period, and Ekman pumping (e.g., Dickey et al., 1998a, b, 2001; Zedler et al., 2002). Phytoplankton concentrations are now thought to increase in the wakes of many hurricanes, as shown by extensive analyses of satellite ocean color data (e.g., Babin et al., 2004). In regard to the present study, we pose the question, "Do tropical storms and hurricanes affect zooplankton abundance?"

During the first half of Deployment 6 (approx. August–October 1996), three hurricanes, Edouard, Hortense, and Lili, passed into the region of the BTM. The eye of Edouard passed 570 km to the west of the BTM on August 31, 1996 while Hortense and Lili passed 530 km to the west on September 13, 1996 and 170 km to the southeast on October 20, 1996, respectively. All three hurricanes are evident in time series of winds. However, the hurricanes generated oceanic responses to different degrees. Hurricane Lili excited the strongest oceanic signals at the BTM location, while the response to Hurricane Hortense was weaker but still evident in relative humidity, short wave radiation, radiance and irradiance data. Hurricane Edouard did not generate a significant response. When Hurricane Lili passed, barometric pressure dropped by about 30 mb from 291 to 295 (October 17–21). This hurricane also excited strong inertial oscillations in the upper ocean, as shown in horizontal currents. Chl-*a* flourescence levels at 45 and 73 m (Fig. 2c) were generally low during the passages of these three storms and showed no significant effect of the atmospheric disturbances. Zooplankton biomass was likewise apparently not impacted by these hurricane passages as indicated by integrated zooplankton biomass time series (Fig. 2b) or the vertical distributions of concentrations of zooplankton biomass (Fig. 3a). Similar results were found for Hurricane Gert which passed within about 160 km of the BTM on September 21, 1999.

Although the physical effects of the hurricanes described thus far were apparently insufficient to significantly affect the local phytoplankton and zooplankton distributions and abundances, data collected in 2003 are especially interesting in regard to hurricane effects on phytoplankton and zooplankton. The eye of Hurricane Fabian passed within 100 km and to the west of the BTM. Time series of wind speed are shown in Fig. 7a.

Direct measurements from the BTM's anemometer were available only through September 5, 2003 when the instrument stopped collecting data. Quikscat satellite wind data are shown as a dashed curve for the remainder of the period. Peak winds reached 34 m s^{-1} at the BTM site. The mixed layer deepened from about 20 to 50 m with the passage and surface waters cooled by over 3 °C as shown in Fig. 7b. Vertical oscillations of the seasonal thermocline near the local inertial period (near 22.8 h) are evident as well. Near-inertial currents reaching well over 100 cm s^{-1} were produced in the upper layer (Fig. 7c). Chlorophyll fluorescence increased after passage of the hurricane. The 35 m chlorophyll fluorescence record appears to have subsequently become erroneous, likely because of biofouling. The zooplankton biomass as estimated from the ADCP acoustic backscatter data indicate a significant decrease as shown in Figs. 7e and f. Interestingly, zooplankton biomass distribution extended deeper into the water column after the hurricane; meanwhile, the depth-integrated zooplankton biomass decreased.

3.4. Diurnal variability and diel vertical migration

Physical variability of the upper ocean is often characterized by energy peaks associated with semi-diurnal (~12.5 h period, or frequency of 1.92 cpd) and diurnal (~25.0 h period or frequency of 0.96 cpd) tides, diurnal cycles of heating and cooling, and mixed layer depth shoaling and deepening associated with the daily solar insolation cycle. In addition, wind events, especially major storms and hurricanes, produce currents near the local inertial period, which is 22.8 h (inertial frequency is 0.0438 cph or 1.05 cpd) at the BTM site. Phytoplankton populations can also exhibit diel rhythms. These various processes contribute to elevated power spectra values in physical and biological variables as discussed in detail with respect to the BTM site by Dickey et al. (2001). The elevation of energy in the range of periods of 22–25 h is illustrated for ADCP current power spectra shown in Fig. 8 for individual BTM Deployments 7 (May 4–July 29, 1997), 8 (August 9–November 19, 1997), and 9 (November 27, 1997–May 30, 1998). The spectra are computed for four depths: 45, 75, 150, and 190 m. Seasonal and depth differences are apparent in these individual spectra. However, the most important result for this study is the clear elevation of energy in the vicinity of the diurnal and near-inertial periods.

Likewise, the power spectra for zooplankton biomass (Fig. 9) indicate a clear diurnal peak in zooplankton biomass variability (due to diel vertical