MODIS Photosynthetically Active Radiation (PAR - MOD 22)

Product Description

This Level 2 and 3 product consists of four related parameters which describe the irradiance at the ocean surface. The first is Downwelling Solar Irradiance, which is the incident irradiance just above the sea surface in each of the visible MODIS ocean bands (8, 9, 10, 11, 12, 13, 14). The second is Instantaneous Photosynthetically Active Radiation (IPAR), which is the total downwelling flux of photons just below the sea surface at the instant MODIS views the pixel, integrated over the wavelength range of 400-to-700 nm. The third is PAR, which is the irradiance averaged over an entire day. Since measurements are only available at the time MODIS views the pixel, this parameter is estimated from IPAR by the algorithm. The product is produced at 1 km daily for Level 2 and gridded at 4.6 km, 36 km, and 1° daily, 8-day weekly, monthly, and yearly for Level 3. The fourth is ARP (Absorbed Radiation by Phytoplankton) averaged over the first optical depth. This parameter is critical for calculation of fluorescence efficiency, a product useful for conditioning phytosynthesis models (MOD 23).

Research and Applications

This product is critical for determining photosynthetic rate of growth of phytoplankton and primary ocean production. Downwelling irradiance is needed as an input to the chlorophyll *a* algorithm (MOD 21), and it is used to convert the normalized water-leaving radiance values (MOD 18) into remote sensing reflectance values. A series of irradiance models specific for terrigenous aerosols have been available; however, the aerosol characteristics of these models differ greatly in size and optical characteristics from marine aerosols. The irradiance model of Gregg and Carder (1990) uses a mixture of marine and terrigenous aerosols and forms the basis for the algorithm for the MODIS PAR product.

Data Set Evolution

Product generation begins with solar-irradiance data at 1-nm resolution taken from the revised Neckel and Labs data and corrected for Earth-Sun distance for the current day. Atmospheric correction is made for the effects of scattering, absorption by ozone, absorption by gas, and water vapor. This spectrum is then binned and weighted appropriately to give the irradiance in each of the MODIS ocean bands. Next, the below-surface values are computed and summed to give IPAR. Inputs to the algorithm are Water-Leaving Radiance (MOD 18), PAR (MOD 22) and Absorption Coefficients (MOD 36).

Suggested Reading

Gordon, H.R., and M. Wang, 1994.

Gregg, W.W., and K.L. Carder, 1990.

Iqbal, M., 1983.

Paltridge, G.W., and C.M.R. Platt, 1976.

MODIS Photosynthetically Active Radiation 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: Ocean chlorophyll, productivity

Key Geophysical Parameters: Photosynthetically available irradiance

Processing Level: 2, 3

Product Type: Validation, at-launch

Maximum File Size: 83 MB (Level 2); 640 MB binned, 134 MB mapped (Level 3)

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

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