Variations in the optical properties of terrigenous mineral-rich particulate matter suspended in seawater

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ABSTRACT: From laboratory measurements, we determined the spectral mass-specific absorption, $a_p^*(\lambda)$, and scattering, $b_p^*(\lambda$, coefficients for terrigenous mineral-rich particulate assemblages suspended in seawater. The samples were derived mostly from surface soils in different locations and consisted of small particles (,10 mm). Both $a_p^*(\lambda$ and $b_p^*(\lambda$ showed large variability associated with variations in particle size distribution (PSD) and origin of samples. Variations in $a_p^*(\lambda$ produced by changes in PSD are consistent with the package effect, in that samples with a higher percentage of small-sized particles have higher $a_p^*(\lambda$. The variability among the samples is also associated with composition of particulate matter. For example, $a_p^*(\lambda$ at blue wavelengths varied from ~0.05 $m^2 g^{-1}$ for organic-dominated soil dust to ~0.1-0.5 $m^2 g^{-1}$ for mineral-dominated samples. The effects of particulate composition are reflected in a broad range of imaginary refractive index of particles, which in the blue can exceed 0.2-0.3 for mineral-dominated samples rich in iron oxides. The patterns of the variability in the scattering coefficient among the samples are quite intricate because of the effects of PSD and composition. In general, $b_p^*(\lambda$ ranged from about 0.5 to 1.5 $m^2 g^{-1}$, and the spectral behavior varied from nearly flat spectra to the spectral dependency ~l2 λ with a slope λ as high as ~1.3 for the sample with the largest contribution of small particles.