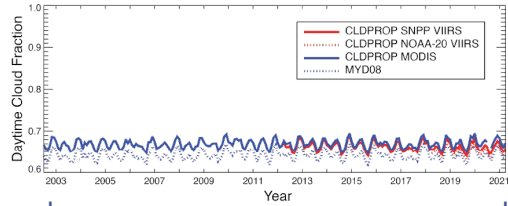
Platnick, S., et al. (2021), The NASA MODIS-VIIRS continuity cloud optical properties products, *Remote Sens.*, 13, 2, doi:10.3390/rs13010002.



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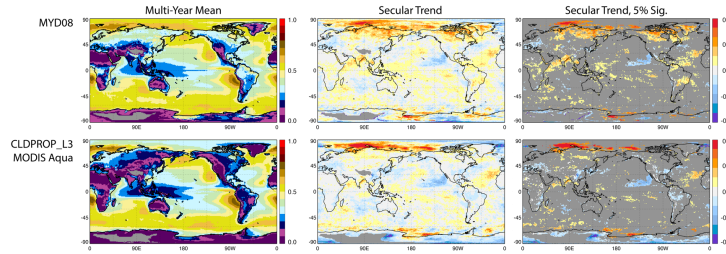
Trending Analysis

Approach



CLDPROP_L3 MODIS Aqua vs MYD08

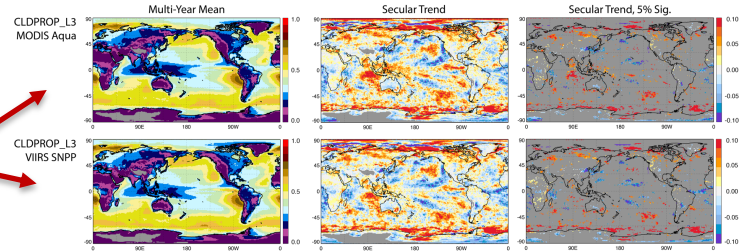
CLDPROP_L3 MODIS Aqua vs VIIRS SNPP



Example: Daytime Low Cloud Fraction
(CTP \geq 800mb) Example

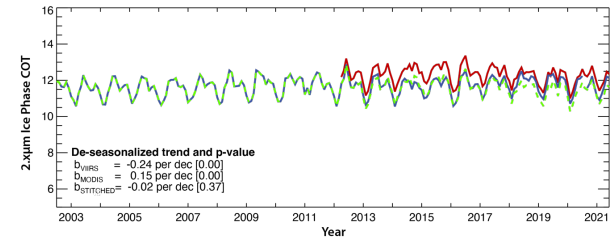
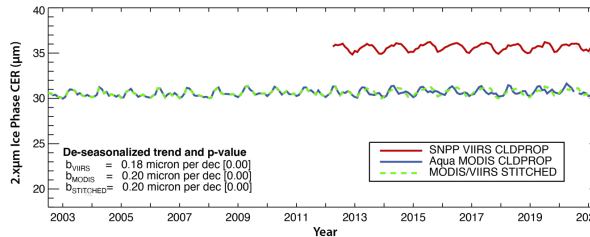
Inter-Algorithm (Same Sensor) Trends:
CLDPROP_L3 MODIS Aqua = MYD08

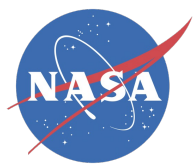
Inter-Sensor (Same Algorithm) Trends:
Aqua MODIS = SNPP VIIRS



Merging MODIS/VIIRS Data Records

Approach at right: Compute mean
VIIRS – MODIS difference over 2013,
subtract from VIIRS

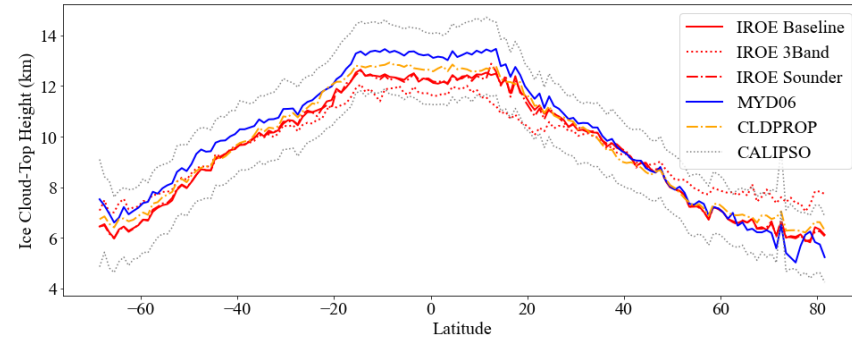
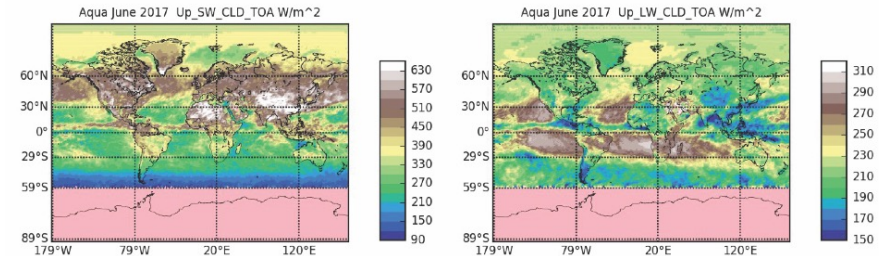




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Key Updates for CLDMSK/CLDPROP v2:

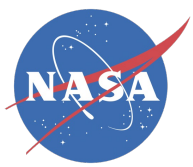
New cloud-top properties algorithm (IROE) that also provides day/night ice cloud optical properties and enables leveraging AIRS and CrIS sounder absorption channels



Pixel-level SW and LW broadband radiative flux calculations (TOA, sfc) using cloud property retrievals as input

Other Science Updates:

- Machine learning algorithm for cloud thermodynamic phase classification (liquid, ice) based on Random Forest approach (Wang et al., 2020)
- Leverage high-resolution VIIRS I-bands for sub-pixel information
- Complementary thin cirrus optical thickness retrievals using 1.38 μ m water vapor absorption channel (Meyer & Platnick, 2010)



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Key Updates for MODIS Standard C7:

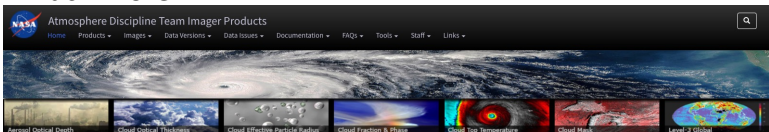
- Same science updates as for CLDMSK/CLDPROP v2 (IROE, flux, etc. on previous slide)
- Will also leverage key continuity algorithms/code to ease maintenance
 - CLDMSK code base for MOD/MYD35 (all MOD/MYD35 tests and thresholds retained) – same code that is used for parallel imager efforts (e.g., GEO)
 - Yori algorithm developed by A-SIPS to replace current MOD/MYD08 algorithm for L3 gridded aggregations
 - Provides scalar/multi-dimensional statistics consistent with current MOD/MYD08
 - But with some consequences:
 - Separate L3 daily and monthly product files for each L2 Atmosphere science product (e.g., cloud, aerosol, etc.)
 - Same internal variable formatting as CLDPROP_L3
- File format change to netCDF-4 for all Atmosphere products



Cloud Mask and Cloud-Top/Optical Properties: MODIS Standard & MODIS/VIIRS Continuity Products

Atmosphere Discipline Team Imager Products Website

Documentation, known issues, browse imagery, and much more...

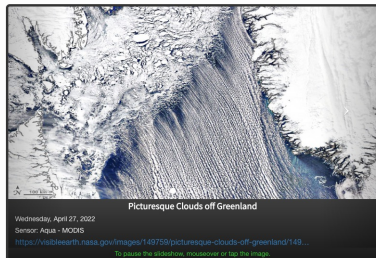


Introduction

The MODIS-VIIRS Atmosphere Discipline Team develops and maintains imager remote sensing algorithms for the creation of long-term climate data records of derived geophysical parameters pertaining to atmospheric properties of the Earth (aerosols, clouds, water vapor). The Atmosphere Team traces its roots to the EOS flagship Terra and Aqua missions, launched in 1999 and 2002, respectively, and specifically in support of the twin Moderate-resolution Imaging Spectroradiometers (MODIS). As these missions and sensors age, NASA is supporting the extension of key EOS-era MODIS climate data records to NOAA's next-generation polar orbiting imager VIIRS, the first of which was launched on the Suomi NPP platform in 2011. Both MODIS and VIIRS provide wide spectral range (narrowband channels from visible to infrared), high spatial resolution, and near-daily to daily global coverage of the Earth and its atmosphere.

To support climate data record production from two different sensors, two product streams are available, both archived at the Level-1 and Atmosphere Archive & Distribution System (LAADS) Distributed Active Archive Center (DAAC): the EOS-Heritage MODIS Standard Products, and the Continuity Products derived from VIIRS. While in many cases the Continuity algorithms are direct descendants of the MODIS Standard algorithms, in some cases (e.g., clouds) they are not. Details on both product streams can be found in their respective Overview sections under the Products pull-down menu at the top of the page.

Visible Earth Slideshow



Ordering Atmosphere Discipline Team Imager Data

Atmosphere Imager Data is distributed free of charge through LAADS. By utilizing the LAADS Search & Order Tool on the LAADS web site, one can search and subset data by collection, date & time, geographic area, science products, and selected metadata. In addition, a web-based directory site is available for direct file download: Direct Download MODIS Standard Atmosphere Data Collection 6.1, Direct Download Continuity Atmosphere Data Version 1.0 or Version 1.1. For all questions and/or problems related to ordering Atmosphere Data from LAADS, email MODAPS User Support at ModapsUSO@lists.nasa.gov or call 1-800-596-8132. For answers to Frequently Asked Questions, visit the FAQ section of this website.

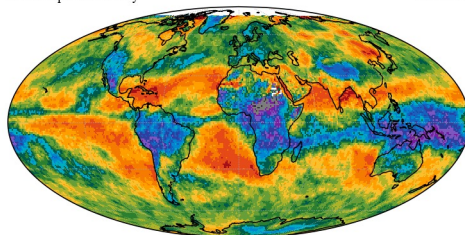
News and Spotlight

Continuity Products Released

Version 1.1 CLDRPROF (Cloud Properties) products are released. Version 1.0 CLDRMGR (Cloud Mask), AEROPR (Aerosol Optical Depth), & AEROT (Aerosol Dark Target) products are also released. Product availability is from 1 March 2012 through the present for all products. For the CLDRMGR and CLDRPROF products, there are both SNPP-VIIRS and Aqua-MODIS streams. For the AEROPR & AEROT products, there is only a SNPP-VIIRS stream. Both Level 2 (L2) and Level 3 (L3) products are available for AEROPR and CLDRPROF. At the present time, only Level 2 (L2) products are available for AEROT. Keep up with late-breaking LAADS news and spotlight items at LAADS-Aeros and issues.

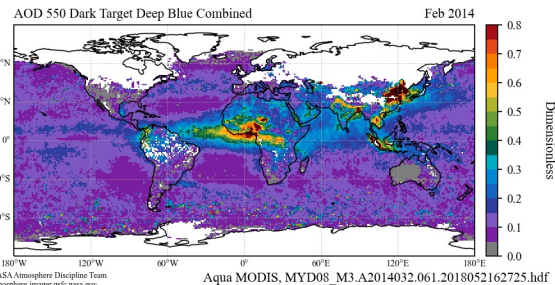
Read all the news.

Cloud Top Pressure Day



NASA Atmosphere Discipline Team
atmosphere-imager.gsfc.nasa.gov

Aqua MODIS, MYD08_M3.A2014032.061.2018052162725.hdf

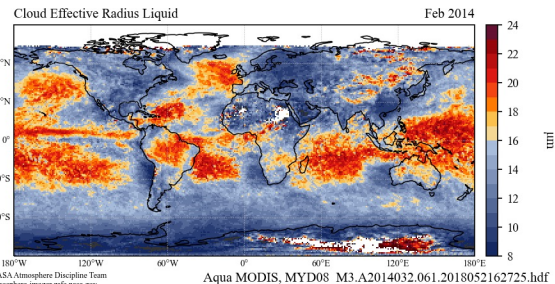


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Aqua MODIS, MYD08_M3.A2014032.061.2018052162725.hdf

New Python-based L3 browse imagery under development

- Platte Carrée and Mollweide projections
- Rainbow and colorblind friendly color bars



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