

## Collection 6 Status

### **1. Atmosphere Team**

L3 Atmosphere Team Product (MOD/MYD08) +  
Joint L2 Product (MOD/MYDATML2) +  
browse imagery, etc.

### **2. Cloud Optical Properties**

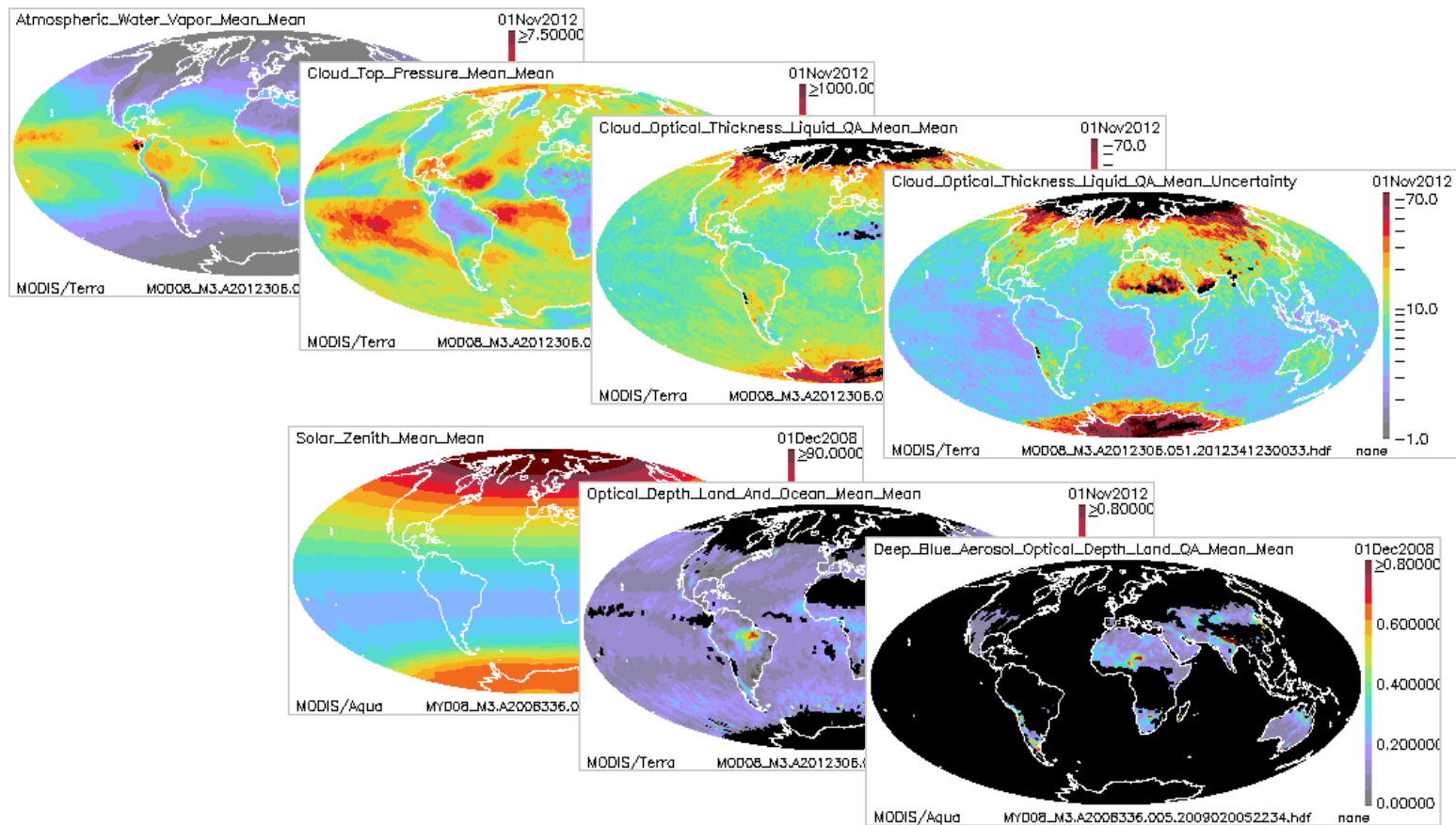
part of MOD/MYD06 product +  
MYD02 Band 1/2 1 km re-registration

- MOD06: S. Platnick, G. Wind, N. Amarasinghe, B. Marchant, J. Riedi, G. T. Arnold, K. Meyer, M. D. King, Z. Zhang, C. Wang, R. Holz, S. A. Ackerman, P. Yang, B. Baum, ...
- MODATML2: G. Britzolakis, S. Platnick, B. Ridgway
- MOD08: P. Hubanks, S. Platnick, B. Ridgway
- MYD02 1km re-registration: R. Wolfe, R. Bennartz, S. Platnick

*with thanks to MODAPS & the Atmosphere PEATE at U. Wisconsin-Madison*



# 1. Atmosphere Team



# Atmosphere Team C6 Status

- Aqua L2 reprocessing started in Dec 2013
  - MYD04/06 and updated MYD35/05/07 with re-aggregated L1 1km
  - Reprocessing status: completed through ~ Oct. 2013 (as of 28 Apr)
  - Forward processing status: started on Jan. 1, 2014 but being re-done due to ancillary production rule problem for cloud optical products
- Terra L2 reprocessing status
  - Updated MCST Terra band 5 (1.24  $\mu\text{m}$ ) de-trending code ready for delivery to MODAPS
  - MOD04 Deep Blue: mid-May for next (final?) science test delivery
- Aqua/Terra L3 (MOD08\_D3, \_E3, \_M3)
  - All SDS code updates other than MOD06 completed and tested. Testing of MOD06 Optical Properties and Cloud-Top code this week.
  - Change in 'Definition of Day' algorithm implemented/tested
  - Updated browse imagery and UI (Starry Monoharan)
- Webinar series (lead: Rich Kleidman)

# MOD08 Collection 6 Change Highlights

- Notable SDS Change Summary
  - Aerosols (MOD04): Addition of 2D aerosol histograms, SDS deletions and renaming, non-pixel count multiday weightings.
  - Cloud-top (MOD06): Addition of cloud-top stats by restricted Sensor ZA limits. Addition of surface type fraction. Improved bin resolution for calculation of means vs. pressure height (high, middle, low). Cloud-top height SDSs.
  - Cloud optical properties (MOD06): Addition of cloud optical property SDSs (e.g., 1.6 & 3.7  $\mu\text{m}$ -derived parameters), removal of QA SDSs.
- Definition of Day
  - UTC definition results in daytime discontinuities in (sub)tropics.
  - Inconsistent with other instrument team approaches. Can impact daily gridded comparisons but makes little difference to monthly analysis.

## MOD08 C6 SDS Change Summary

Product	SDSs Added/Modified	SDSs Renamed	SDSs Deleted
Aerosol: Dark Target	19	10	24
Aerosol: Deep Blue	8	–	–
Cloud-Top Properties	60	–	–
Cloud Optical Properties	54	10	numerous (incl. all QA- weighted)
Solar/View Geometry Stats	12	–	–

*Each SDS changed needs to be implemented in 4 files (tile, daily, 8-day, & monthly).*

Item	No. Lines of Code
Common Data Language (CDL) File Specifications	120,000 (+70%)
C, F90, F77 code	180,000 (+34%)
Ancillary files (process control, packing lists, etc.)	8,000 (+16%)
Comments	21,000 (+7%)

*L3 C6 code metrics and changes relative to C5.*

# MOD08 Collection 6 Browse Imagery

<http://modis-atmos.gsfc.nasa.gov/IMAGES>

L2 browse  
(Min Feng)

### Cloud Optical Properties

Standard 2.1 $\mu$ m-derived retrievals. With the exception of pixels identified as partly cloud (PCL) by the Clear Sky Restoral (CSR) algorithm, all datasets were available in the Collection 5.

	Uncertainty_Mean	Standard_Deviation
Liquid		
Ice		
Undetermined		
Combined		
PCL_Liquid		
PCL_Ice		
PCL_Undetermined		
PCL_Combined		

MODIS/Aqua MYD08\_D3.A2008028.006.2014008014430.hdf none

L3 browse  
(S. Monoharan,  
B. Ridgway)

# MOD08 Collection 6 Documentation

[http://modis-atmos.gsfc.nasa.gov/products\\_C006update.html](http://modis-atmos.gsfc.nasa.gov/products_C006update.html)

**MODIS Atmosphere**

HOME PRODUCTS IMAGES DATA ISSUES NEWS STAFF FORUM REFERENCE TOOLS HELP

AEROSOL H<sub>2</sub>O VAPOR CLOUD PROFILE CLD. MASK JOINT (Level-2 Products)

DAILY EIGHT DAY MONTHLY (Level-3 Products) ALBEDO NDI ECOSYSTEM (Level-3 Ancillary)

**PRODUCTS**

OVERVIEW  
AVAILABILITY CALENDAR  
COLLECTION 006  
COLLECTION 005  
ACQUISITION  
KNOWN PROBLEMS  
HDF FILENAMES  
FLOW DIAGRAM

### Collection 006 Update

The documents below describe Collection 6 (C6) changes to all L2 and L3 MODIS data.

#### C6 Release Announcements

- MODIS/Aqua C6 Level-2 Aerosol, Cloud, & other Products (01/09/2014) [View PDF](#)
- MODIS/Terra & Aqua C6 Level-1; and Level-2 Cloud Mask & Atm. Profile Products (11/05/2012) [View PDF](#)

#### C6 QA Plan

##### C6 MODIS-Atmosphere QA Plan

- MODIS-Atmosphere QA Plan C6 Update (04/23/2013, v4.10) [View PDF](#)

#### C6 Level-2 Change Summary Documents

##### C6 Level-2 Change Documentation

- Aerosol (04\_L2) (v28, 04/08/2011) [View PDF](#)
- Aerosol, Deep Blue (04\_L2) (JGR, 2013) [View PDF](#)
- Water Vapor (05\_L2) (v27, 01/11/2010) [View PDF](#)
- Cloud Optical (06\_L2) (final, 12/20/2013) [View PDF](#)
- Cloud Top (06\_L2) (ATBD, 2013) [View PDF](#)
- Cloud Top (06\_L2) (v28, 04/11/2011) [View PDF](#)
- Cloud Top (06\_L2) (PPT, 05/08/2012) [View PDF](#)
- Profiles (07\_L2) (v29, 12/26/2013) [View PDF](#)
- Profiles (07\_L2) (PPT, 06/22/2012) [View PDF](#)
- Cloud Mask (35\_L2) (v28, 04/13/2011) [View PDF](#)
- Cloud Mask (35\_L2) (ATBD, 2010) [View PDF](#)
- Cloud Mask (35\_L2) (PPT, 05/08/2012) [View PDF](#)
- Joint L2 (ATML2) (SDSs, 12/24/2013) [View PDF](#)

##### C6 Level-2 CDL File Specifications

- CDL File Spec for L2 Aerosol Product (04\_L2) (03/21/2013) [View TXT](#)
- CDL File Spec for L2 Cloud Product (06\_L2) (03/28/2013) [View TXT](#)

#### C6 Level-3 Change Summary Documents

##### C6 Level-3 Change Documentation

- Global (08) - SDS Change Table (04/16/2013, v34) [View PDF](#)

# Webinar Series Draft Schedule (July–Sept 2014)

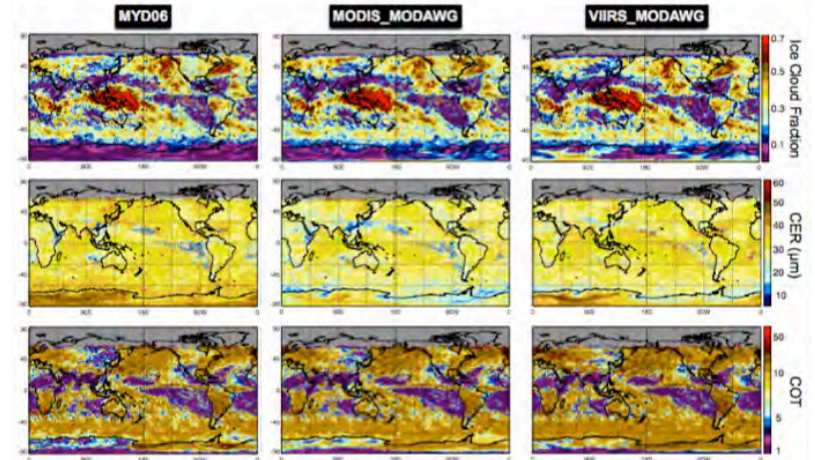
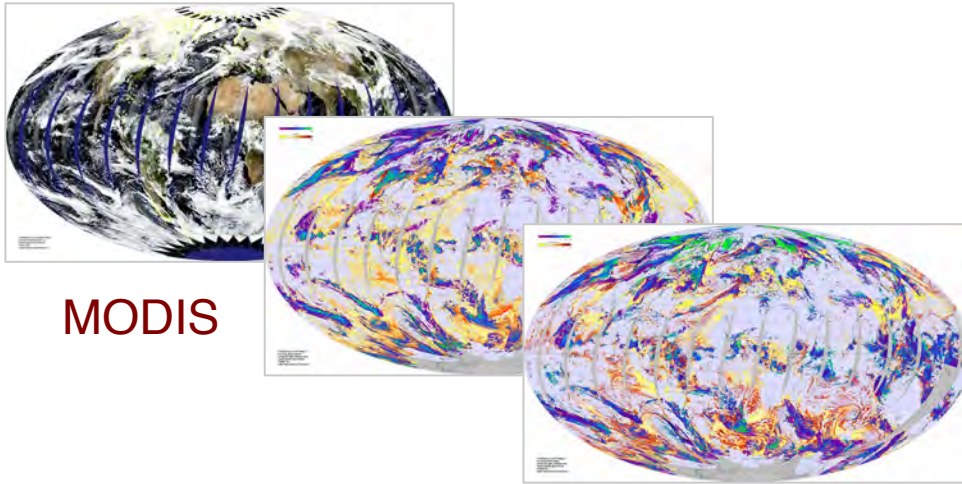
Goal: Educate user community on the MODIS atmosphere products in conjunction with the release of C6 via weekly webinar sessions.

## **Session/Topic:**

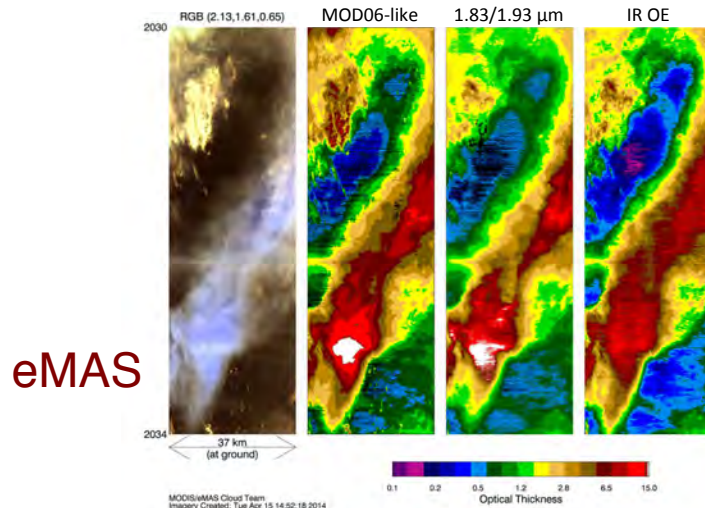
- MODIS C6 overview, web resources, etc.: Platnick, Xiong
- MOD04 Dark Target: Levy
- MOD04 Deep Blue: Sayer
- MOD04 Overview/Combined DB-DT and 3 km product: Levy, Sayer
- MOD35 Cloud Mask: Ackerman
- MOD06 Cloud-Top/Optical properties: Ackerman, Platnick
- MOD06 Optical Properties: Platnick
- MOD08 Atmosphere Team L3 products: Hubanks, Ridgway, Platnick
- Data Acquisition LAADS, LANCE, WorldView, MIRADOR, ECHO–REVERB: TBD
- Giovanni – Aerosols Express: Chris Lynnes
- MODIS Atmo Educational Materials and Resources: Kleidman



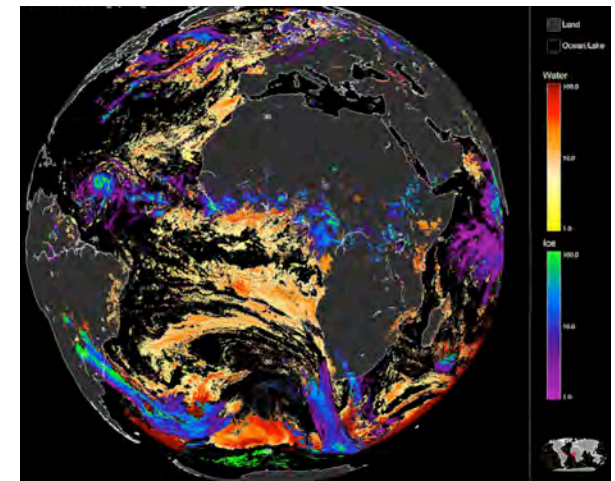
# 2. Level-2 Cloud Optical Properties (MOD/MYD06) + “Chimaera” multi-sensor retrieval package



common VIIRS/MODIS algorithm



**SEVIRI**



# MOD06 Collection 6 Change Highlights

(see poster by *Wind et al.*)

- Radiative transfer models and related ancillary datasets
- Algorithm
  - Retrieval Science (e.g., retrieval phase)
  - QA assignment/ filtering (e.g., partly cloudy FOVs)
  - Pixel-level uncertainties

**TABULAR SUMMARY OF MOD06 CLOUD OPTICAL PROPERTIES COLLECTION 6 EFFORTS**

The following table provides a summary of the key Collection 6 MOD06 optical/microphysical algorithm development efforts. The symbol  $\Delta$  denotes the main evaluation and refinement activities that are expected to continue subject to future support.

Category	Collection 5	Collection 6	Notes
<b>Radiative Transfer</b>			
Cloud Model: all phases	Combined discrete ordinate LUT (small COT) + asymptotic theory parameters (large COT)	Full reflectance, flux, and emissivity LUTs across retrieval space/geometry. LUT entries provided for multiple scattering component only; phase function provided in file for direct calculation of single scattering component.	<ul style="list-style-type: none"> <li>• Single approach (LUT) =&gt; easier retrieval code maintenance.</li> <li>• LUT grid designed to limit median linear interpolation error to &lt;&lt; 1%.</li> <li>• Separation of single scattering component =&gt; fewer LUT grid points and interpolations during processing.</li> <li>• Required DISORT code mod to improve efficiency for BRDF-specified surfaces.</li> </ul>
$\Delta$ Ice Cloud Model	Variable habit (smooth) vs. size/empirical distributions. Relatively large asymmetry parameter ( $g$ ) and highly dependent on	Single habit (severely roughened aggregated columns) w/analytic distribution ( $\gamma$ , $\mu$ )	<ul style="list-style-type: none"> <li>• Smaller <math>g</math> reduces COT &amp; provides closure with non-opaque IR COT retrievals.</li> <li>• Nearly constant</li> <li>• SWIR/MWIR particle absorption decreases =&gt; larger retrieved</li> </ul>
Surface Ancillary	Team designed	New dynamic gap filled	• CF albedo dataset

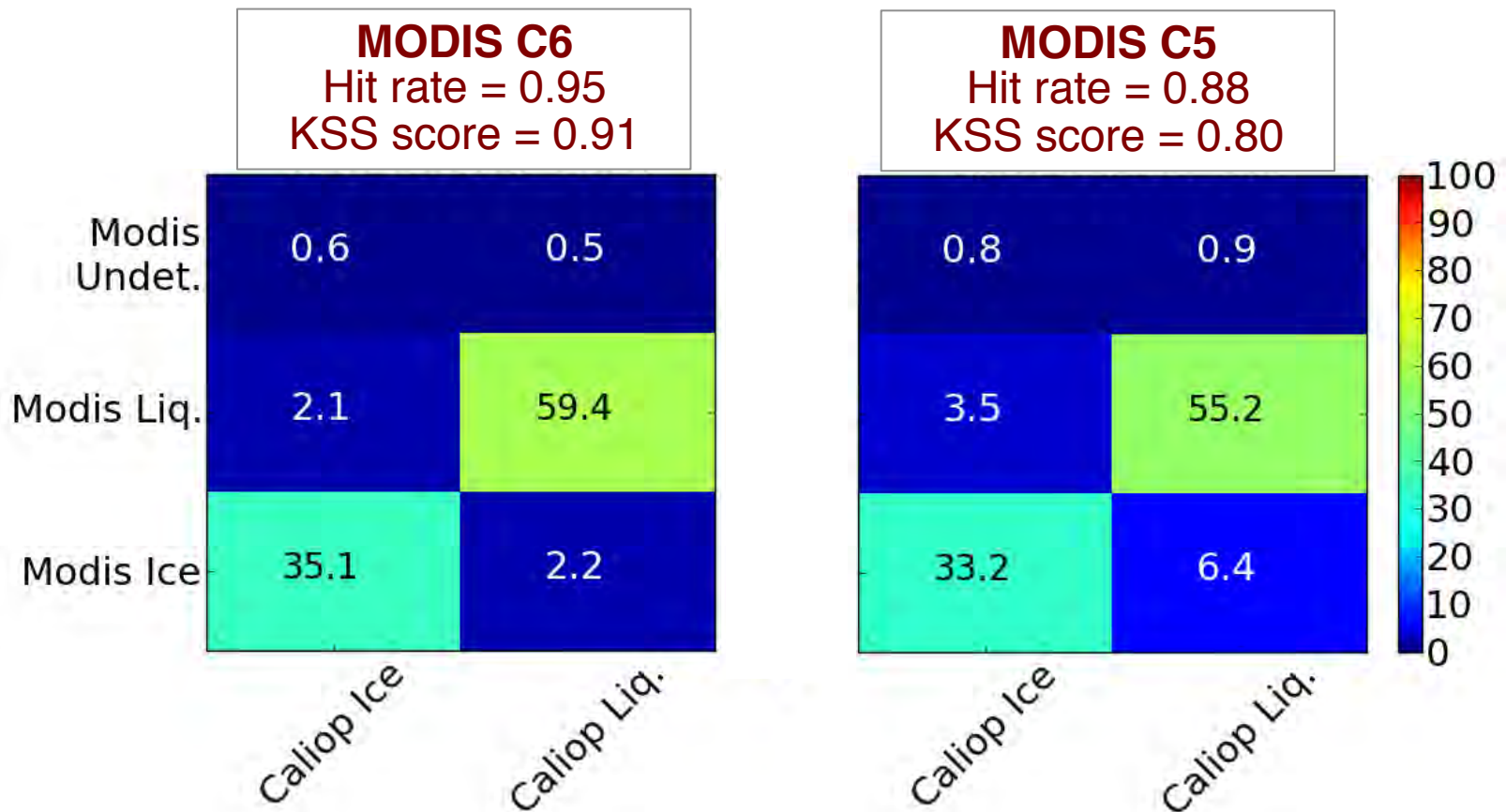
[modis-atmos.gsfc.nasa.gov/\\_docs/C6MOD06OPExecSum.pdf](http://modis-atmos.gsfc.nasa.gov/_docs/C6MOD06OPExecSum.pdf)

# MOD06 C6 Change Highlight: Retrieval Phase

(see poster by *Marchant et al.*)

Combined IR and SWIR/VNIR tests (reflectance ratio tests replaced with separate ice and liquid water retrievals). CALIOP, POLDER validation.

## MODIS vs. CALIOP: Ocean Scenes Only, CSR=0, Jan. 2008

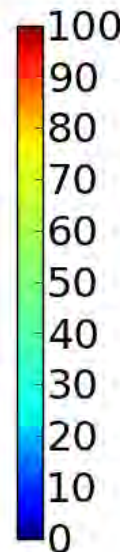
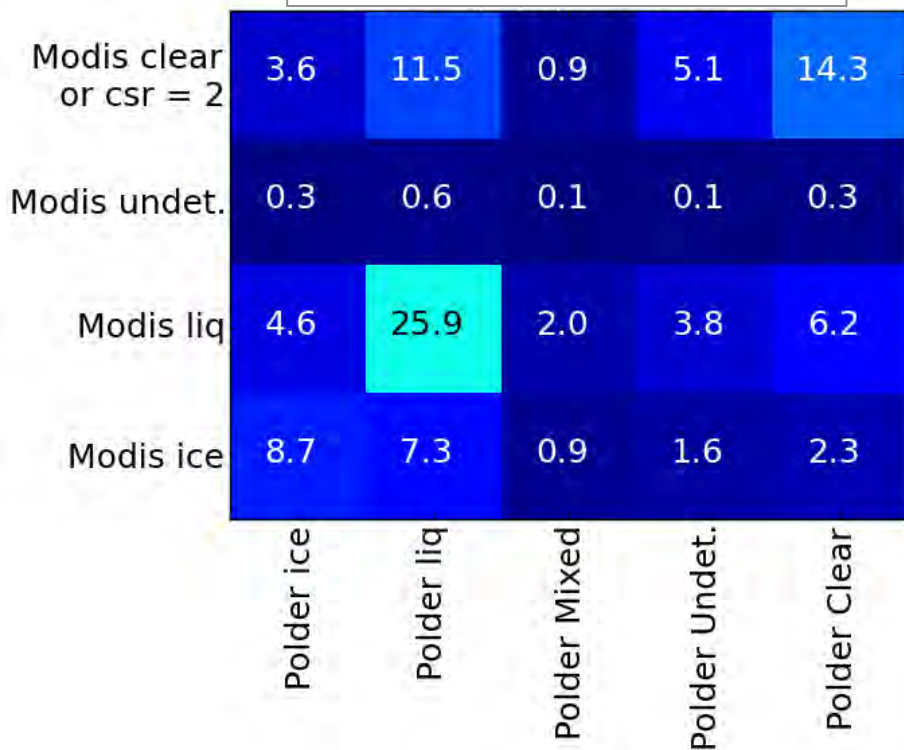


# MOD06 C6 Change Highlight: Retrieval Phase

## MODIS vs. POLDER: All Scenes, Jan. 2008

**MODIS C6 (CSR=0,1,3)**  
Hit rate = 0.73

**MODIS C5 (CSR=0)**  
Hit rate = 0.67



# MOD06 C6 Change Highlight: Retrieval Phase

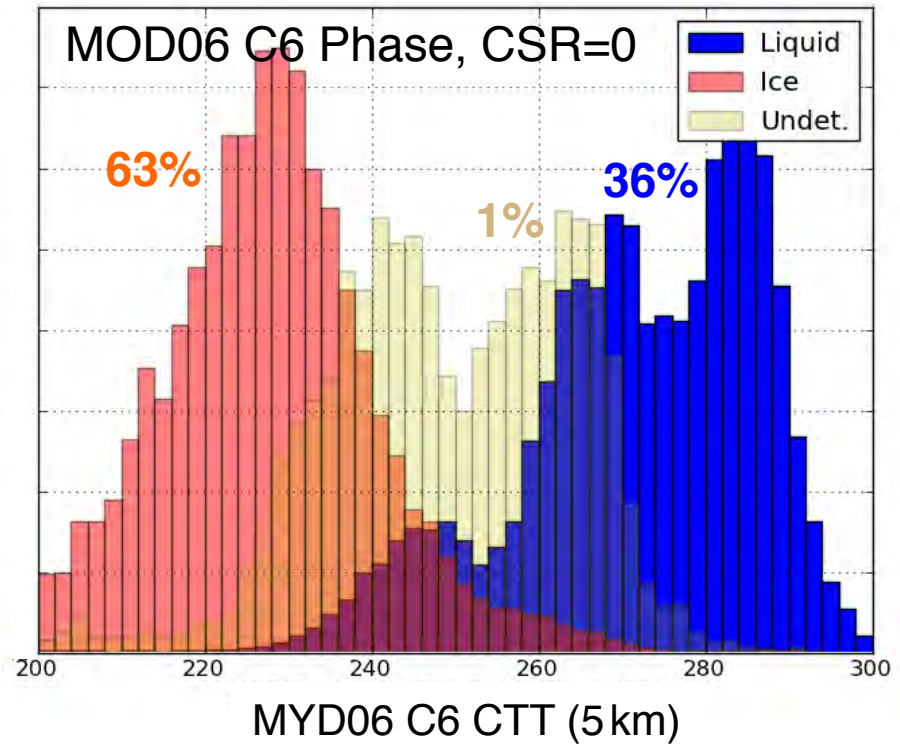
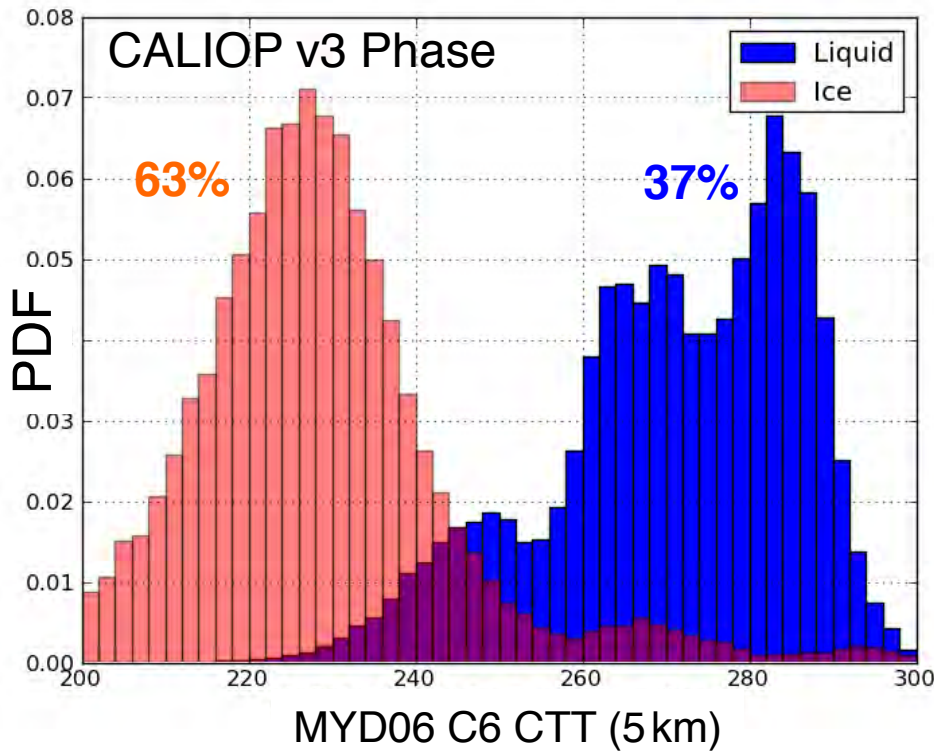
MODIS vs. CALIOP: July 2008, CSR=0

Surface	Ocean		Land		Desert & snow/ice	
CALIOP cloud opacity	Thin	Opaque	Thin	Opaque	Thin	Opaque
C6 retrieval phase	0.85 0.72	0.95 0.92	0.79 0.65	0.93 0.88	0.77 0.62	0.88 0.77
C5 retrieval phase	0.73 0.62	0.89 0.87	0.65 0.51	0.89 0.82	0.56 0.53	0.62 0.72
C6 IR phase	0.85 0.73	0.82 0.81	0.69 0.68	0.76 0.89	0.43 0.70	0.44 0.83

Hit Rate KSS

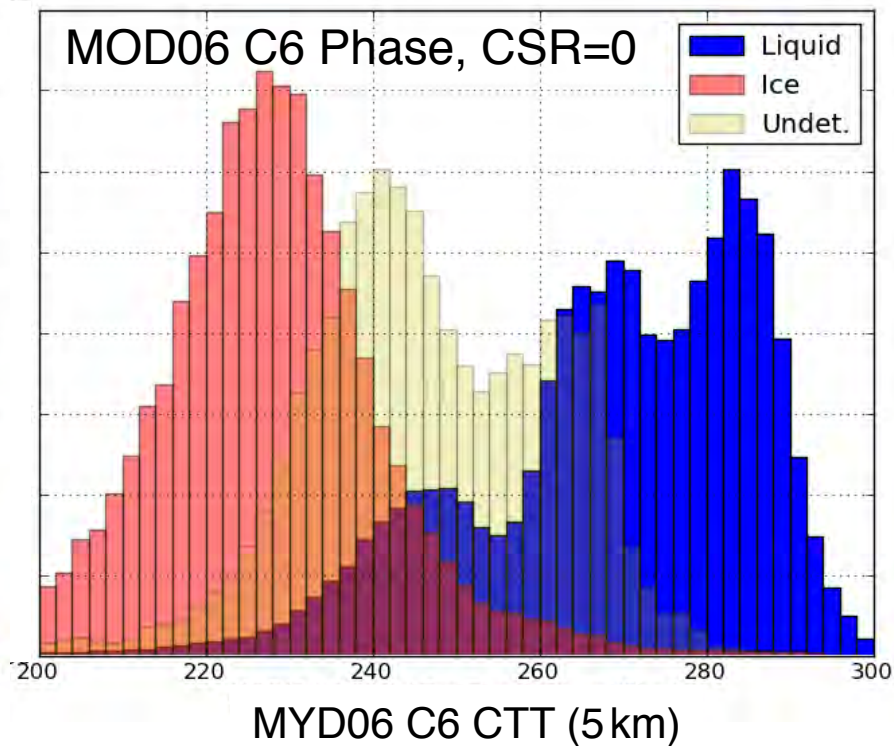
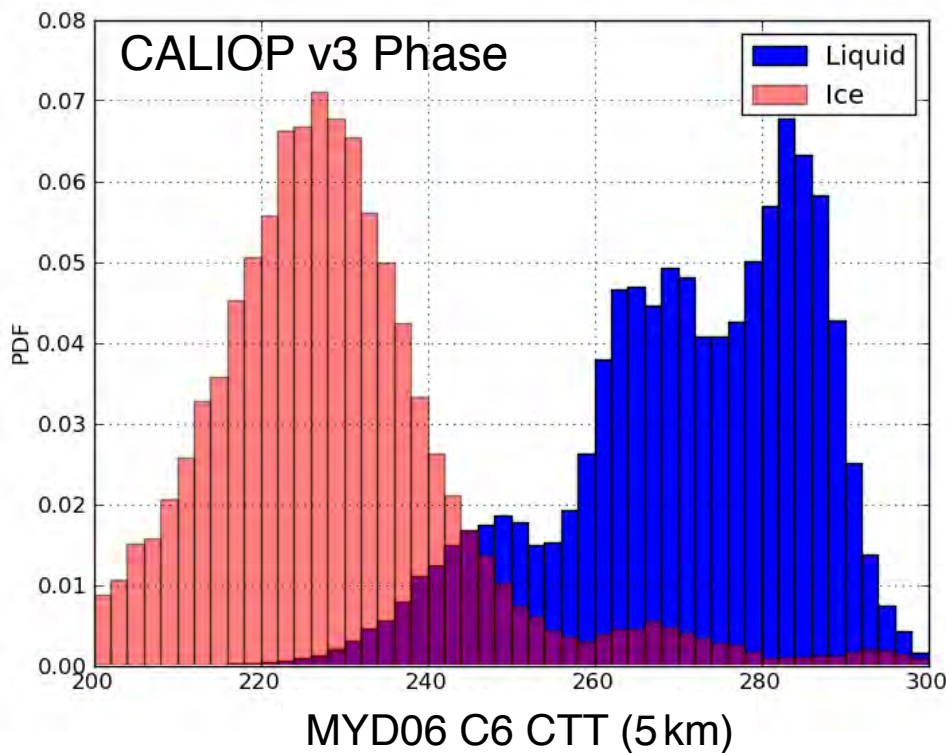
# MOD06 C6 Change Highlight: Retrieval Phase

Phase vs. CTT over non-ice ocean, Jan. 2008,  
filtered by CALIOP single phase in the column



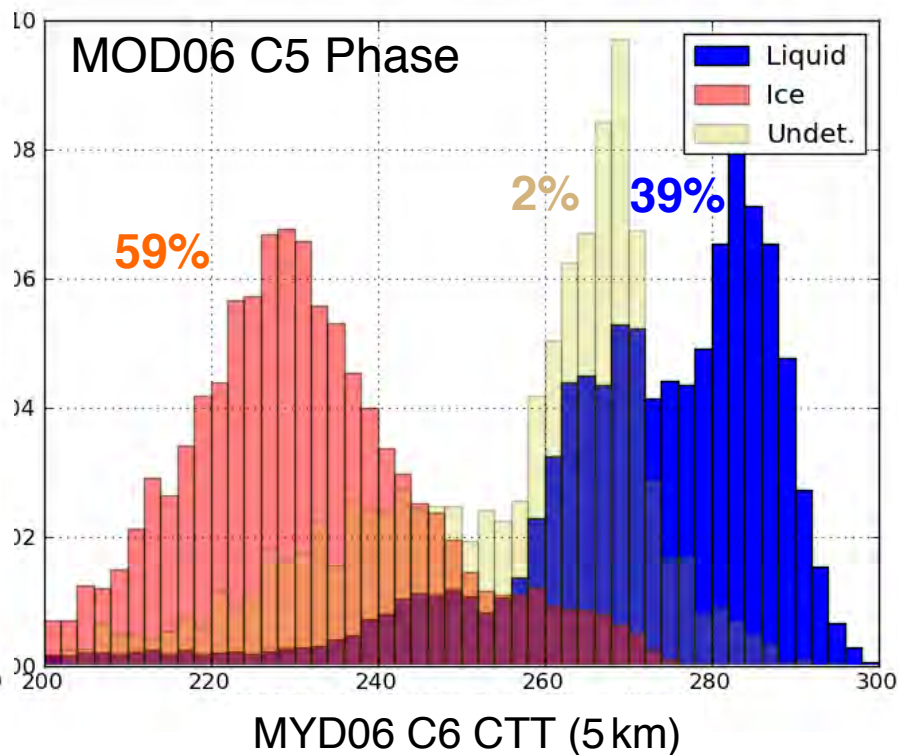
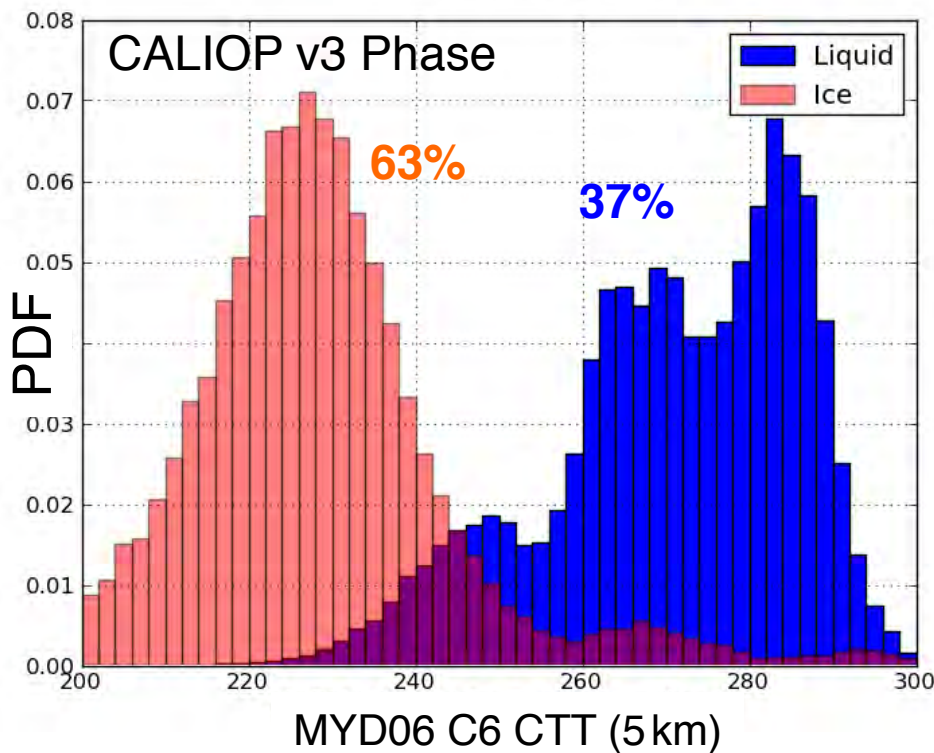
# MOD06 C6 Change Highlight: Retrieval Phase

Phase vs. CTT over non-ice ocean, Jan. 2008,  
filtered by CALIOP single phase in the column (LHS only)



# MOD06 C6 Change Highlight: Retrieval Phase

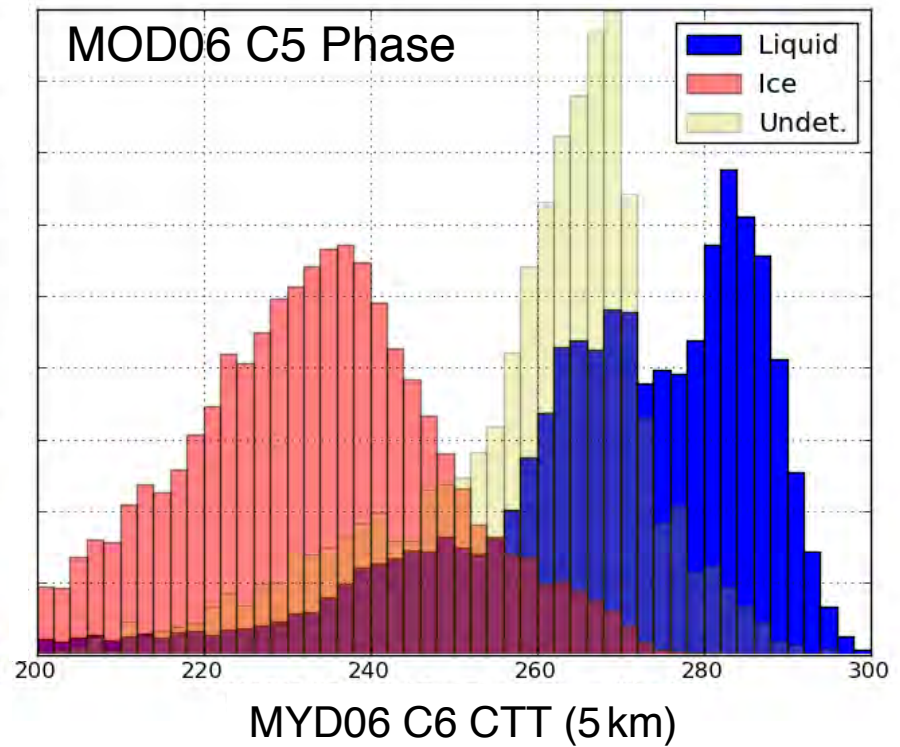
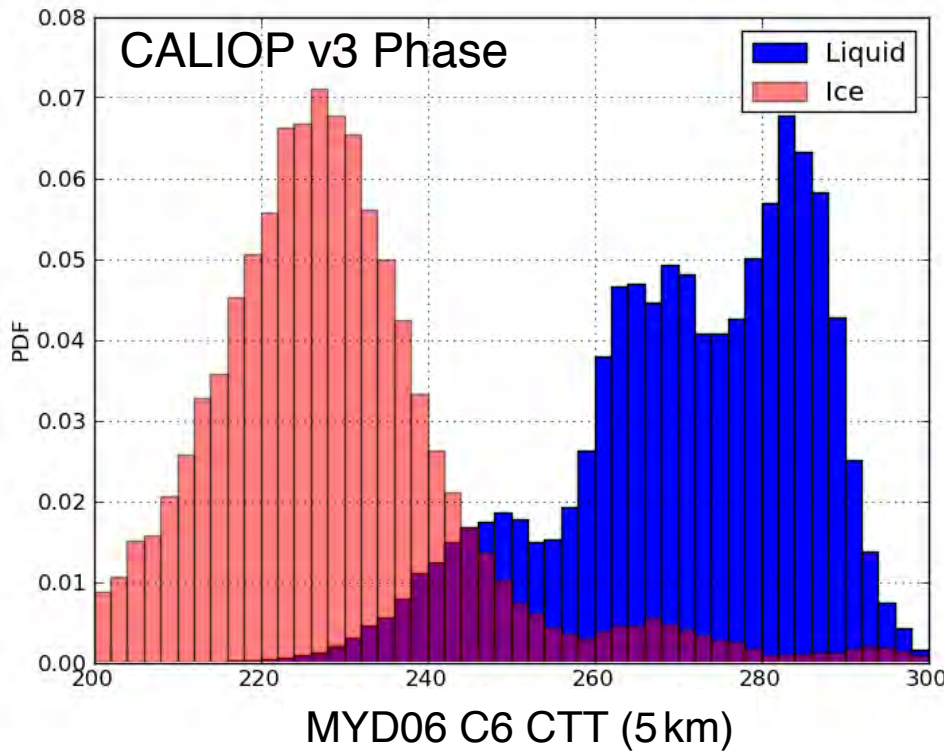
Phase vs. CTT over non-ice ocean, Jan. 2008,  
filtered by CALIOP single phase in the column





# MOD06 C6 Change Highlight: Retrieval Phase

Phase vs. CTT over non-ice ocean, Jan. 2008,  
filtered by CALIOP single phase in the column (LHS only)

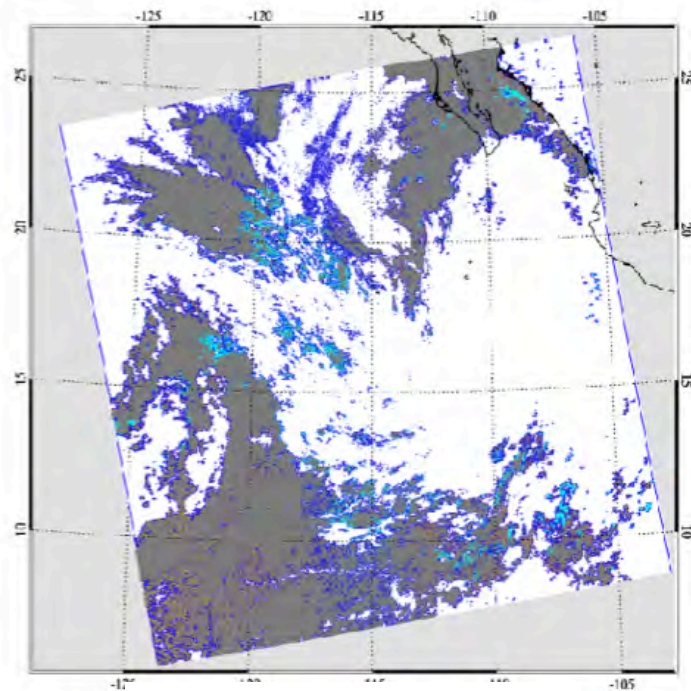
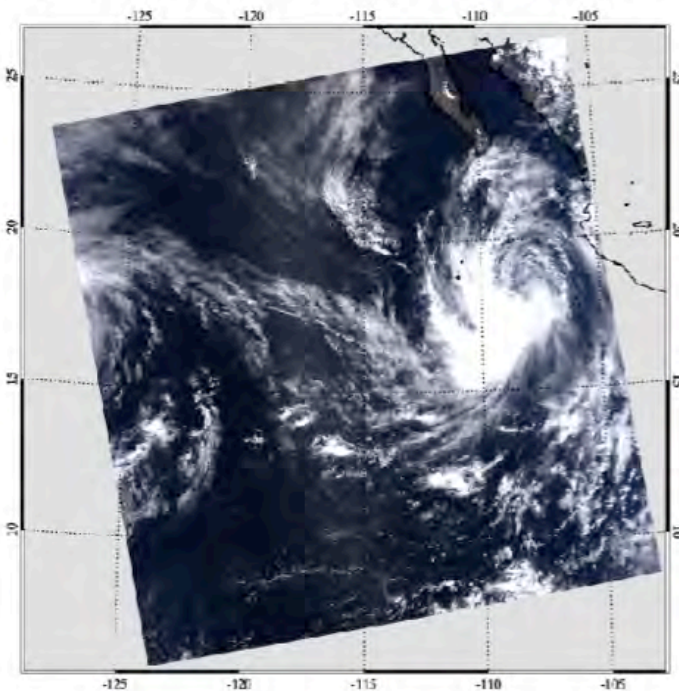


# MOD06 C6 Change Highlight: “Partly Cloudy” (PCL) FOVs

(see poster by *Meyer et al.*)

Attempt retrievals on pixels expected to be partly cloudy (Clear Sky Restoral algorithm). Provide solution space metrics on failed retrievals.

Aqua MODIS, 2 July 2008 (2105 UTC)



Clear Sky Restoral Flags



MOD35 MOD35 1 2 3  
clear cloudy

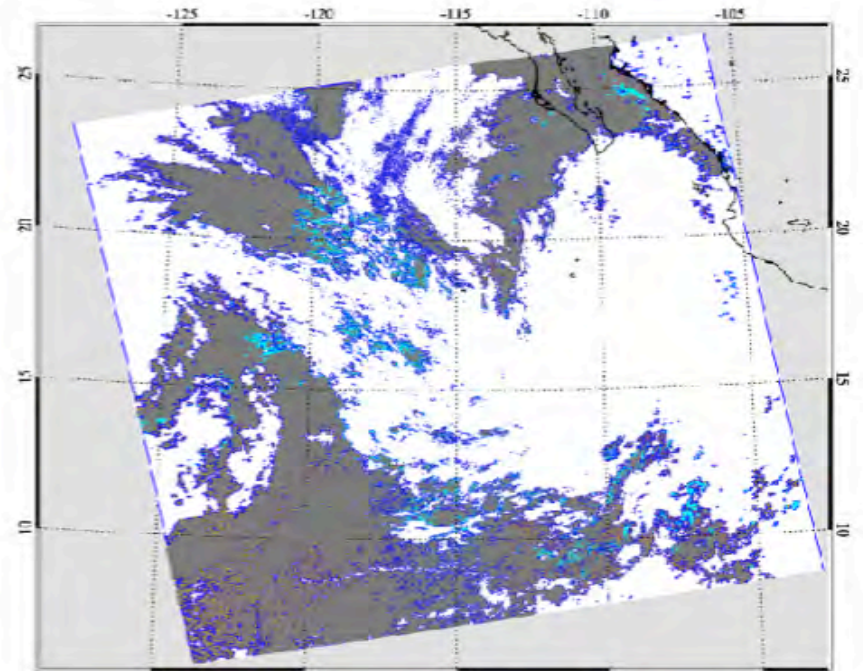
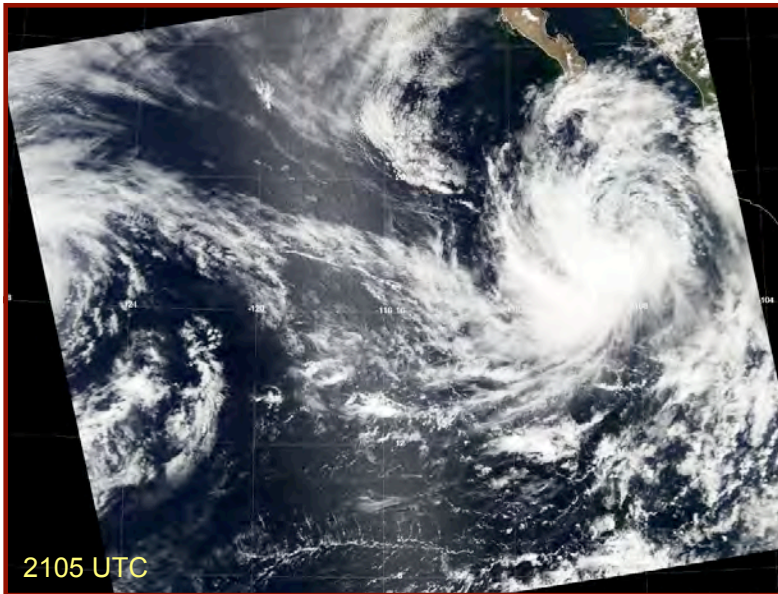
“Partly  
Cloudy”

# MOD06 C6 Change Highlight: “Partly Cloudy” (PCL) Pixels

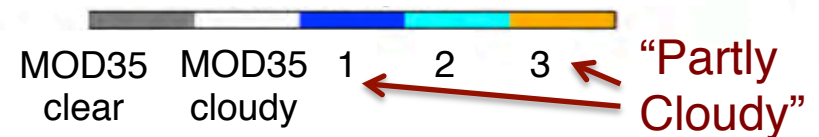
(see poster by *Meyer et al.*)

Attempt retrievals on pixels expected to be partly cloudy (Clear Sky Restoral algorithm). Provide solution space metrics on failed retrievals.

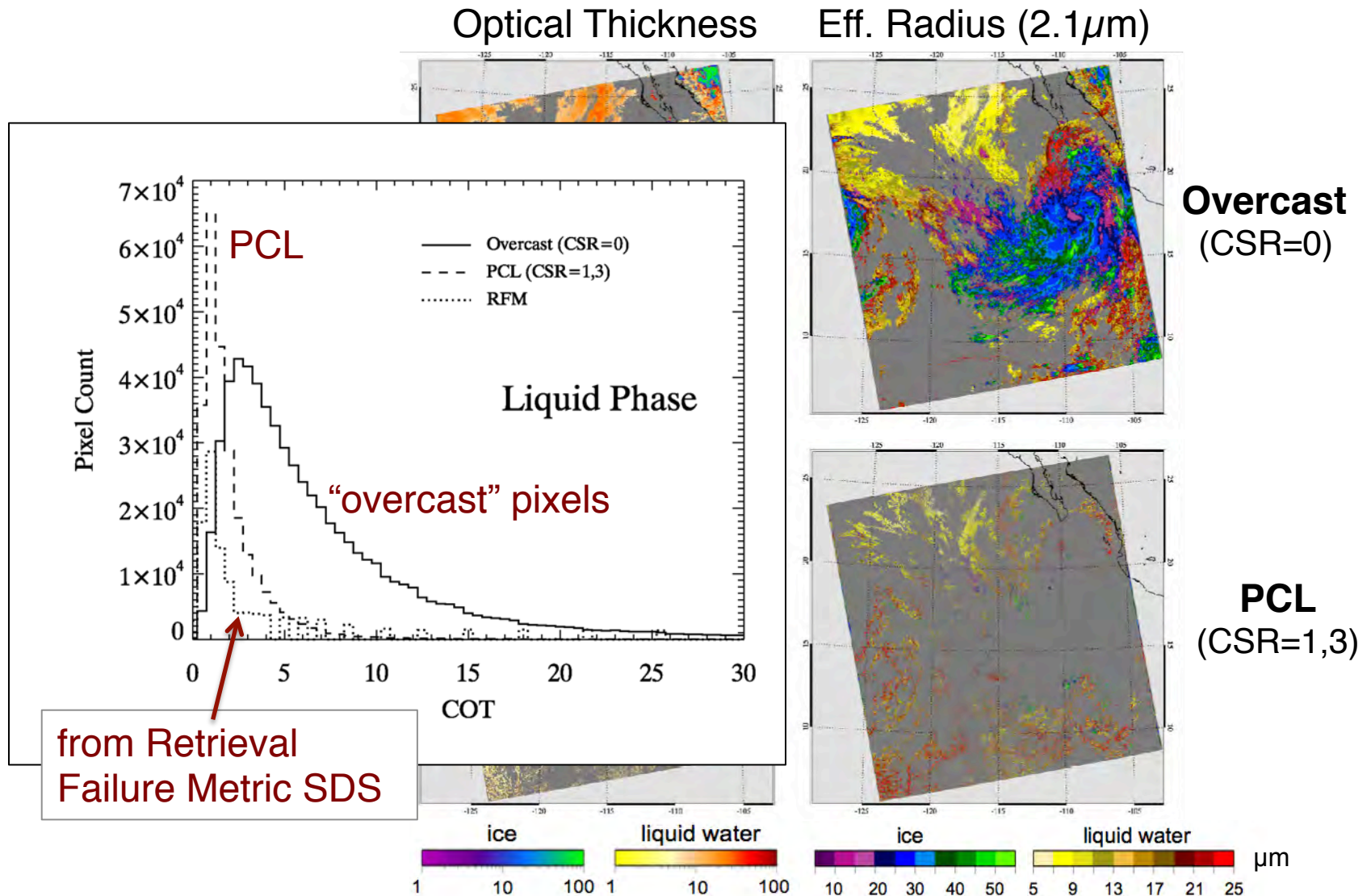
Aqua MODIS, 2 July 2008



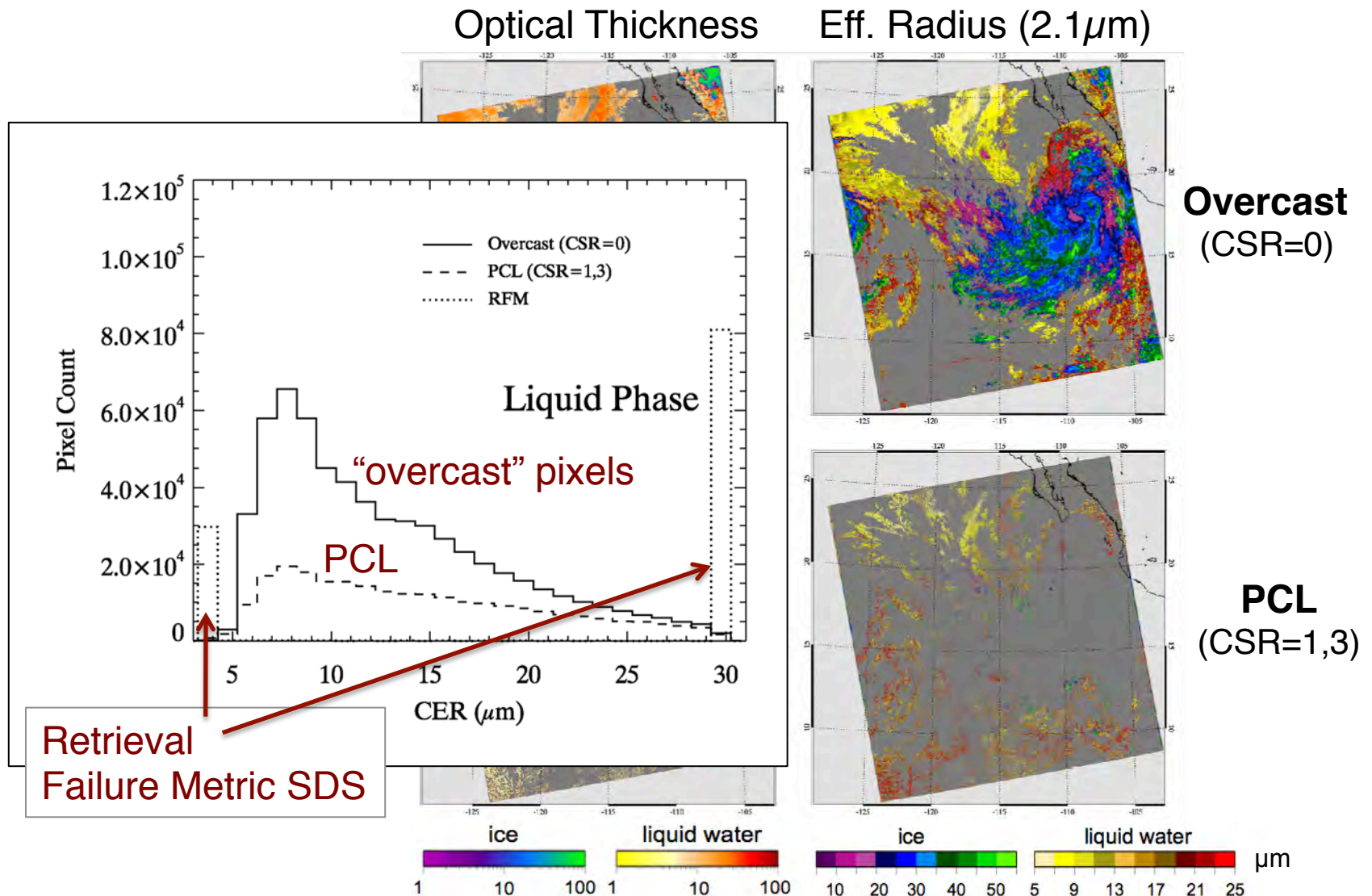
Clear Sky Restoral Flags



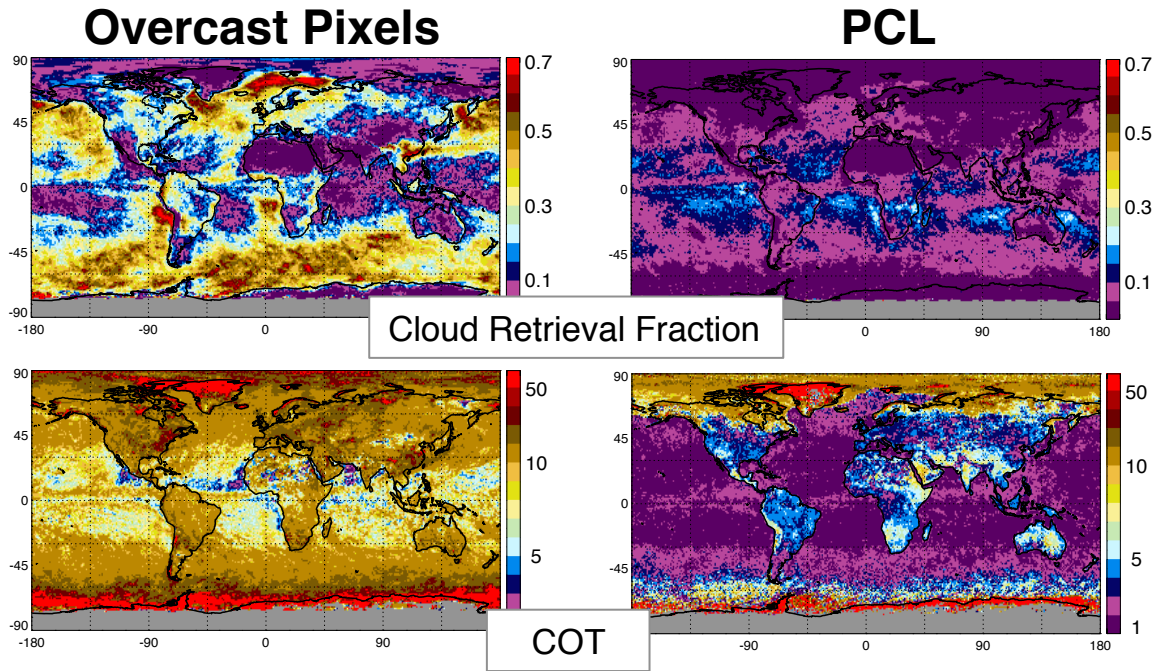
# MOD06 C6 Change Highlight: “Partly Cloudy” (PCL) Pixels



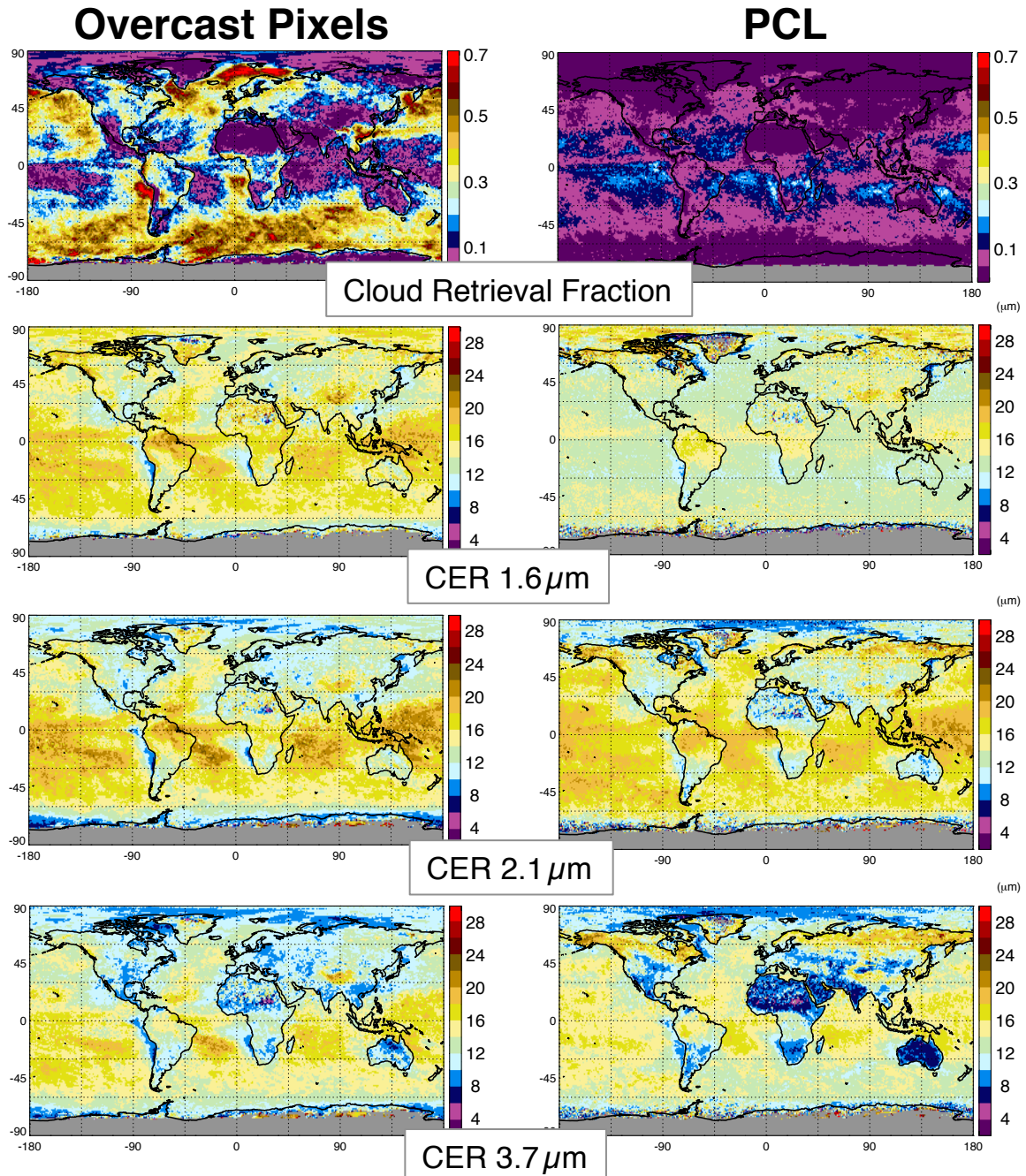
# MOD06 C6 Change Highlight: “Partly Cloudy” (PCL) Pixels



# Aqua MODIS Liquid Clouds April 2005 Monthly L3



# Aqua MODIS Liquid Clouds April 2005 Monthly L3



# MODIS Atmosphere Team Collection 6 Amber Ale

retrieval



The Finest Retrievals ROSES Can Brew

**NASA GSFC • University of Wisconsin-Madison**

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