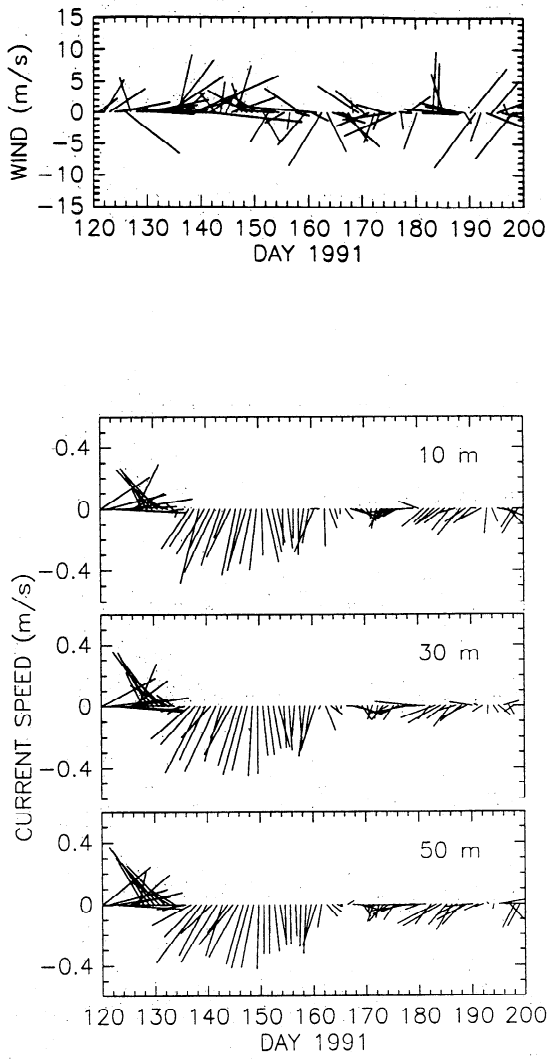

Figure 3. Time series of daily averaged wind and current vectors. North is directed up.

of time than during the other two periods (Figure 7, upper panel). At first glance it may even appear paradoxical, as our data suggest a relation opposite to what is commonly expected (i.e, we observed more intense phytoplankton bloom when the mixed layer was relatively deep). However, as we will see next, this temporal behavior of the phytoplankton stock can be viewed as a specific example of the balance between physical and biological processes.

To explain this point and to illustrate that changes in biomass were closely coupled to physical conditions, two 10-day subsets of time series data were selected. These two examples are shown in Figures 8 and 9, corresponding to "deeper" and "shallower" mixed layer periods (periods 2 and 3 in Figure 7). The "deeper" ML period is actually characterized by large-amplitude fluctuations in the MLD (Figure 8a). Importantly, the ML was often shallow enough to allow intense phytoplankton growth in the near-surface water. Note that during that period of time the "critical depth" was very close to the MLD (Figure 7). Critical depth (Z_c) was estimated according to the formula given by *Nelson and Smith* [1991]:

$$Z_c = 0.8E_{tot}/(K_{par}E_c)$$

where E_{tot} is the total daily irradiance of PAR at the surface (Einst m^{-2} d^{-1}), K_{par} is the diffuse attenuation coefficient for PAR (m^{-1}), 0.8 is the correction term for surface reflectance and strong absorption of PAR at 650-700 nm in the surface waters, and E_c is the compensation intensity taken as 3.1 Einst m^{-2} d^{-1} [see *Langdon et al.*, this issue].

The term "critical depth", often used by biologists, was first defined by *Sverdrup* [1953] as the depth where vertically integrated, daily primary production is not smaller than the community losses by respiration. However, we would like to point out here that Sverdrup's classic model is a considerable simplification for our data set. This is because Sverdrup assumed a uniform mixing layer which was actively mixing at all times. Contrary to this assumption, our time series for "period 2" document strong variability of the surface water stability, which was changing significantly on the timescale of hours. Note also that the critical depth estimate depends strongly on the values of the parameters used for such computations [*Nelson and Smith*, 1991; *Smetacek and Passow*, 1990].

High biomass concentration in deep waters during "period 2" (Figure 8d) is not likely to be accounted for by local growth at these depths. Such a notion is supported by the time-depth

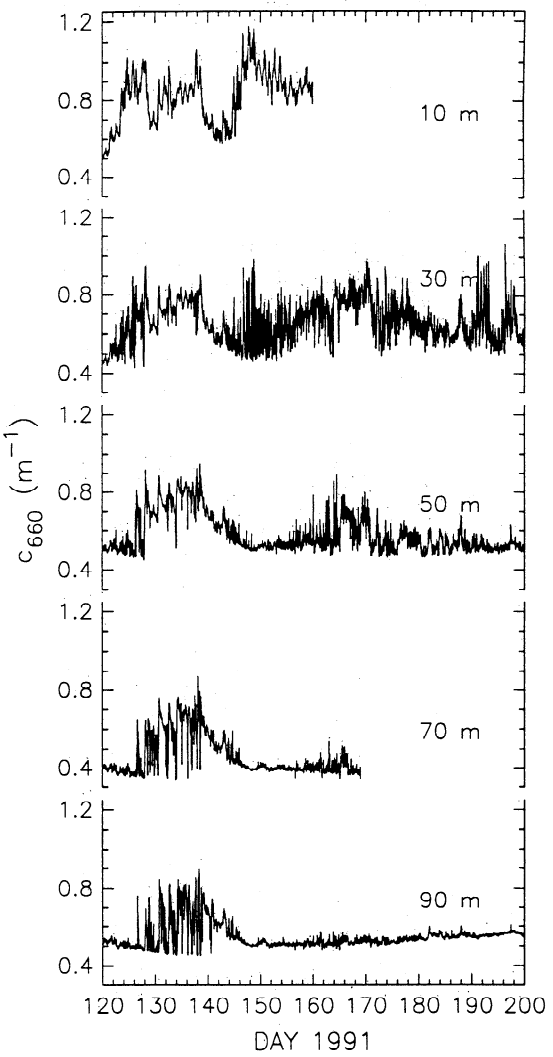

Figure 4. Time series of beam attenuation coefficient at 660 nm at 10-, 30-, 50-, 70-, and 90-m depths. Note that parts of the 10- and 70-m records are missing due to instrument failure.