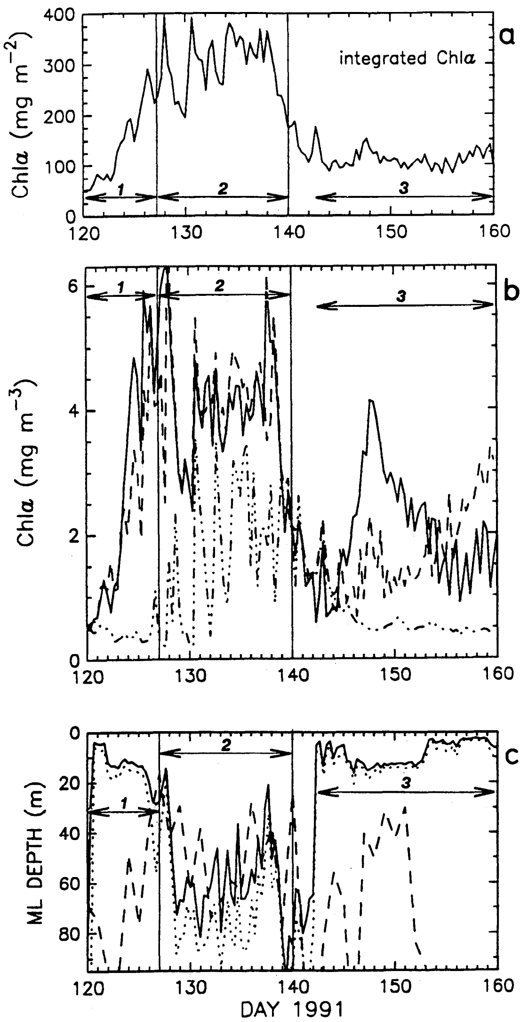

Figure 7. (a) Time series of water column integrated phytoplankton biomass. This was calculated using the Chl a time series shown in Figure 5. (b) Superimposed time series of fluorometrically determined concentration of chlorophyll a at 10 (solid line), 30 (dashed line), and 90 m (triple dot-dash). (c) Time series of 0.05°C (solid line) and 0.1°C (dotted line) mixed layer depth, and "critical depth" (dashed line) estimated using formula given by Nelson and Smith [1991].

Second, it appears that deep waters were well isolated from above, because there was basically no correlation between the bio-optical signals at 10- and 50-m depths (the same was true for the water temperature at 10- and 50-m depths, Figure 12). Third, characteristic diel cycles in c_{660} and fluorescence were apparent at 10-m depth [e.g. *Stramska and Dickey*, 1992b], but there was no strong correlation between bio-optical parameters and water temperature at this depth. In contrast, at greater depths there was a strong correlation of bio-optical properties with water temperature, including intense short-term variability, which was probably related to the presence of internal waves [e.g., *Denman*, 1976]. All of these relationships, which are relatively easy to assess by a visual inspection of the data plotted in Figure 9, were supported by the spectral analysis. Only the most important results of the spectral analysis are summarized in Figure 12.

Discussion and Conclusions

Our MLML time series collected in 1989 and 1991 show that there is large inter-annual variability in the scenario of high-latitude North Atlantic spring blooms. For example, there were obvious differences in the timing of progress of the water's thermal stratification, with periods of extremely deep mixing observed only during the 1989 experiment. As a result, the bloom in 1991 apparently began a few weeks earlier than in 1989 (day 120 compared to day 140, see *Dickey et al.*, [1994] for the 1989 mooring data). Additionally, the Chl *a* concentration in the spring of 1991 was significantly higher than in 1989.

The most striking observation in the 1991 data set was the several day long period of strong MLD variability (with 0.05°C MLD daily amplitude of about 40 m) during which phytoplankton standing stock reached a maximum. During this period, phytoplankton biomass was mixed down to greater depths during nighttime. As a result, the variability of the bio-

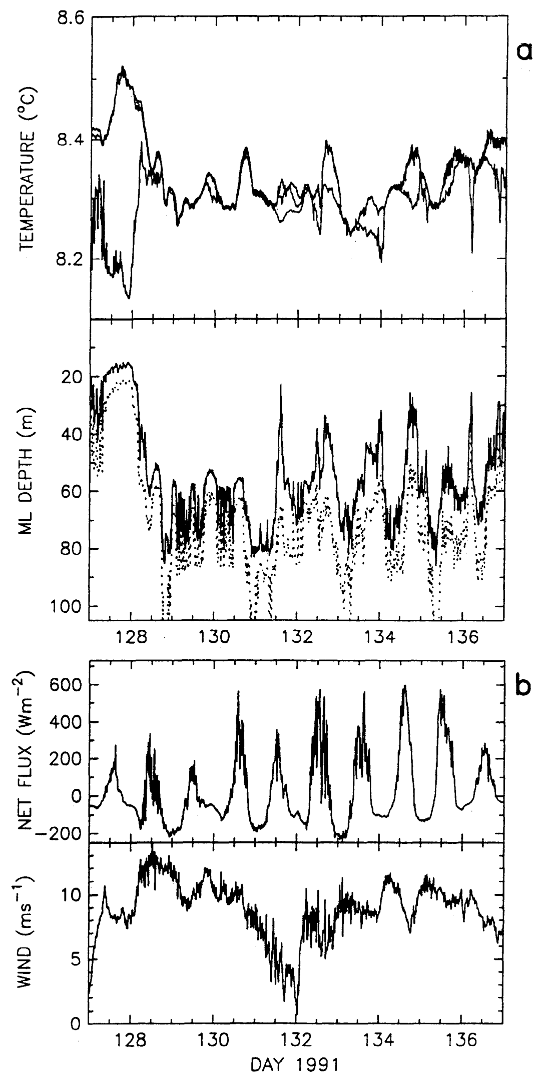

Figure 8. The 10-day subset of the MLML data from the period of extremely variable MLD. (a) Water temperature (at 2, 10, and 50 m), and mixed layer depth. (b) Meteorological data: net heat flux and wind speed. (c) 10-m data: PAR, chl a, c_{660}, and water temperature. (d) 50-m data: PAR, chl a, c_{660}, and water temperature.