

MODIS Atmosphere Level-2 Cloud Optical and Microphysical Products Collection 005 Updates. Part 1 of 2

Changes to Retrievals and Ice Crystal Libraries

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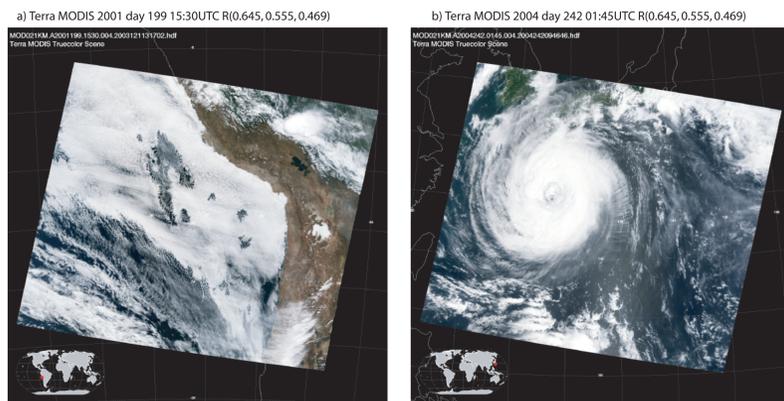
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Introduction

The MODIS cloud optical and microphysical properties algorithm will have undergone a number of major changes between collection 4 and collection 5 processing streams.

In this poster we will discuss and illustrate the updates that were made to the retrieval of cloud optical thickness (τ) and effective particle radius (r_e), as well as updates to the ice cloud models.

We will illustrate these updates using two data granules from Terra MODIS. The first one is 2001 day 199, 15:30 UTC: marine stratocumulus off the coast of Peru. The second granule is 2004 day 242, 01:45 UTC: typhoon Chaba making landfall in Southern Japan. The images of these data granules are shown below.

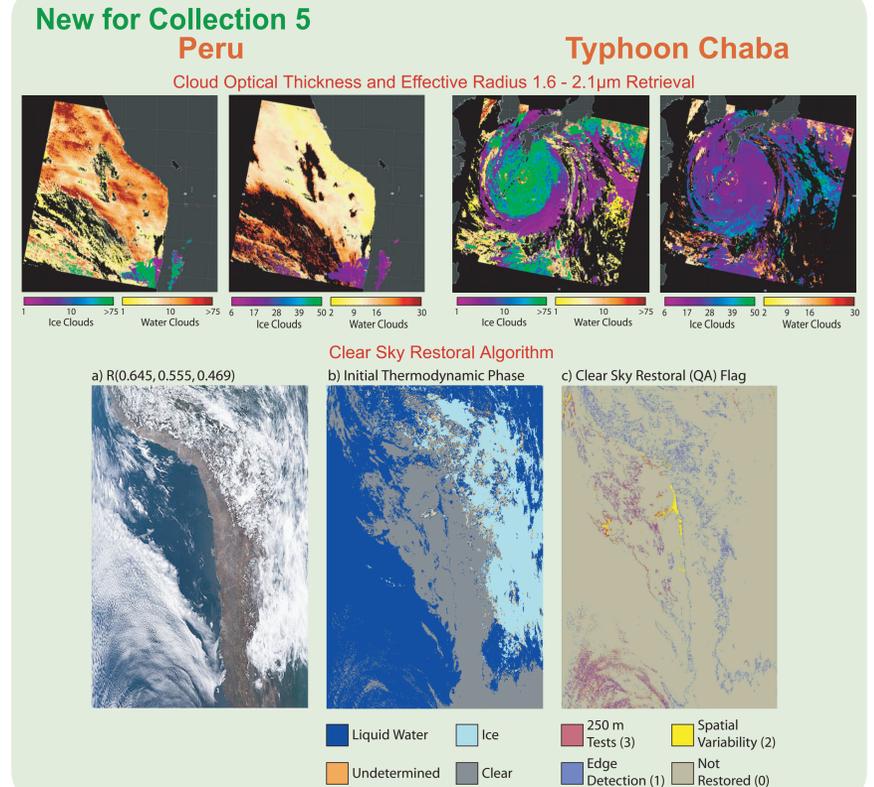
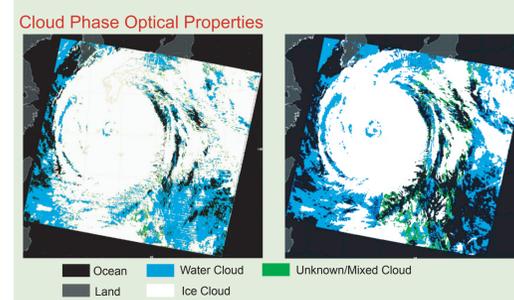
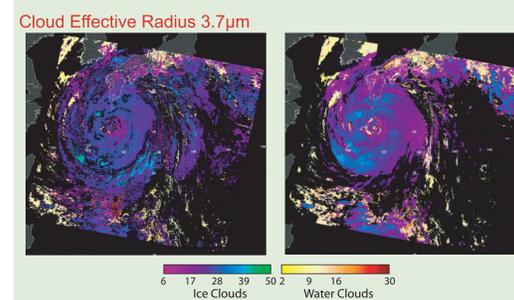
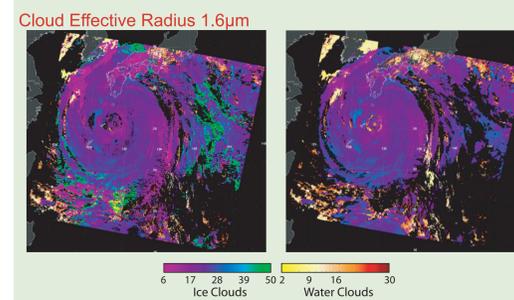
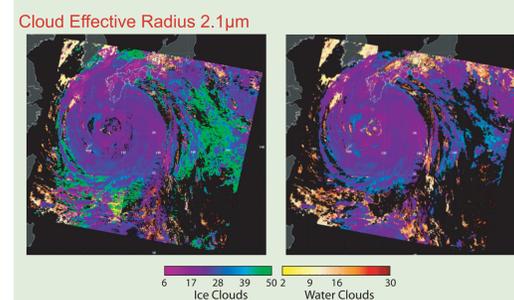
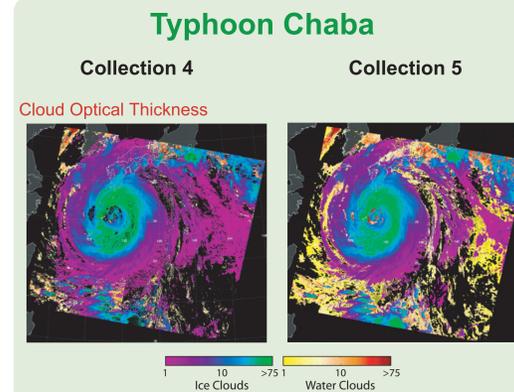
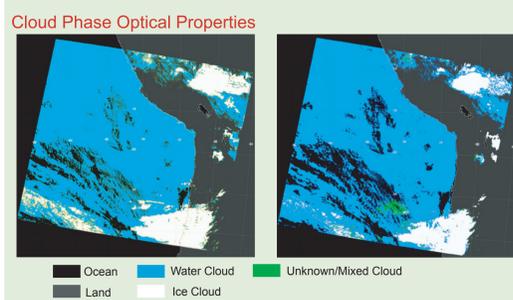
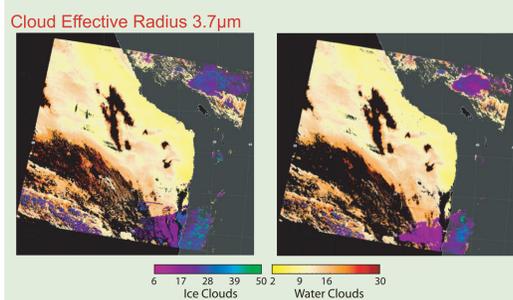
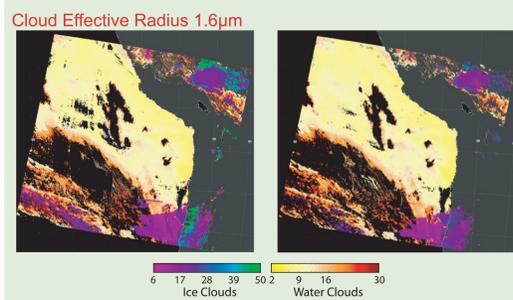
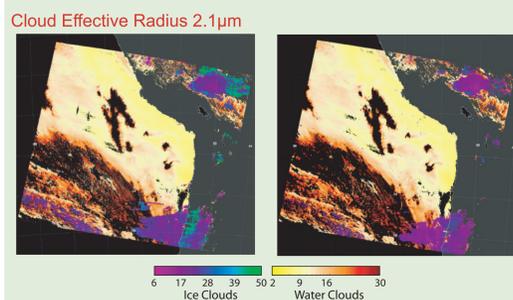
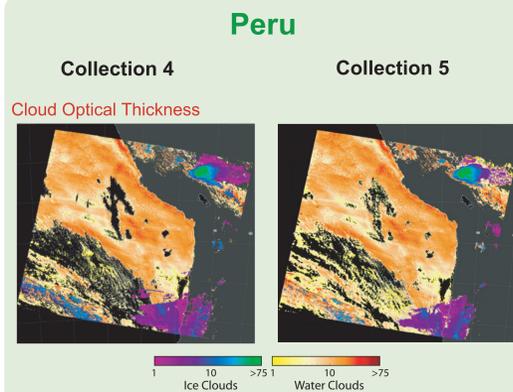


Updates to Collection 5

Major updates to the retrieval algorithm include:

1. A new 2-band retrieval SDS: τ , r_e , and water path retrievals using the 1.6 μm and 2.1 μm band combination over snow/ice and water surfaces
2. Retrieval logic updated to deal with the absence of cloud-top pressure retrievals.
3. New clear-sky restoral logic to provide additional discrimination for glint, heavy aerosol/dust, and broken cloud fields.
4. Maximum solar zenith angle for retrieval reduced to 81.4 degrees.
5. Updated the retrieval cloud phase thresholds with additional set of thresholds for snow/ice surfaces.
6. Effective radius solution logic had been improved and replaced with a more robust algorithm.
7. L1B radiance uncertainty index being used in the algorithm logic.
8. Eliminated consequence of 0.86 μm band saturation on retrieval drop-outs by switching to the 0.65 μm band in such instances.
9. A new ice cloud library had been implemented .
10. Optical thickness retrievals are allowed to proceed in cases where effective radius retrieval had failed. (Evident strongly in the images for Typhoon Chaba)

Updates to ancillary files and new SDSs included in the Collection 5 MOD06 delivery are described in the accompanying poster: *MODIS Atmosphere Level-2 Cloud Optical and Microphysical Properties Part 2*.



Ice Crystal Library Update

The ice cloud library had been updated to utilize the new ice particle size distributions developed by Baum et al. (2005). The new distributions provide a more realistic representation of ice crystal habits and sizes derived from in situ measurements during field experiments.

Another library change is that the 3.7 μm escape functions (used in asymptotic reflectance calculations) have been computed using a more realistic value of infinite scaled optical thickness to avoid occasional numerical instabilities. Images shown below illustrate the changes. Fig. 1 shows the differences in infinite reflectance between the two ice phase function sets. Fig. 2 shows the improved behavior of the 3.7 μm escape function.

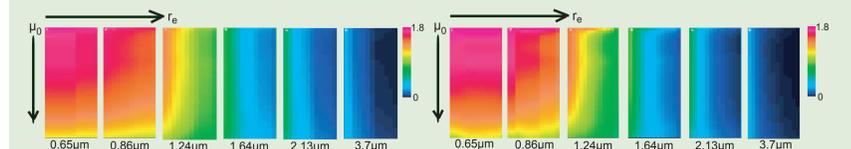


Fig. 1: Left panel is library reflectance at infinite optical depth as a function of r_e and μ_0 at $\phi = 0$ and $\mu = 1.0$ using the Collection 4 ice phase functions. The panel on the right is the same quantity computed using the new ice crystal habits from Bryan Baum, used in Collection 5 retrievals.



Fig. 2: Left panel is the escape function as a function of r_e and μ using the Collection 4 library infinite optical thickness values. The right panel is the Collection 5 escape function with the infinite value adjusted.

Conclusion and References

This poster summarizes major changes made to the main algorithm for the Collection 5 processing stream, including the forward libraries. Part 2 will describe the new products included in this data release and discuss improvements to ancillary data used during retrievals.

1. Baum, B. A., P. Yang, A. J. Heymsfield, S. Platnick, M. D. King, and S. M. Thomas, 2005: Bulk scattering properties for the remote sensing of ice clouds. 2: Narrowband models, J. Appl. Meteor., 44, 1896 - 1911.
2. http://modis-atmos.gsfc.nasa.gov/products_C005update.html
3. http://modis-atmos.gsfc.nasa.gov/_docs/QA_Plan_2005_06.pdf