


The spectral upwelling radiance distribution in optically shallow waters

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ABSTRACT: The upwelling radiance distribution in optically shallow water is investigated with experiments and Hydrolight numerical simulations for two different benthic surfaces and a range of solar zenith angles (<60°). Over a bright sand surface (water depth 5 m) the upwelling radiance distribution was brightest at nadir and decreased toward the horizon. The upwelling radiance distribution was nearly azimuthally symmetric but was strongly influenced by wave focusing. *Q* (E_u/L_u, where E_u is the upwelling irradiance and L_u is the upwelling radiance) for this case was significantly less than . *Q*, at 440 nm and 670 nm, was almost independent of solar zenith angle. The Hydrolight model results agreed well with the experimental measurements in this case. Over a seagrass surface (water depth 8 m) at 440 nm the radiance distribution was more uniform, while at 670 nm the benthic surface has a negligible effect on the upwelling radiance distribution. In this case, *Q* was dependent on solar zenith angle, with *Q*(670 nm) close to the values expected in optically deep water. At 440 nm, the agreement between the radiance distribution obtained from Hydrolight and the data is better at larger solar zenith angles, but at small solar zenith angles the experiments indicated that there were significant non-Lambertian effects over the seagrass surface, with a much higher reflectance at small nadir view angles.

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