MODIS Airborne Simulator (MAS) Final Report for CLASIC

The MAS was flown aboard the NASA ER-2 for the CLASIC field experiment, and for all data collected, provided calibrated and geolocated (Level-1B) radiance data for it's 50 spectral bands (ranging in wavelength for 0.47 to 14.3 μm). From the Level-1B data, as directed in the Statement of Work, higher order (Level-2) data products were derived. The Level-2 products include:

a) cloud optical thickness,
b) cloud effective radius,
c) cloud top height (temperature),
d) cloud fraction,
e) cloud phase products.

Preliminary Level-1B and Level-2 products were provided during the field experiment (typically within one or two days of data collection). Final version data products were made available in December 2008 following considerable calibration analysis. Data collection, data processing (to Level-2), and discussion of the calibration work are summarized below.

Data Collection

In support of the science objectives of the CLASIC field campaign, the MAS, aboard the NASA ER-2, flew seven science missions over the Oklahoma/Kansas Southern Great Plains (SGP) research site during the CLASIC Intensive Operation Period (IOP) in June 2007. In addition, the MODIS/ASTER Airborne Simulator (MASTER) flew an additional science flight over the SGP research site in September 2007. (Use of MASTER instead of MAS for the later flight was necessary due to a failure of MAS in late July 2007during the TC4 field experiment). The MAS/MASTER flights are summarized in Table 1.

Table 1

Flight Date	Instrument	# of Flight Tracks	Data Collection Time
12 June 2007	MAS	16	1842 - 2242
21 June 2007	MAS	14	1531 - 2014
22 June 2007	MAS	14	1536 - 2018
23 June 2007	MAS	13	1528 - 2005
28 June 2007	MAS	11	1745 - 2106
29 June 2007	MAS	9	1549 - 1926
30 June 2007	MAS	6	1357 - 1620
21 Sept. 2007	MASTER	20	1412 - 2105

Data Processing

The onboard recorded Level-0 (raw) data for each to the 50 MAS/ MASTER wavelength channels have been processed to Level-1B calibrated and geo-located radiance, and saved as one file per ER-2 flight track, and formatted in Hierarchal Data Format (HDF). The MAS Level-1B data is archived in Level1/Atmosphere Archive and Distribution System (LAADS) which can be accessed through the URL: http://ladsweb.nascom.nasa.gov/data/MAS.html), and the MASTER data in the Jet Propulsion Laboratory (JPL) data archive, which can be accessed through the URL: (http://masterweb.jpl.nasa.gov/).

As per the SOW requirements, all flight tracks from the 7 MAS and one MASTER data flights were processed to the Level-2 HDF data to compute the higher order cloud retrieval products. These products include:

1) Cloud Optical Thickness
2) Cloud Effective Radius
3) Cloud Top Temperature and Pressure.
4) Cloud Thermodynamic Phase
5) Cloud Fraction
6) Cloud Water Path

To obtain Level-2 products (via anonymous ftp) email: tom.arnold@nasa.gov.

All Level-1B and Level-2 HDF data products include significant metadata to describe each of the scientific data sets (SDS) contained in the HDF products, and including relevant information necessary to read to be able to read/decode each SDS. Additional information about the Level-1B and Level-2 data can be found on the MAS CLASIC web page (http://mas.arc.nasa.gov/data/deploy_html/clasic_home.html), including sample Level-1B and Level 2 imagery for all MAS/MASTER flight Tracks. A sample Level-2 Cloud product imagery is shown in Figure 1.

MAS/MASTER Calibration

Prior to the first CLASIC science flight, but after the pre-deployment laboratory calibration of MAS, a problem with the digitizer for the MAS occurred. Given time and equipment/repair facility constraints, the best solution was to swap out the MAS digitizer with the MASTER digitizer. While effects of switch on the MAS calibration likely were not large, calibration of MAS for CLASIC nonetheless relied heavily on the post deployment laboratory calibration, and comparison of MAS data to MODIS Aqua data on June 28th, and to MODIS-Terra on July 9th 2007. The MAS under-flight data of MODIS was carefully reviewed (including comparison of retrieval products) and employed to adjust the MAS calibration for the visible – shortwave infrared bands (1-25) as appropriate. (Calibration for bands 25-50 is unaffected as those bands are calibrated from observation of the onboard

blackbodies.) Similar MODIS under flight comparison analysis of MASTER data was also conducted for the subsequent July/August 2007 TC4 campaign. The derived calibration adjustment for the TC4 data was then applied to the Sept. 21 2007 MASTER data flight collected during the attempted CLASIC campaign extension.

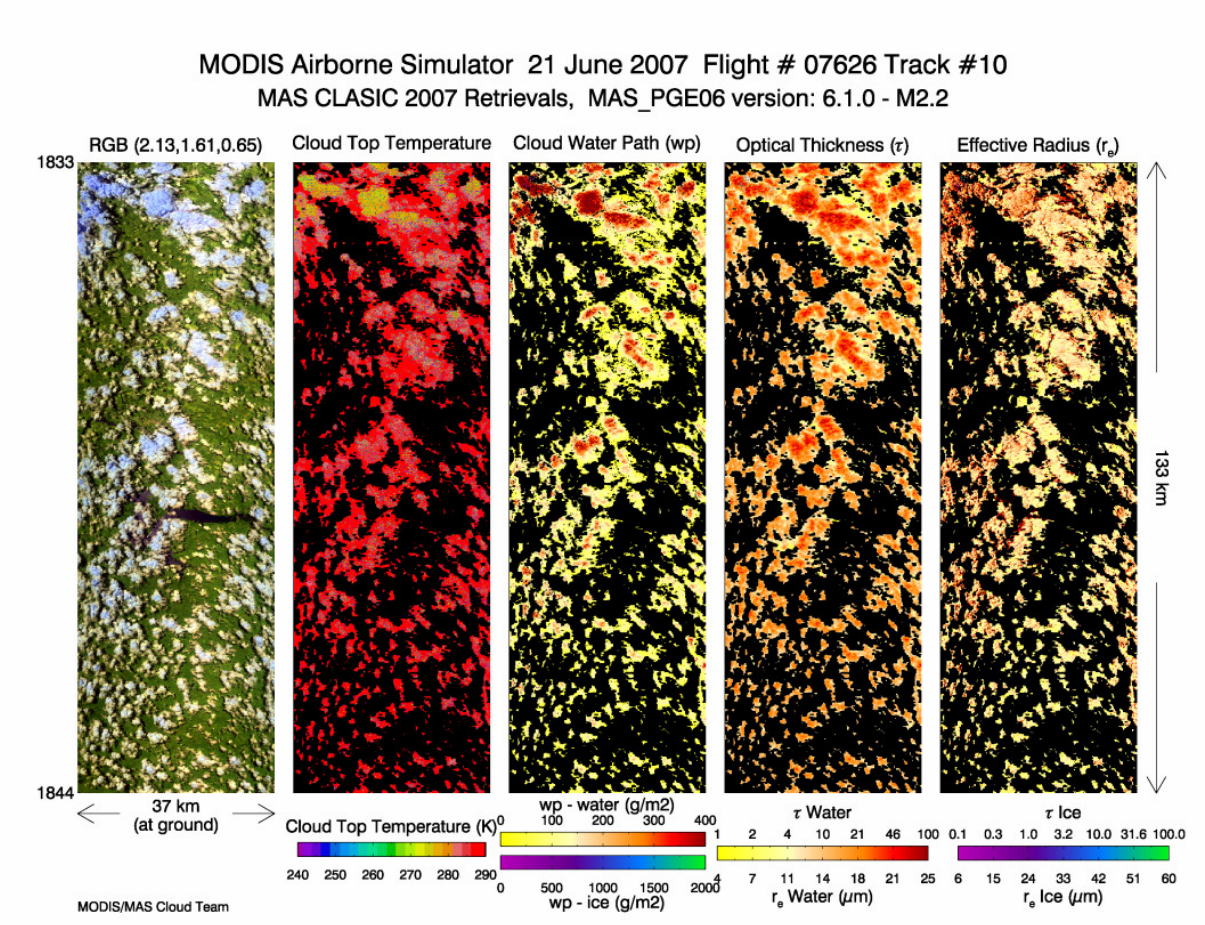

Figure 1. Sample MAS cloud retrieval product imagery for some cumulus clouds over the SGP research site.