Rowan Galina Wind was born Monday at 5:29AM
7 lbs, 4 oz
20 inches

Mother and daughter are doing well!

MOD06 Optical/Microphysical Product – C6 Plans and schedule

(Platnick, King, Wind, et al.)

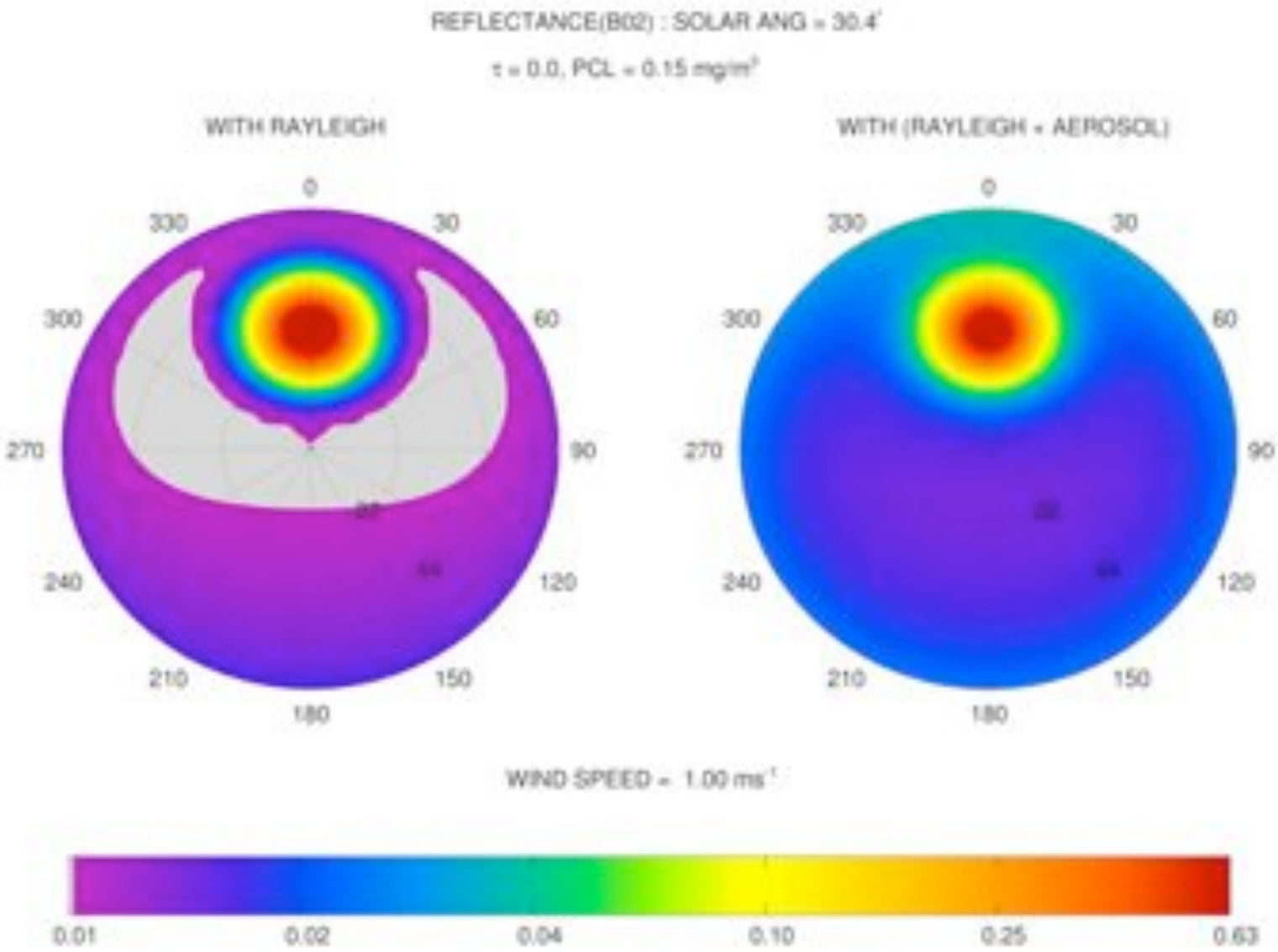
- **MOD06_OD**
  - Thermodynamic phase, τ, r_e, *WP*
  - 1 km retrievals, global (land, ocean, ice), daytime
- **C5 highlights**
  - Primary r_e from band combinations w/2.1 μm, but L2 also includes 1.6 and 3.7 μm retrievals (given as differences w/2.1 μm). L3 aggregations for 2.1 μm retrieval only.
  - Ice cloud radiative models from Baum, Yang, et al. (2005)
  - Various QA including:
    - "Clear Sky Restoral" (CSR): spatial (edge removal, 250m cloud mask over water surfaces) and spectral tests, used to help eliminate cloudy pixels not suitable for retrievals or incorrectly identified cloudy pixels. MOD35 pixels eliminated via CSR are not processed.
    - multilayer/phase cloud detection (separate aggregation in L3)
  - Land and snow/ice spectral surface albedo: gap-filled BU C4 product, Moody et al. (2005)
  - Pixel-level baseline uncertainties

MOD06 Optical/Microphysical Product – C6 Plans and schedule

- **C6 Plan Highlights**
  - Includes 1.6 and 3.7 μm retrievals as absolutes, allowing for L3 aggregations.
  - Ice cloud radiative models: TBD, but understood to be an important issue. Have included arrays of g_λ and $\varpi_{0,\lambda}$ so users can compare/scale retrievals to their own radiative models.
  - Thermodynamic Phase: replace swir to vis/nir ratio tests with separate ice and liquid water retrievals; continue validation vs. CALIOP. (Benjamin Marchant)
  - Various QA including:
    - "Clear Sky Restoral" (CSR): Considering processing pixels identified by CSR; add appropriate flag to allow for separate L3 aggregation (which L3 statistics are TBD).
    - multilayer/phase detection: included Pavolonis & Heidinger algorithm.
  - Land spectral surface albedo: gap-filled C5 product from BU team.
  - Pixel-level baseline uncertainties: link to retrieval QA assignments.
  - New LUTs: DISORT w/wind-speed interpolated Cox-Munk BRDF. (Nandana Armarasinghe)

Cox-Munk LUT: Band 2 BRDF vs. Wind Speed Animation

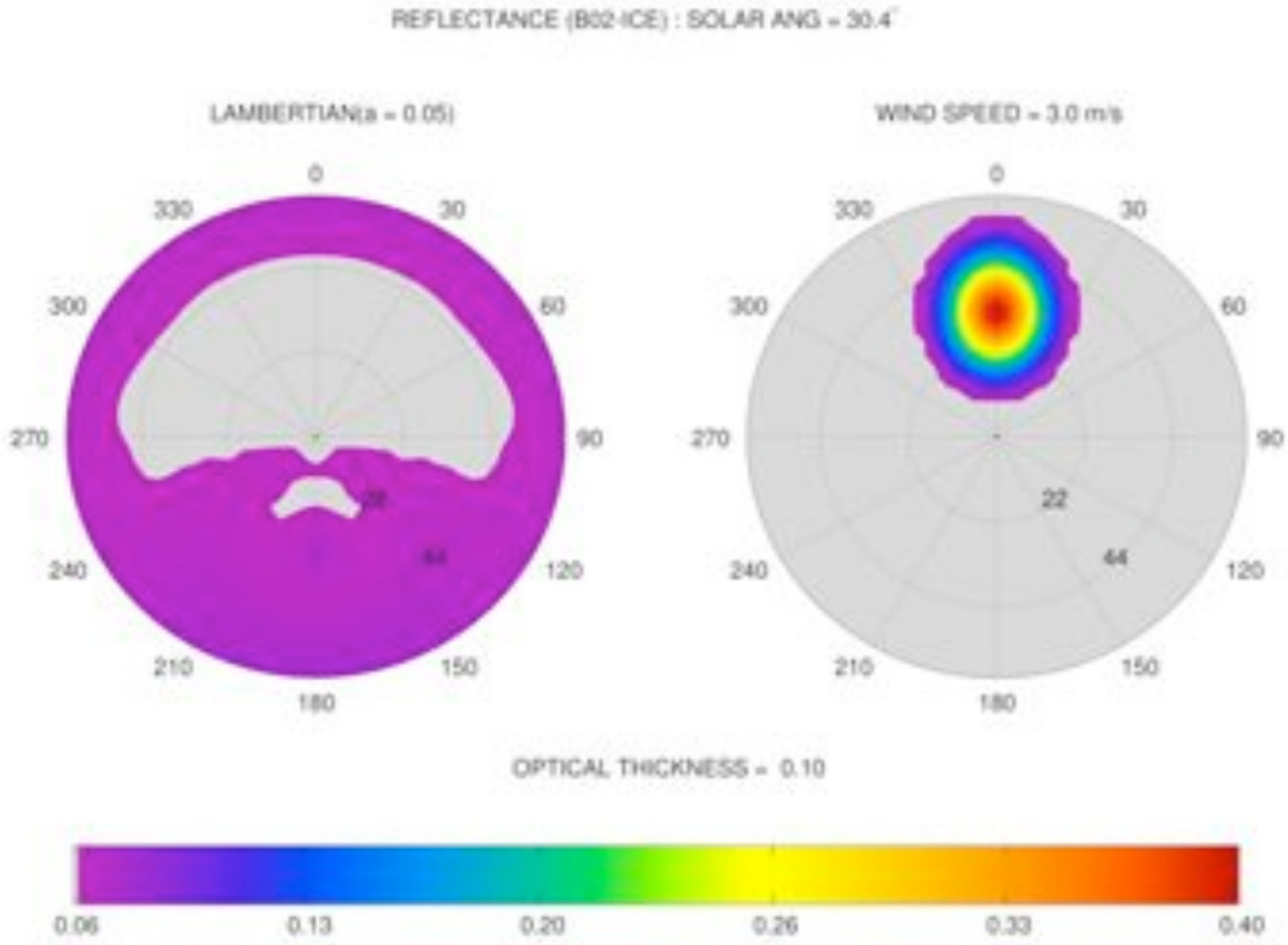
(see Nandana's poster for further details)



S. Platnick et al., MOD06_OD C6, MODIS Atmosphere Team Breakout, 26 Jan 2010

Cox-Munk LUT: Band 2 BRDF vs. Wind Speed Animation

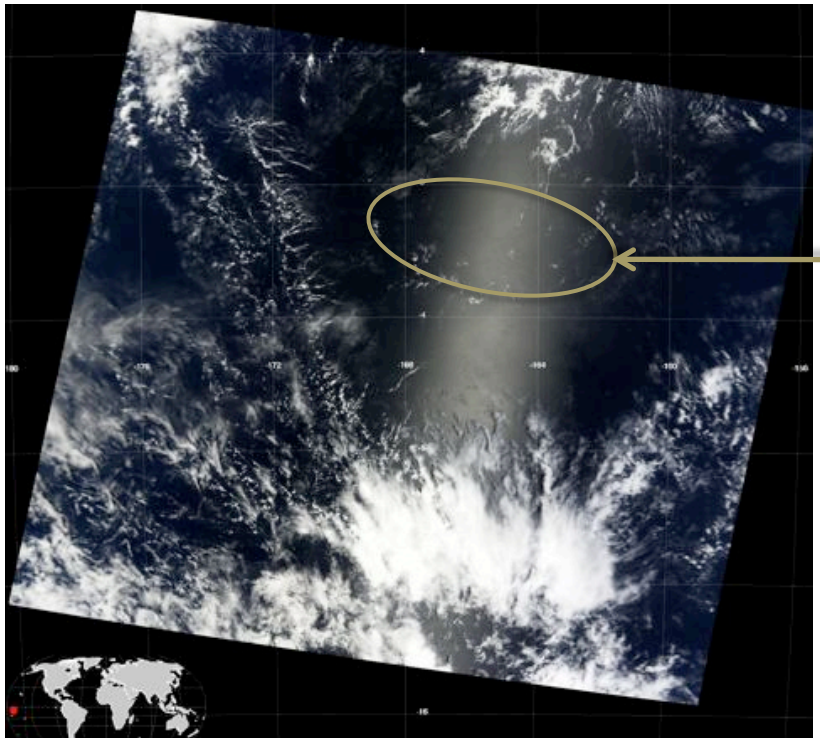
(see Nandana's poster for further details)



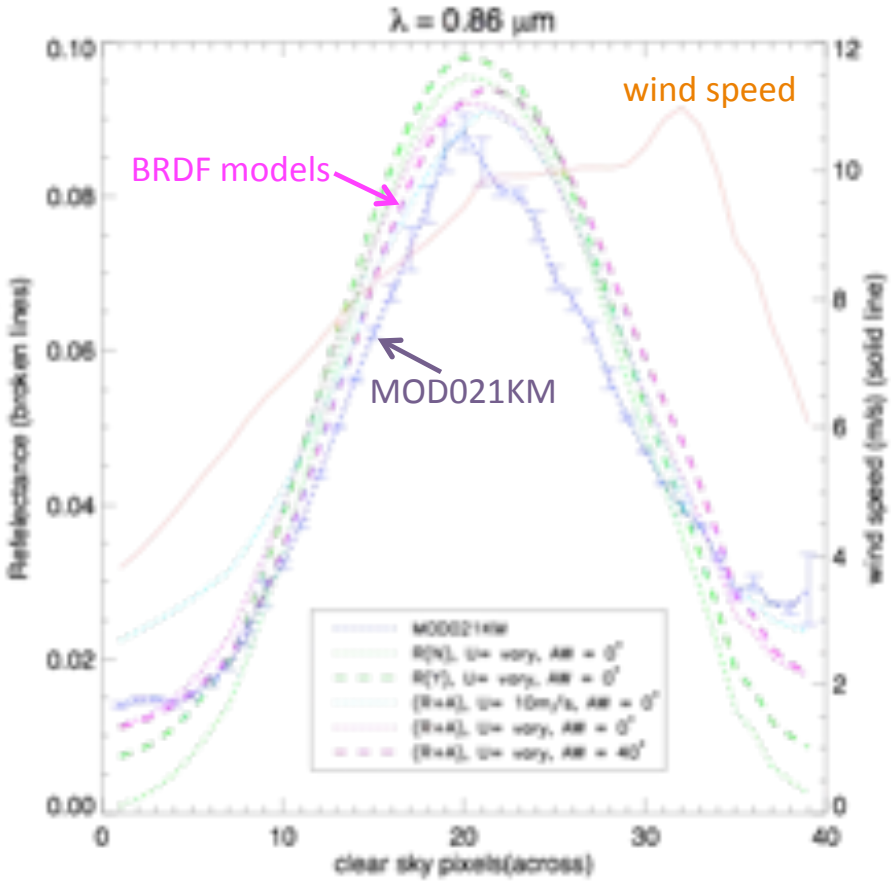
S. Platnick et al., MOD06_OD C6, MODIS Atmosphere Team Breakout, 26 Jan 2010

Cox-Munk LUT: Band 2 Comparison with MODIS swath data

(see Nandana's poster for further details)

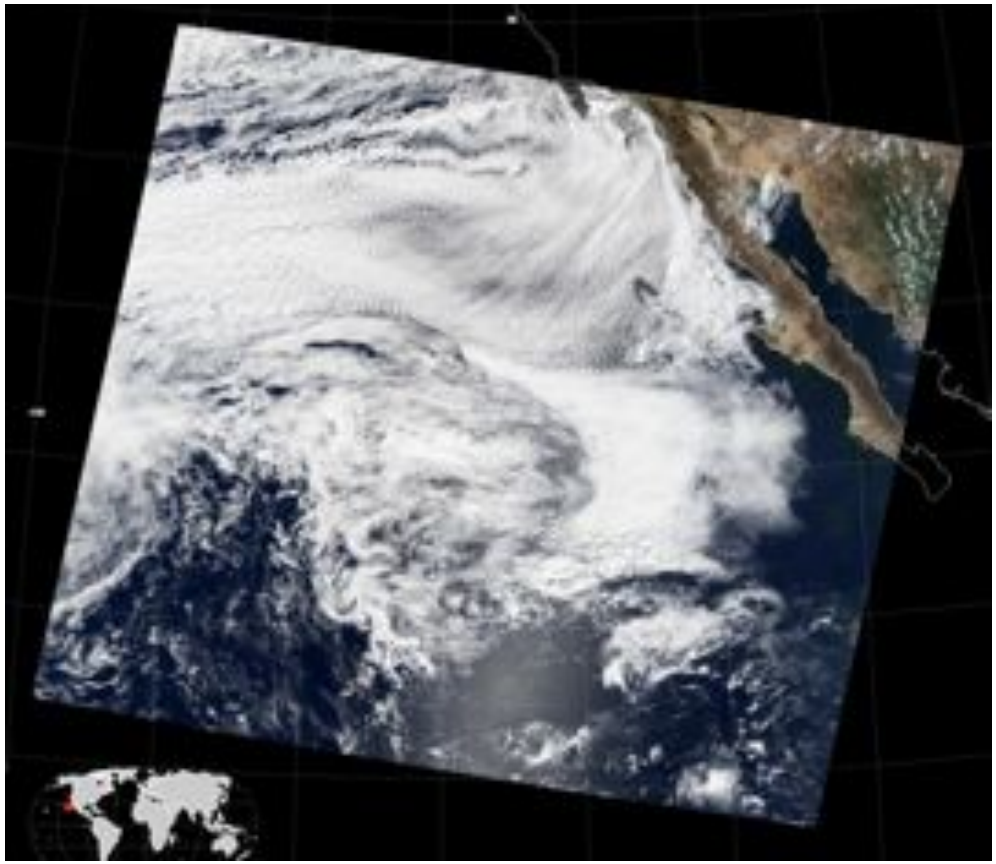


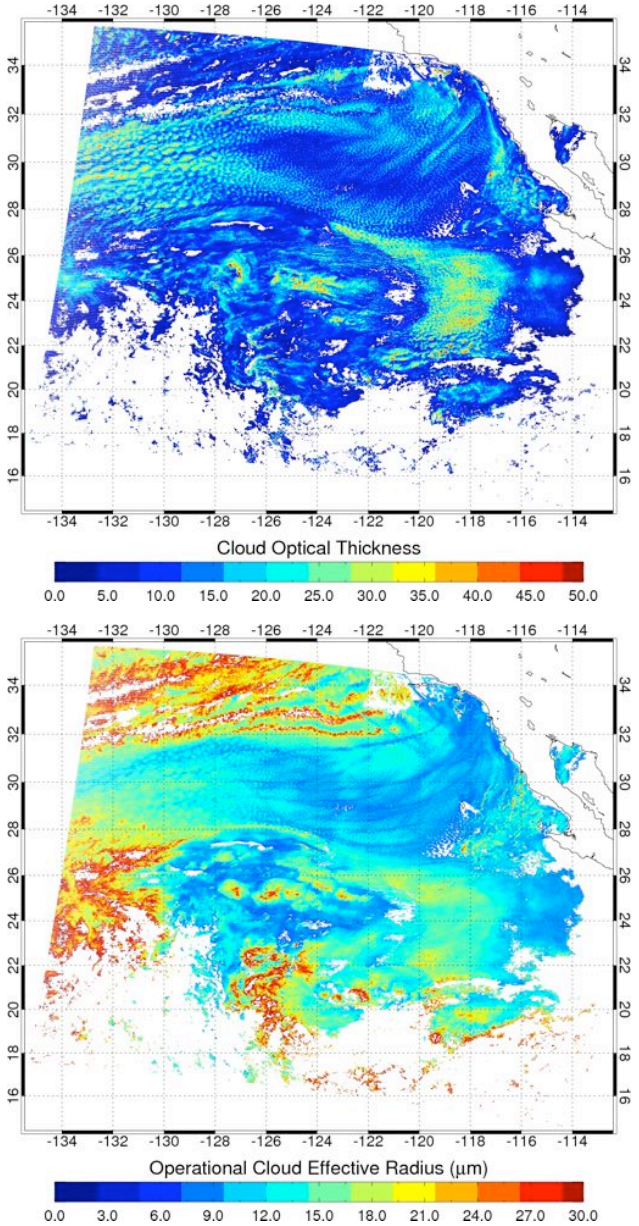
MOD021KM.A2009296.2135.005.2009297073904.hdf



LUT Test: Improved Interpolation and Angular Detail

(see Gala Wind poster for further details; analysis from Zhibo Zhang)





S. Platnick et al., MOD06_OD C6, MODIS Atmosphere Team Breakout, 26 Jan 2010

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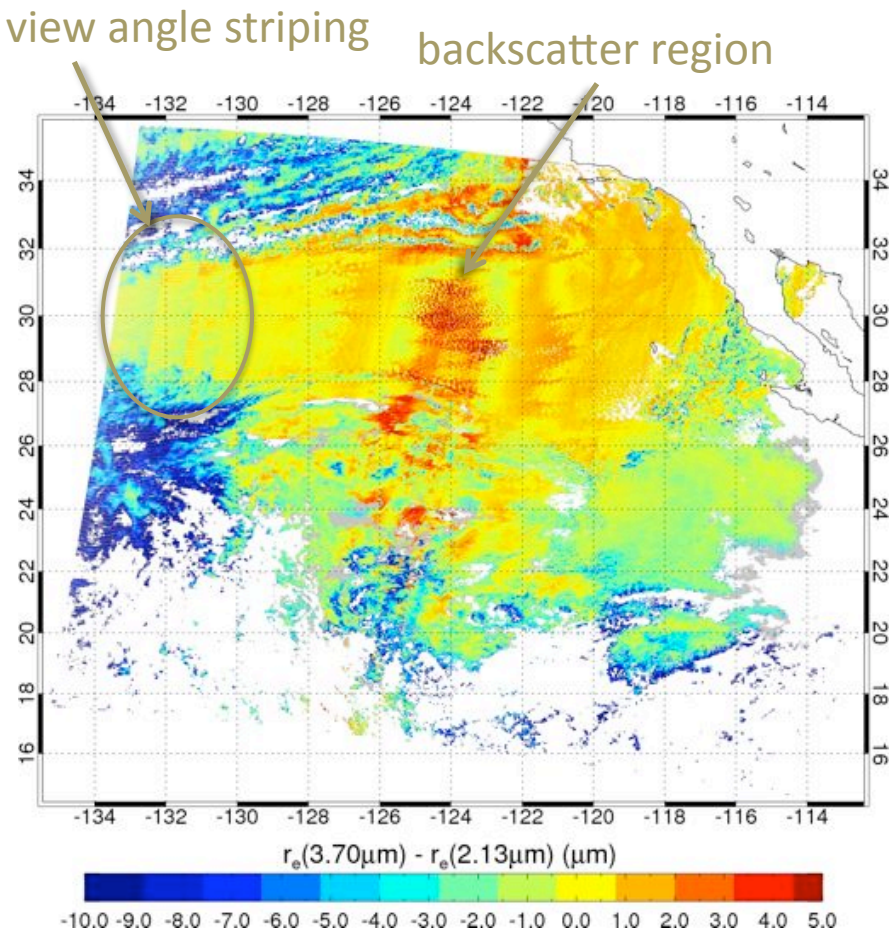
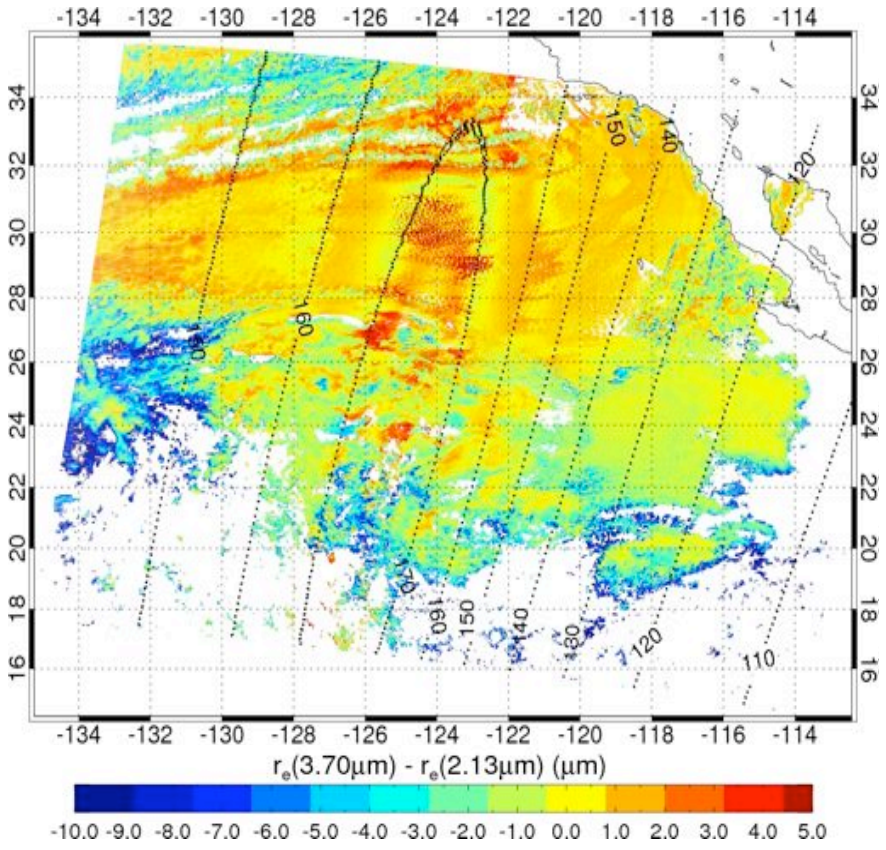


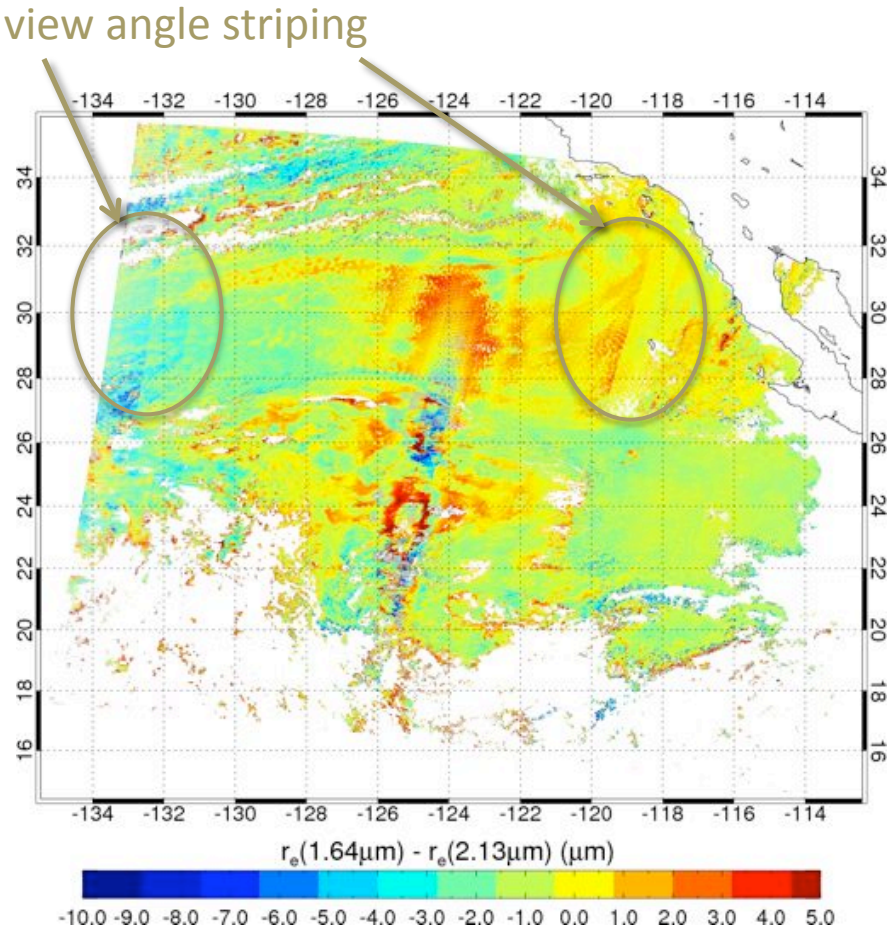
C5



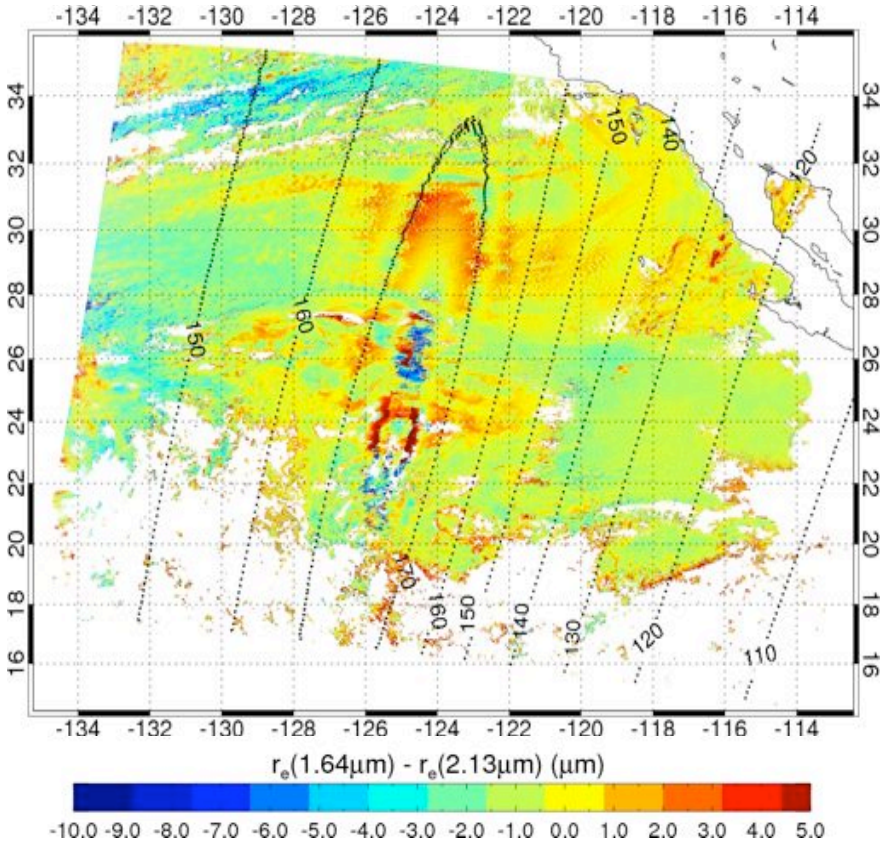
C6 w/Lambertian water surface

Cox-Munk LUT: Improved Interpolation and Angular Detail

(see Gala Wind poster for further details; analysis from Zhibo Zhang)



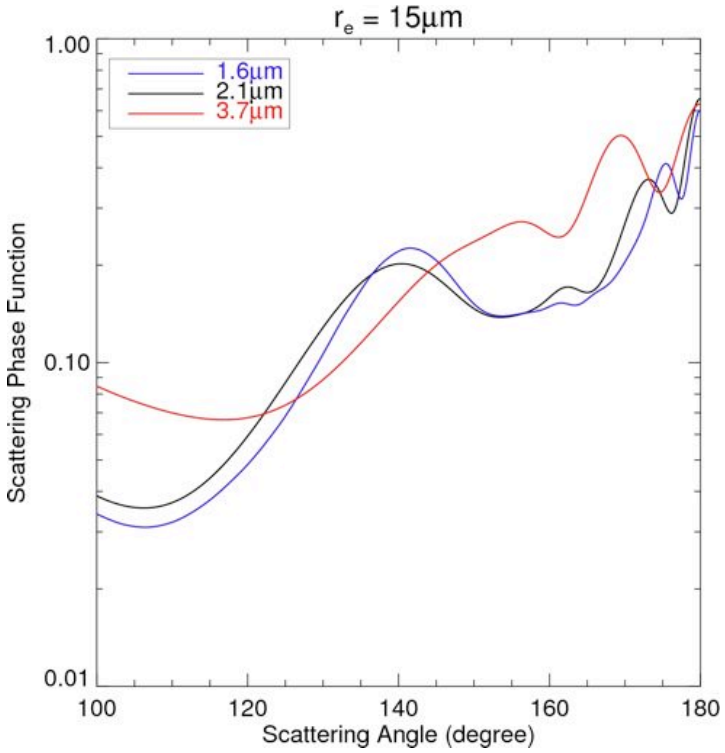
C5

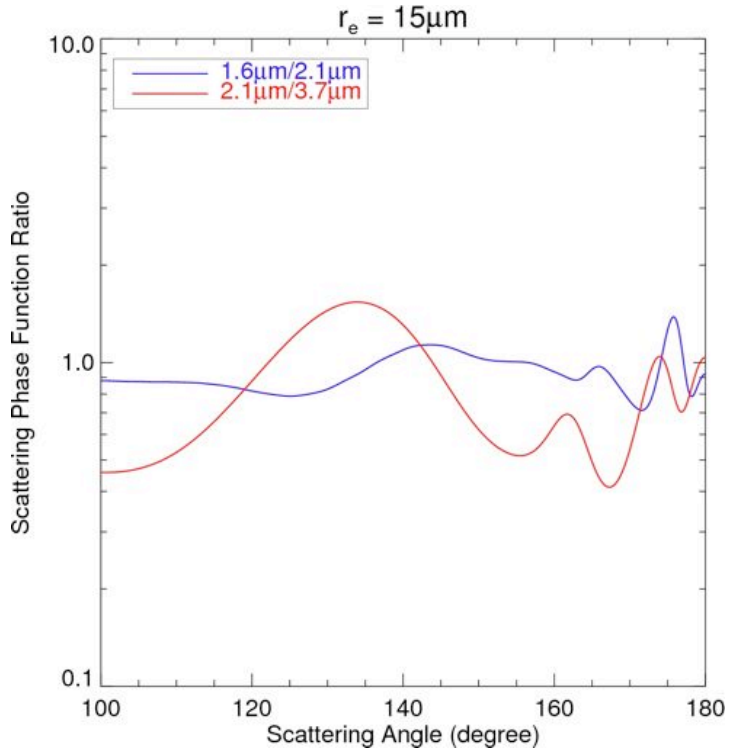


C6 w/Lambertian water surface

Cox-Munk LUT: Improved Interpolation and Angular Detail

(see Gala Wind poster for further details; analysis from Zhibo Zhang)



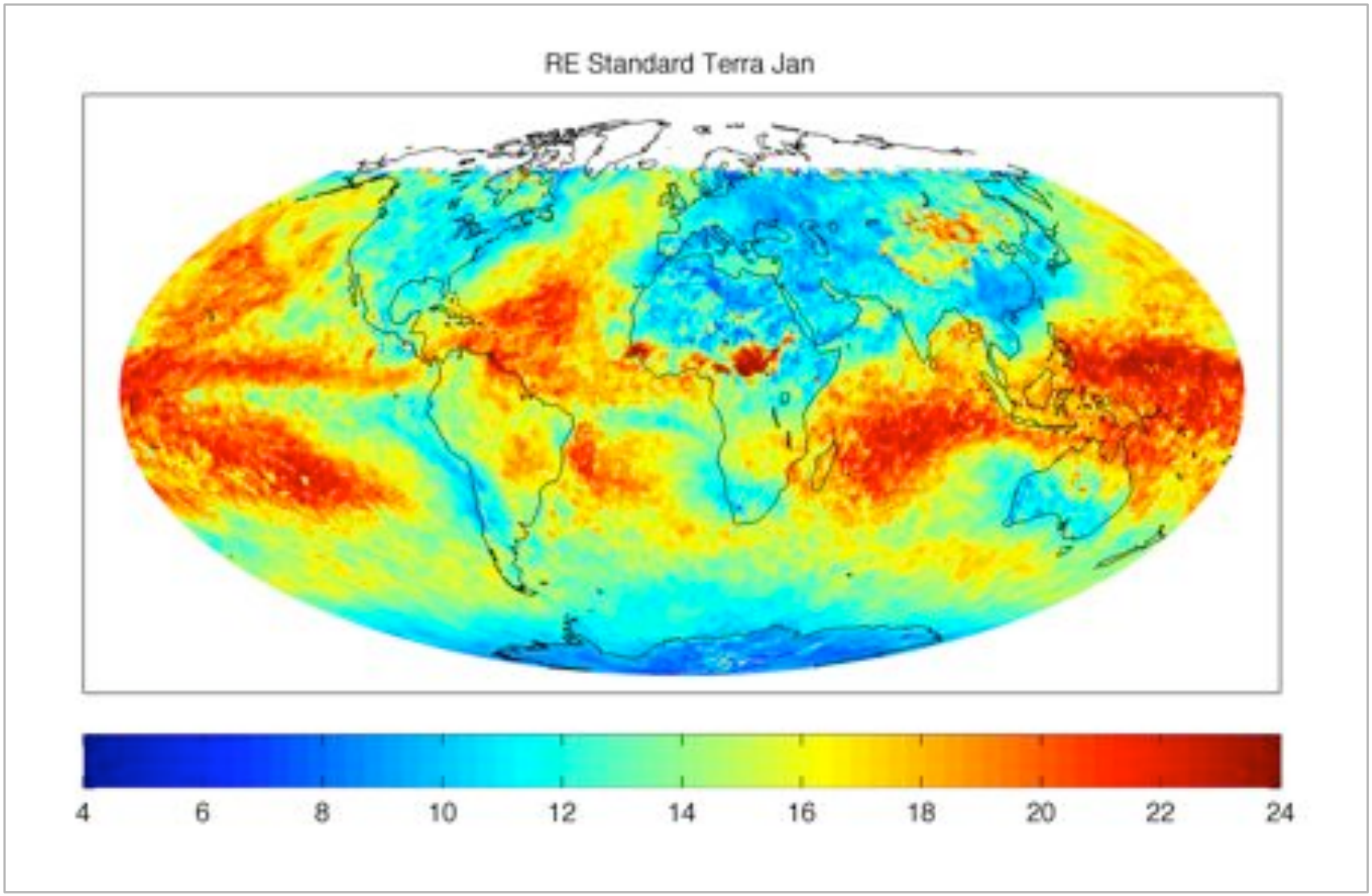


MOD06 Optical/Microphysical Product – C6 Plans and schedule

- **C6 Plan Highlights (cont.)**
  - Use new C6 1km cloud-top properties. Integrate low-cloud temperature retrievals into the MOD06OD algorithm to include non-unity emissivity (from optical thickness, effective radius retrieval). Iterative approach requiring independent 11 µm cloud-top properties code (retrieval logic and 11 µm radiative transfer code). Consequences for 3.7 µm r_e retrieval.
  - Ancillary files.
    - GDAS: use temporally/spatially interpolated surface temperature from Wisconsin 1km cloud-top properties product in 3.7µm retrieval. Read in the entire profile instead of roughly half of it, as is done currently.
    - NISE: examine possibility/effects of using next day's NISE in order to better capture freshly fallen snow.
- **Schedule**
  - Have scoped 12 primary tests, 3 have been completed.
  - With assumptions on testing through-put, nominal analysis time, and 50% contingency, don't believe testing will be done until Oct/Nov 2010 … so inclined to say end of calendar year.

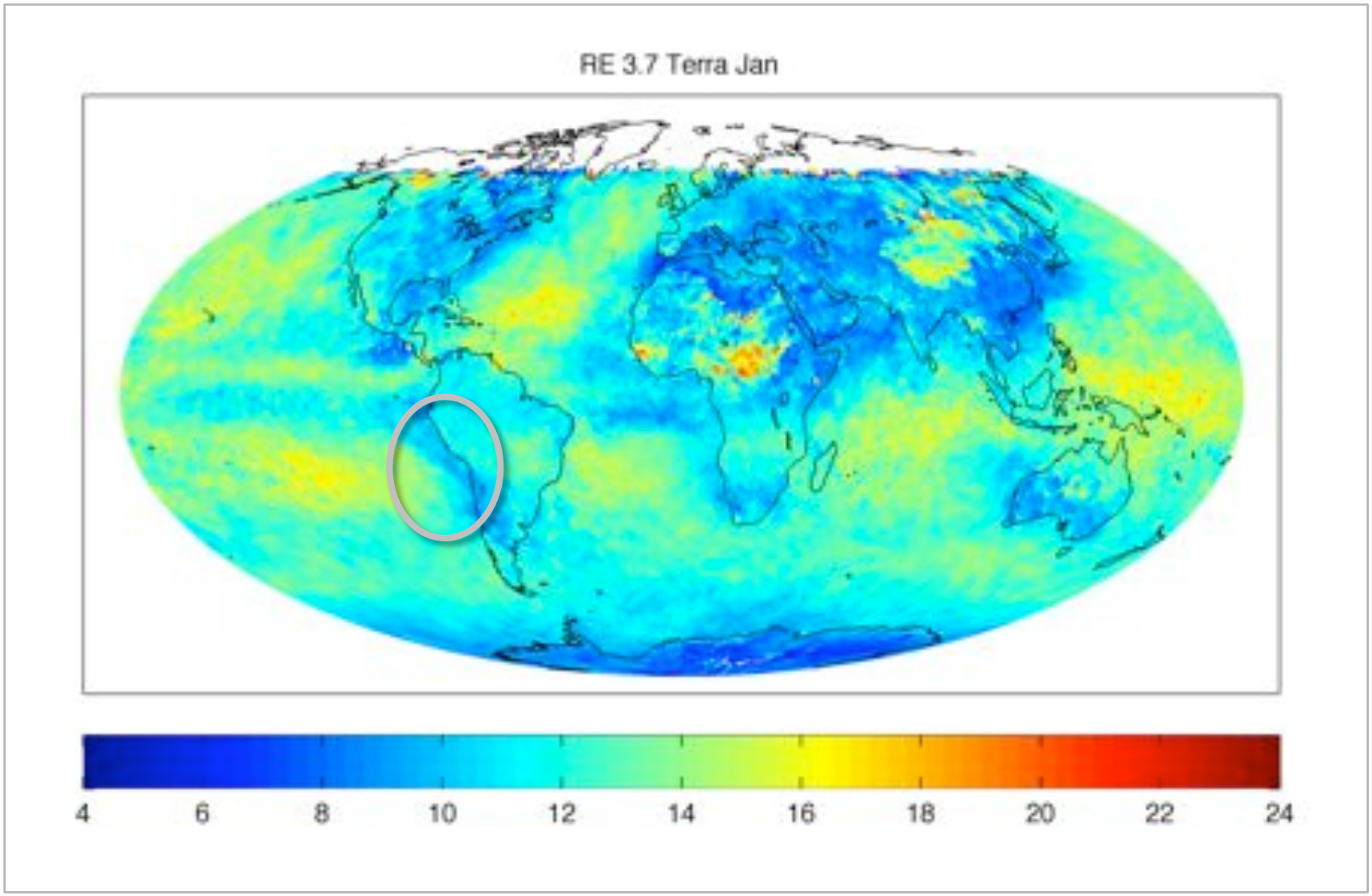
Monthly Mean Cloud Effective Radius: 2.1 vs. 3.7 µm

Terra MODIS June 2005 (Brent Maddux et al.)



Monthly Mean Cloud Effective Radius: 2.1 vs. 3.7 µm

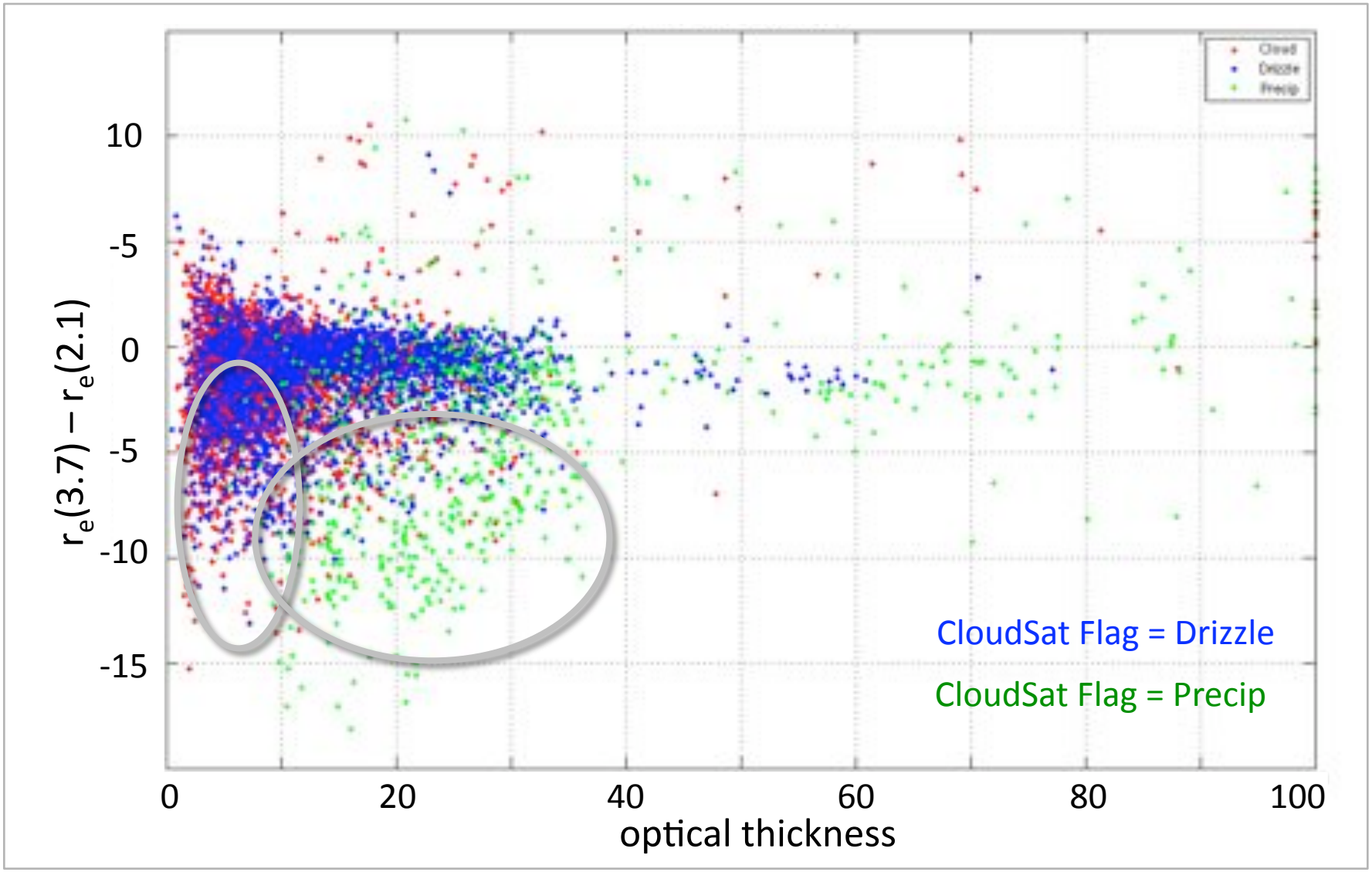
Terra MODIS June 2005 (Brent Maddux et al.)



Cloud Effective Radius Regional Differences: 2.1 vs. 3.7 µm

Region off the cost of Peru/Chile, Multiday MODIS Aqua + CloudSat

(Brent Maddux, Ralf Bennartz, et al.)

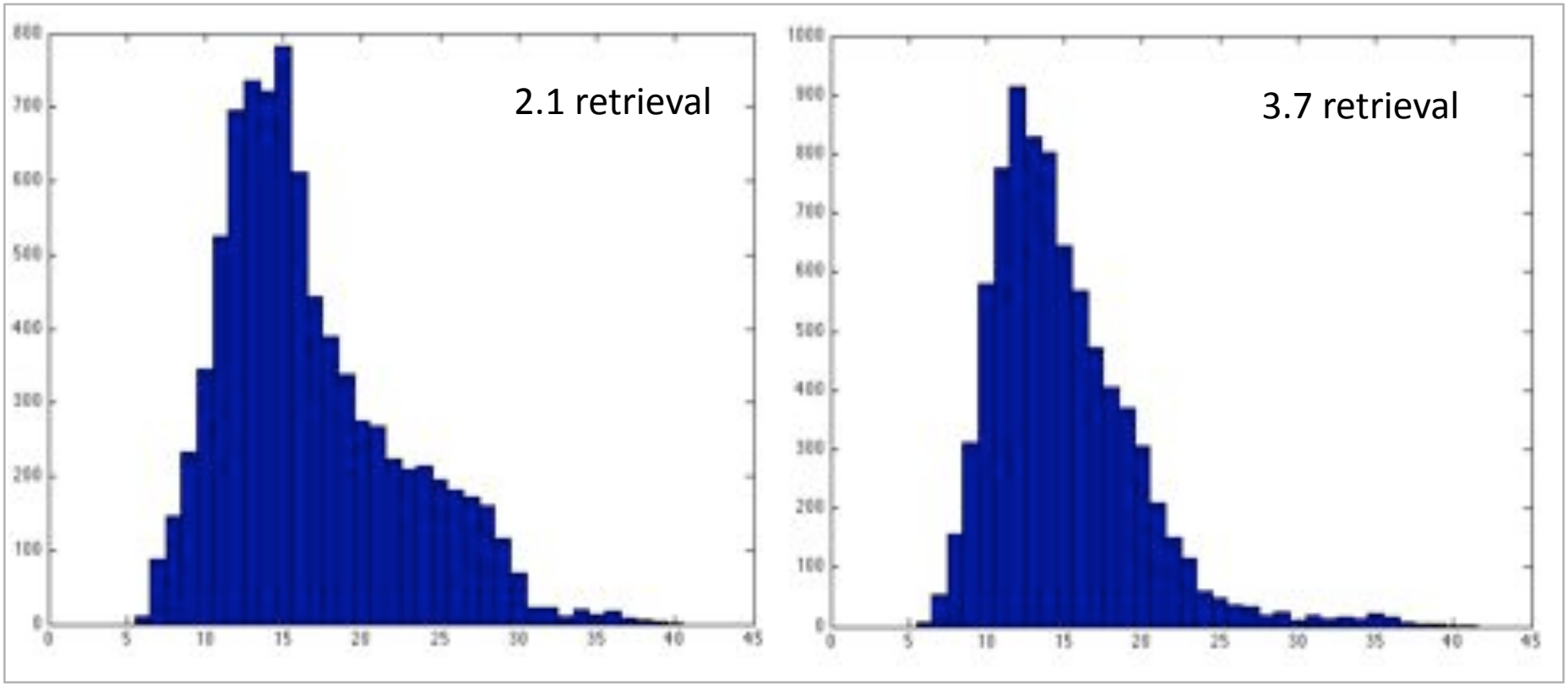


Cloud Effective Radius Differences: 2.1 vs. 3.7 µm

Region off the cost of Peru/Chile, Multiday MODIS Aqua + CloudSat

(Brent Maddux, Ralf Bennartz, et al.)

MODIS retrieval histograms w/no CloudSat drizzle or precip detection

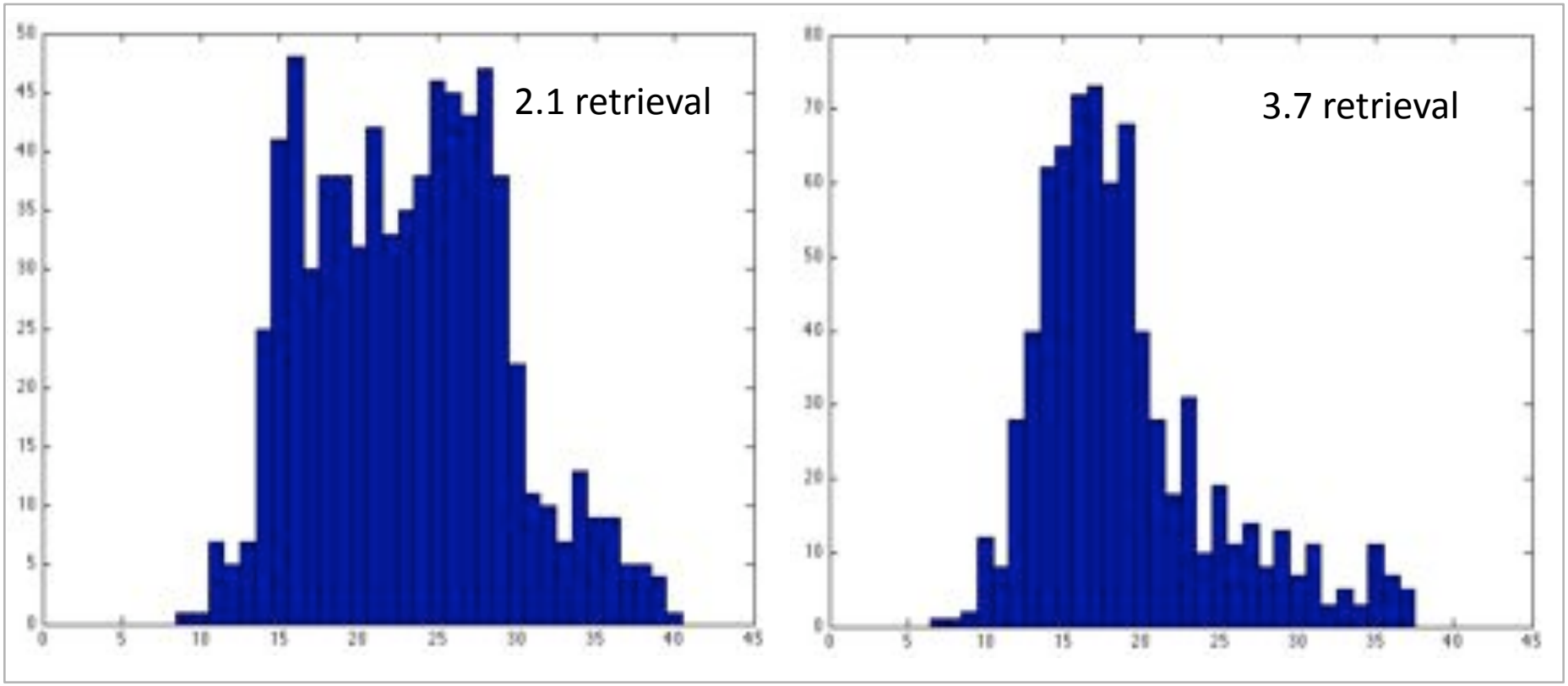


2.1 µm retrieval histogram broader than 3.7 µm

Cloud Effective Radius Differences: 2.1 vs. 3.7 µm

Region off the cost of Peru/Chile, Multiday MODIS Aqua + CloudSat
(Brent Maddux, Ralf Bennartz, et al.)

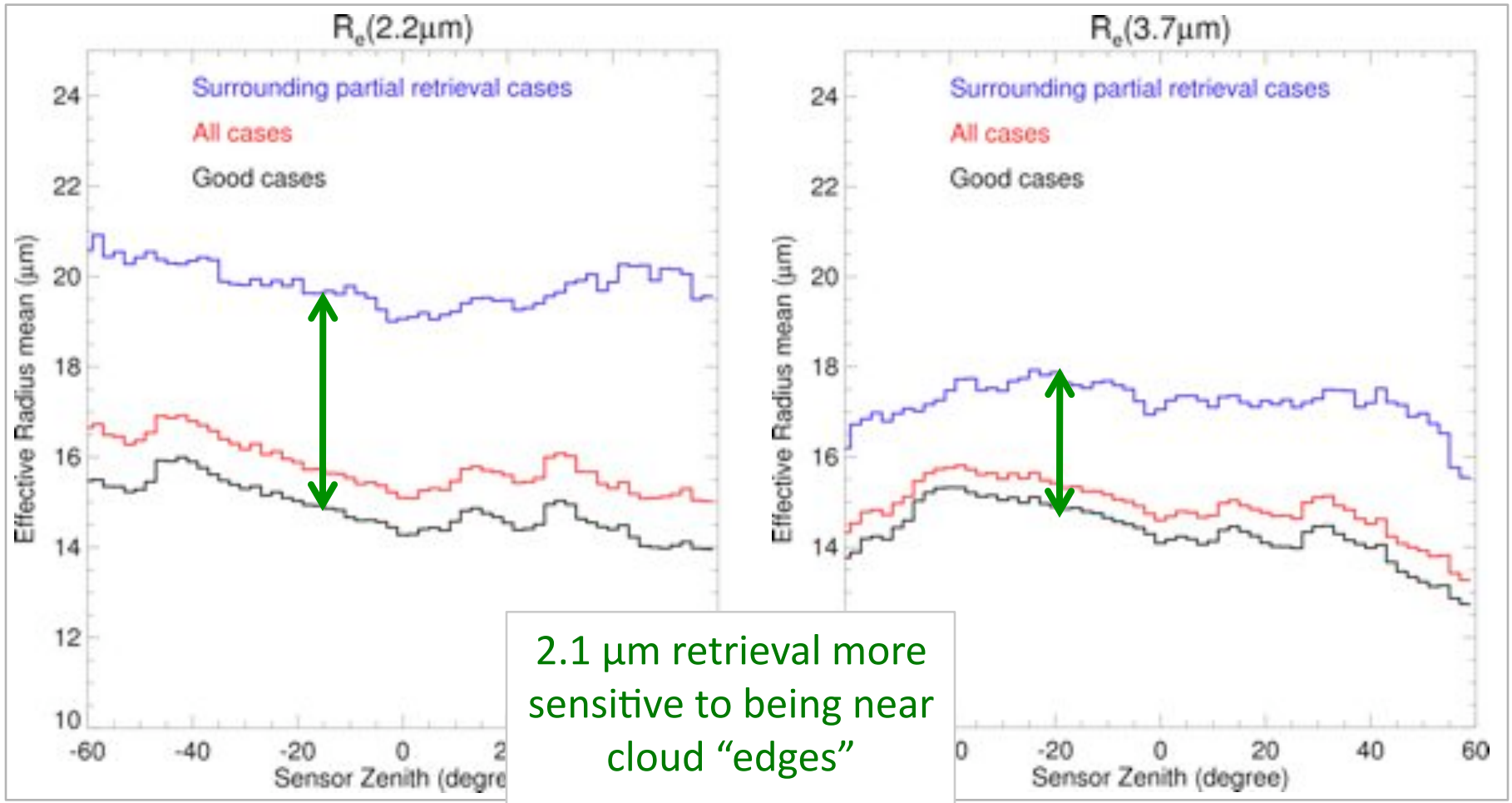
MODIS retrieval histograms w/CloudSat precip. detection



Both retrievals larger in presence of precipitation,
but 2.1 µm retrieval more sensitive
(though few occurrences of precip. flag)

Cloud Effective Radius Differences: 2.1 vs. 3.7 µm

Retrievals vs. VZA, Multiday granules off cost of Peru/Chile (Z. Zhang)



2.1 µm retrieval more sensitive to being near cloud “edges”

Summary of 2.1 µm vs. 3.7 µm r_e Results

For water clouds, so far …

- Global r_e statistics between 2.1 and 3 7 µm retrievals are significantly different.
  - Shouldn't directly compare MODIS standard retrieval (2.1 µm) with AVHRR or MODIS/CERES 3.7 µm derived data sets.
  - Differences between these data sets are due to choice of bands uses, not algorithmic.
- Adiabatic-like relations between the retrievals can be found, but dramatically different in oceanic broken cloud regions.
  - From prelim. CloudSat study (single region), most dramatic differences appears to be related to drizzle/precip which may be correlated with broken clouds.
  - Some/more significant positive (2.1–3.7) bias with VZA (beyond pixel level uncertainties) in broken oceanic regions.
- Pursuing MOD06 retrievals from marine BL LES runs

CRM Modeling Study: 1.6 and 2.1 vs. 3.7 µm r_e Retrievals

- Zinner et al., *ACPD*

  LES fields (A. Ackerman)

  – 12 km square fields, 50m horizontal, ~20m vertical

  – RICO and FIRE-I simulations

  – Cloud microphysics are reported in 25 droplet size bins, ranging from 1 to 280 µm radius

  Monte Carlo simulations (T. Zinner)

  – MYSTIC + libRadtran (Mayer, 2000)

  – bi-modal Gamma function distributions (droplet and drizzle modes, separately)

  – no atmosphere (apart from $T(z)$ in cloud), black surface

  – SZA = 10º and 45º, nadir view

  MOD06 retrievals

  Results: 3D effects minimally affect mean values, though increase the range of scatter for the LES cases analyzed.

CRM Modeling Study: 1.6 and 2.1 vs. 3.7 μm r_e Retrievals

- Zhibo Zhang et al.

  LES fields (B. Stephens – finished several runs; G. Feingold – starting runs)

  Monte Carlo simulations

  – I3RC code (Pincus et al.)

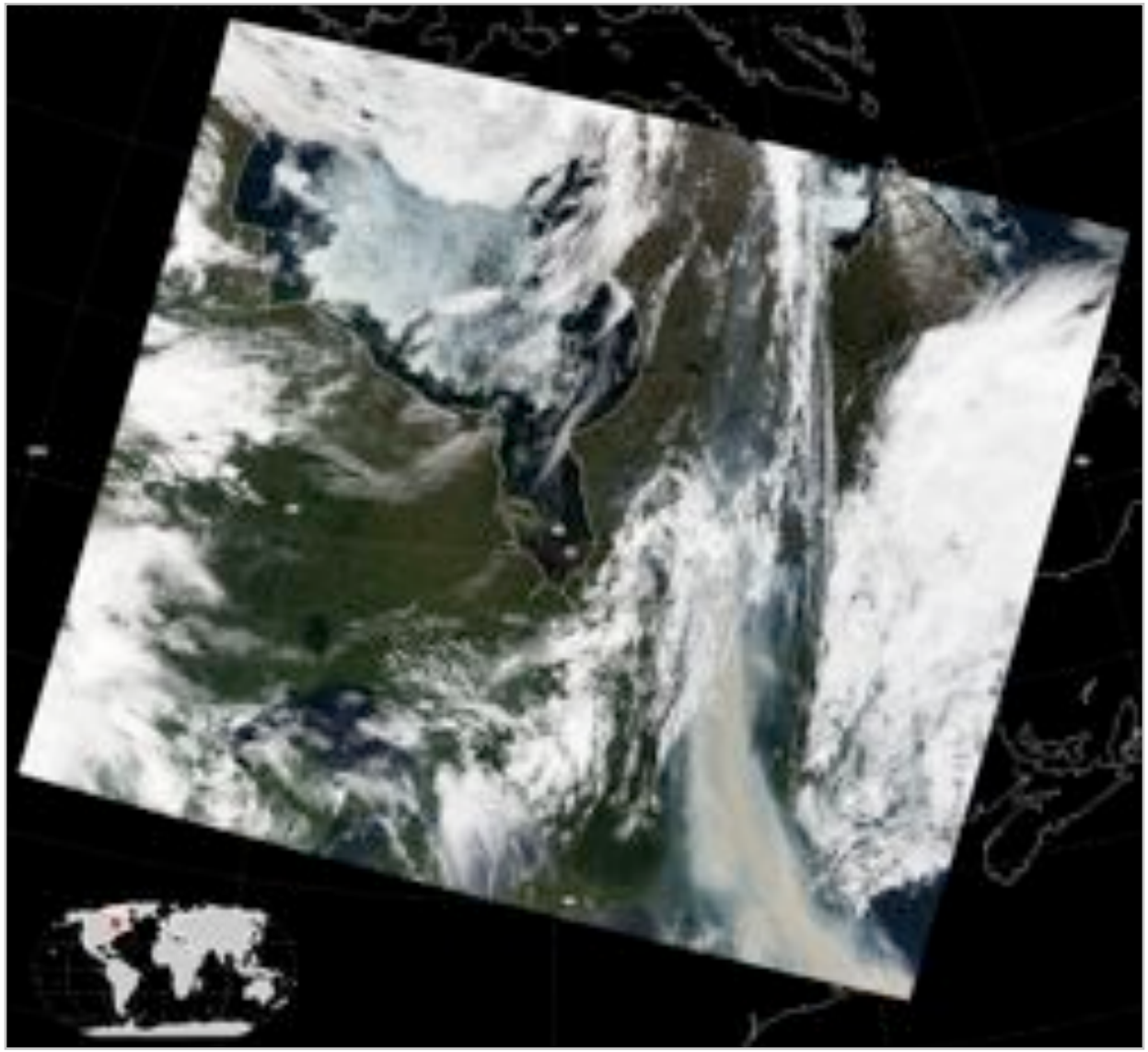
  – no atmosphere (apart from $T(z)$ in cloud), black surface

  MOD06 retrievals

  Results: 3D effects minimally affect mean values, though increase the range of scatter for the LES cases analyzed.

Example MODIS Data Granule

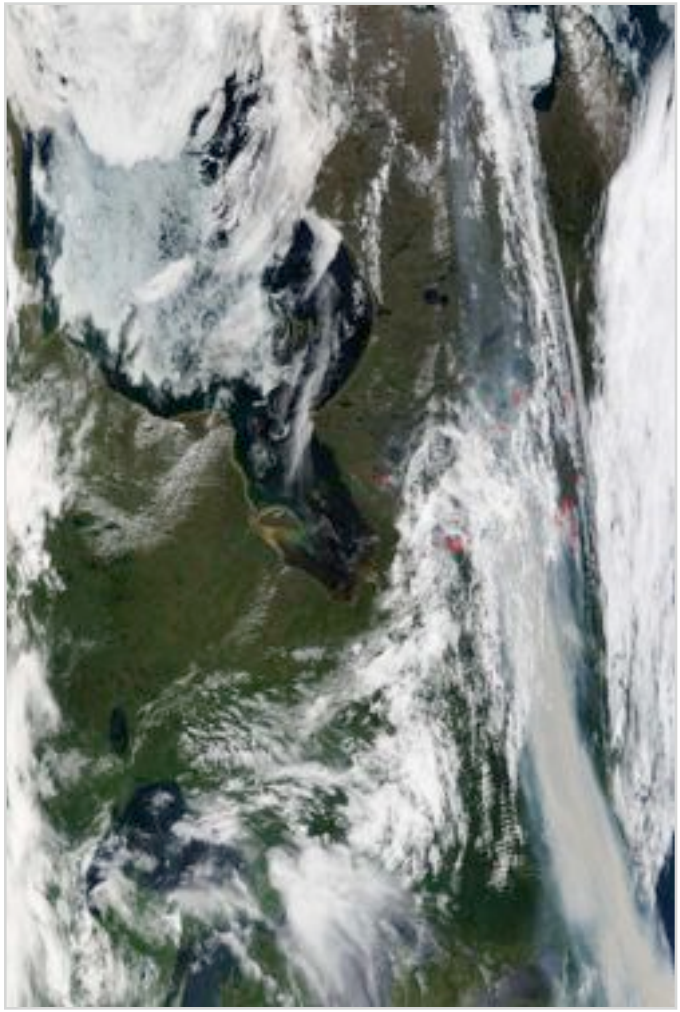
Canadian Fires, MODIS Terra, 7 July 2002



Example MODIS Data Granule

Canadian Fires, MODIS Terra, 7 July 2002

true color



SWIR composite

SWIR composite

Cloud Mask overall conf.

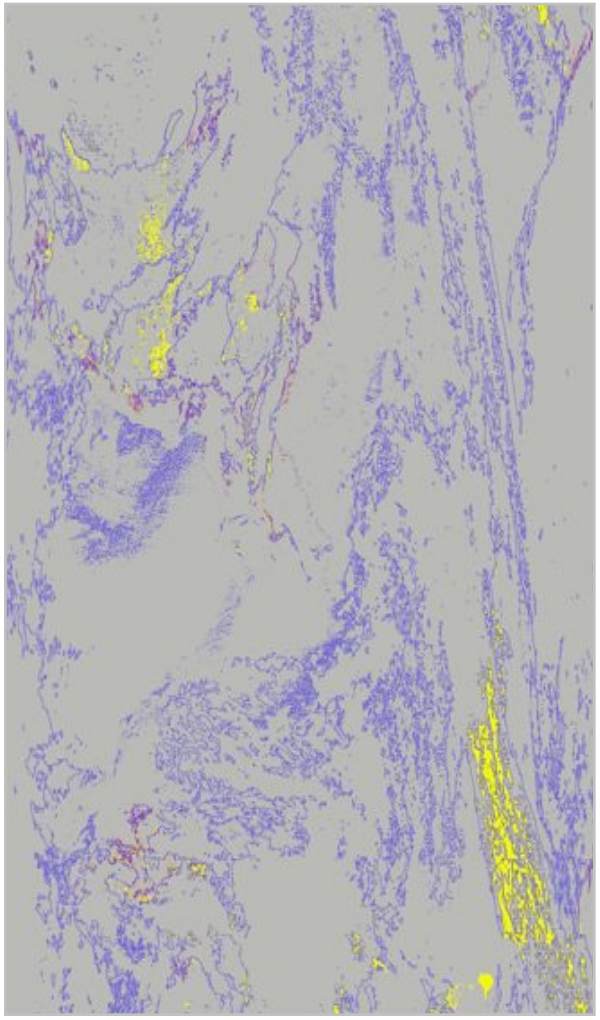
probably clear

clear

cloudy

probably cloudy

"Clear Sky Restoral"



spatial/spectral tests

edge detection

250m cloud mask

SWIR composite

Cloud Mask overall conf.

probably clear

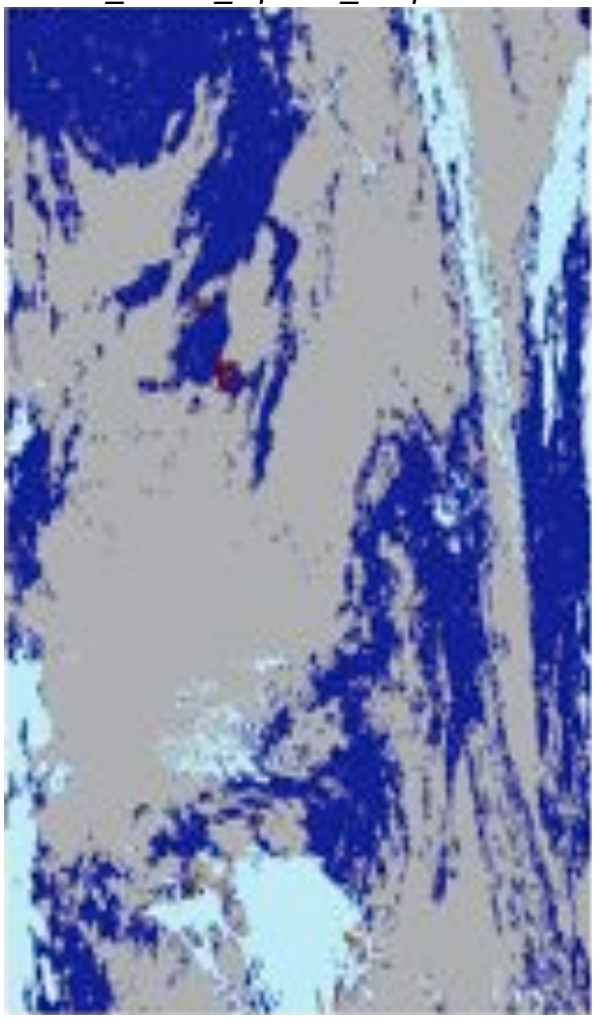
clear

cloudy

probably cloudy

Retrieval process. phase

Cloud_Phase_Optical_Properties



liquid water

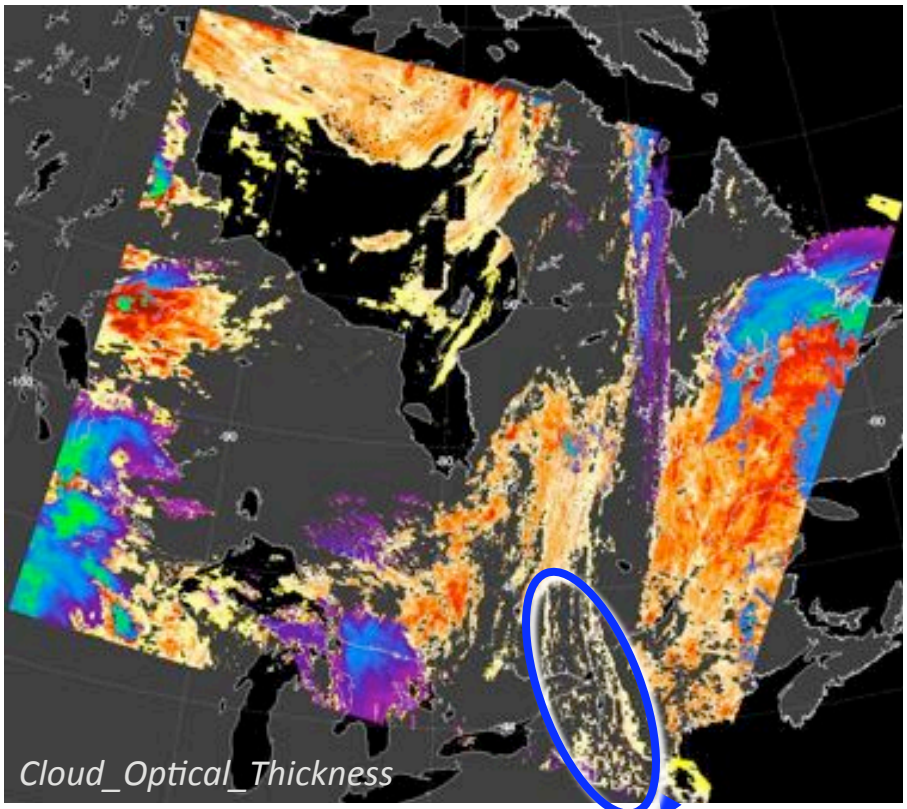
ice

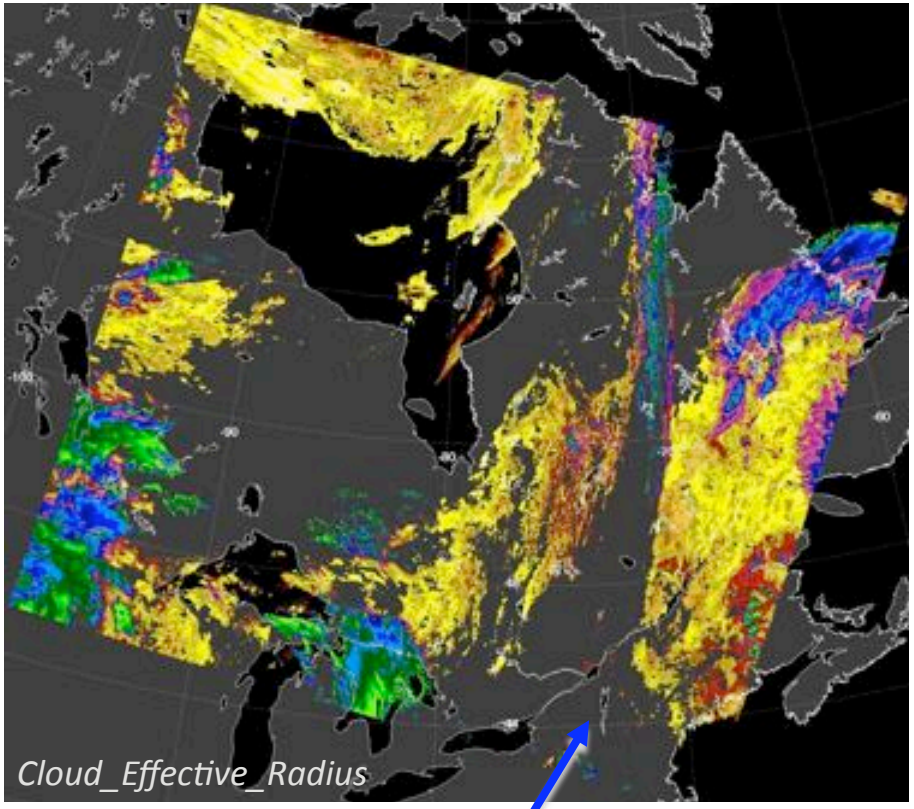
undetermined

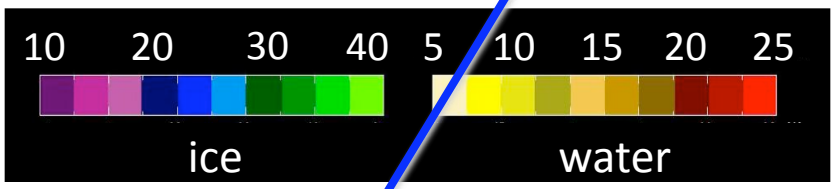
Optical Thickness, Effective Radius Retrievals

optical thickness

effective radius (µm)



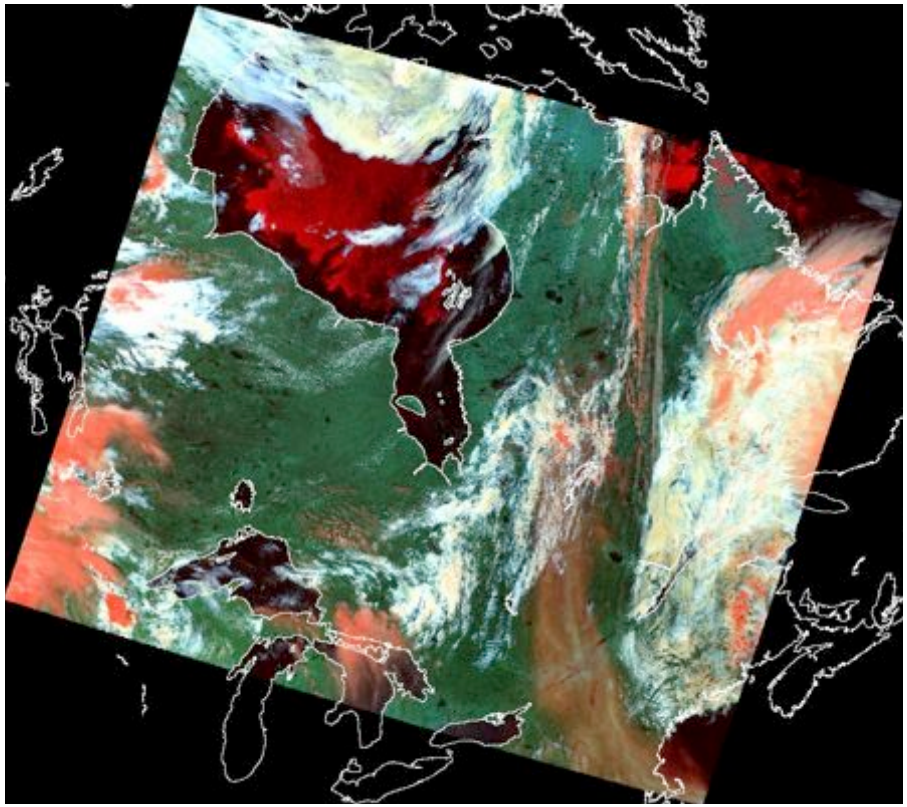




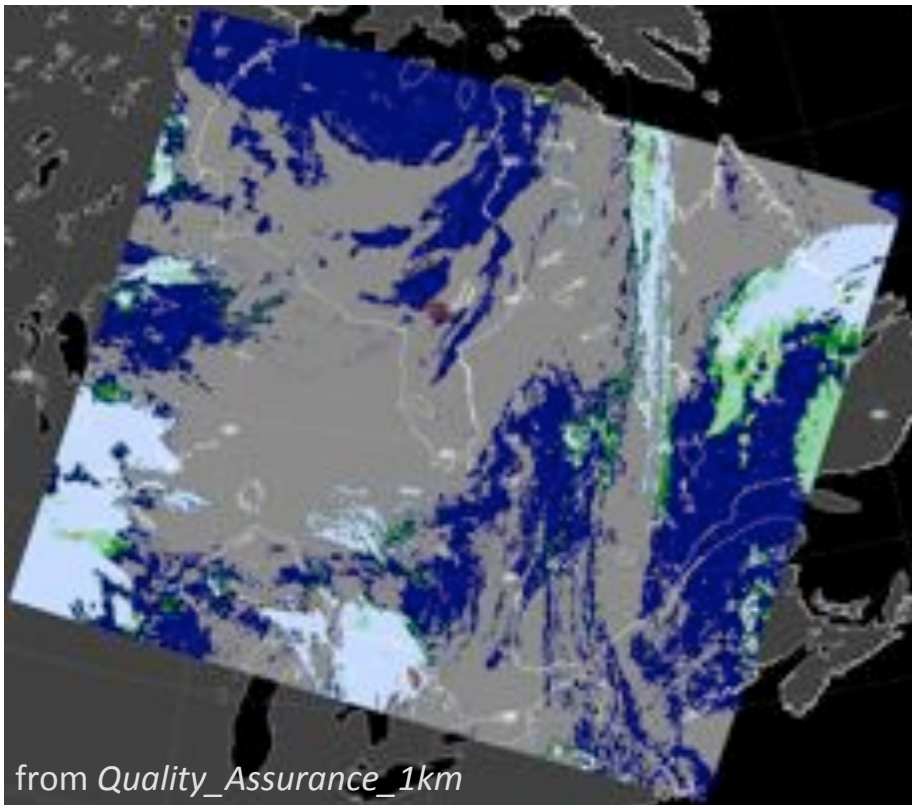
Partial retrievals (not aggregated to L3)

Multilayer Flag

- Multilayers of different phases: disagreement between IR-phase retrieval and phase derived for optical/microphysical retrieval (SWIR bands, cloud mask tests, …).
- General multilayer: 0.94 μm water vapor absorption band.



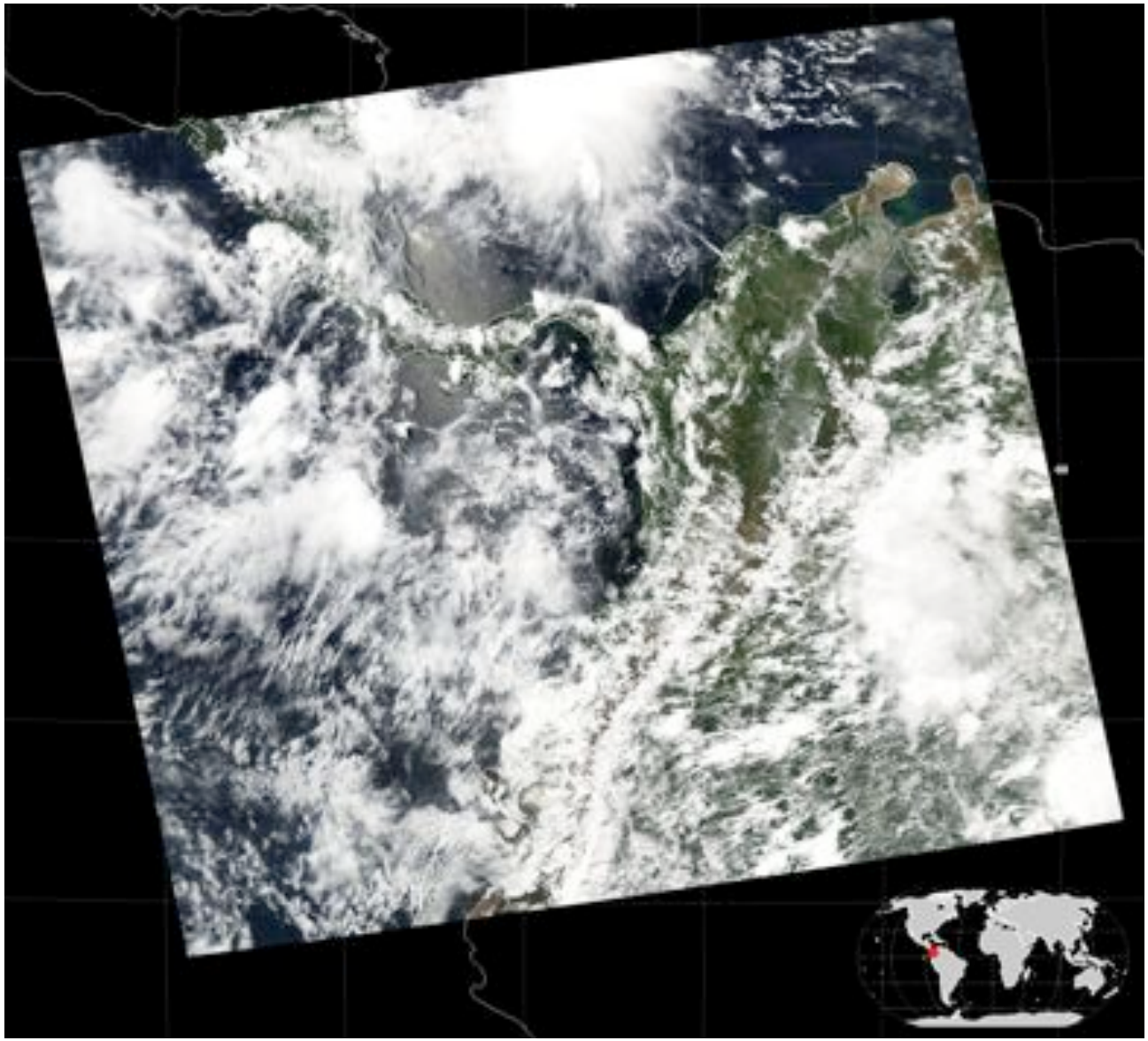
SWIR composite



- liquid water
- ice
- undetermined
- ML, retr'd as water
- ML, retr'd as ice
- ML undetermined

MODIS Aqua Example

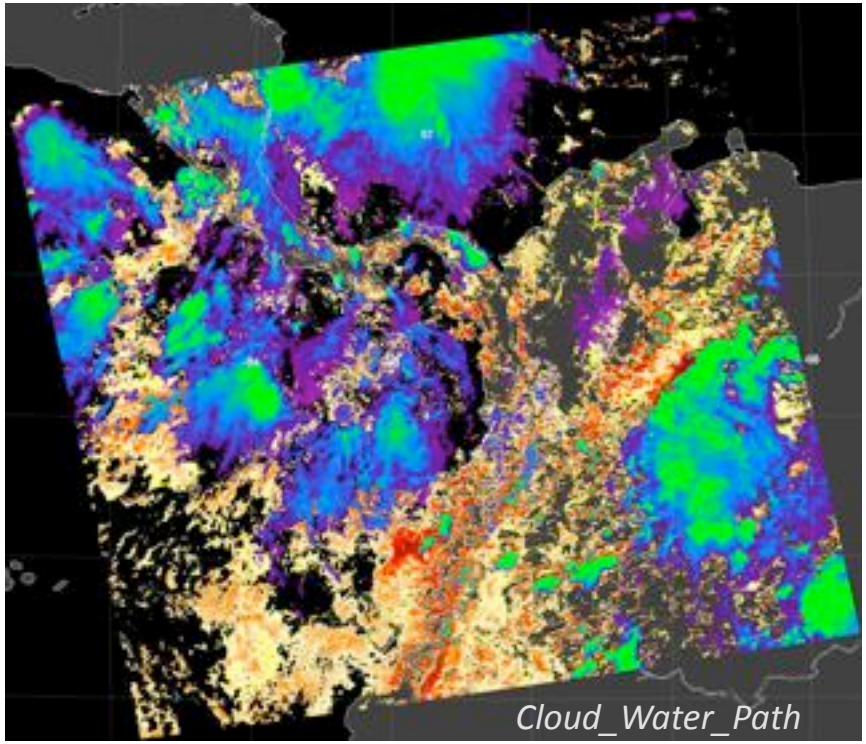
20 Aug 2006, Central Am./NW SA, true color composite

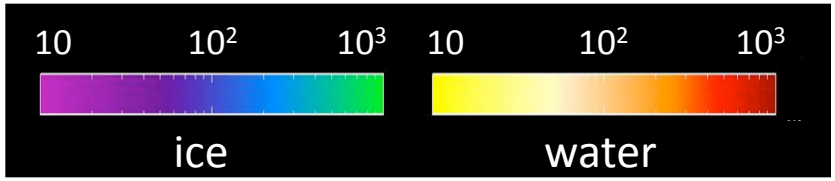


MODIS Aqua Example, cont.

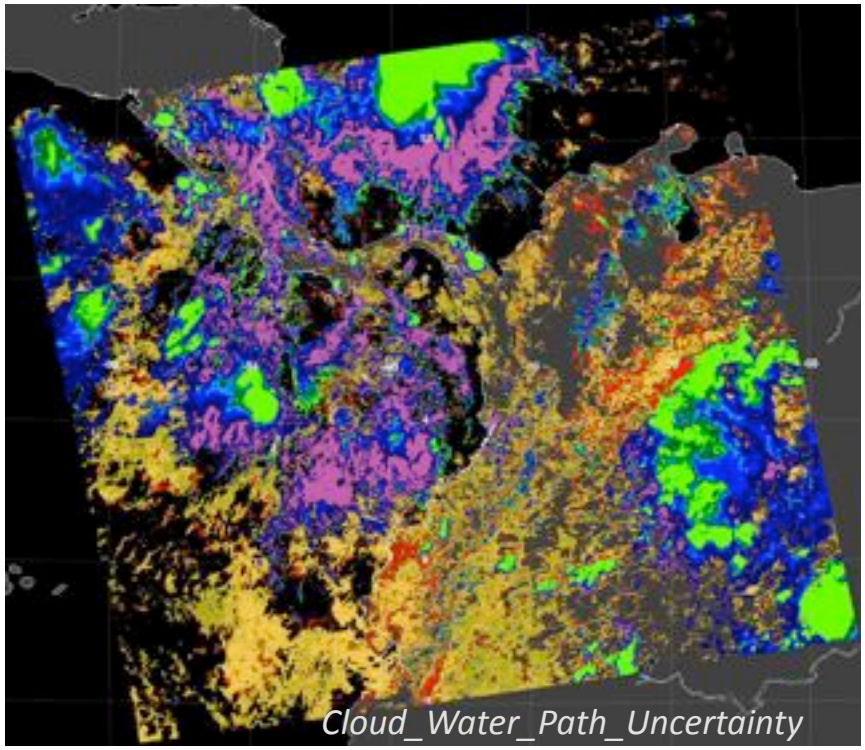
IWP, LWP, and Baseline Uncertainty Estimate

WP (gm^{-2})





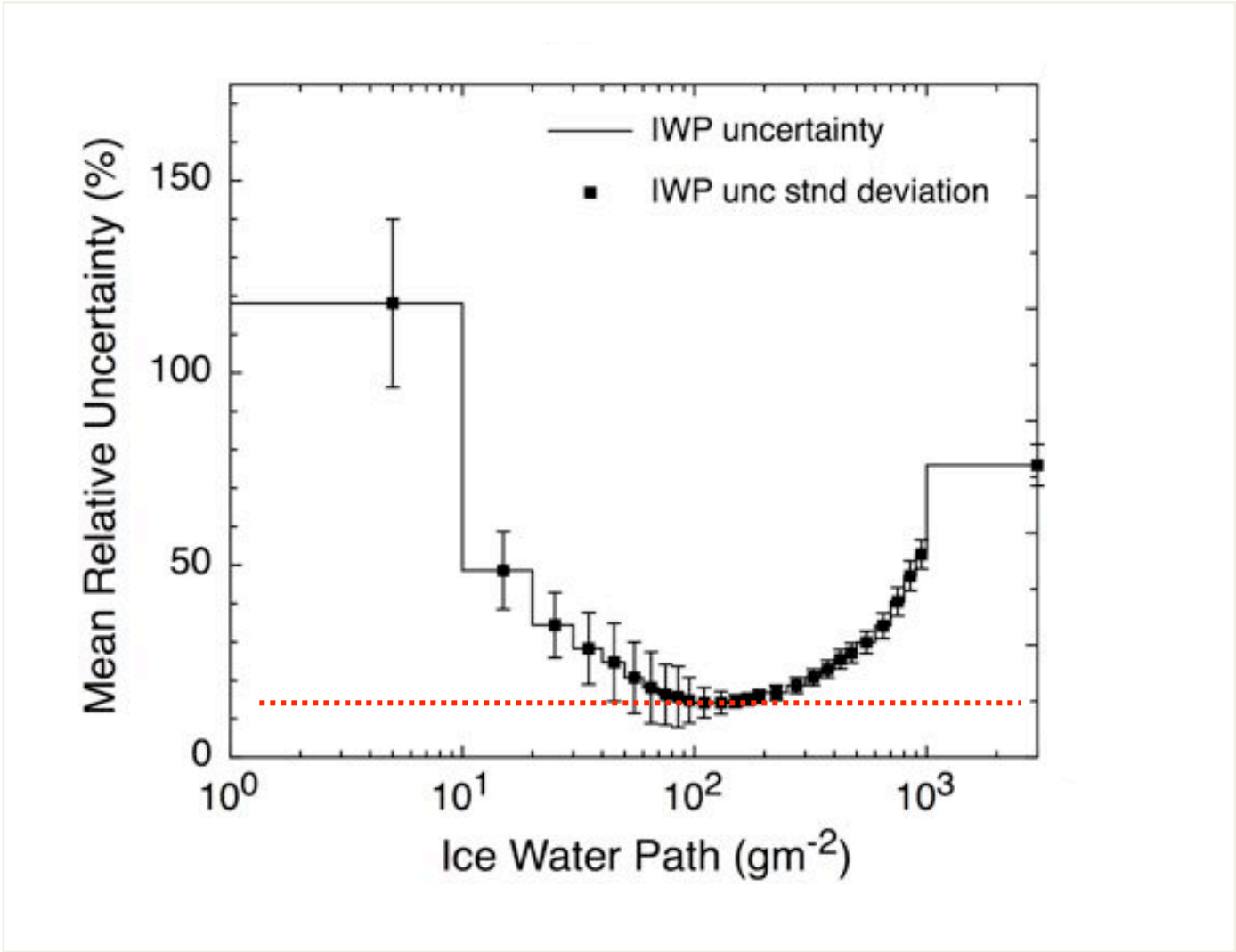
$\Delta WP/WP$ (%)

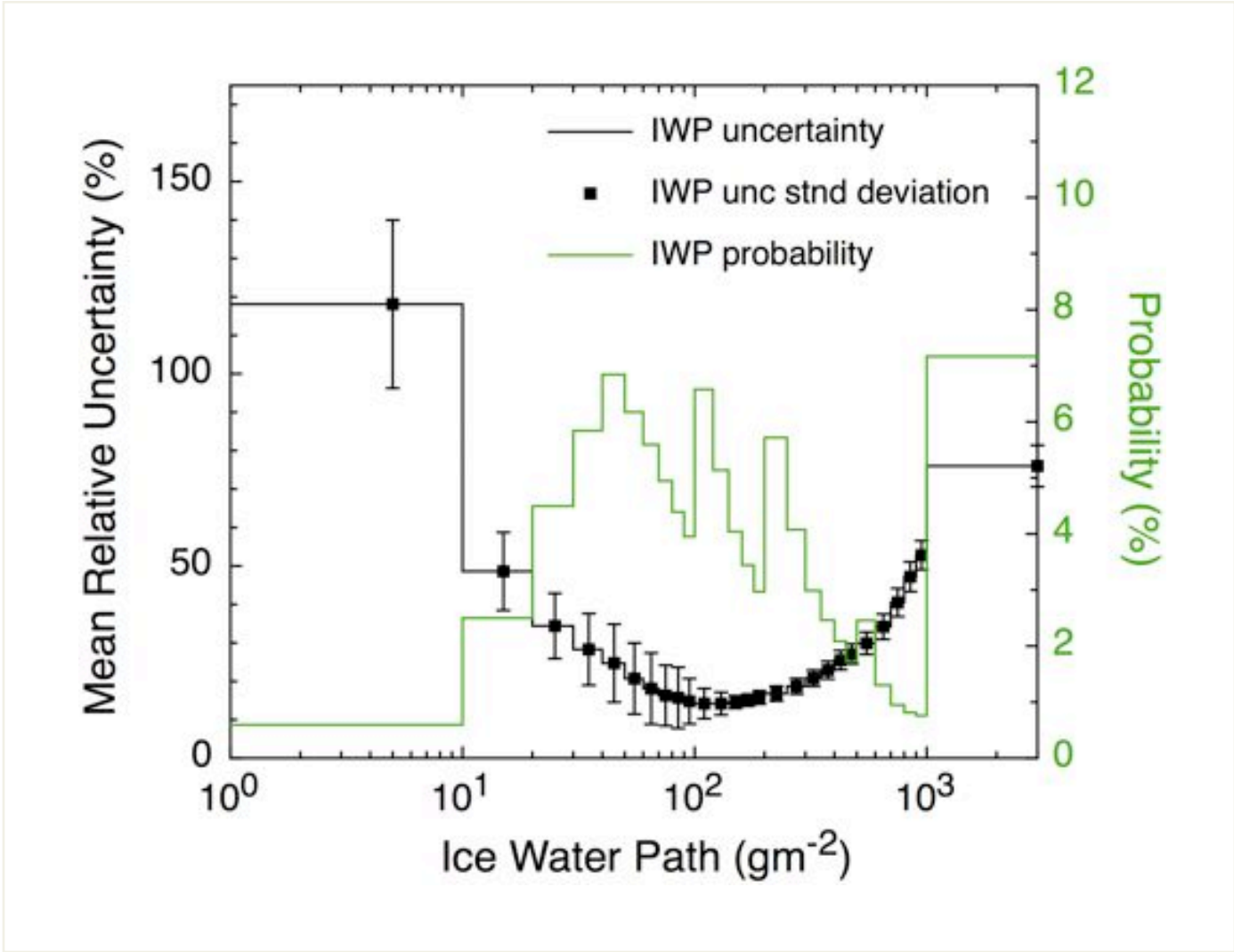


Error sources: calibration/forward model, surface albedo, atmospheric correction

MODIS Aqua Example, cont.

Uncertainty vs. IWP: Ocean Pixels Only



MODIS Aqua Example, cont.

Uncertainty vs. IWP: Ocean Pixels Only