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

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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
			MODIS Aqua	3/2019
CLDPROP_L2	Cloud-Top, Optical, and Microphysical Properties	v1.1	VIIRS SNPP	11/2019
			VIIRS NOAA-20	4/2021
			MODIS Aqua	11/2019
CLDPROP_L3	Daily, Monthly Gridded Aggregations	v1.1	VIIRS SNPP	11/2019
			VIIRS NOAA-20	4/2021
			MODIS Aqua	11/2019

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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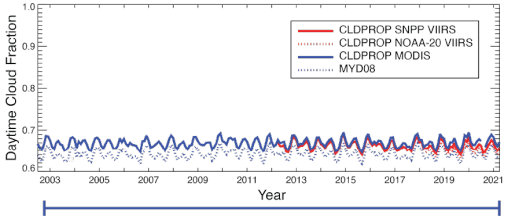
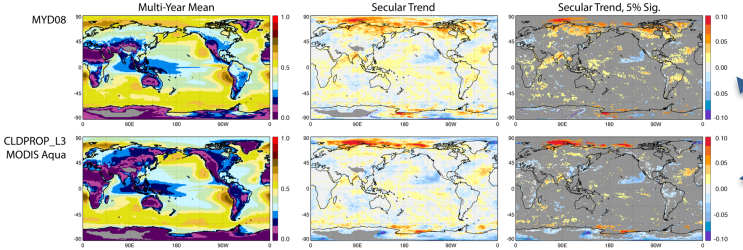
Trending Analysis

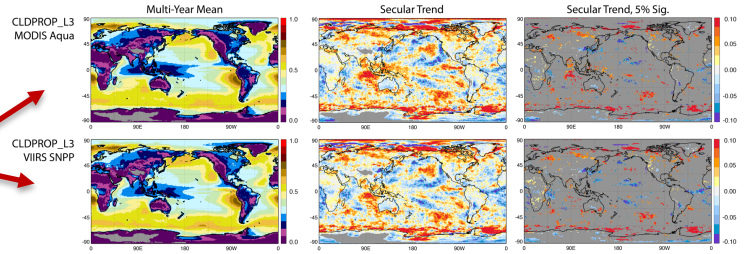
Approach





Example: Daytime Low Cloud Fraction (CTP ≥ 800mb) Example

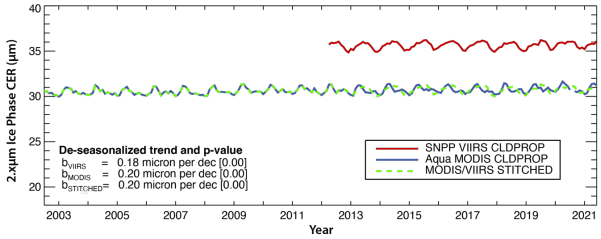
Inter-*Algorithm* (Same Sensor) Trends: CLDPROP_L3 MODIS Aqua = MYD08

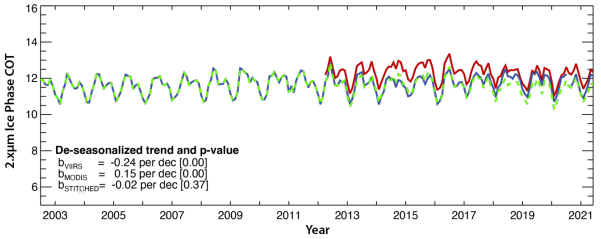


Inter-*Sensor* (Same Algorithm) Trends: Aqua MODIS = SNPP VIIRS

Merging MODIS/VIIRS Data Records

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





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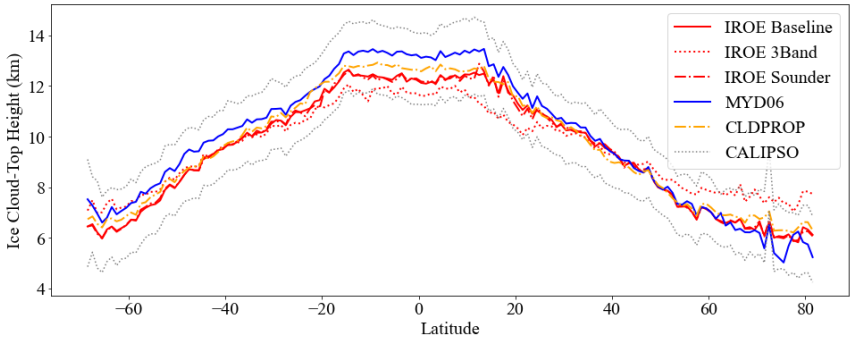
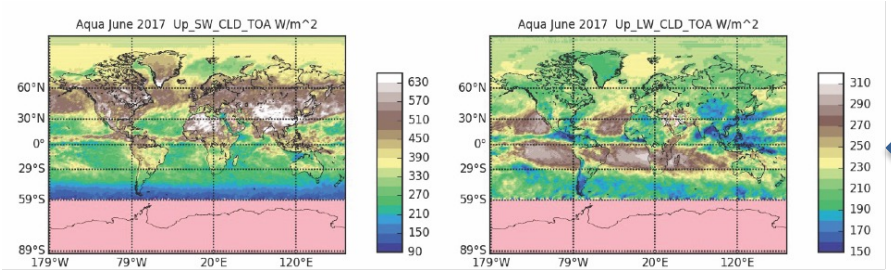
Key Updates for CLDMSK/CLDPROP v2:

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 1.38µm 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

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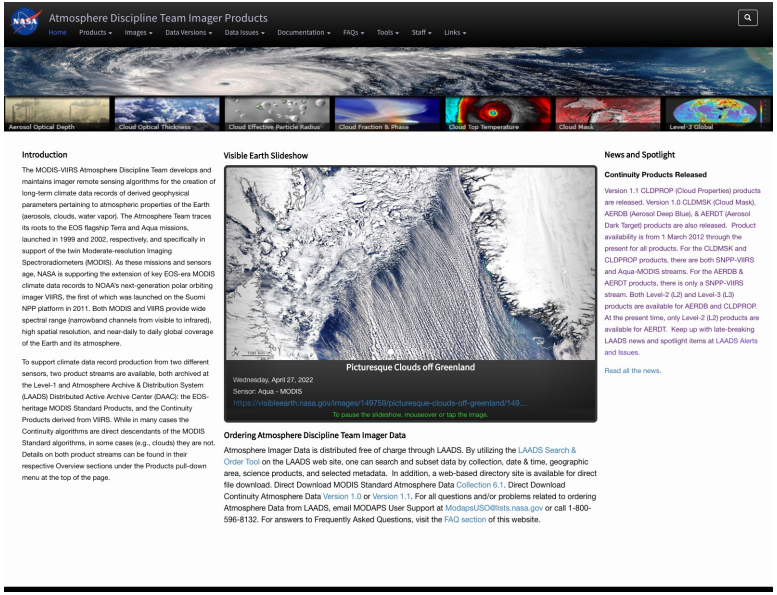
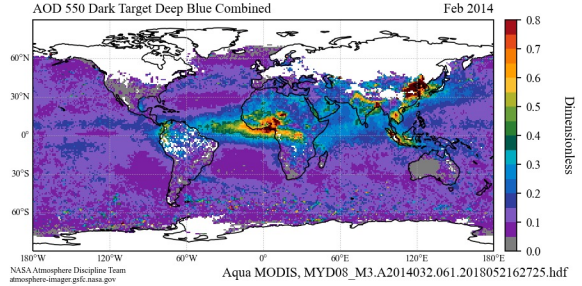
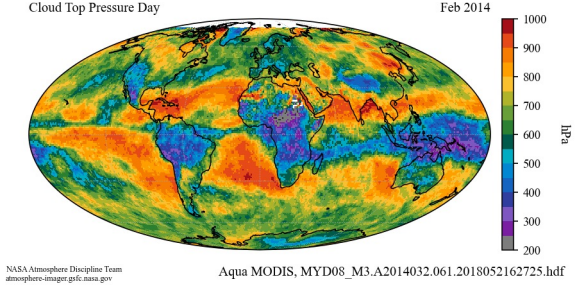
Atmosphere Discipline Team Imager Products Website

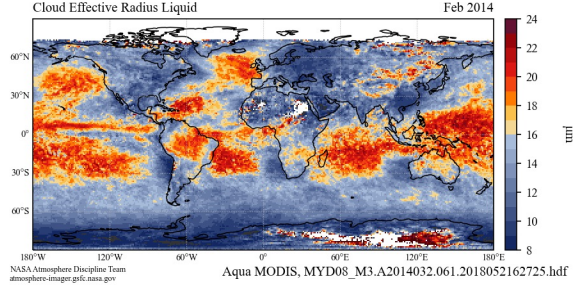
Documentation, known issues, browse imagery, and much more…



https://atmosphere-imager.gsfc.nasa.gov/





New Python-based L3 browse imagery under development

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