Title: Aircraft Remote Sensing of Phytoplankton Spatial Patterns during the 1989 Joint Global Ocean Flux Study (JGOFS) North Atlantic Bloom Experiment

Authors: James A. Yoder, University of Rhode Island
Frank E. Hoge, NASA/Goddard Space Flight Center

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The NASA P-3 aircraft and the Airborne Oceanographic Lidar (AOL) system provided remote sensing support for the North Atlantic Bloom Experiment-the first JGOFS field program. The principal instrument of the AOL system is a blue-green laser that stimulates fluorescence from phytoplankton chlorophyll, the principal photosynthetic pigment. Other instruments on the P-3 include up- and down-looking spectrometers (256 spectral bands), PRT-5 for infrared measurements to determine sea surface temperature and a system to deploy and record AXBTs to measure subsurface temperature structure.

The purpose of this report is to discuss mesoscale phytoplankton chlorophyll variability near the JGOFS study sites along the 20 W meridian at 34 N, 47 N and 59 N. Shipboard results during the same study showed that the spatial distributions of chlorophyll and the partial pressure of dissolved carbon dioxide (PCO2) in the surface mixed layer were inversely correlated, as would be expected if phytoplankton productivity was the dominant process removing carbon dioxide from surface ocean waters.

Structure functions (semi-variograms) showed that chlorophyll spatial distributions were characterized by dominant length scales averaging ca. 50 km (wavelengths). Chlorophyll length scales were highly correlated with length scales associated with surface temperature distributions. Power spectra of the spatial series for results collected along some of the longer transects showed spectral power law exponents near -2 for both chlorophyll fluorescence and temperature for wavelengths ranging from 6 to 80 km. These results indicate that physical mixing processes, such as ocean eddies, were the dominant process affecting the near-surface distribution of surface chlorophyll. The results are useful for developing numerical models linking ocean productivity to air/sea exchange of carbon dioxide.

