Bidirectional reflectance measurements of sediments in the vicinity of Lee Stocking Island, Bahamas

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ABSTRACT: In situ measurements of bidirectional reflectance factors (REFFs) are presented for submerged carbonate sediments at six sites in the vicinity of Lee Stocking Island. Sediment grain sizes ranged from 400 µm to >1000 µm. Several features were common to all data sets. Although overall sediment reflectance varied spectrally, normalized REFF was independent of wavelength within the natural sample variability. This allowed us to derive a model REFF which, when multiplied by REFF($\theta_r = 0°$, $\theta_i = 45°$, φ) at a specific wavelength, represented the data well. In addition, normally illuminated samples were almost Lambertian, but samples with larger grain sizes had an REFF that decreased with increasing view angles. As the illumination angle increased, samples became increasingly non-Lambertian. The dominant feature of the REFF in these non-Lambertian surfaces is in the backscattering direction. In this direction the REFF was significantly larger than the nadir value. The largest backscattering REFFs correspond to large grain sizes and increases with increasing illumination angles. The empirical model, which represents the data within one standard deviation of sample variation, is presented for these sediments. This model is well behaved at angles out to 90° and thus can be used in radiative transfer models. This model provides a realistic bottom reflectance that can be used to improve light field predictions in shallow water.

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