Granule-level Intercomparisons of IR and Reflectance-based Ice Cloud Optical Thickness Retrievals

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Outline

- Review of IR Method
- Granule Comparisons
- Issues with Size Distribution Sensitivity

Review of the IR Method

- Collection 6 MYD06 Data will contain cloud emissivities at 8.5, 11 and 12 mm. Previous collections only gave the 11 mm emissivities from the CO_2 slicing algorithm.

- With NASA/ROSES funding, we developed a technique to estimate optical depth and particle size from this information for cirrus clouds.

- Paper drafted and final data set will be generated when Collection 6 is available.

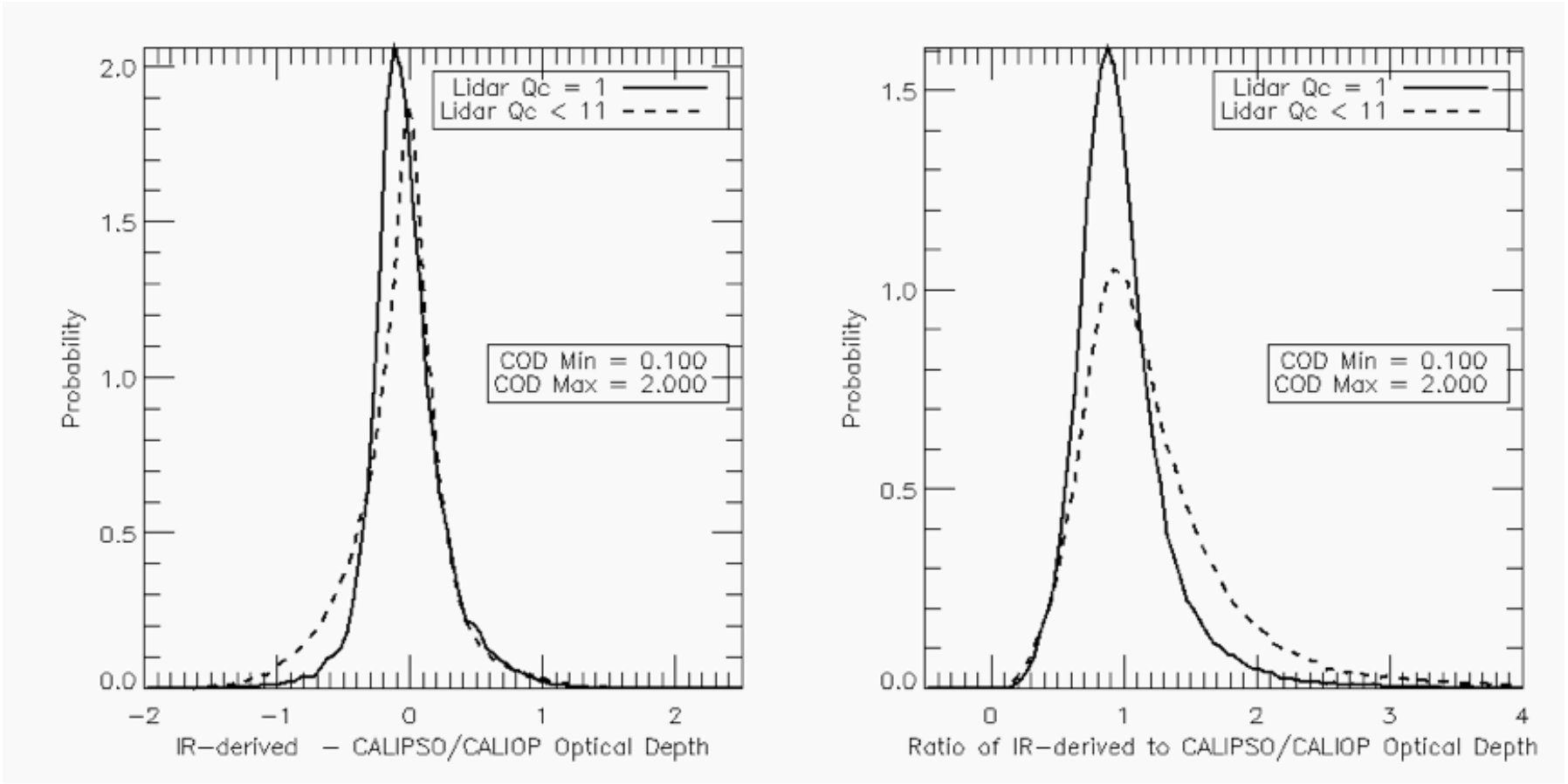
- Optical depths were shown to agree well with CALIPSO/CALIOP.

- C5 MYD06 optical depths were also known to be higher than CALIPSO/CALIOP.

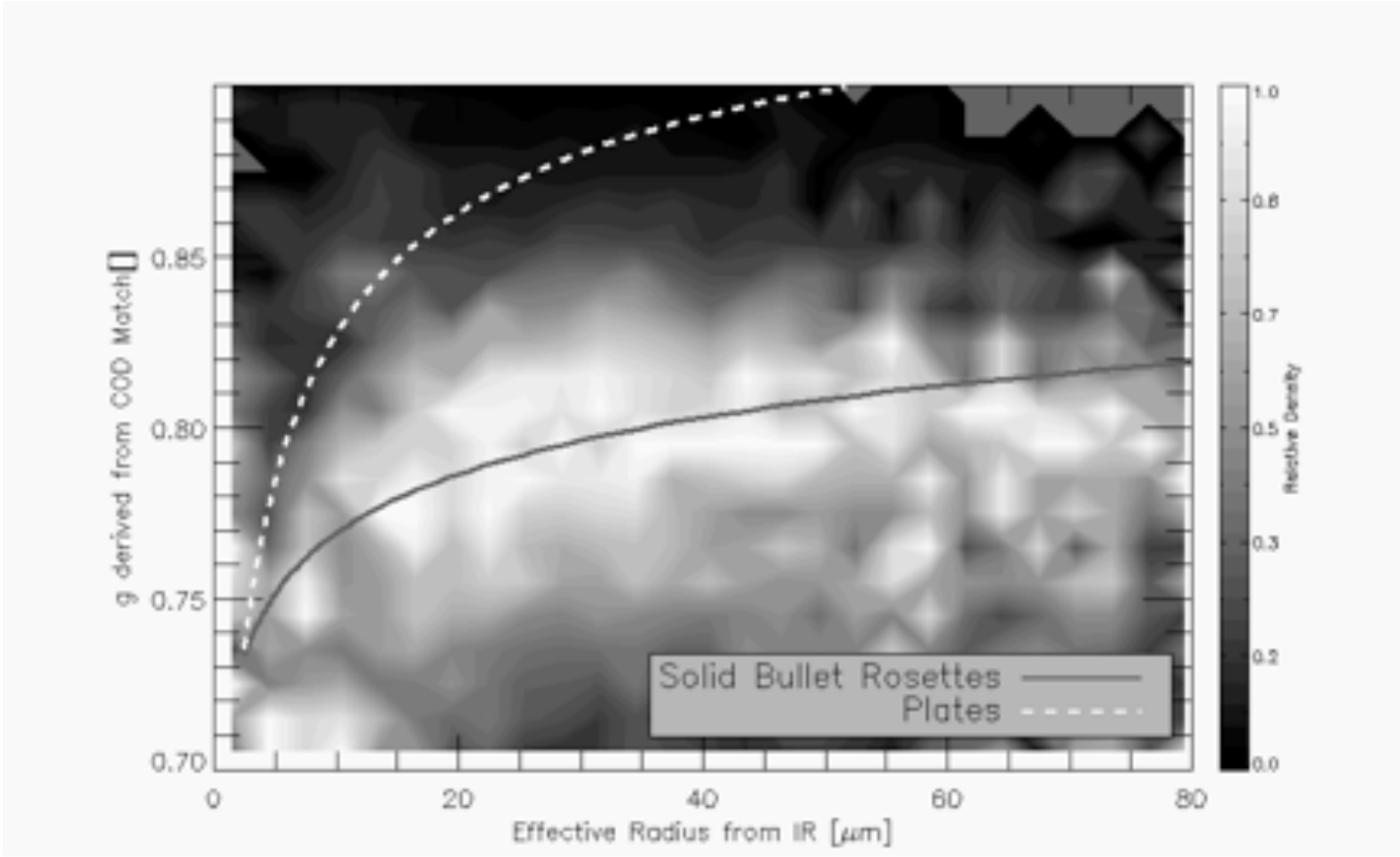
- We used a scaled optical depth argument to infer the g vs re relationship that should exist at 0.65 mm.

- Solid bullet rosettes were the habit from Ping Yang's database that best matched this inferred g vs. r_e relationship.

Example Agreement of IR-derived Optical Depth to those from CALIPSO/CALIOP for August 2006 from NPP Atmos PEATE



Comparison of Inferred g vs r_e relationship with g vs r_e for Solid Bullet Rosettes (severely roughened)

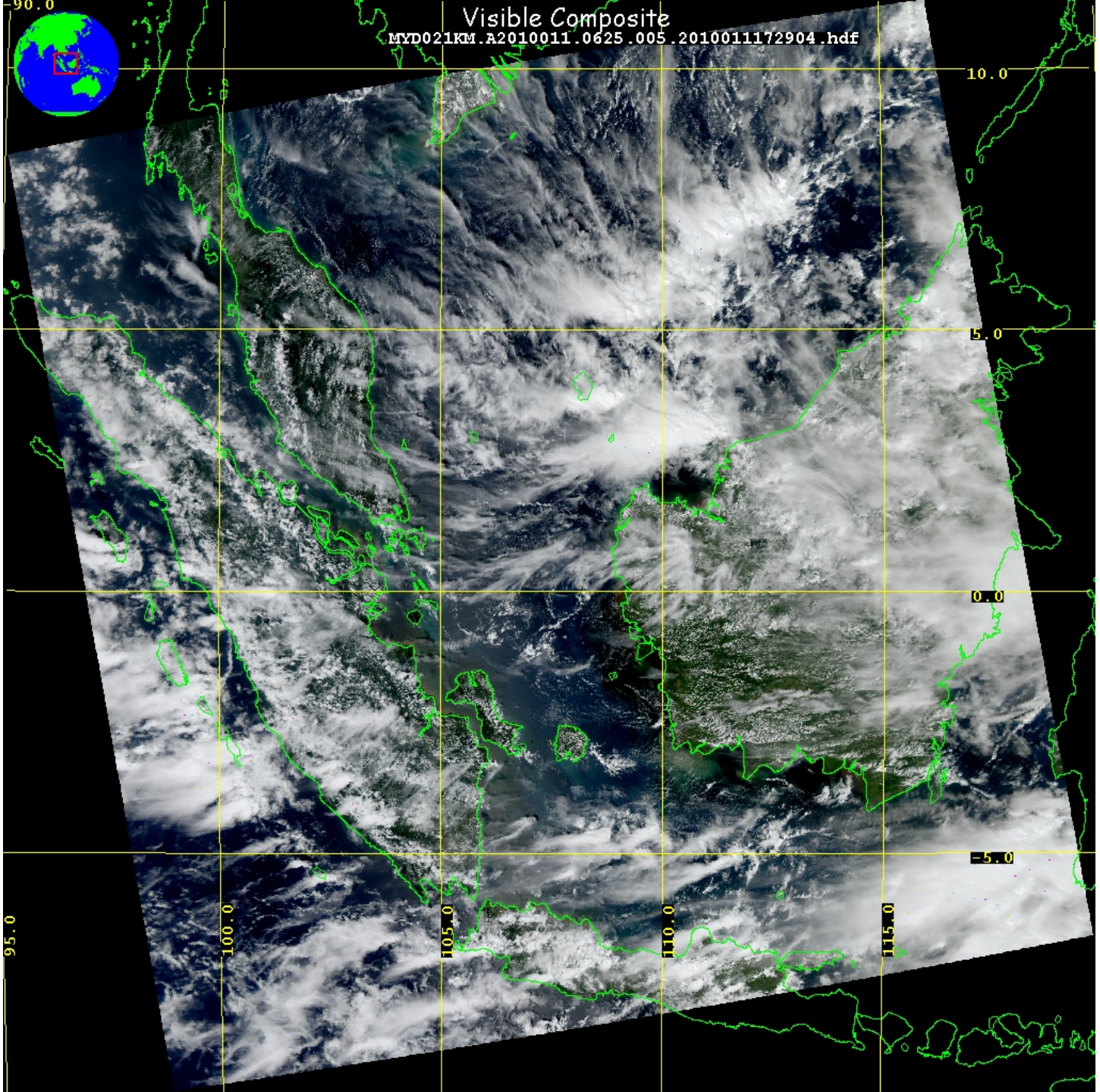


Conclusions from IR Method

- Agreement of IR with CALIOP implies C5 solar optical depths are in error.
- If one habit is chosen, IR analysis supports Solid Bullet Rosettes.
- There is one caveat, Plates “win” in the IR-only analysis but fail to produce a g vs r_e curve at 0.65 mm that is realistic. In the IR-only analysis, Plated and Solid Bullet Rosettes are indistinguishable.

Granule Analysis of IR vs. VIS results using SBR

This work is done in the NOAA PATMOS-x system with the DCOMP algorithm.
DCOMP is the NOAA AWG analog for the solar reflectance retrievals in MYD06.
We use DCOMP since we could swap our tables more easily.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0.0
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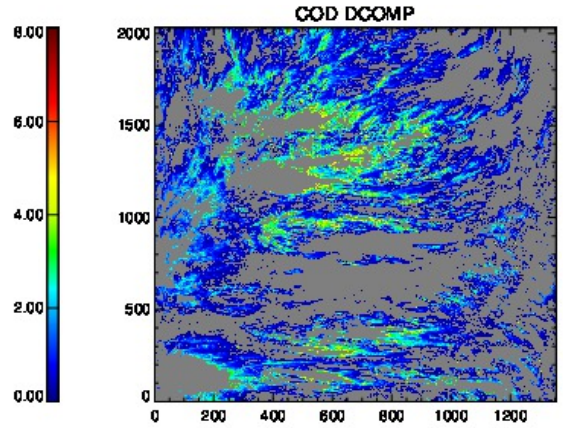
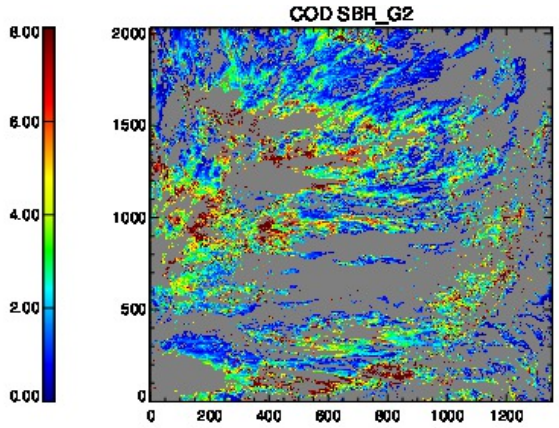
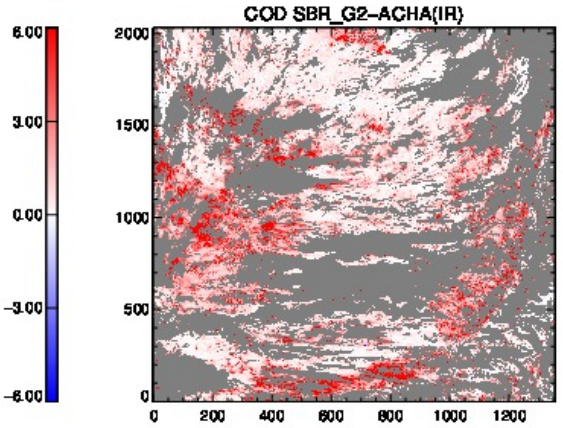
95.0
100.0
105.0
110.0
115.0

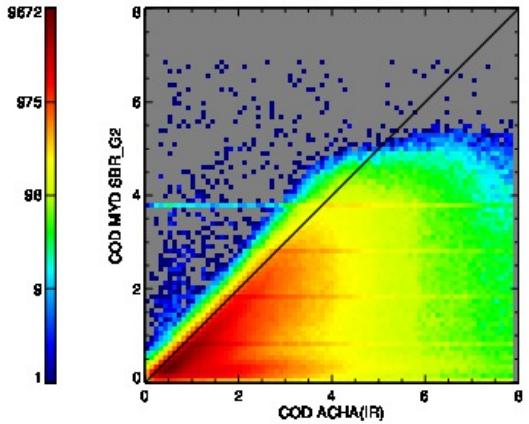
Comparison MYD06 SBR_G2 and ACHA (IR) COD

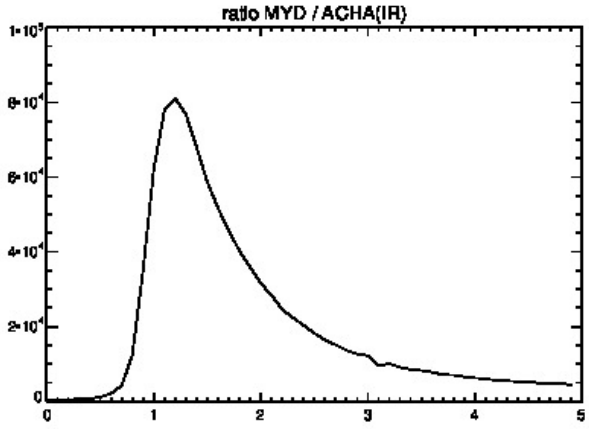
- ACHA = NOAA IR Cloud Algorithm (assumes SBR G2)
- Only cirrus clouds and IR COD < 3
- All COD are defined at 0.65 mm.





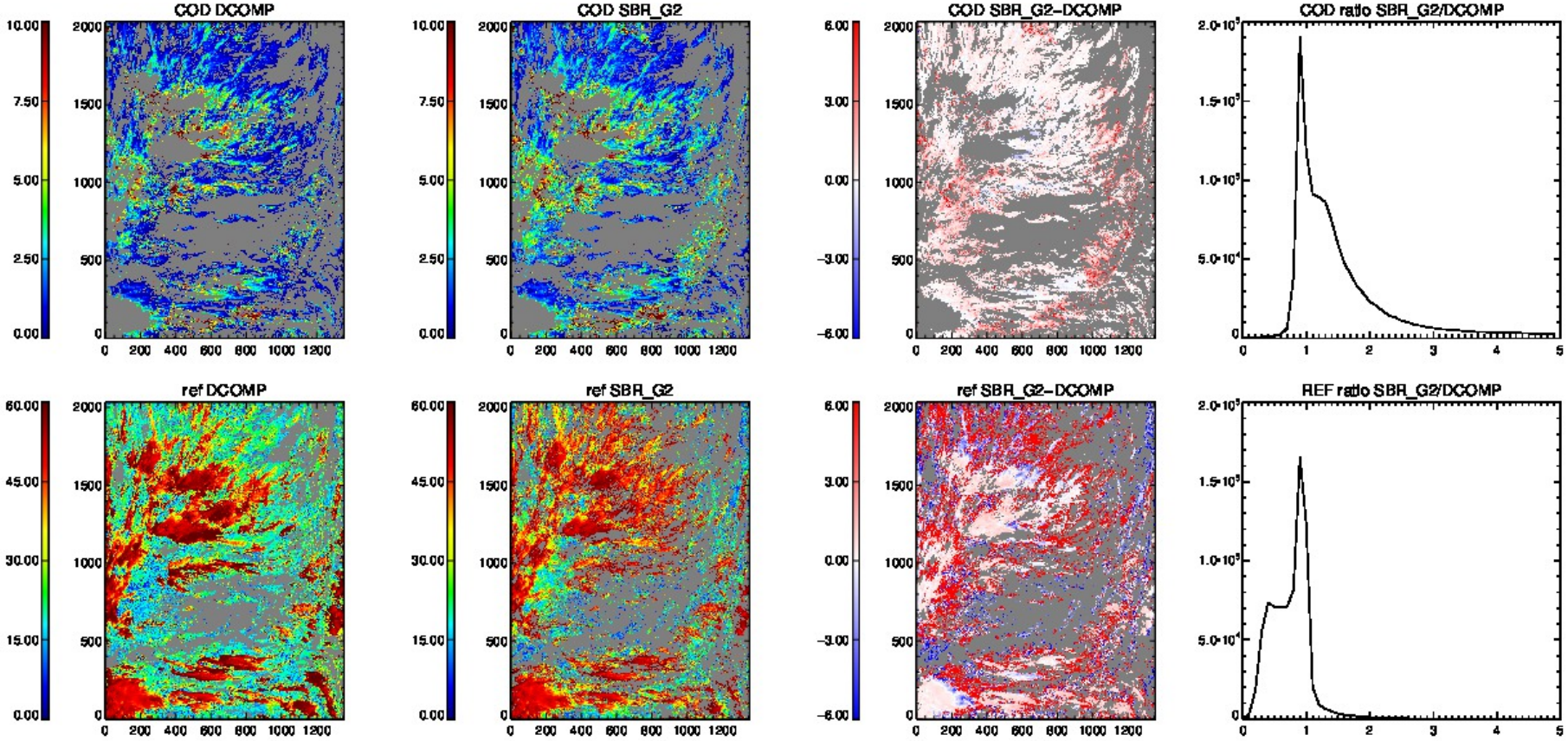






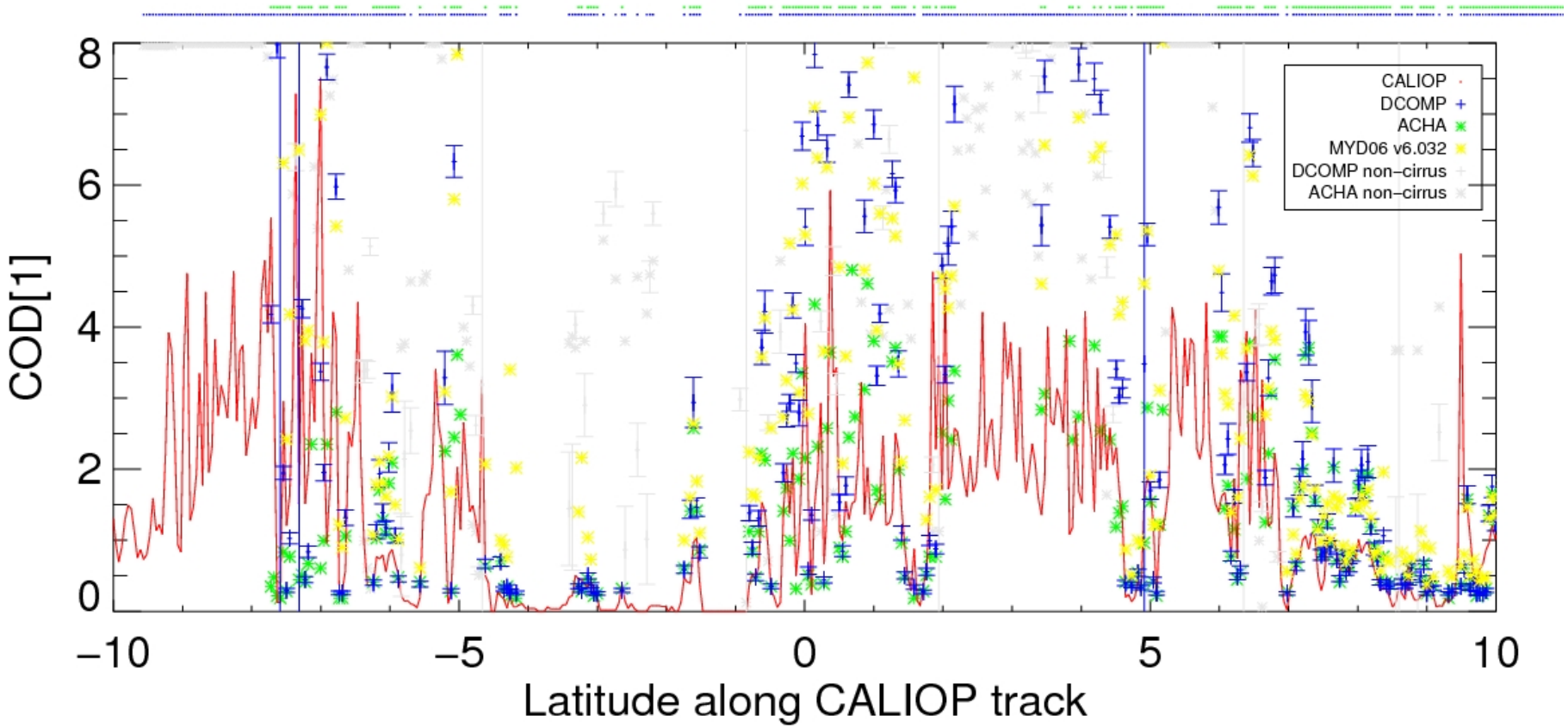
Comparison of NOAA/DCOMP and MYD06 SBR_G2

- ACHA = NOAA IR Cloud Algorithm (assumes SBR G2)
- Only cirrus clouds and IR COD < 3
- All COD are defined at 0.65 mm.

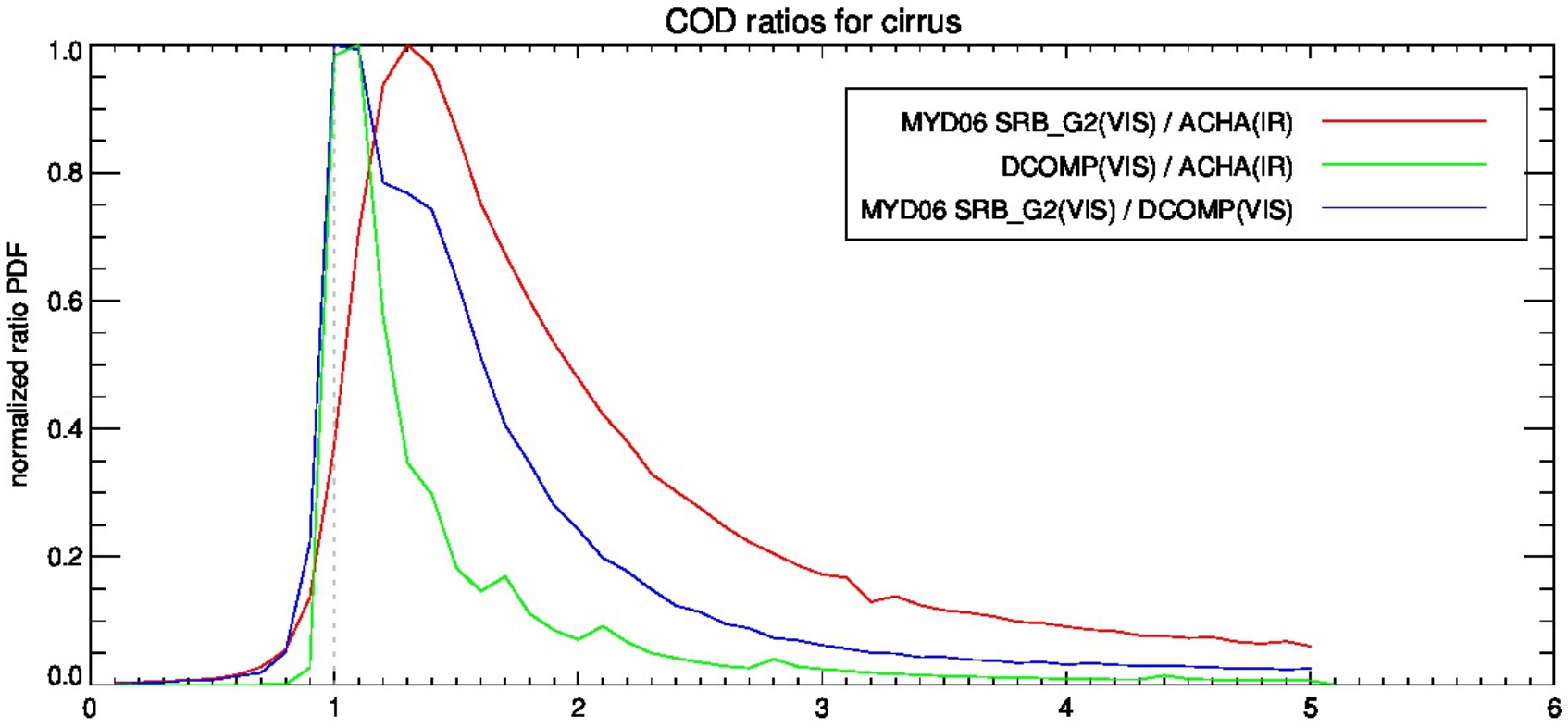


Comparison of IR–derived and Solar-derived 0.65 mm Optical Depth Along the CALIPSO Track

- ACHA = IR results from the NOAA PATMOS-x system



Comparisons of Optical Depth Ratios (Solar to IR, MYD06 to NOAA/DCOMP)



Testing of LUTS within MYD06 at the NPP Atmos. PEATE

Where we are (in my opinion)

- IR method(s) offer accurate estimates of 0.65 mm optical depth for thin cirrus relative to CALIPSO/CALIOP and be used to guide MYD06 Collection 6.

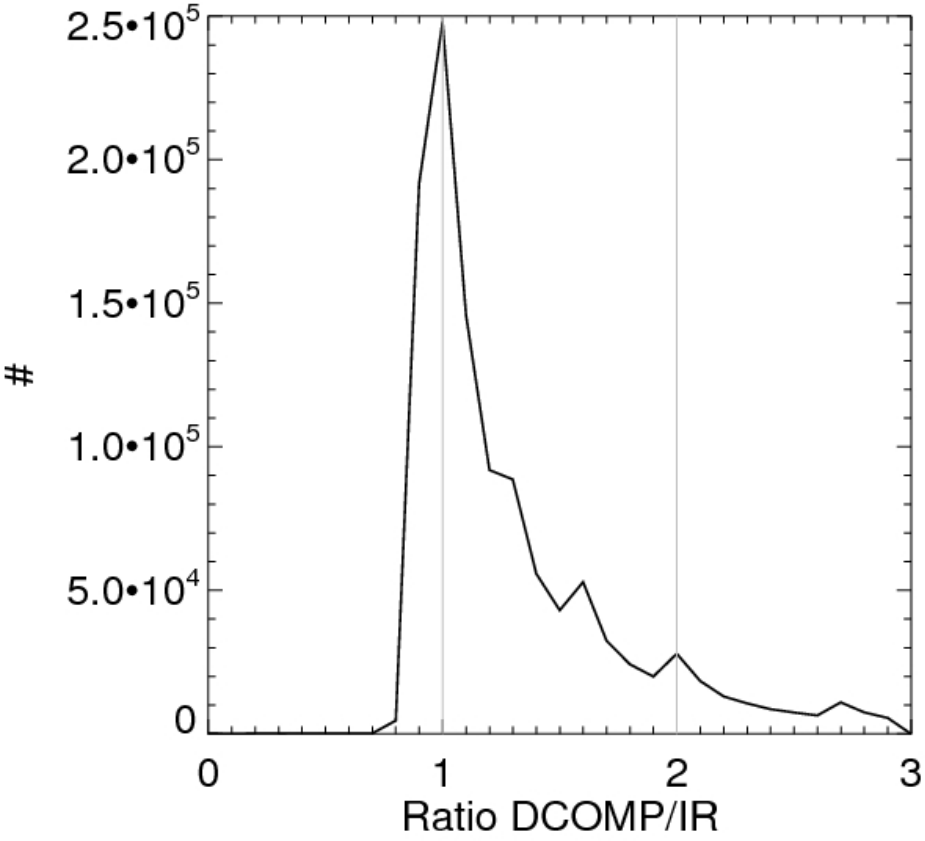
- Analysis of the IR and Solar Reflectance methods seems to point to SBR as the most appropriate habit if one habit were to chosen.

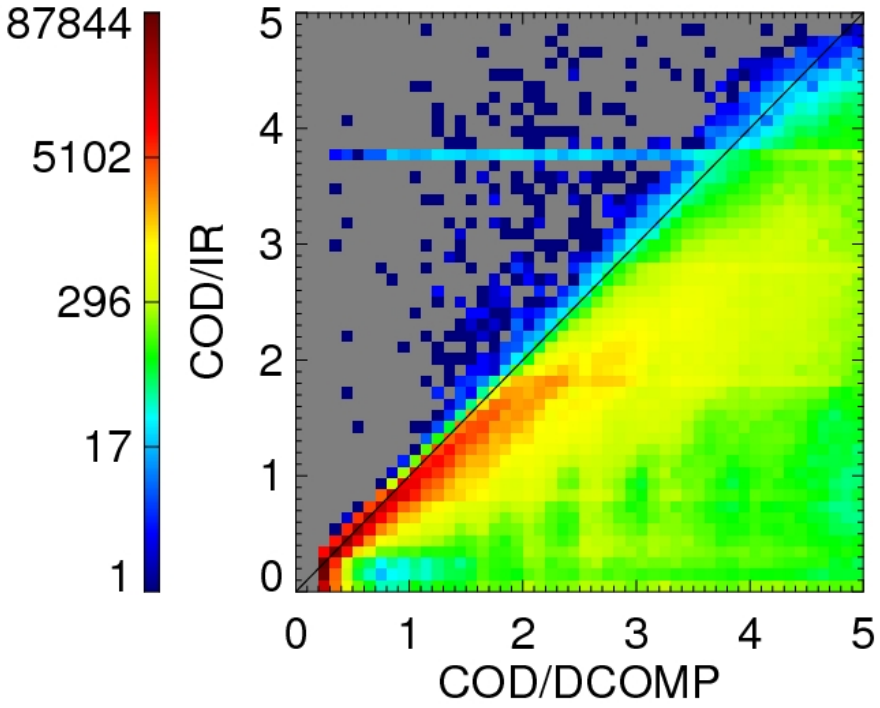
- NOAA/DCOMP and MYD06 LUTS agree well.

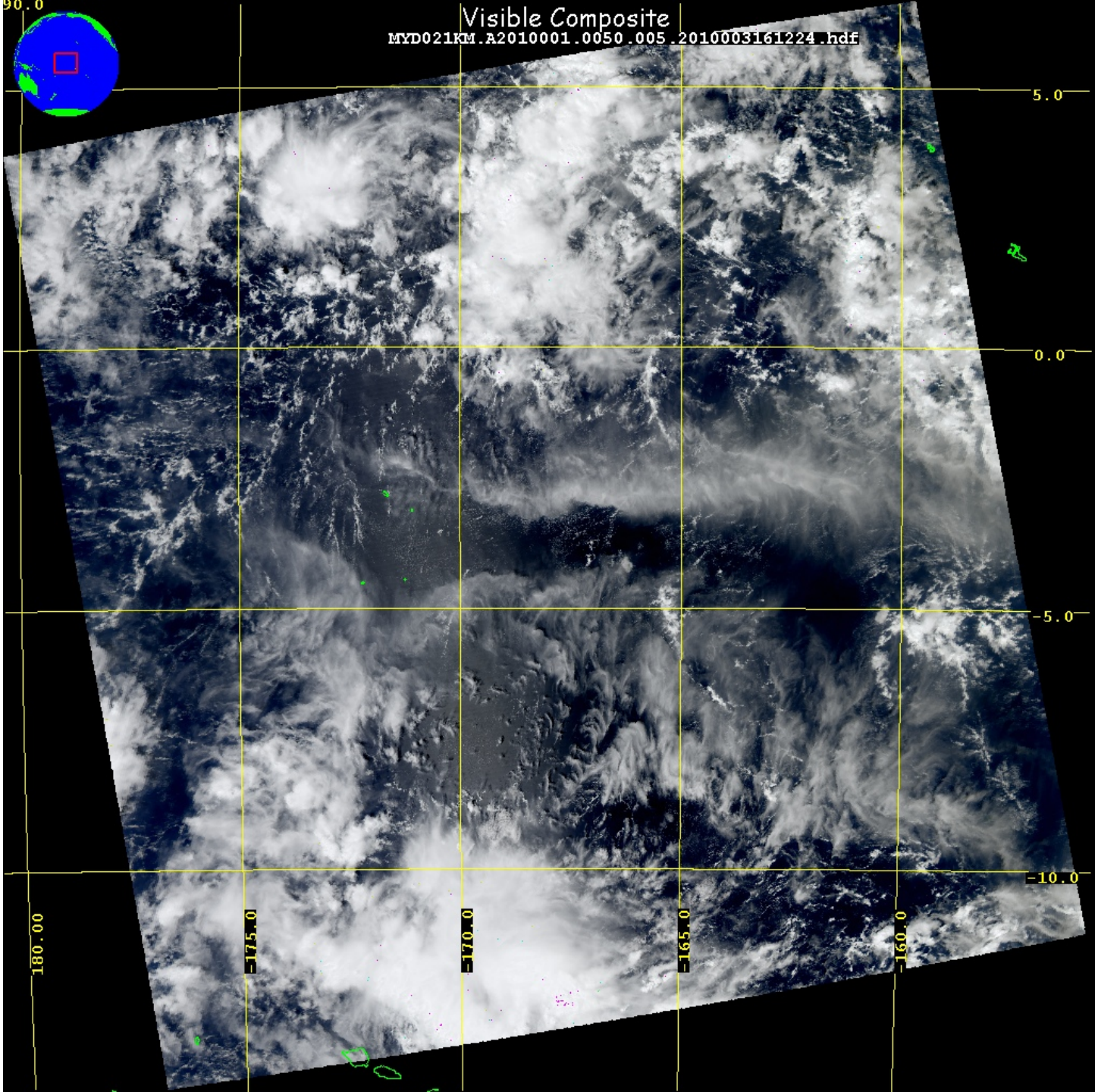
- NOAA/DCOMP and MYD06 optical depth retrievals are biased but not as well as predicted by LUT agreement. Differences in retrievals may be driving this. Important to realize that error bars for thin cirrus are approximately 50%.

- Results show a large sensitivity to size distribution which is unexpected.

Comparison of IR–derived and Solar-derived 0.65 mm Optical Depth



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-165.0
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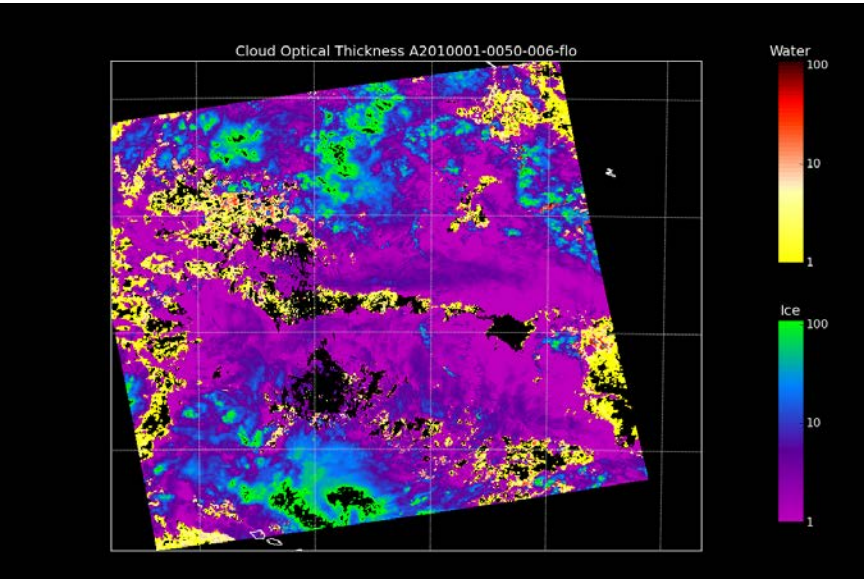
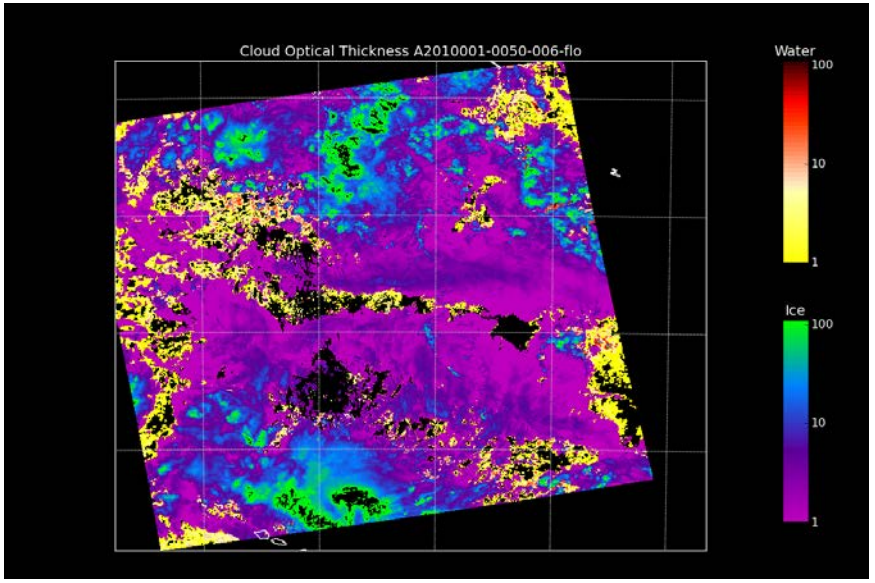
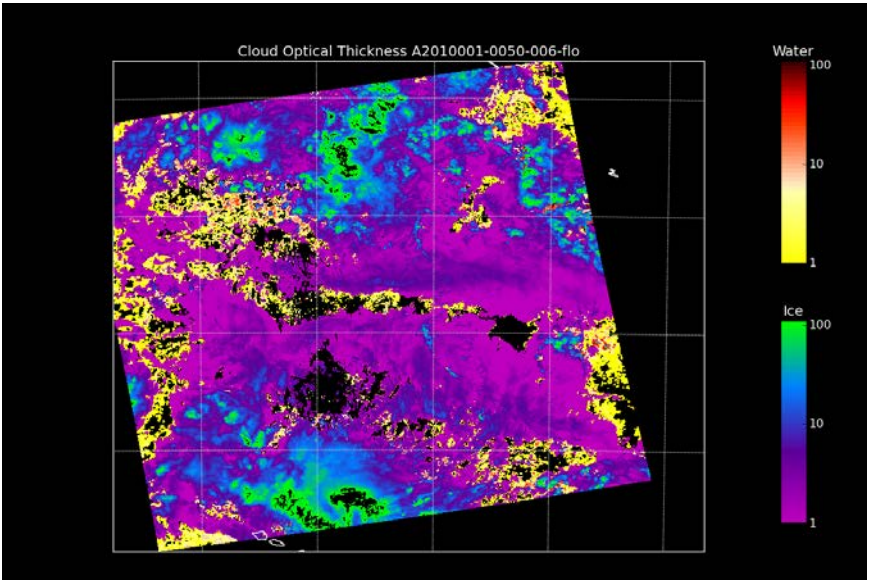
V6.0.32



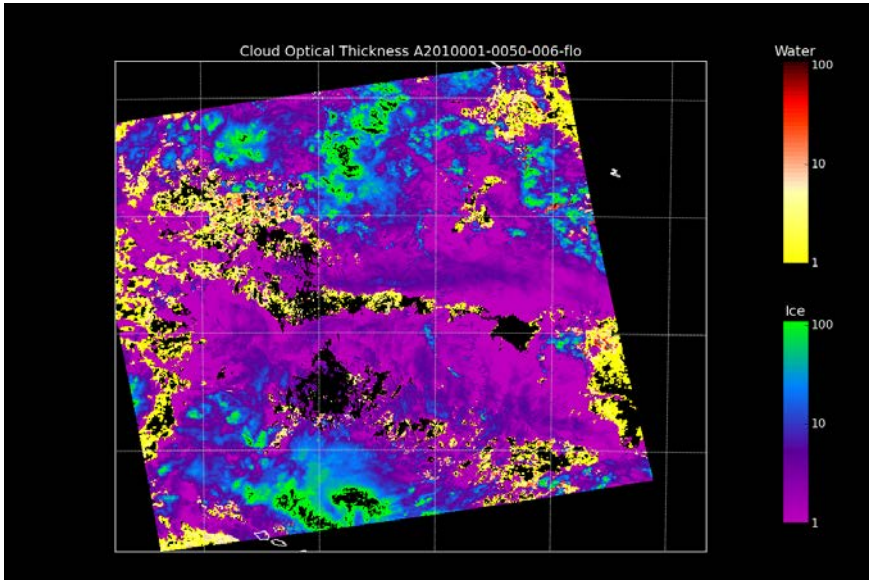
V6.0.32 with SBR_G2



V6.0.32 with SBR



V6.0.32 with COL



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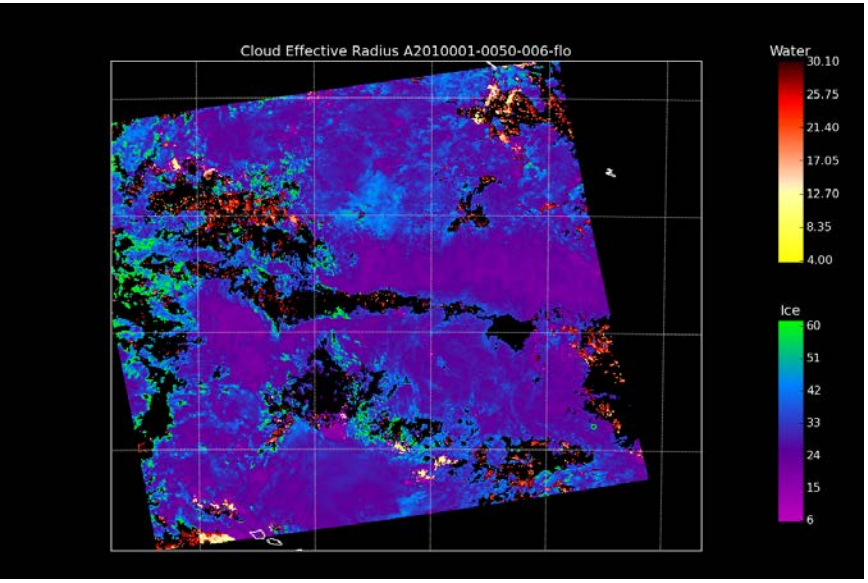
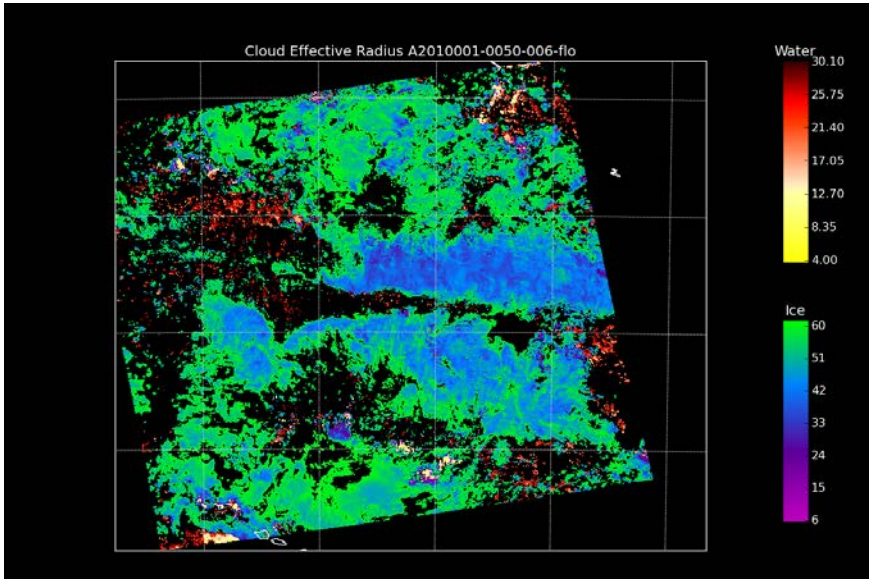


V6.0.32 with SBR_G2



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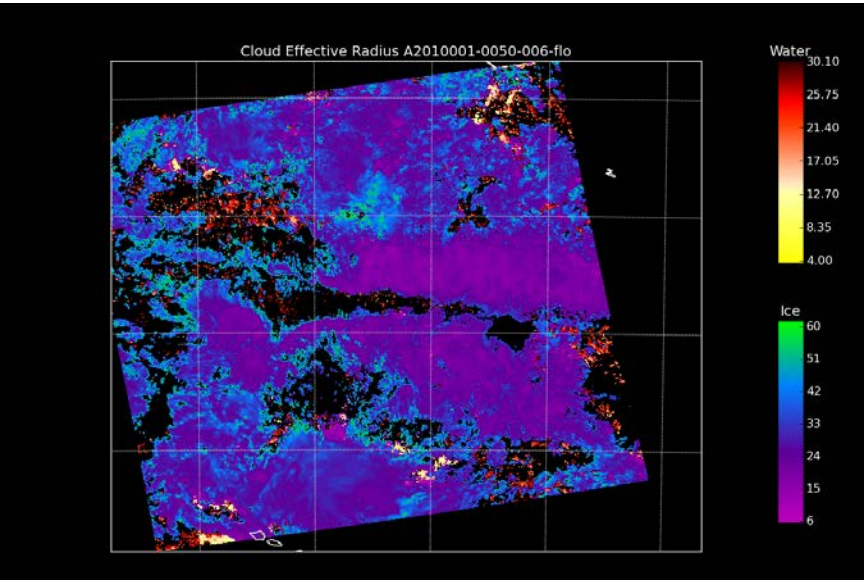

V6.0.32 with COL