Visbeck (1993) and will require new ideas and technologies.

4.1. Seasonal variability in zooplankton biomass

The seasonal variability of zooplankton biomass has rarely been studied using high temporal resolution data sets and thus our results provide some new insights. Our study indicates the mean seasonal signal results from the integrated effects of many episodic events as well as the periodic physical forcing at the annual cycle driven by solar insolation. Cool and likely nutrient rich waters along with shoaling mixed layers and increased light exposure contribute to spring blooms as evidenced in both elevated chl-*a* and zooplankton biomass. The lack of a significant lag in time between phytoplankton and zooplankton spring blooms is somewhat surprising. However, it appears that these were locally realized springtime blooms in that the temperature and current records during the blooms do not indicate significant eddy or advective features that could explain the results. Thus the cross-correlation analyses indicated a tight coupling between increases in phytoplankton and zooplankton, and both the phytoplankton and zooplankton blooms appear as pulses that eventually are manifested in monthly averaged increases in the springtime.

The nearly continuous sampling afforded by the ADCP technique is effective for making good seasonal estimates, especially because of the degree of short-term variability in the biology that cannot be adequately sampled using traditional ship-based net tows, which can generally be done only for a few days per month and not during inclement ocean conditions. Nevertheless, our seasonal composite data comparison with that of Madin et al. (2001) indicates that the net tow data approximate the seasonal cycle—with a high spring, and a second, smaller summer biomass peak-quite well. The nighttime net tow measured biomass was, however, higher than the BTM estimated biomass. There are several likely explanations for the observed differences between the two data sets: the methodologies were quite different (ADCP acoustics vs. net tows), sampling was nearly continuous with the ADCP opposed to once per month for the net tows, the depths of integration for the ADCP were about 22–190 m whereas the net tows sampled from 0 to 200 m, and the organisms sampled with the ADCP are from a selected size class whereas the net tow data include organisms ranging over a much broader size range. The latter two differences likely account for the smaller values of depth-integrated zooplankton biomass observed at night by the ADCP method, as the larger diel migrators are less likely to be detected by the ADCP than sampled by the net. Thus we conclude that while the monthly net sampling represents the seasonal cycle in zooplankton biomass well, the episodic changes that make up the seasonal signal are best captured by the ADCP.

4.2. Effects of eddies

Mesoscale eddies are of special interest for upper ocean ecology and biogeochemistry (e.g., review by Lewis, 2002) and have been suggested as playing an important role for new production and phytoplankton dynamics near Bermuda (e.g., Jenkins, 1988; McGillicuddy et al., 1998; McNeil et al., 1999). For example, the influence of mesoscale features was estimated by McGillicuddy et al. (1998) using the BTM data set, shipboard observations, and a regional eddy-resolving model. They have suggested that the flux of nutrients induced by mesoscale eddies may be sufficient to balance the nutrient budget of the Sargasso Sea. Mesoscale eddies are also known to affect oceanic zooplankton communities (e.g., Wiebe et al., 1992; Piontkovski et al., 1995; Hernández-León et al., 2001) and elevated zooplankton biomass and enhanced fecal pellet flux have been found in a cold-core and a mode water eddy in the Sargasso Sea off Bermuda (Goldthwait and Steinberg, submitted). Mesoscale eddies often pass the BTM mooring site (e.g., Dickey et al., 1998a, 2001; McNeil et al., 1999; Conte et al., 2003). Previous reports have documented enhanced primary productivity associated with first and second baroclinic mode eddies. However, the present study is the first to examine a long record of eddy influence on zooplankton distributions as well. The strongest eddy to pass the BTM was likely the summer 1994 event; however, this was prior to acquisition of an ADCP. The time period of prime interest here indicates the passages of eddies. Some of these appear to reflect enhanced zooplankton as well as phytoplankton concentrations. However, others do not. This is important with respect to inferred influence of these features, as it appears not all mesoscale eddies play a significant role in modulating upper ocean plankton community structure, biogeochemistry, and carbon fluxes. Our