the PSD. Recent investigations relaxed the nonabsorption assumption and theoretically linked γ to the PSD power-law parameters quantitatively, allowing their retrieval from ocean color data (Kostadinov et al. 2009). However, γ is sensitive to the wavelength range from which it is computed and is also sensitive to the measurement noise (McKee et al. 2009). Therefore, the use of γ to investigate dynamics of the PSD is here only qualitative. Low γ values (say, between about 0 and 1) would indicate that large particles dominate, whereas larger values (say, above about 2) would indicate that the community is dominated by smaller particles. Discussing more subtle changes in γ is inappropriate considering the strong limitation of determining its value from two wavelengths only, with one of them being affected by absorption, in particular by phytoplankton (443 nm).

Particulate scattering coefficient—At BOUSSOLE, a WetLabs® AC-9 attenuation and absorption meter (bands at 412, 440, 488, 510, 532, 555, 650, 676, and 715 nm) is deployed on profiling mode during the monthly cruises to the site, providing measurements of $c(\lambda)$ and $a(\lambda)$, from which $b(\lambda)$ is derived by difference (Antoine et al. 2006). A similar instrument is deployed on the PnB cruises, with a slightly different band set (i.e., 412, 440, 488, 510, 555, 630, 650, 676, and 715 nm) (Kostadinov et al. 2007).

Beam attenuation coefficient—The beam attenuation coefficient at 660 nm, c(660), is measured at BOUSSOLE at depths of 4 m and 9 m with 25-cm–path length WETLabs® C-star transmissometers (Table 2; acceptance angle of 1.2°). The particulate beam attenuation coefficient (c_p) is computed as $c - c_w$, with $c_w(660) = 0.364$ m^{-1} (Bishop 1986). This assumes that absorption, by colored dissolved substances organic matter (CDOM) in particular, is negligible at 660 nm (Bricaud et al. 1981). It was also verified that $a_p(660)$ is on average only $\sim$ 5% of $c_p(660)$ at BOUSSOLE. The same instruments are deployed on the monthly casts, and their measurements are used to correct the buoy transmissometer data for possible drifts. Buoy c_p values are not corrected for a deep background value, as is usually done when using c_p vertical profiles, because correcting for the deep background is incompatible with the buoy b_{bp} measurements, which in essence cover the total pool of particles and cannot be corrected for a deep background value.

At PnB, the surface beam attenuation coefficient is calculated from profile measurements at 650 nm with the AC-9 (averaging the top 15 m of data), and the surface particulate beam attenuation at 650 nm is estimated by subtracting the absorption due to CDOM at 650 nm, as measured by the laboratory spectrophotometer (Table 2) for discrete surface-water samples.

The particle backscattering probability ($\tilde{b}_{bp}$) is determined using Eq. 3. For BOUSSOLE, b_p is computed in three different ways. The first uses the buoy measurements of the particulate beam attenuation coefficient at 660 nm, $c_p(660)$, and assumes that particulate and CDOM absorption are negligible at 660 nm [so $c_p(660) = b_p(660)$] and that the particle scattering coefficient is spectrally flat [i.e., $b_p(\lambda) = b_p(660)$], which is supported by the BOUSSOLE AC-9 observations (not shown). The second technique uses $b_p(\lambda)$, as determined from chlorophyll using the $b_p(\lambda)$-to-chlorophyll relationship established from the BOUSSOLE AC-9–derived b_p values. The third solution uses $b_p(\lambda)$ as determined from chlorophyll using existing bio-optical parameterizations. The data from the MVSM instrument are also used here to complement other determinations of the particle backscattering ratio. At PnB, $\tilde{b}_{bp}$ is computed as $b_{bp}(\lambda)/b_p(\lambda)$ using AC-9 determinations for $b_p(\lambda)$, linearly interpolated to the respective Hydroscat-6 wavelengths (Kostadinov et al. 2007).

Phytoplankton pigments and particulate absorption—Water sampling is performed during the BOUSSOLE cruises between the surface and a depth of 200 m, from which only the data obtained from samples at 5 m and 10 m are used here. Particles are collected onto 25-mm Whatman glass-fiber filters GF/F (0.7-μm porosity) and then stored in liquid nitrogen, until algae pigment contents are measured in the laboratory using HPLC, following the method of Ras et al. (2008). The total chlorophyll *a* concentration ([Chl]) is computed as the sum of the concentrations of Chl *a* (including allomers and epimers), chlorophyllide *a* plus divinyl Chl *a*. Before pigments are extracted, the filters are used to determine spectral particulate absorption, $a_p(\lambda)$, with a Perkin-Elmer Lambda 19 dual-path spectrometer with an integrating sphere compartment attached (Antoine et al. 2006). Phytoplankton and nonalgal particle absorption are determined by numerical decomposition following the method of Bricaud and Stramski (1990).

In order to interpret IOP changes at the daily scale (buoy measurements), a reconstructed cycle of daily chlorophyll values is built by combining the HPLC determinations with satellite-derived daily chlorophyll values (Antoine et al. 2008*a*).

For PnB, data obtained from fluorometric chlorophyll measurements are used here. Particulate and phytoplankton absorption are measured as well. *See* Table 2 and Kostadinov et al. (2007) for details.

Results

Water types at the two sites—Field determinations of the surface irradiance reflectance at 560 nm, R(560), are displayed as a function of [Chl] in Fig. 3. Also shown is the theoretical upper limit of R(560) for Case 1 waters, $R_{lim}(560)$, following the method of Morel and Bélanger (2006). Data from the two sites are essentially below the theoretical curve, which means that the BOUSSOLE site and the deep-water PnB stations (Sta. 2–6) are all Case 1 waters. Exceptions occur relatively infrequently at low chlorophyll values at BOUSSOLE and at higher chlorophyll values for PnB. This confirms that an appropriate value of $R_{lim}(560)$ remains elusive in the low-chlorophyll domain (Morel and Bélanger 2006).

General characteristics of the two particle backscattering data sets—The 2-yr time series of $b_{bp}(555)$, γ (Eq. 5), and [Chl] at BOUSSOLE are displayed in Fig. 4A, and the $\sim$ 4.5-yr time series of the same parameters at PnB is