MODIS Coccolith Concentration (MOD 25)

Product Description

This Level 2 and 3 product provides five parameters describing the concentration of coccoliths in sea water: the detached coccolith concentration in number/m^3; the estimated calcite concentration due to the coccoliths in mg-$CaCO_3/m^3$; the pigment concentration in the coccolithophore biomass; a descriptor for the particular look-up table used; and a quality measure. The product is produced at 1-km spatial resolution daily for Level 2 and at 4.6-km, 36-km, and 1° resolution daily, 8-day weekly, monthly, and yearly for Level 3.

Research and Applications

Coccolithophores are small marine phytoplankton which form external calcium carbonate ($CaCO_3$) scales (called coccoliths) having diameters of a few mm and a thickness of 250 to 750 nm. Coccolithophores are the largest source of calcium carbonate on Earth. Thus, coccolith production is an important part of the biogenic carbon cycle. The observed characteristics of coccolithophores, including their ubiquitous nature, possible role in climate, and intense scattering property, make a global-scale study of their distribution an important application for MODIS imagery. Specifically, it is important to estimate the rate at which $CaCO_3$ is formed by phytoplankton and to look for long-term changes in that rate.

Data Set Evolution

The algorithm for extracting the detached coccolith concentration from surface waters is based on the semianalytic model of ocean color of Gordon (1988). The model relates the normalized water-leaving radiance to the absorption and scattering properties of the constituents of the water using radiative-transfer theory. The absorption and scattering properties are then related to the constituent concentrations through statistical analysis of direct measurements. The model is validated by comparison with a set of water-leaving radiances independent of the measurements used to establish the statistical relationships between constituents and optical properties.

Suggested Reading

Balch, W.M. *et al.*, 1991.

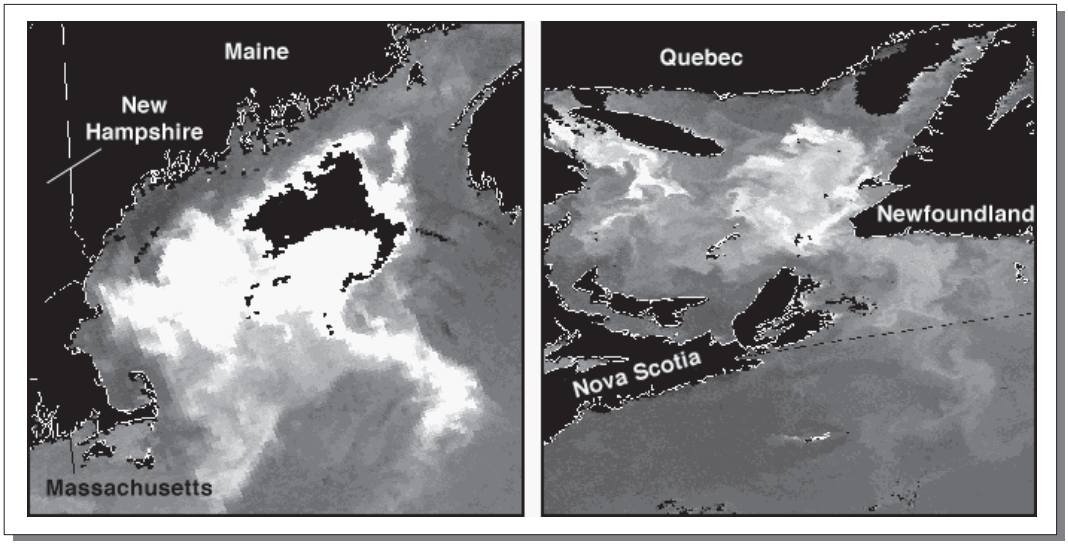
Gordon, H.R. *et al.*, 1988.

Groom, S.B., and P.M. Holligan, 1987.

Holligan, P.M. *et al.*, 1983.

Sarmiento, J.L. *et al.*, 1988.

Sikes, S., and V. Fabry, 1994.



Coastal Zone Color Scanner Images of the Gulf of Maine and the Gulf of St. Lawrence. Satellite ocean-color imagery, in addition to allowing the concentration of single-celled plants to be measured remotely, permits the detection and identification of certain algal blooms. The white-to-light-grey waters in both regions are blooms of a single type of algae (called coccolithophores), that affects regional climate and fisheries.

(MODIS Coccolith Concentration, continued)

MODIS Coccolith Concentration Summary

Coverage: Global ocean surface, clear-sky only

Spatial/Temporal Characteristics: 1 km/daily (Level 2); 4.6 km, 36 km, 1°/daily, 8-day, monthly, yearly (Level 3)

Key Science Applications: Input to global biogeochemical cycle models

Key Geophysical Parameters: Coccolith and calcite concentration, pigment concentration in coccolithophore blooms

Processing Level: 2, 3

Product Type: Standard, at-launch

Maximum File Size: 102 MB (Level 2); 640 MB binned, 134 MB mapped (Level 3)

File Frequency: 144/day (Daily Level 2); 3/day (Daily Level 3), 3/8-day (8-day Level 3), 3/month (Monthly Level 3), 3/year (Yearly Level 3)

Primary Data Format: HDF-EOS

Browse Available: 36 km sample imagery available at the Goddard DAAC (Level 3 only)

Additional Product Information: http://modis-ocean.gsfc.nasa.gov/dataprod.html

DAAC: NASA Goddard Space Flight Center

Science Team Contacts: H.R. Gordon, W.B. Balch

MODIS Ocean Primary Productivity (MOD 27)

Product Description

This Level 4 product provides an estimate of the Ocean Primary Productivity on an 8-day and an annual basis at spatial resolutions of 4.6 km and 36 km.

Research and Applications

The objective of the product is to quantify the magnitude and interannual variability (for decadal trends) in the oceanic primary productivity and phytoplankton carbon fixation. Primary productivity is the time rate of change of phytoplankton biomass, and, with allowance for excreted soluble carbon compounds, reflects the daily integrated photosynthesis within the water column. The integral of the values over the year is the annual primary productivity. The annual productivity product will be used for global- and regional-scale studies of interannual variability of ocean productivity, for comparisons with annual summations of short-term analytic estimates, and for comparison with global biogeochemical models.

Data Set Evolution

Ocean primary-productivity algorithms fall into two general classes, termed empirical and analytic algorithms. The empirical approach is based on simple correlation between time-averaged *in situ* estimates of productivity and satellite-derived estimates of surface chlorophyll concentration. The analytic approach is based on models of the general photosynthetic response of the algal biomass as a function of major environmental variables such as light, temperature, and nutrient concentration. The overall methodologies differ significantly in the way various parameters are estimated and in the way they are assigned spatially and temporally across ocean basins. The approach taken for the MODIS algorithm is to begin implementation of an annual, global, empirical algorithm for at-launch product generation, while pursuing a vigorous research program within the SeaWiFS Science Team, to develop a consensus analytic algorithm for short-term (daily to weekly) global productivity. Cloudiness prevents deriving chlorophyll *a* concentrations over about 60% of the ocean on daily basis, excluding that already lost due to high sun glint. Chlorophyll *a* concentrations derived from all available sensors, including the Terra and Aqua MODIS instruments, will be used to increase sampling fre-