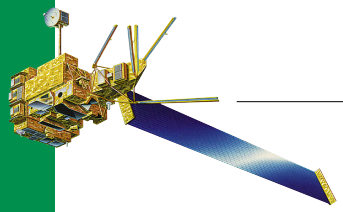
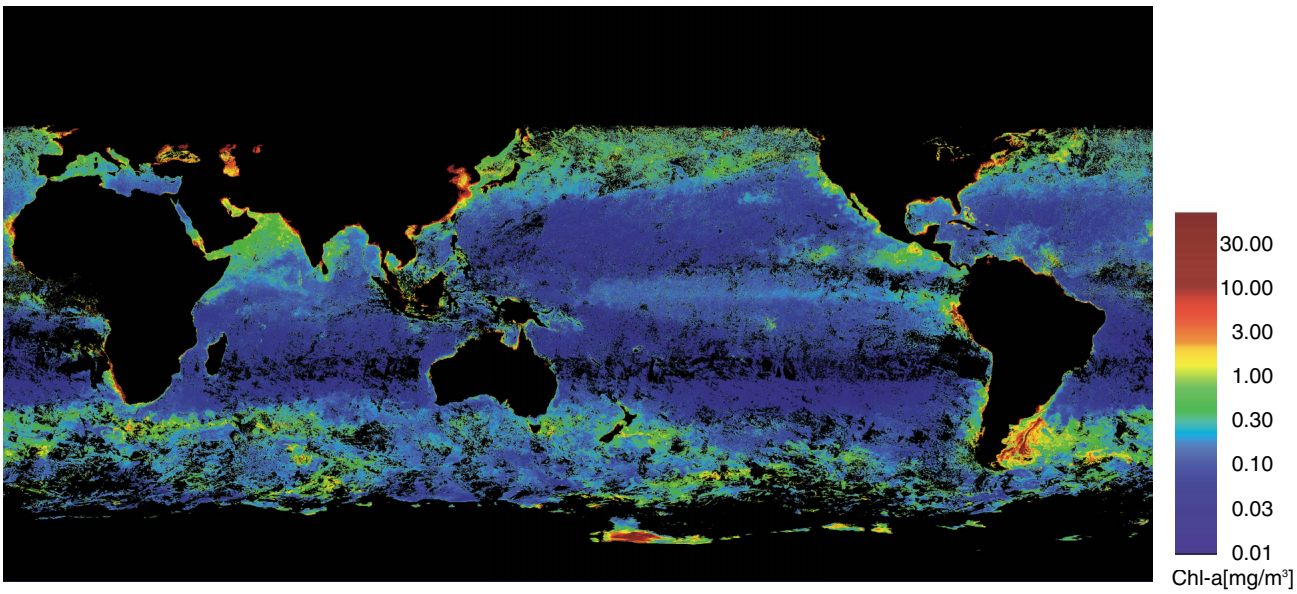
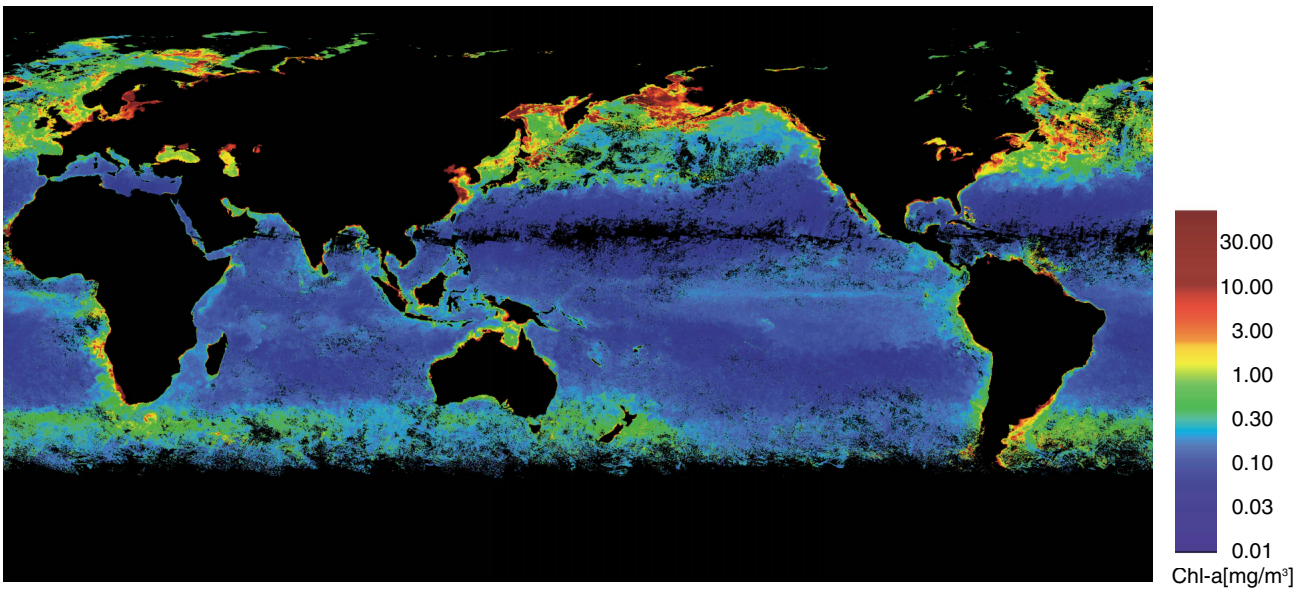


Global Chlorophyll-a Distribution



OCTS Global Chlorophyll-a Map (Monthly Binned : 1 December 1996 - 29 December 1996) ver.4



OCTS Global Chlorophyll-a Map (Monthly Binned : 1 May 1997 - 31 May 1997) ver.4

Provided by NASDA

Global Chlorophyll-a Distribution

All phytoplankton species have chlorophyll-a, a pigment which is essential for them to photosynthesize, grow and increase in biomass. This is why chlorophyll-a measured by OCTS can provide valuable information on the abundance and distribution of phytoplankton in near-sea-surface waters. Phytoplankton, through photosynthesis, absorbs CO_2 that permeates into seawater from the atmosphere and transforms it into organic compounds which comprise their cellular material. By virtue of this unique ability, phytoplankton occupies a prominent place in the marine food web as they serve as a food source for all marine organisms which do not perform photosynthesis. In addition, this ability to assimilate CO_2 affords them an important position in processes that contribute to the sinking of atmospheric CO_2 into the oceans bottom.

Light and nutrients are essential for phytoplankton to sustain their growth. Without the supply of nutrients from the lower layers of the ocean, phytoplankton cannot photosynthesize and maintain their biomass in the upper lighted layers. Invariably, therefore, high chlorophyll-a regions correspond to regions where the nutrient supply from the oceans lower layers is strong.

This close correspondence between phytoplankton abundance and nutrient supply is evident in the monthly composite Level 3 binned map images from the OCTS that show the seasonal variability in chlorophyll-a distribution in the winter of 1996 (December 1996) and the spring of 1997 (May 1997). In the region north of 30°N Lat., the cooling of surface water in winter causes convective overturning which results in large inputs of nutrients from the deeper layers into the sea surface. By spring, as solar insolation increases, phytoplankton benefit from the abundant pool of nutrients available to them, resulting in the formation of blooms. These so-called spring phytoplankton blooms (*1) appear as red (>3 mg/m^3) regions in the OCTS chlorophyll a imagery in the north Pacific and north Atlantic oceans. The same images, however, present a contrasting picture for the Arabian Sea, in the northern Indian ocean, where the season of high chlorophyll-a is winter. Although the supply of nutrients here also results from the northeasterly monsoonal winds, optimal light levels available in winter itself allow phytoplankton to thrive and form blooms. In spring, phytoplankton abundance is at its lowest as nutrient supply is restricted by intense stratification during this season.

Another noteworthy region is the equatorial Pacific where a belt-like zone of elevated chlorophyll-a concentration is seen straddling the equator. This region of high chlorophyll-a is maintained by equatorial upwelling. While OCTS was operating, the on-set of El Niño event, believed to be the largest of this century, started from January 1997. The occurrence of the El Niño event resulted in a positive sea surface water temperature anomaly in the eastern equatorial Pacific. In this event, upwelling which normally occurs in the equatorial region is considerably constrained. As can be seen in the May 1997 image, the length of the chlorophyll-a belt-like zone was reduced, and off the coast of Peru, the normally high chlorophyll a zone was smaller than in the Dec. 1996 image.

In the southern hemisphere a region of high chlorophyll-a can be seen south of the subtropical convergence zone at 40°S Lat.. It can be noted that the region of high chlorophyll-a is equilatitudinal in the Atlantic and Indian Oceans, but it moves poleward in the southern South Pacific. Chlorophyll-a concentrations are especially high between the Argentinean coast and Falkland Islands. This is probably because the continental shelf in this region is wide and phytoplankton can benefit from an enhanced nutrient supply from the sea bottom.

*1 Spring phytoplankton blooms: A phenomenon in which phytoplankton concentration rapidly increase in spring season.