MODIS Cloud Product (MOD 06)

Product Description

The MODIS Cloud Product (MOD 06) combines infrared and visible techniques to determine both physical and radiative cloud properties. Daily global Level 2 (MOD 06) data are provided. Cloud-particle phase (ice vs. water, clouds vs. snow), effective cloud-particle radius, and cloud optical thickness are derived using the MODIS visible and near-infrared channel radiances. An indication of cloud shadows affecting the scene is also provided. Cloud-top temperature, height, effective emissivity, phase (ice vs. water, opaque vs. non-opaque), and cloud fraction are produced by the infrared retrieval methods both day and night at 5×5 1-km-pixel resolution. Finally, the MODIS Cloud Product includes the cirrus reflectance in the visible at the 1-km-pixel resolution, which is useful for removing cirrus scattering effects from the land-surface reflectance product.

Research and Applications

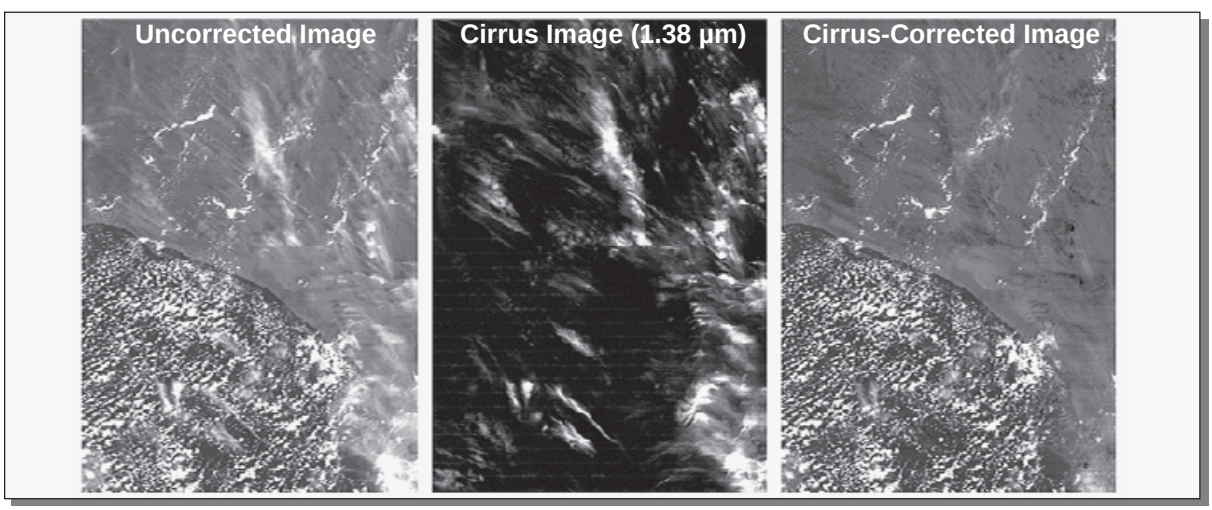
A thorough description of global cloudiness and its associated properties is essential to the MODIS mission for two reasons. First, clouds play a critical role in the radiative balance of the Earth and must be accurately described in order to assess climate and potential climate change accurately. In addition, the presence or absence of cloudiness must be accurately determined in order to retrieve properly many atmospheric and surface parameters. For many of these retrievals, cloud cover, even thin cirrus, represents contamination. Key radiative properties of clouds such as phase, optical thickness, and temperature may be retrieved using MODIS instruments with unprecedented resolution.

Data Set Evolution

The determination of cloud-top properties will require the use of MODIS bands 29 and 31-36, along with the cloud-mask product (MOD 35), to screen for clouds. In addition, NCEP or DAO global model analyses of surface temperature and pressure, profiles of temperature and moisture, and blended SST analyses will be required in the calculation of cloud forcing as a function of atmospheric pressure and emissivity. The Menzel cloud-phase algorithm will require MODIS bands 29, 31, and 32 and analyses of surface emissivity.

The validation of cloud-top heights will be conducted through comparisons with stereo determinations of cloud heights from GOES and lidar estimates and aircraft observations of cirrus heights. Cloud emissivity will be compared to lidar-determined values. These interim products will be used in concert with field campaigns with the MAS instrument. The Menzel cloud-phase parameter will be validated using HIRS/AVHRR data and by comparison to the King cloud-phase parameter.

The King cloud-phase algorithm requires product MOD 02, calibrated multispectral radiances. Cloud-particle size and optical thickness require these radiances plus the cloud-top parameters within MOD 06



Sample Cloud Images from MODIS data on Terra, collected over South America on February 28, 2000. The left panel shows a 0.645 µm image revealing both the upper level cirrus clouds and the lower level cumulus clouds. The middle panel shows the 1.38 µm channel image. The upper level cirrus clouds are seen clearly in this image. The right panel is an image similar to the one in the left panel, except that the cirrus clouds shown in the middle panel have been removed.

and the Menzel cloud-phase parameter. In addition, these parameters require MODIS product MOD 43 (surface reflectance) and the NCEP or DAO analyses and profiles described above. The validation and quality control of these products will be performed primarily through the use of *in situ* measurements obtained during field campaigns and with the use of the MAS instrument.

The related MODIS Cloud Product ATBDs, *MODIS: Cloud Top Properties and Cloud Phase* and *Cloud Retrieval Algorithms for MODIS: Optical Thickness, Effective Particle Radius, and Thermodynamic Phase*, can be found in PDF format at http://eospso.gsfc.nasa.gov/atbd/modistables.html.

Suggested Reading

Gao, B.C. *et al.*, 1998.

King, M.D. *et al.*, 1992.

King, M.D. *et al.*, 1996.

Nakajima, T.Y., and T. Nakajima, 1995.

Platnick, S. *et al.*, 2000.

Strabala, K.I. *et al.*, 1994.

Wylie, D.P., and W.P. Menzel, 1998.

MODIS Cloud Product Summary

Coverage: Global

Spatial/Temporal Characteristics: Resolutions of 1 km or 5 km/once or twice per day (varies with parameter)

Key Science Applications: Cloud parameterization, climate modeling, climate monitoring, increasing accuracy of other MODIS retrievals

Key Geophysical Parameters: Cloud-particle phase (two algorithms), cloud-particle size and optical thickness, cirrus reflectance at 1.375 µm, and cloud-top temperature, emissivity, and height

Processing Level: 2

Product Type: Standard, at-launch

Maximum File Size: 65 MB

File Frequency: 288/day

Primary Data Format: HDF-EOS

Browse Available:
http://modis-atmos.gsfc.nasa.gov/MOD06_L2/sample.html

Additional Product Information:
http://modis-atmos.gsfc.nasa.gov/MOD06_L2/index.html

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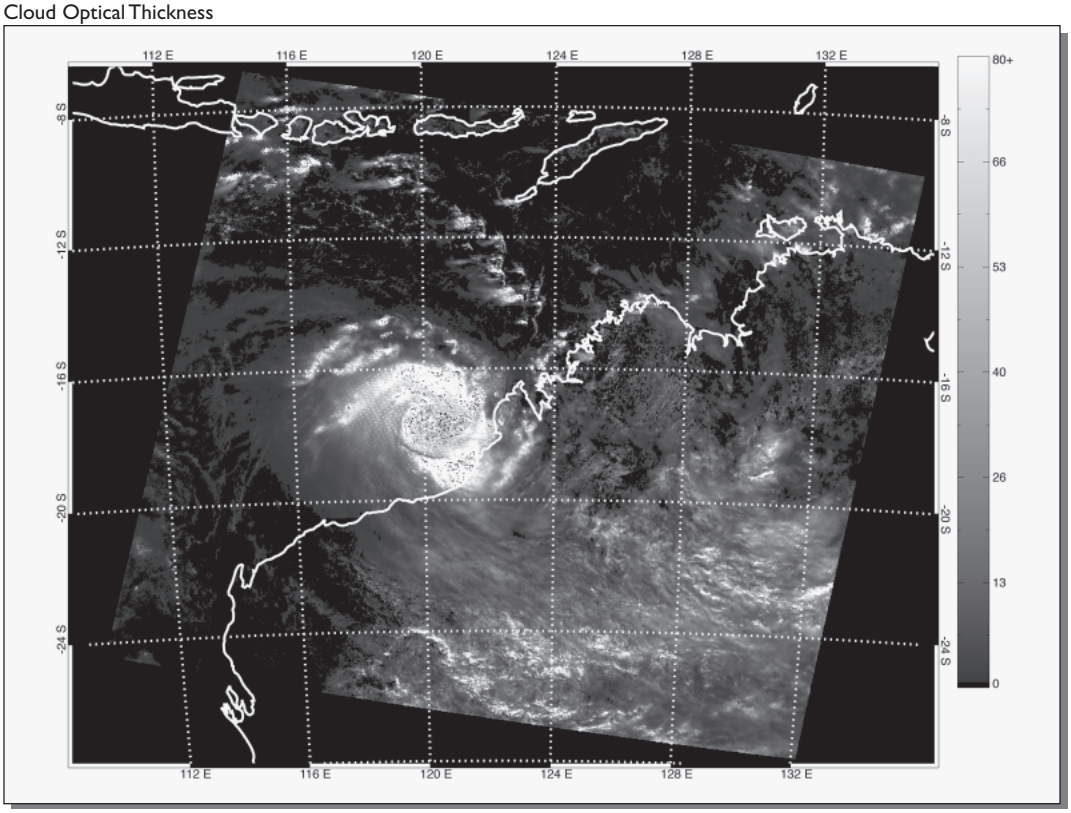
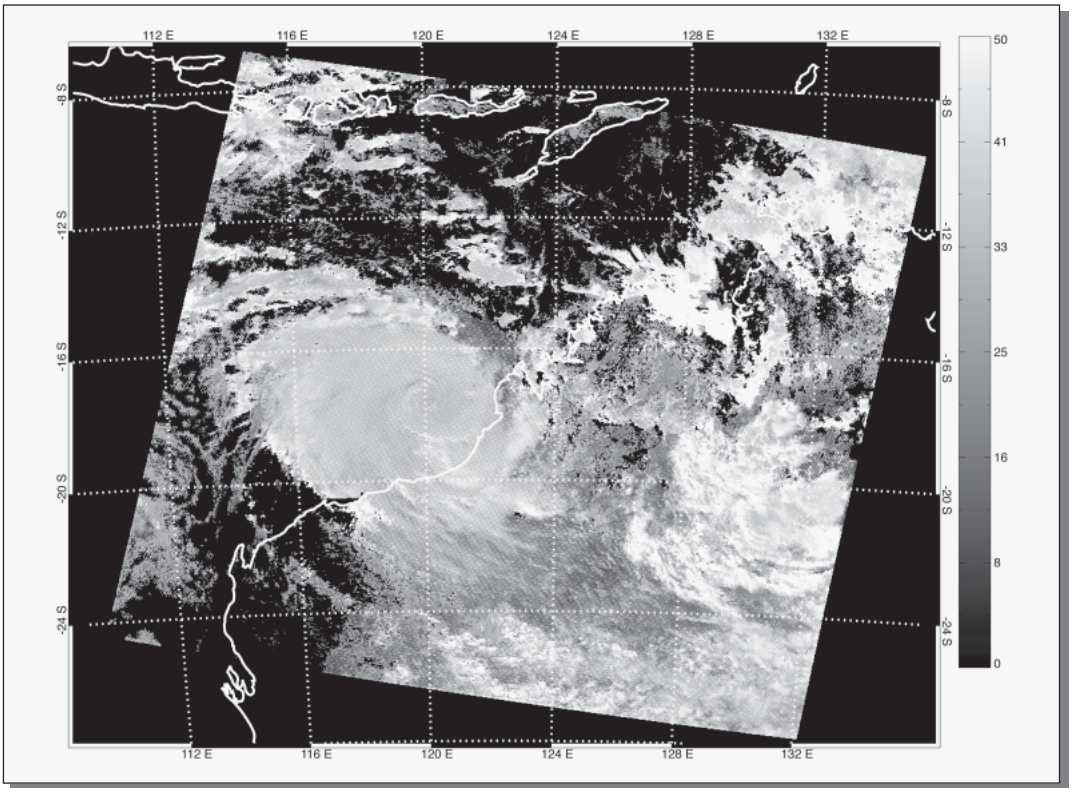
Cloud Optical Thickness



Effective Cloud-Particle Radius



MODIS Retrieved Cloud Optical Thickness (unitless) and Effective Cloud-Particle Radius (in microns) for Tropical Cyclone Rosita shortly before it crossed the western Australian coastline at 0220 UTC on April 19, 2000. The images are derived from data from the visible and 2.1-µm channels on the Terra MODIS instrument.