MODIS Sea Ice Cover (MOD 29)

Product Description

Global sea ice cover will be mapped daily and every eight days at 1-km resolution using an algorithm called ICEMAP. Global sea ice cover will be an at-launch MODIS product. Sea ice is present over approximately 7% of the Earth's ocean surface (Parkinson, 1997). Snow-covered sea ice, with its high albedo, is a key parameter of the global energy balance, reflecting much of the incident solar radiation back to space. Additionally, the sea ice cover is an insulating layer between the ocean and atmosphere; heat loss through open water is up to 100 times greater than heat loss through thick ice. As a consequence, leads and polynyas (linear and nonlinear openings in the sea ice, respectively) are significant to the energy budget of the ice-covered ocean and to local and regional climatology. Such open-water areas and areas of reduced ice concentration are also important for shipping in ice-covered seas.

Research and Applications

Sea ice cover is currently mapped by NOAA visible and near-infrared sensors, and by microwave sensors, both passive and active. Using the NOAA sensors, snow/cloud discrimination is a major hindrance in identifying sea ice. The passive-microwave sensors map sea ice through cloud cover, but at a resolution of only about 30 km. Active microwave sensors have good spatial resolution, up to about 25 m, but currently do not map sea ice cover globally on a daily basis. MODIS will be able to map sea ice globally, but with the significant limitation that cloud cover will obscure the view of the surface for much of the time. Together, the MODIS and microwave sensors will provide important information on the presence and concentration of sea ice. MODIS data, when available, will provide the higher resolution view of sea ice that is not obtainable using passive-microwave data.

Data Set Evolution

ICEMAP has a considerable heritage. It is based on the normalized difference of a visible and a shortwave infrared band. This technique has been used to map snow from aircraft and satellites (Kyle *et al.*, 1978; Dozier, 1984; and Hall *et al.*, 1995) and has been shown to be effective for mapping sea ice as well. The 8-day composited sea-ice-cover product is designed to provide sea-ice-cover persistence statistics for each pixel so that users can determine how long sea ice has been present during the previous 10 days in any given location. A cloud mask (MOD 35) will be provided by another MODIS investigator.

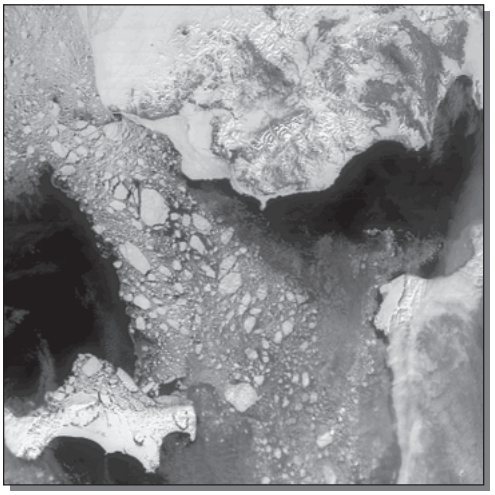
Suggested Reading

Dozier, J., 1984.

Hall, D.K. *et al.*, 1995.

Kyle, H.L. *et al.*, 1978.

Parkinson, C.L., 1997.



Sea Ice Image of the Bering Sea for May 7, 2000, generated from Terra MODIS band 2 (0.85 µm) data at 250 m spatial resolution. The Seward Peninsula is visible at the top of the image, and St. Lawrence Island can be seen in the lower left. Black areas are either clouds or open water. Individual snow-covered ice floes are visible, as is newly-formed sea ice, which has a lower reflectance and can sometimes be difficult to distinguish from the surrounding water. The ice flow direction is predominantly southward from the Bering Strait (upper left).

(MODIS Snow and Sea Ice Albedo, continued)

MODIS Sea Ice Cover Summary

Coverage: Global, daytime over nonequatorial ocean

Spatial/Temporal Characteristics: 1 km/daily; 1 km/8-day composite; 1/4°/daily and 8-day composite

Key Geophysical Parameters: Sea ice cover

Processing Level: 2, 3 (mapped)

Product Type: Standard, at-launch

Maximum File Size: 19 MB (Level 2); 6 MB (Daily Level 3), 12 MB (8-day Level 3)

File Frequency: 288/day (Daily Level 2); 626/day (Daily Level 3), 626/8-day (8-day Level 3)

Primary Data Format: HDF-EOS

Browse Available: No

Additional Product Information: http://snowmelt.gsfc.nasa.gov/MODIS_Snow/modis.html

DAAC: National Snow and Ice Data Center

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MODIS Snow and Sea Ice Albedo (MODISALB)

Product Description

As currently envisioned, the MODIS snow and sea ice albedo product will provide daily albedo estimates of the seasonally snow-covered areas of the Earth with a spatial resolution of 1 km, and, for the climate-modeling grid product, 1/4° × 1/4° resolution. Once a surface has been identified as covered by either snow (MOD 10) or sea ice (MOD 29), the snow-albedo algorithm will be used to estimate the albedo of these surfaces under clear-sky conditions (Klein and Hall, 2000).

In addition to relying on other MODIS snow products to determine whether an area is snow or sea-ice covered, the planned MODIS snow-albedo product will utilize the MODIS cloud mask and the MODIS surface reflectance and global land cover products.

Research and Applications

The albedo of snow and sea ice is among the highest of all naturally occurring land surface albedos. The high albedo and large areal extent enable snow and sea ice to influence strongly the Earth's radiation budget. At a local scale, the high albedo of these surfaces affects energy exchange between the surface and the atmosphere.

Snow and ice albedos will be used in general circulation models to improve the parameterization of the Earth's albedo on a daily basis. This will enable more accurate forecasts of the Earth's climate. In addition, for sea ice, the differences in sea ice albedo will help to classify sea ice type. Determination of sea ice type is important for calculating the energy exchange between the ocean and the atmosphere.

Data Set Evolution

The MODIS snow albedo product builds on a heritage of snow and sea ice albedo algorithms (De Abreu *et al.*, 1994; Knap and Oerlemans, 1996; Stroeve *et al.*, 1997) developed for use with sensors on other environmental satellites, primarily NOAA AVHRR.