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Under-water light regime and SPM: a multiple-grain size model and SmartBuoy observations

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Accurate representation of light attenuation by inorganic suspended particulate matter (SPM) is a major restriction in developing coupled physical-biogeochemical models that are used to model primary production in shelf seas. The main problem is the accurate calculation of SPM concentrations. A multiple-grainsize advection-diffusion method is presented, and results are compared to observations. The method was incorporated in the 1DV General Ocean Turbulence Model (GOTM), along with a method to calculate light-attenuation coefficients. A sediment pickup formulation was used, based on upward diffusion from a dynamic reference concentration near the sea bed that depends on local waves and currents. The sea bed is assumed to consist mainly of a coarse fraction with fixed proportions of finer fractions, and pickup is governed by the coarse fraction. Model results are compared with multi-year time series of surface-observations of SPM and light attenuation on 'SmartBuoy' at two sites on the UK shelf, showing good agreement for daily-averaged values. The method will be extended to include the biogeochemical model BFM, and will be extended to 3D in the near future.