

Spring Distribution of Chlorophyll-a on the Bering Sea Shelf

Calvin W. Mordy¹, Edward Cokelet², Nancy Kachel¹, Carol Ladd², Frederick Menzia¹, Peter Proctor¹, Sigrid Salo², Phyllis Stabeno², Dean Stockwell³, Terry Whitledge³, Eric Wisegarver²

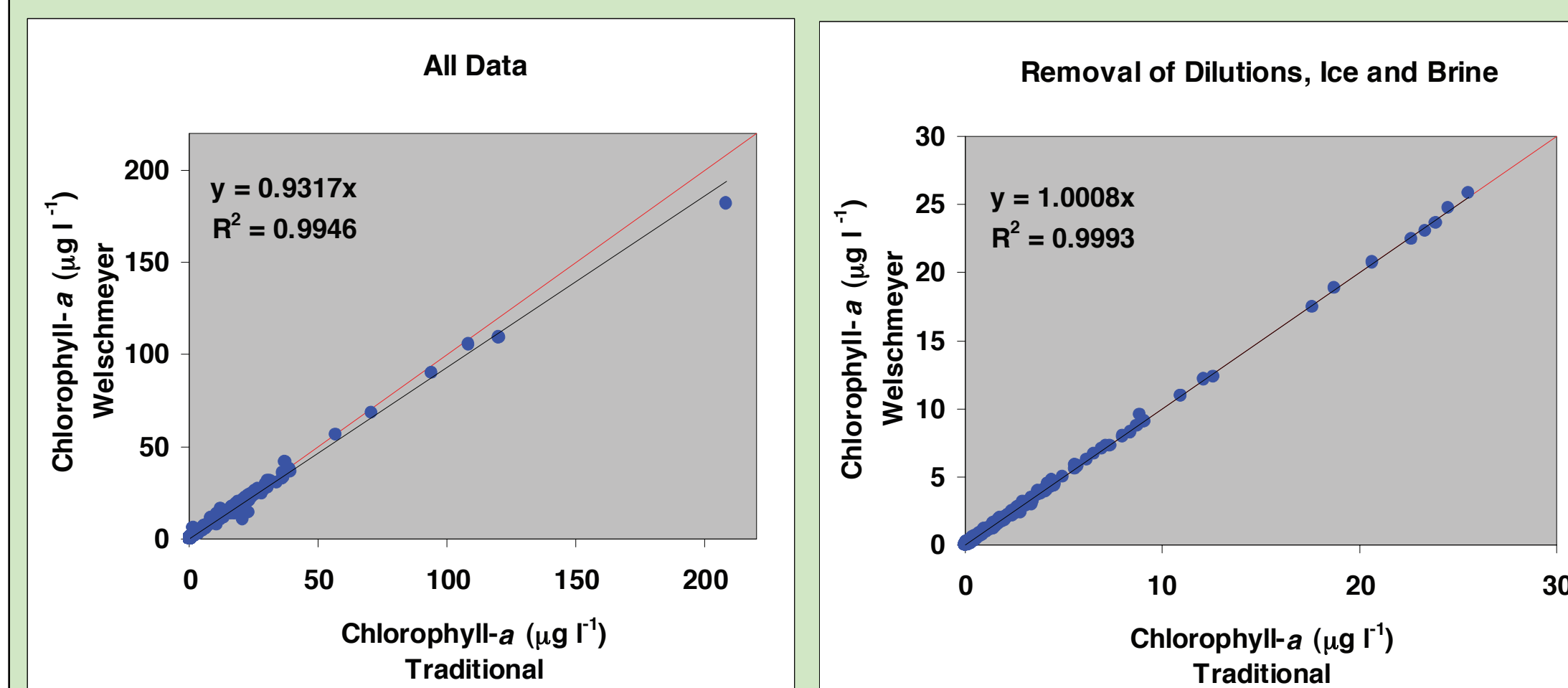
¹Joint Institute for the Study of the Atmosphere and Ocean, University of Washington
²Pacific Marine Environmental Laboratory/NOAA, Seattle WA
³University of Alaska, Fairbanks



Comparison of Analytical Methods: Traditional vs. Welschmeyer

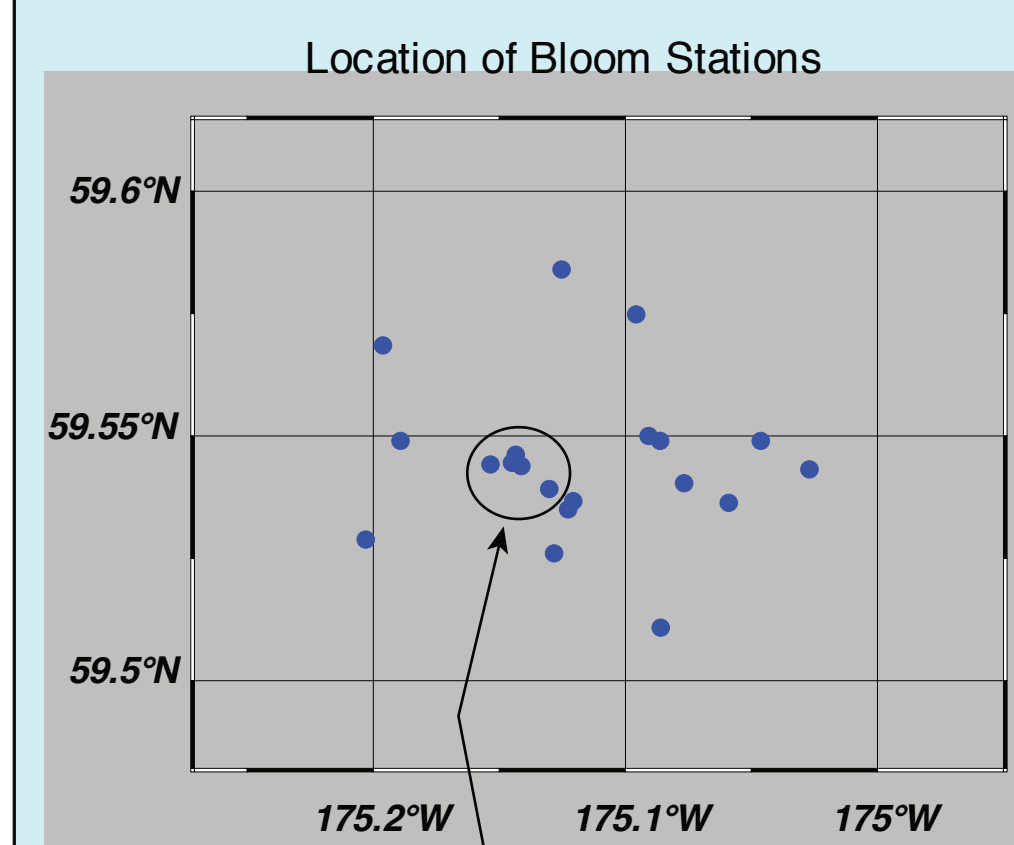
Biologists in the BEST program are using two different methods for measuring chlorophyll-a; a traditional method and the Welschmeyer method. These methods use the same procedure for extracting chlorophyll-a from sample filters (the filters are placed in 90% acetone for approximately 24 hr, then vortexed and centrifuged). The difference between these methods are 1) the use of different excitation and emission wavelengths in the fluorometer (different filters and lamps), and 2) the traditional method employs a second acidification step to account for phaeopigments.

In this comparison, one fluorometer was setup for each method. Both fluorometers were calibrated with the same set of colorimetrically determined standard solutions. Each extract was measured in both fluorometers, followed by acidification and a second measurement in the traditional fluorometer.

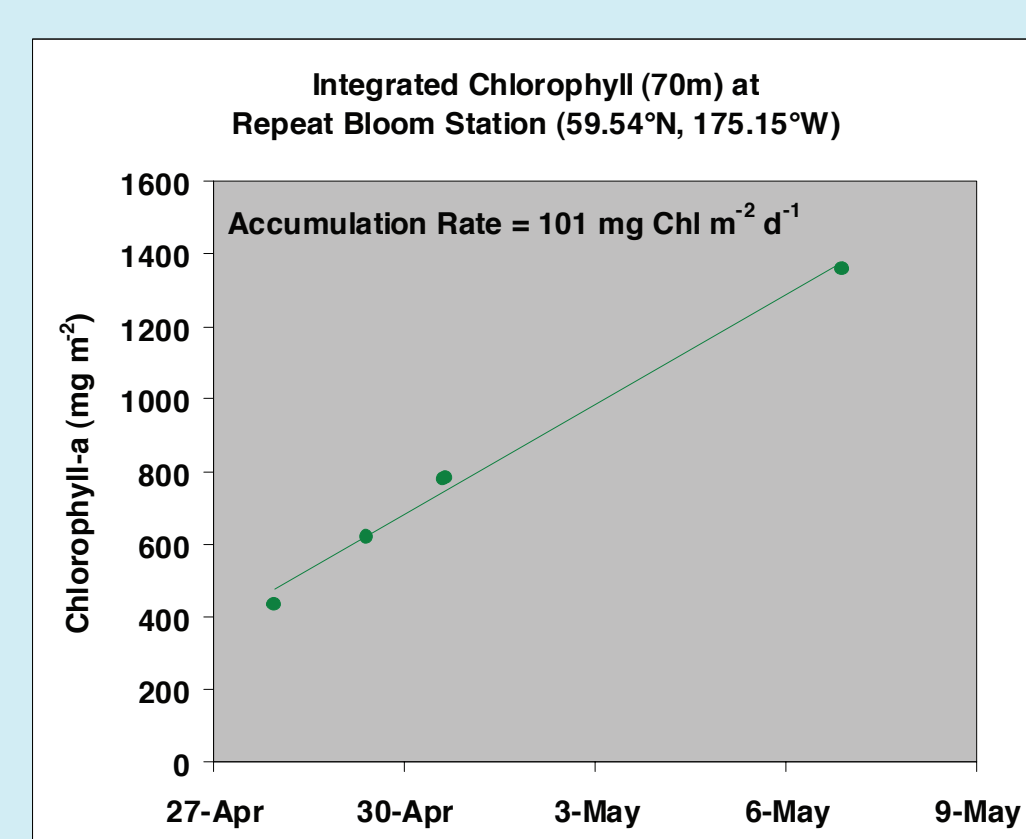


- In Spring 2009, 1838 samples were measured using both methods
- At high concentrations (>25 µg/l), the fluorescence was off scale and required a second dilution. In these samples, there was less agreement between the two methods (traditional > Welschmeyer).
- Disregarding samples that required a second dilution and the more variable ice & brine samples (125 samples in all), we find no distinguishable difference between the two methods.

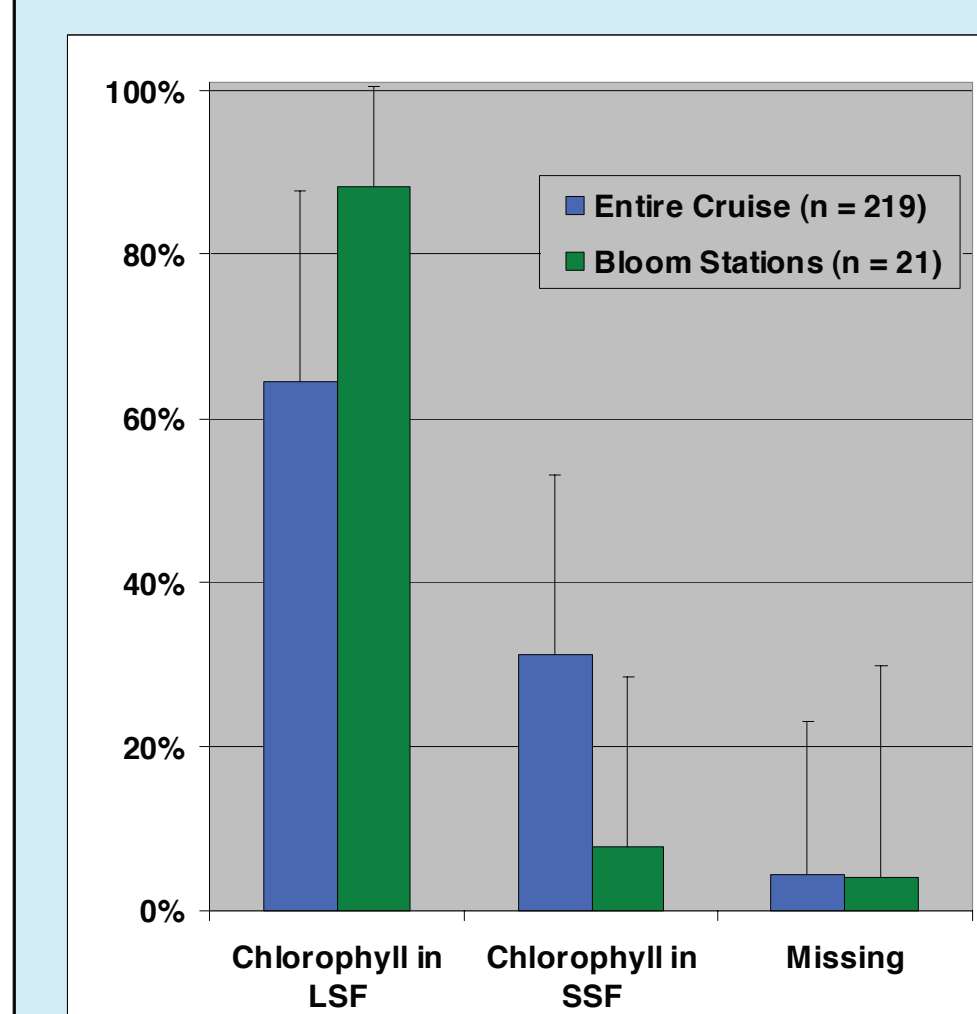
Accumulation and Size Fractionation of Chlorophyll-a in 2009 Bloom Stations



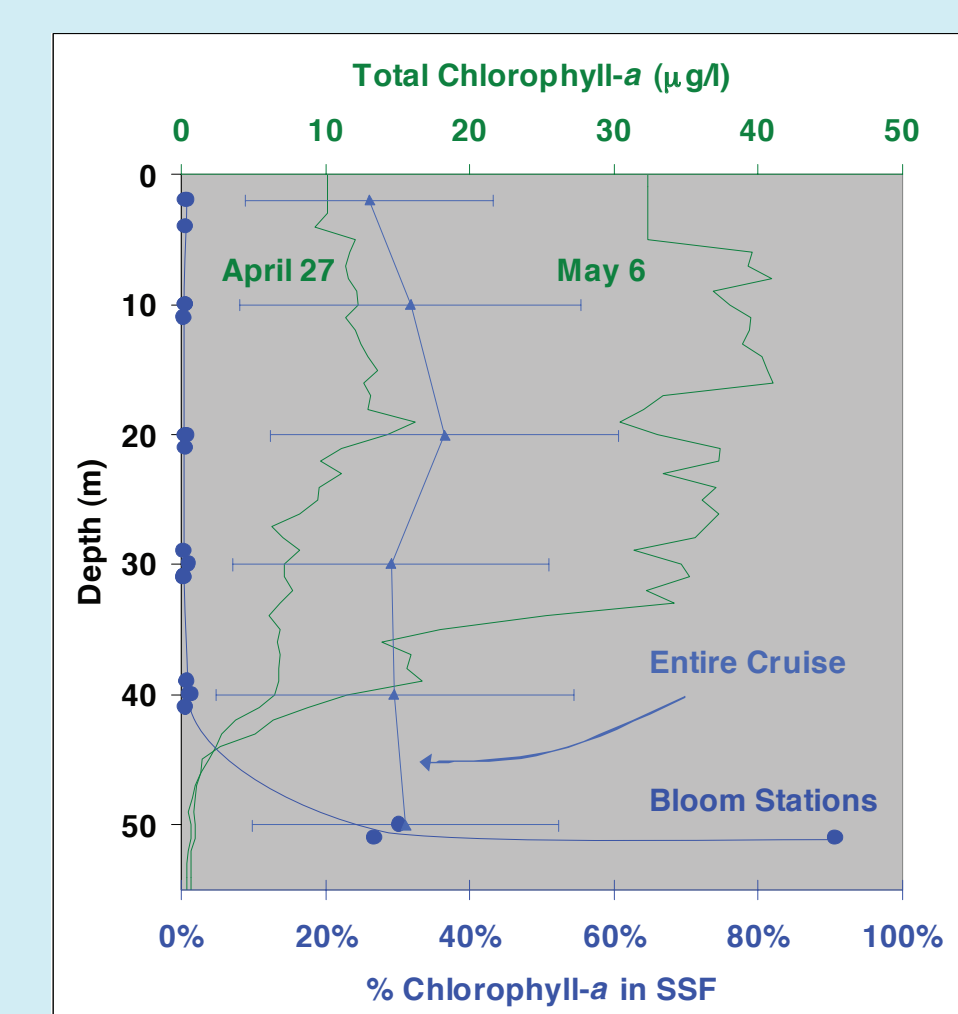
During the Spring 2009 expedition, a bloom was located using Modis color imagery, and the region was sampled for about 10 days.



The accumulation rate of chlorophyll-a (101 mg Chl m⁻² d⁻¹) was determined through repeat sampling at a single station in the bloom region.



For the entire cruise, most of the chlorophyll-a (>60%) was in the large size fraction. In the bloom region, > 80% of chlorophyll was in the large size fraction (LSF). This was consistent with production of diatoms



In general, % chlorophyll in the SSF was variable, and higher when chlorophyll concentrations were very low. In the bloom region, the small size fraction (SSF) dominated only at depth.

Horizontal and Vertical Distribution of Chlorophyll-a in Spring 2008 & 2009

Satellite Imagery (Modis Chlorophyll-a) Each cruise was broken into three periods with diamonds indicating station locations. In 2008, there was almost complete cloud & ice coverage, but a bloom can be observed on the outer shelf north of the Pribilof Islands, and on the CN line. In 2009, blooms could be observed in parts of the middle and outer shelf. The MN line crossed the bloom, and the 70m line was at the edge of the bloom.

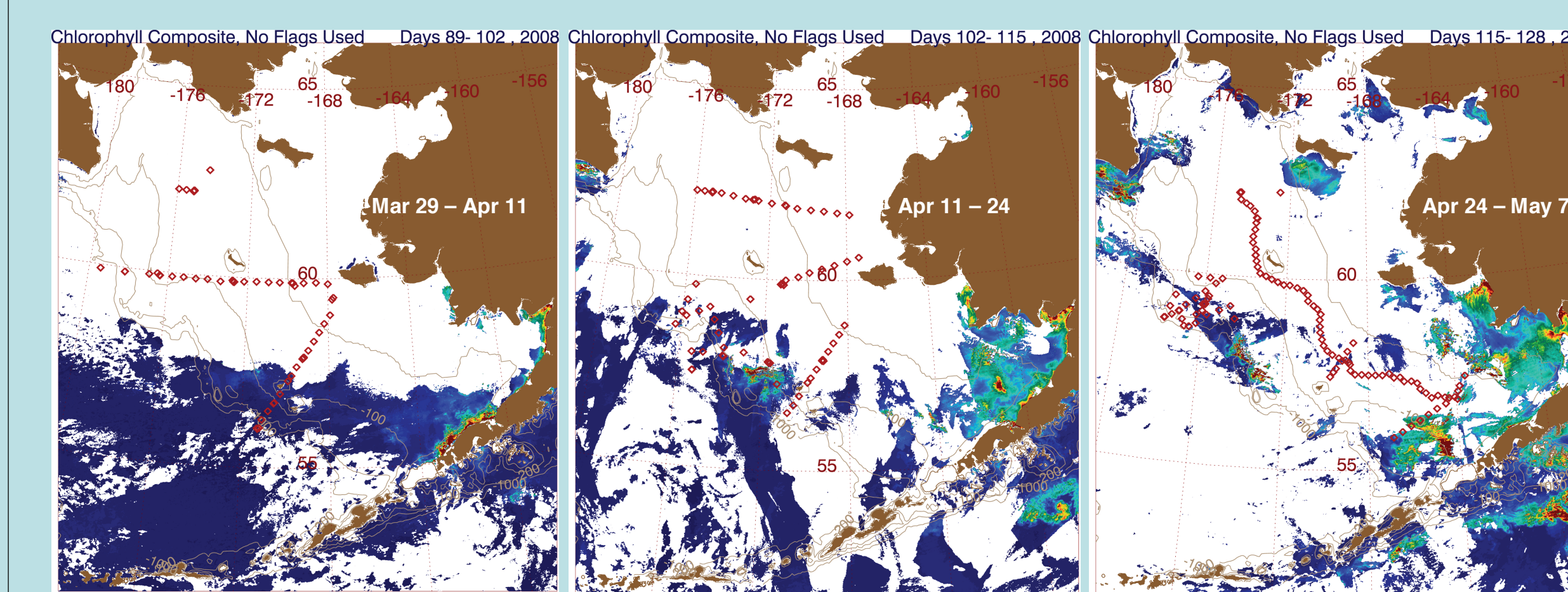
Surface Maps Integrated CTD chlorophyll-a and underway chlorophyll-a were higher in those bloom regions identified from satellite imagery, and also to the north. In some ice-covered waters, underway chlorophyll-a concentrations were high, but integrated chlorophyll-a remained very low. This may result from ice algae being sampled in the underway system.

Vertical Sections Vertical sections include contours of % oxygen saturation (white), the mixed layer depth (sigma-t > 0.123 relative to the surface, black), and the 1% light level (green, dashes are interpolated data at night). The 1% light level tended to shoal in regions of high chlorophyll-a (self-shading). Compared to 2009, chlorophyll-a concentrations in 2008 were higher in the north, and the distribution of chlorophyll on the CN line was more widespread.

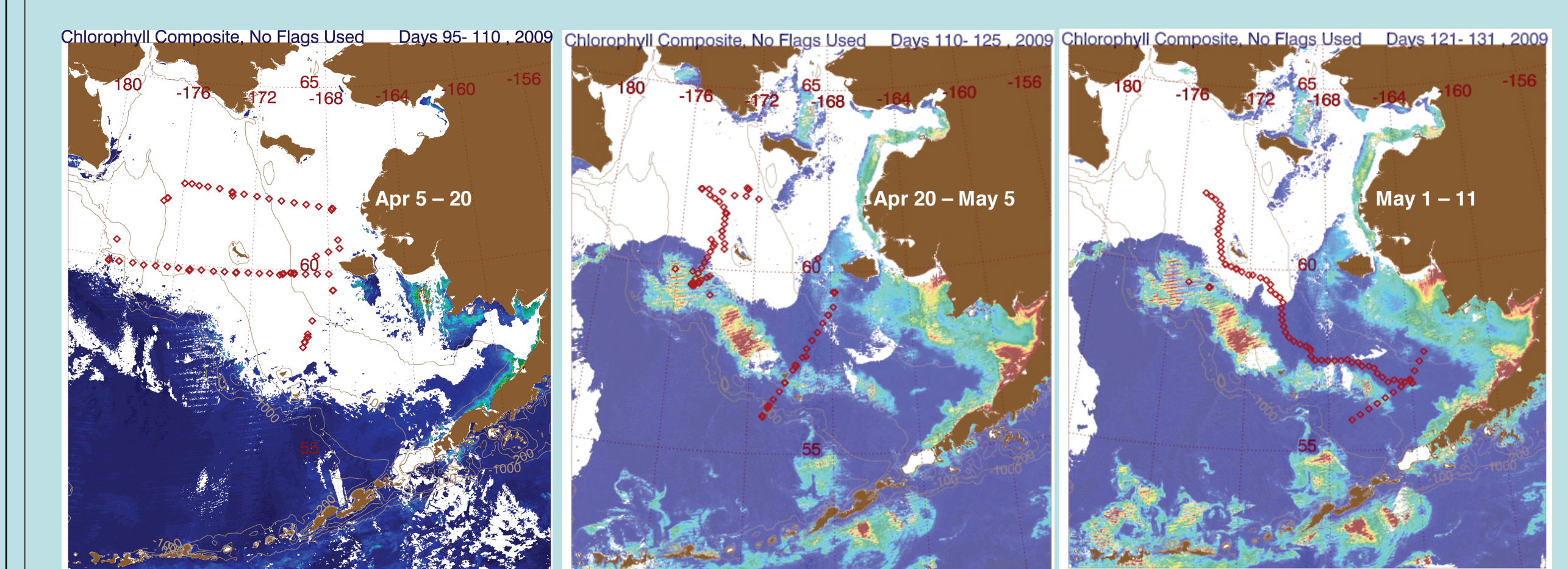
2008

2009

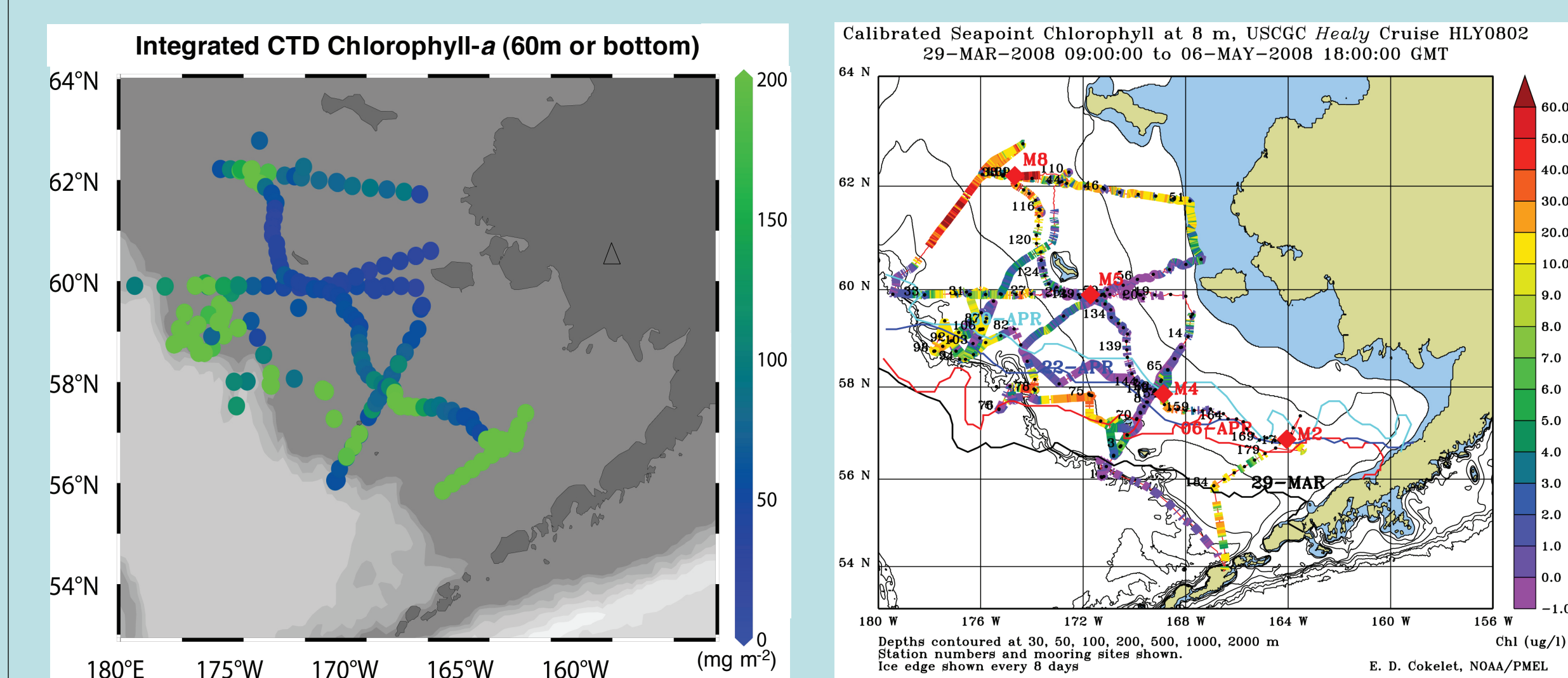
Satellite Imagery (Modis Chlorophyll-a)



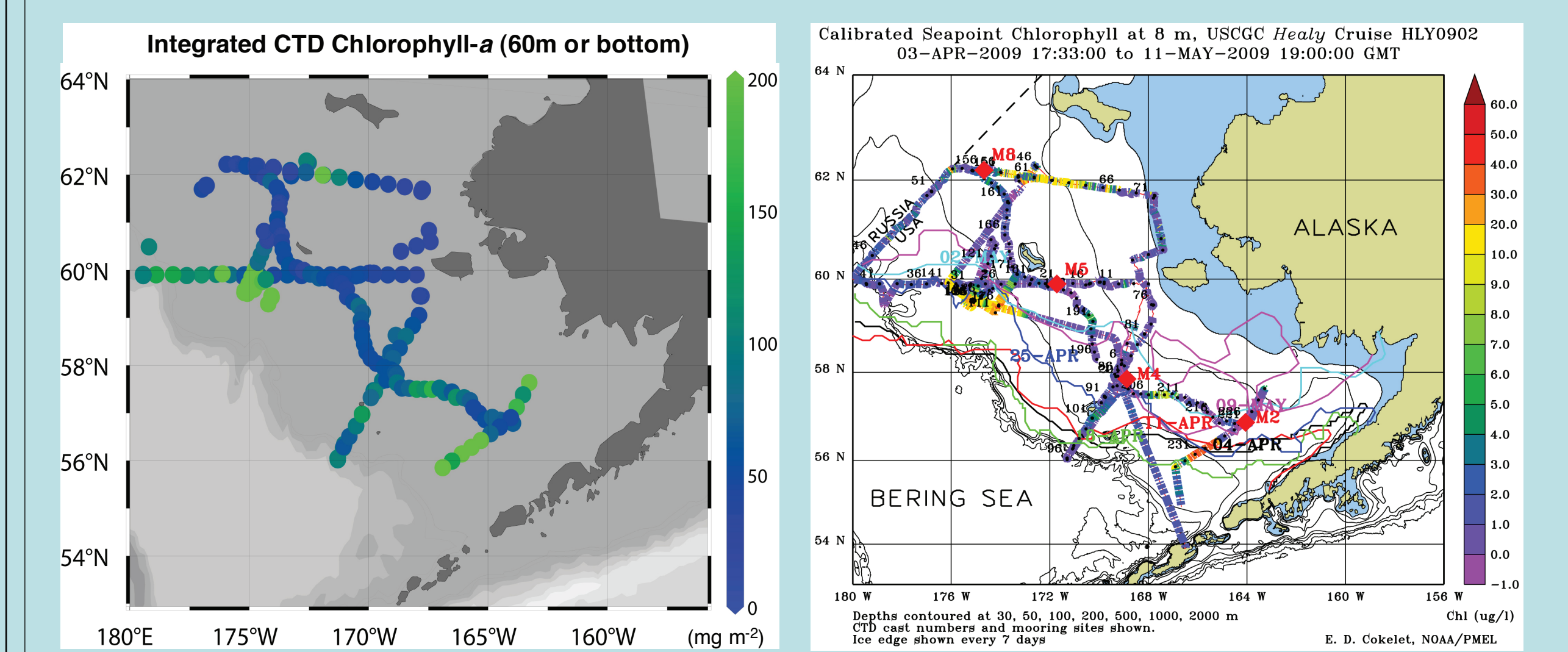
Satellite Imagery (Modis Chlorophyll-a)



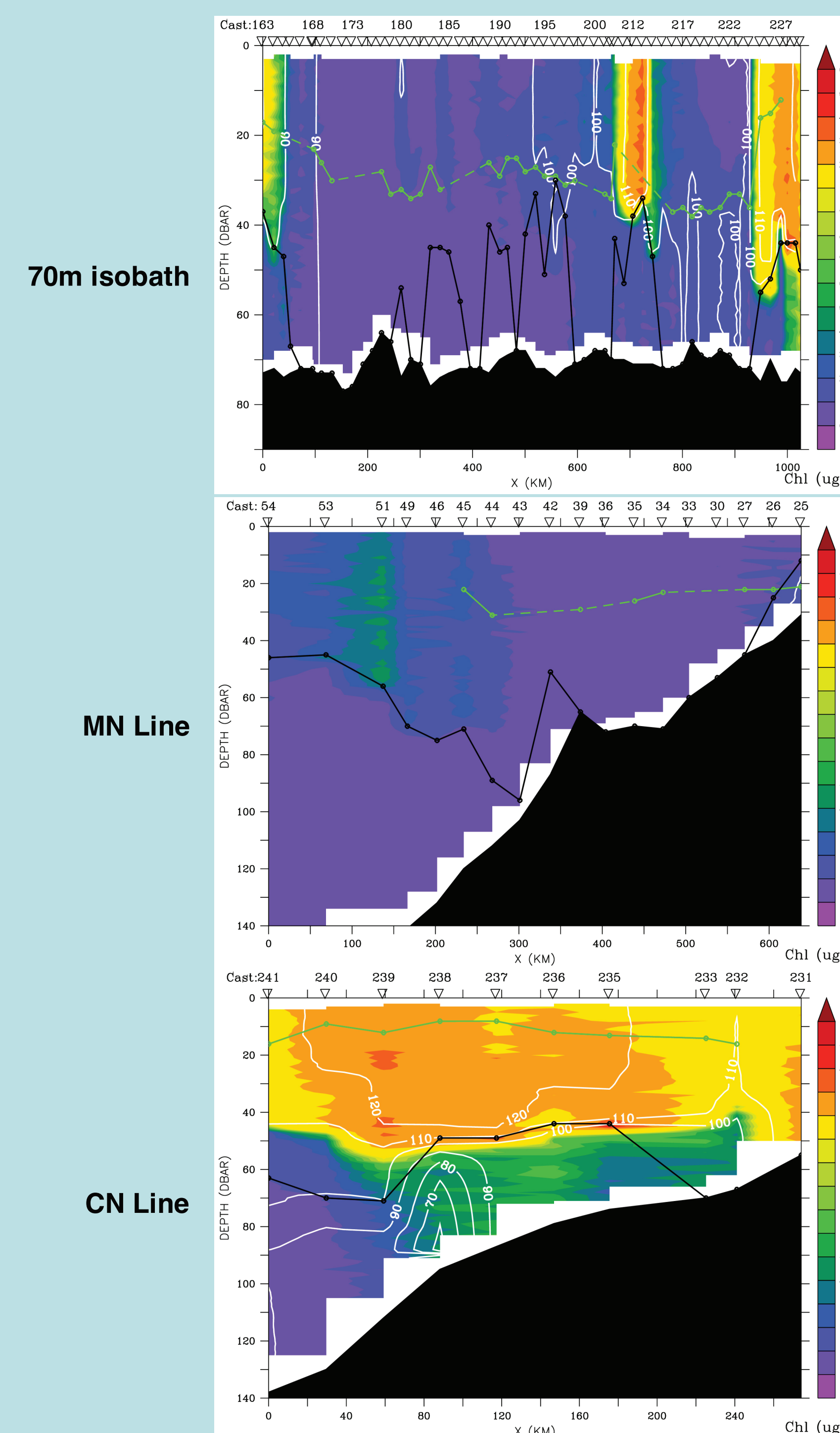
Surface Maps



Surface Maps



Vertical Sections



Vertical Sections

