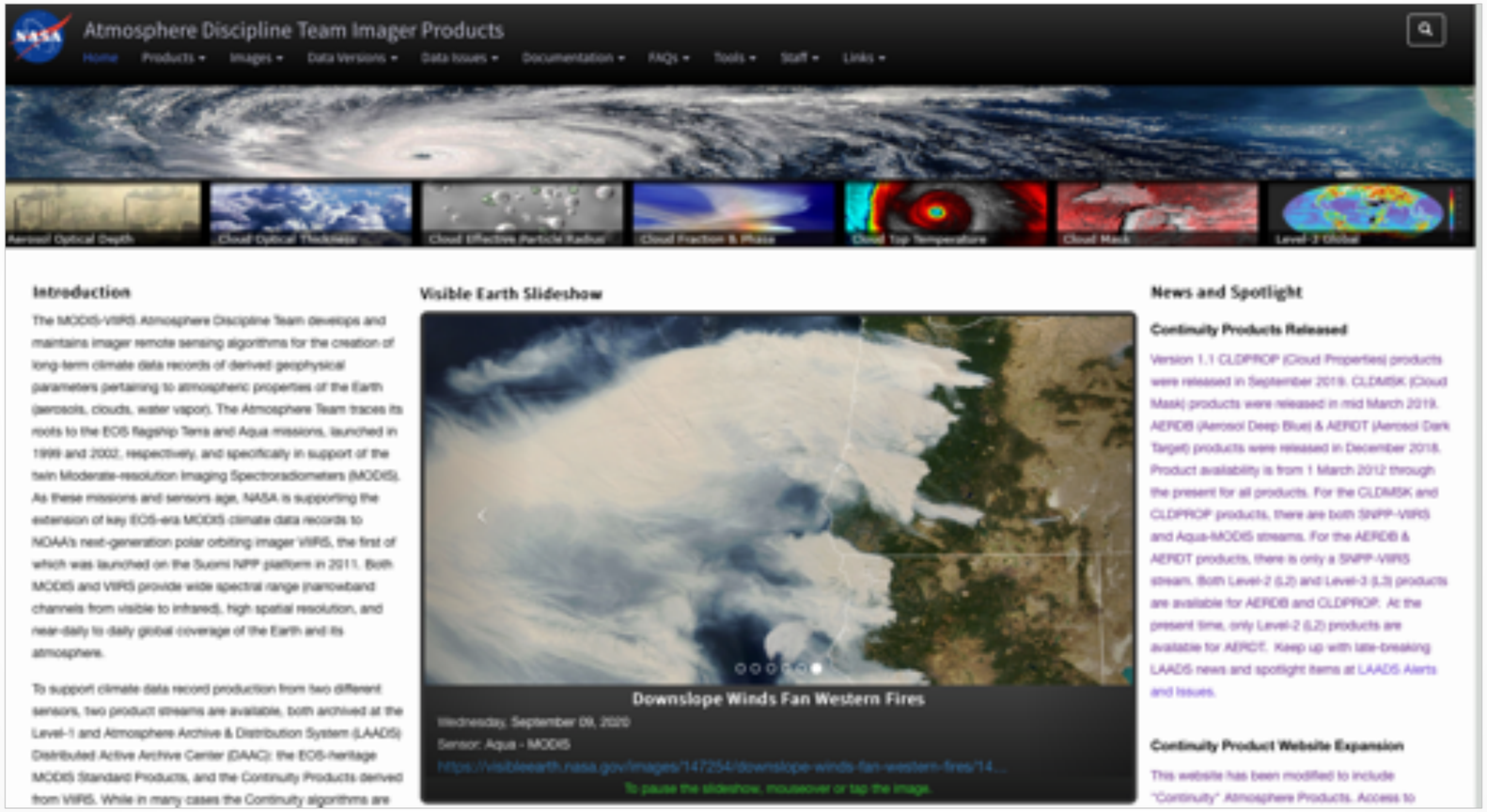
MODIS and Suomi-NPP Discipline Summary Report – Atmosphere

S. Ackerman, S. Platnick



MODIS-VIIRS Atmosphere Discipline Meeting
16 November 2020

1:00-1:30 PM EST

Part 1: Intro

1. Objectives, Atmosphere Discipline Overview,
   Where We Left Off in Nov. 2019: the Steves [15 min]
2. HQ remarks: Mike Falkowski, Barry Lefer or Hal Maring [5 min]
3. Terra/Aqua Senior Review Status: Lazaros Oreopoulos [10 min]

1:30-3:10 PM EST

Part 2: Production and Products

1. Atmosphere SIPS status and plans: Liam Gumley [20 min]
2. Aerosol Deep Blue: Christina Hsu [10 min]
3. Aerosol Dark Target: Rob Levy [10 min]
4. Clouds products
   a. mask: Rich Frey [10 min]
   b. continuity cloud top properties: Andy Heidinger [10 min]
   c. cloud optical properties: Kerry Meyer [10 min]
5. VIIRS/CrIS fusion: Bryan Baum, given by Eva Borbas [10 min]
6. Volcanic SO2 detection/mapping: Vince Realmuto [10 min]

   General product discussion, user needs, etc. [10 min]

Break

3:30-5:00 PM EST

Part 3: Science Analysis Investigations

1. Zhibo Zhang: *Analysis of MODIS and CALIOP dust climatology and trends* [10 min]
2. Hongbin Yu: *June 2020 "gorilla" dust event analysis: MODIS, CALIOP and GEOS-5* [10 min]
3. Eric Wilcox: *A Study of Atmospheric Heating by Black Carbon Aerosols and its Impacts* [10 min]
4. Jay Mace: *Influence of volcanic sulfate aerosol on cloud properties using MODIS and the A-Train* [10 min]
5. Anthony Davis: *Multi-angle/multi-spectral/multi-pixel remote sensing of 3D convectively-driven clouds with MISR and MODIS: A Progress Report* [10 min]
6. Larry Di Girolamo: *CAMP2Ex campaign overview* **+** *Terra Data Fusion* [20 min]

   Discussion [as needed]

The TASNPP 2017 MODIS & VIIRS Atmosphere Team

Team Members	Organization	E-mail Address	MODIS	VIIRS	Discipline	Algorithm development and maintenance
King, Michael	Univ. of Colorado - LASP	michael.king@lasp.colorado.edu	x		Team Leader	MODIS Team Leader
Baum, Bryan	STC	baum@stcnet.com		x	Team Leader/atmo	SNPP/VIIRS Team Leader; Fusion of VIIRS and CrIS data to construct supplementary infrared radiances for VIIRS
Ackerman, Steve	Univ. of Wisc. - Madison	saackerm@wisc.edu	x	x	atmosphere	VIIRS atmosphere discipline lead; Cloud mask
Davis, Anthony	JPL	anthony.b.davis@jpl.nasa.gov	x		atmosphere	Cloud process modeling for 3D convective clouds, merging MODIS and MISR
Fu, Qiang	Univ. of Washington	qfu@atmos.washington.edu	x		atmosphere	Influence of tropical clouds on tropical lower stratospheric temperatures
Gassó, Santiago	GSFC	santiago.gasso@nasa.gov		x	atmosphere	Aerosol single scattering albedo using VIIRS & OMPS-N
Gu, Yu	UCLA	gu@atmos.ucla.edu	x		atmosphere	Anthropogenic aerosol effects on ice clouds
Gupta, Pawan	GSFC	pawan.gupta@nasa.gov	x		atmosphere	Biomass burning and aerosol characteristics in India
Hsu, Christina	GSFC	christina.hsu@nasa.gov	x	x	atmosphere	Aerosol properties over bright-reflecting land (Deep Blue)
Levy, Rob	GSFC	robert.c.levy@nasa.gov	x		atmosphere	Aerosol properties using dense dark vegetation & ocean
Mace, Jay	Univ. of Utah	jay.mace@utah.edu	x		atmosphere	Influence of volcanic sulfate aerosol on cloud properties
Norris, Joel	UCSD	jnorris@ucsd.edu	x	x	atmosphere	Boundary layer cloud processes
Platnick, Steve	GSFC	steven.platnick@nasa.gov	x	x	atmosphere	MODIS atmosphere discipline lead; Cloud optical properties, and level-3 joint atmosphere
Meyer, Kerry	GSFC	kerry.meyer@nasa.gov				co-I with Platnick, Ackerman, et al.
Holz, Bob	Univ. of Wisc. - Madison	reholz@ssec.wisc.edu				co-I with Platnick, Ackerman, et al.
Realmuto, Vincent	JPL	vincent.j.realmuto@jpl.nasa.gov	x	x	atmosphere	TIR-based volcanic SO_2 products
Soden, Brian	U. Miami	bsoden@rsmas.miami.edu	x	x	atmosphere	Investigating Radiative Feedbacks during the EOS Era [A-Train]
Tan, Ivy	UMBC	ivy.tan@nasa.gov	x		atmosphere	Extratropical cloud optical depth feedback
Várnai, Tamas	GSFC	tamas.varnai@nasa.gov	x	x	atmosphere	Aerosol properties in partly cloudy regions
Wang, Zhien	Univ. of Colorado - LASP	zhien.wang@lasp.colorado.edu	x		atmosphere	Seasonal and interannual variations of convective clouds
Wilcox, Eric	DRI	eric.wilcox@dri.edu	x		atmosphere	Atmospheric heating by black carbon aerosols
Yang, Ping	Texas A&M Univ.	pyang@tamu.edu	x		atmosphere	Consistency of ice cloud models in forward retrieval and radiative forcing
Yu, Hongbin	GSFC	hongbin.yu@nasa.gov	x	x	atmosphere	Net radiative effect of mineral dust
Zhang, Zhibo	UMBC	zzbatmos@umbc.edu				co-I with Hongbin
Stone, Tom	USGS	tstone@usgs.gov	x	x	calibration	Lunar calibration

Report out, MODIS/VIIRS Atmos. Disc., Nov. 2020

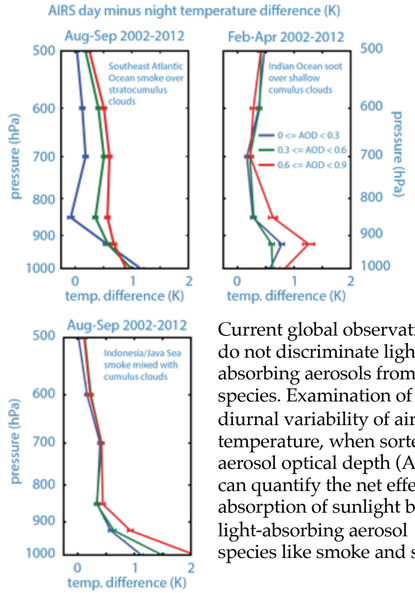
from *MODIS-VIIRS Team Members 2018.xlsx*

Atmosphere Disc. Team: example 2-page project summary

A Study of Atmospheric Heating by Black Carbon Aerosols and its Impacts

Eric Wilcox and Marco Giordano, Division of Atmospheric Sciences, Desert Research Institute, Reno, NV
Jun Wang and Xiaoguang Xu, Department of Chemical and Biochemical Engineering, University of Iowa

FIGURE/CHARTS



Current global observations do not discriminate light-absorbing aerosols from other species. Examination of the diurnal variability of air temperature, when sorted by aerosol optical depth (AOD), can quantify the net effect of absorption of sunlight by light-absorbing aerosol species like smoke and soot.

Objectives

- Evaluate the vertical profile of day/night air temperature contrast as a viable diagnostic for black carbon (BC) radiative heating.
- Characterize low cloud responses to variations in that BC aerosol heating.
- Broad quantification of these responses across the global tropics and subtropics.
- Supporting analyses of in-situ observations and modeling of radiative transfer and clouds.

21

A Study of Atmospheric Heating by Black Carbon Aerosols and its Impacts

Eric Wilcox and Marco Giordano, Division of Atmospheric Sciences, Desert Research Institute, Reno, NV
Jun Wang and Xiaoguang Xu, Department of Chemical and Biochemical Engineering, University of Iowa

Status and Updates:

- Robust signal of BC aerosols in AIRS temperature broadly identified.
- Seeking verification with in-situ observations and radiative transfer modeling.
- Quantifying cloud responses with AMSR-E, MODIS and CALIPSO cloud products.

Needed Products:

- AIRS temperature profiles
- MODIS AOD, cloud-top properties
- AMSR-E cloud water path
- CALIPSO cloud layer detection

Known Issues:

- N/A

Recent Publications:

Xu, X., Wang, J., Zeng, J., Hou, W., Meyer, K.G., Platnick, S.E. and Wilcox, E.M., 2018. A pilot study of shortwave spectral fingerprints of smoke aerosols above liquid clouds. *JQSRT*, *221*.

MODIS is crucial to constraining the aerosol variations in this study. The application of newer aerosol-over-cloud retrievals can better discriminate cases where BC aerosol heating is important for cloud responses.

MODIS cloud property retrievals (liquid water path, particle effective radius) are important for characterizing cloud responses to BC aerosol heating.

22

proj. summaries will be compiled/posted on MODIS site

MODIS & VIIRS Atmosphere Team Processing Organization

MODIS Terra/Aqua L1B
(MOD/MYD02)

↓

MODAPS processing (GSFC)

Aerosols: MOD04
Water Vapor: MOD05; Profiles: MOD07
Cloud Mask: MOD35
Cloud Top + Optical Properties: MOD06
L2 joint: MODATML2
Team L3: MOD08; Cloud L3: COSP

↓

LAADS (GSFC) archive and distribution
+ LANCE (GSFC) NRT

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NASA SNPP/NOAA20 VIIRS L1B (SIPS-intermediate)
(VNP/VJ102MOD)

↓

Atmosphere SIPS processing (U. Wisconsin)

Aerosol Deep Blue: AERDB
Aerosol Dark Target: AERDT*
Cloud Mask: CLDMSK [VIIRS + MODIS Aqua]
Cloud Top + Optical Properties: CLDPROP [V + M-A]
VIIRS-CrIS IR channe
Water Vapor*: WAT
L3 (for each L2 proc

Naming convention ex.:
AERDB_M3_VIIRS_SNPP
CLDMSK_L2_VIIRS_NOAA20

Cloud continuity products:
CLDPROP_L2_VIIRS_SNPP
CLDPROP_L2_MODIS_Aqua

LAADS (GSFC) archive and distribution
+ LANCE (GSFC) NRT

** not funded via TASNPP 2017*

Collection/Version History

MODIS Atmosphere Team Products (MOD/MYD 04, 05, 06, 07, 35, 08, ATML2)

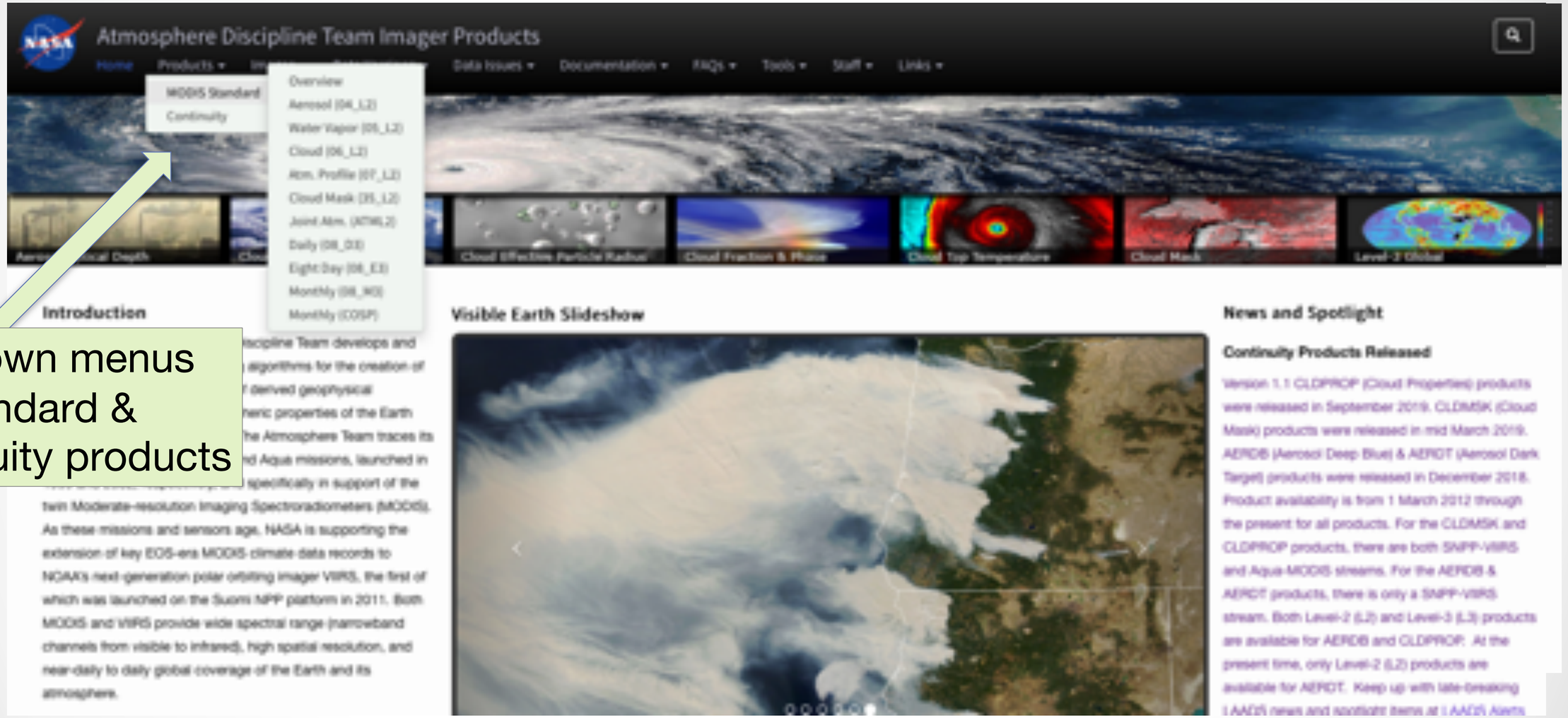
Collection	Start of Reprocessing MODIS Terra	Start of Reprocessing MODIS Aqua
6.1	Sept. 2017 (completed Dec. 2017)	Dec. 2017 (completed March 2018)
6.0	2014	2013
5.1	2008	2008
5.0	2005	2005
4	2002	2002
3	2001	2002
1	2000	–

SNPP Continuity Products (AERDB[3], AERDT[3], CLDMSK[2], CLDPROP[3], FSNRAD[1])

Version	A-SIPS delivery to LAADS
1.1 (CLDPROP)	Jan. 2020
1.0	Dec. 2018–Feb. 2020 (depending on product)

NOAA 20 availability: [1]Nov. 2019, [2]Nov. 2020, [3]Dec. 2020

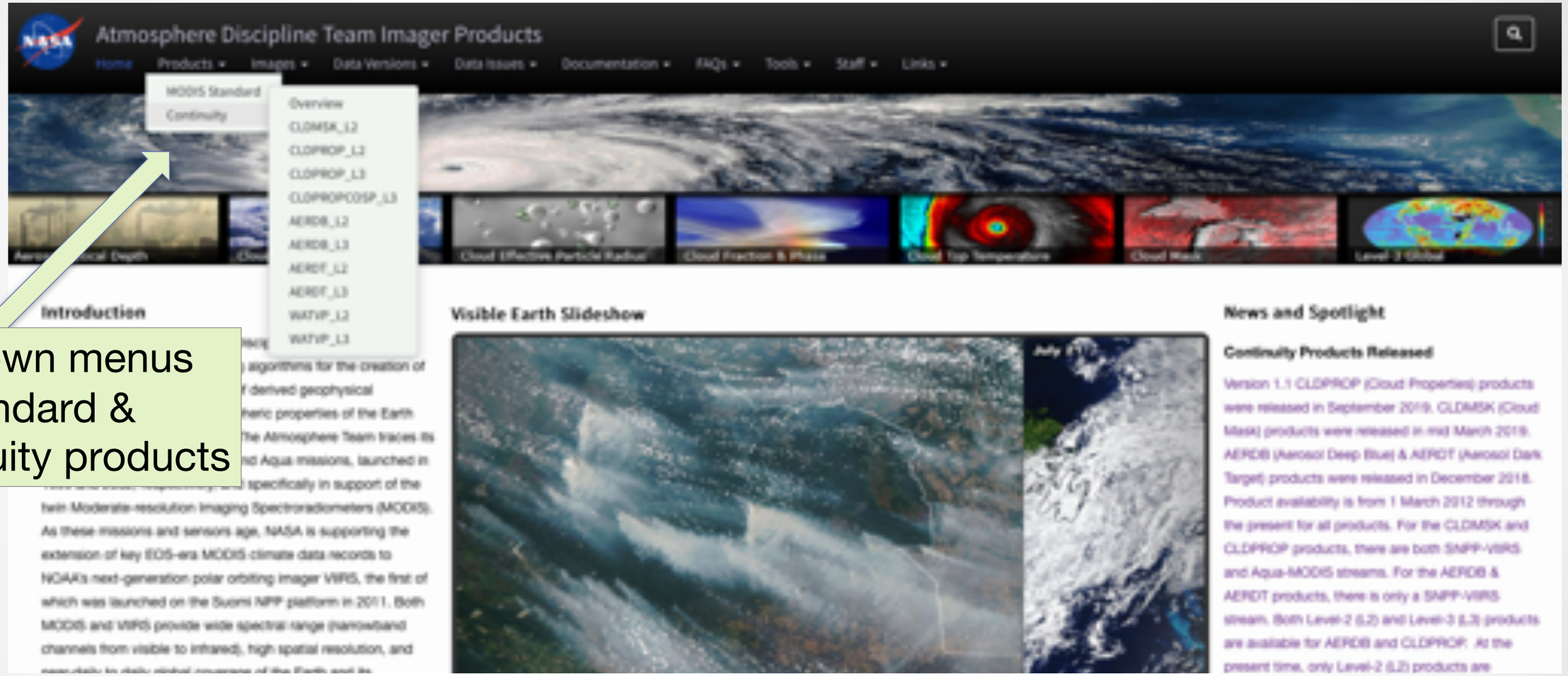
Atmospheres Imager Team Web Site



pull-down menus for standard & continuity products

atmosphere-imager.gsfc.nasa.gov

Atmospheres Imager Team Web Site

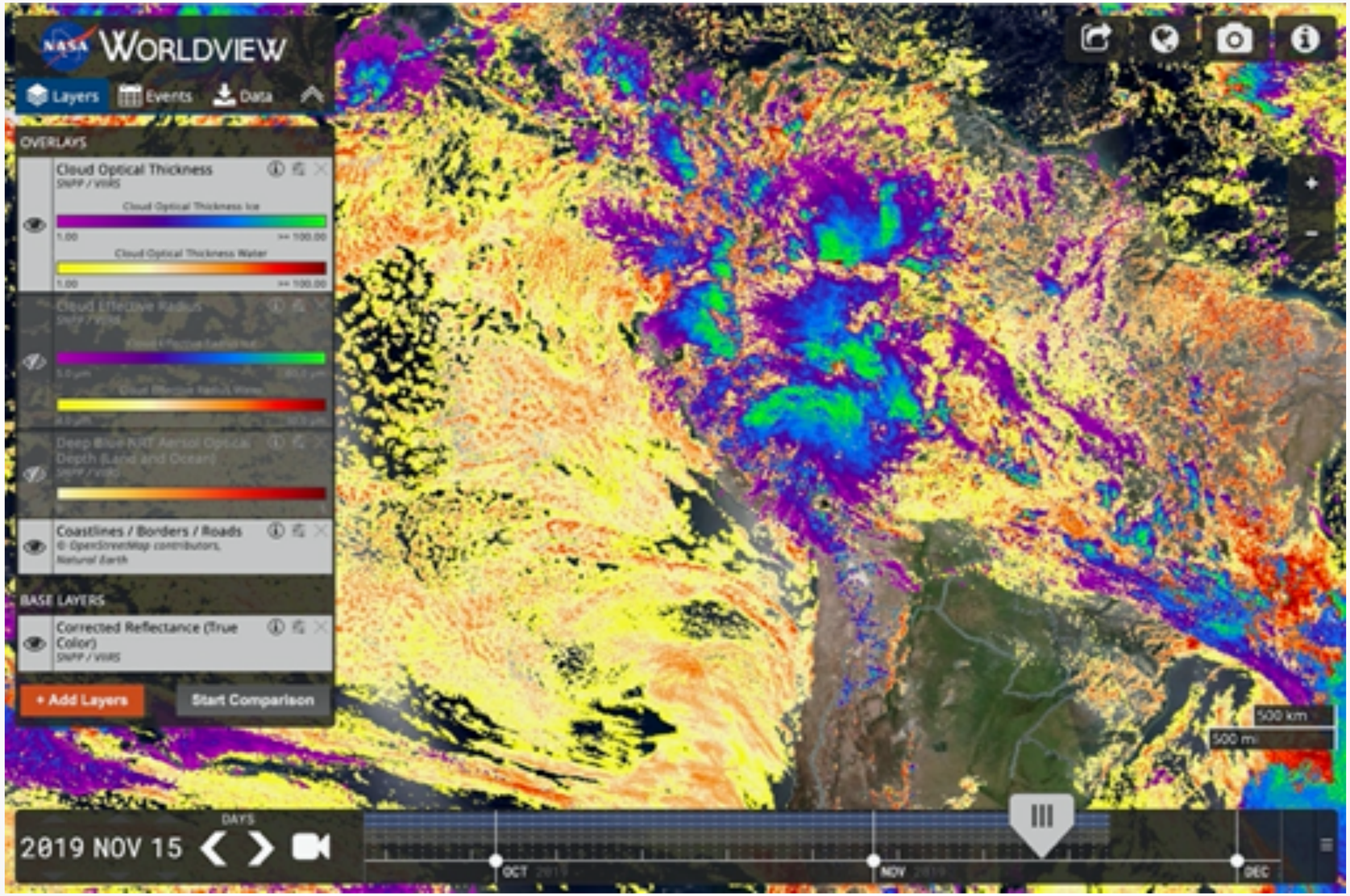


pull-down menus for standard & continuity products

Report out, MODIS/VIIRS Atmos. Disc., Nov. 2020

atmosphere-imager.gsfc.nasa.gov

CLDPROP in Worldview Example (VIIRS COT)



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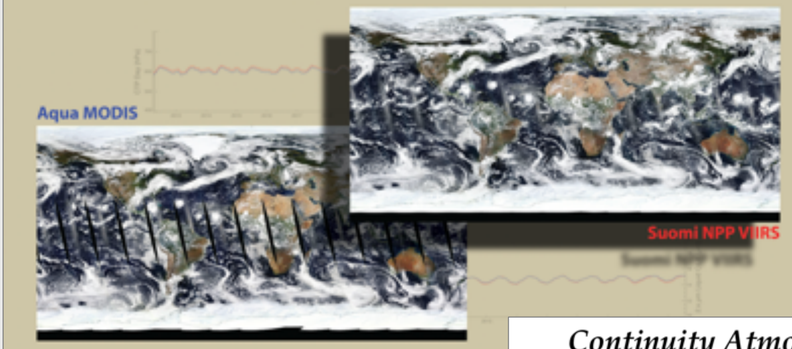
Continuity Product User Guides

EOS MODIS and SNPP VIIRS Cloud Properties:
User Guide for the Climate Data Record Continuity
Level-2 Cloud Top and Optical Properties Product
(CLDPROP)

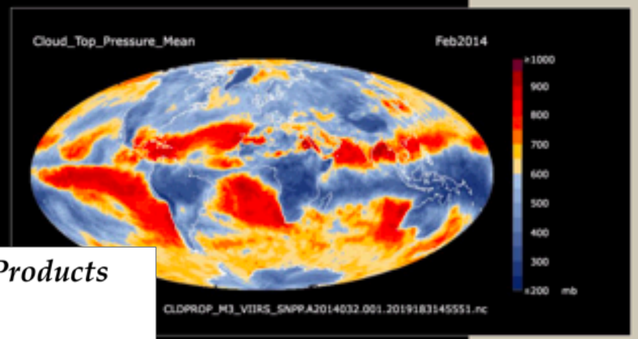


Version 1.1
October 2019

Cloud Masking Team
Steven A. Ackerman[6], Richard Frey[6]
Cloud Top Property Team
Andrew Heidinger[2], Yue Li[6], Andi Walther[6]
Cloud Optical Property Team
Steven Platnick[1], Kerry G. Meyer[1], Gala Wind[3,1], N
Chenxi Wang[4,1], Benjamin Marchant[5,1]
Product Assessment Support
Robert E. Holz[6], Steven Dutcher[6], Paul Hubanks[7,1]

1 Earth Sciences Division, NASA Goddard Space Flight Center, Greenbelt
2 NOAA NESDIS/STAR/CIMSS, Madison, WI
3 Science Systems and Applications, Inc., Lanham, MD
4 Earth System Science Interdisciplinary Center, University of Maryland,
5 Goddard Earth Sciences Technology and Research, Universities Space R
6 Cooperative Institute for Meteorological Satellite Studies, University of
7 ADNET Systems, Inc., Bethesda, MD

Level-3 Continuity Cloud Properties (CLDPROP_L3)
Global Gridded Product
User Guide



Continuity Atmosphere L3 CLDPROP
(VIIRS SNPP & MODIS Aqua)
l Gridded Products for Daily (D3) and Monthly (M3)
User Guide

User Guide, Version 1.7, 12 Septembe

s Platnick[2], Kerry Meyer[2], Michael King[3], Steve Acker
ger[4], Yue Li[4], Rich Frey[4], Andi Walther[4], Steve Dutche
e[4], Denis Botambekov[4], Gala Wind[5], Nandana Amarasin
amin Marchant[2], Bhaskar Ramachandran[5]

iland Space Flight Center, Greenbelt, MD
ric Physics, University of Colorado, Boulder, CO
adison, WI

Continuity Atmosphere Products
QA Plan
for CLDPROP, CLDMSK, & AERDB

Version 1.1
2 April 2019

The Continuity MODIS-VIIRS Cloud Mask (MVCM) User's Guide

Based on NASA MODIS Cloud Mask (MOD35, MYD35)
Reprocessed Data - Version 1
Product User's Guide Version 1.0

Richard Frey, Steve Ackerman, Robert Holz, Steve Dutcher
Space Science and Engineering Center
University of Wisconsin-Madison

January 2019

Table of contents

The Deep Blue aerosol project:

Aerosol retrievals from S-NPP VIIRS

Data product user guide and file specification document

This guide is specific to Version 1 of the VIIRS Deep Blue data products

Report out, MODIS/VIIRS Atmos. Disc., Nov. 2020

Update on Nov. 2019 Product Report Out [1/2]

A-SIPS partnership

- A-SIPS doing excellent work in processing data and engaging developers. Science team fully responsible for science code, enabling efficient product development and delivery, and clear line of responsibilities. Flexibility in science team code development and implementation is a strength of A-SIPS (and MODAPS).
- A-SIPS developed critical tools to support colocation, L3 aggregation, and assessment and validation using multi-instrument datasets (A-Train, etc.). Extensive A-SIPS data holdings (MODIS, CALIOP, VIIRS, CrIS, GEO, ancillary, etc.).

Continues!

Recommendation for processing/resources for products from non-NASA assets

- A-SIPS investments should be leveraged for future atmosphere algorithm efforts (such as combined geostationary and next generation LEO instruments). Fully capable of processing NOAA-20 (fusion implemented, other projects in spring 2020) and GEO ABI/AHI. Work with initial GEO imagers demonstrated but go-ahead to support further efforts associated with ROSES 2019 ESROGSS not yet approved by ESDIS.

Update on Nov. 2019 Product Report Out [2/2]

Product Documentation and Publications (ATBD/User Guide discussion)

- Agreed to combine ATBD/User Guide to focus documentation for science investigators. Documents for standard and continuity products posted to new Atmosphere Imager web site. DONE

Level-2 inter-sensor cal: [continuing concern, will revisit in next slide]

Level-3

- Yori tool developed by A-SIPS (science determines aggregation). To be used for cloud product aggregations. In production for clouds (e.g., CLDPROP_M3_VIIRS_SNPP), being ported to MODAPS for C7.
- Atmosphere Imager web site working to provide L3 browse imagery. DONE (clouds) need to add aerosols
- Aerosol and Cloud algorithms adjusting inter-sensor calibration. Adjustment factors given in the L2 cloud products, aerosol will do that in their next release. Handled different for aerosol and cloud products (bright vs. dark target scenes). GSFC => A-SIPS tool doing forward analysis for clouds
- How to handle 3-satellites not yet determined (MODIS Aqua is the current reference). NOAA-20 VIIRS analysis/adjustments added to cloud product (minor adjustments rel. to SNPP, *Meyer et al.* 2020)

Worldview: Valuable resource, need to add more satellite observations. Initial atmo. VIIRS datasets added. Discrimination of standard v. continuity product streams needed.

Transition of MODIS products NetCDF? NetCDF for MODIS standard products to be done by MODAPS.

Product Report out: Nov. 2020 virtual meeting [1/2]

A-SIPS continues to be a strong partner in developing and producing products

- A-SIPS continues to develop needed tools to support product development and assessment.
- Extensive A-SIPS data holdings helpful in development (MODIS, CALIOP, VIIRS, CrIS, GEO, ancillary, etc.).
- A-SIPS granule browser functionality also developed to support algorithm development

Processing/resources for products from non-NASA assets

- Automated monitoring of VIIRS Level-1, working on methods for Level-2 and Level-3
- A-SIPS preparing to ingest JPSS-2 sensor data (CrIS, VIIRS, ATMS)
- Is there a plan for SNPP once NOAA-21 launches?
- Awaiting ESDIS A-SIPS permission to assist on GEO imager algorithm testing.

Product, Documentation and Publications

- Volcanic plume SO2 (Vince Realmuto) is developing an ATBD/user guide. Need direction from HQ on ATBD review => production approval process.

Reflective Band Calibration between instruments

- Adjustment factors are archived in the L2 cloud products. Deep Blue aerosol product will do so in next version. Dark Target does not currently apply calibration adjustments to their code processing.

Product Report out: Nov. 2020 virtual meeting [2/2]

Atmosphere Discipline Team product challenges (mostly reminders)

- VIIRS spectral coverage and channel location
  - critical impact on cloud product suite: cloud top properties, cloud mask and a variety of QA and other information used in optical properties
  - continuity of some MODIS atmo. products not directly possible (water vapor, other clear sky datasets)
  - studies of how best to add sounder observations continue
- Two SIPS facilities. Not necessarily a negative, silver lining is that we've established extremely helpful tools and workflows at the A-SIPS. However, there is a labor/schedule impact in working with different science test/production facilities that is significant upfront; does not go to zero in the long term.
- Other sensors the teams have been involved in: AHI/ABI [ROSES ESROGSS] and various airborne, Landsat 8, Sentinel-2 [as support available] … increasingly challenging to phase fragmented funding across a broad sensor portfolio to support unified algorithms that broadly support ESD programs and the DS PoR.
- For situational awareness: In ROSES TASNPP 2017, an atmosphere product team received funding for MODIS standard product Collection 7 dataset development and testing that also leveraged separate maintenance funding from the Senior Review. This work would not have happened with maintenance funding alone. Such work not expected to be possible under TASNPP 2020.