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Kilometre- scale remote sensing of light attenuation and euphotic depths in an optically complex shelf sea.

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A combination of radiative transfer modelling and in situ measurements was used to assess the performance of remote sensing algorithms based on the Quasi-Analytical approach of Lee et al. (2005) in the Irish Sea. For modelled data generated using locally determined specific inherent optical properties and constituent concentrations, the absorption coefficient, a(λ), the backscattering coefficient bb(λ) and the attenuation coefficient for downward irradiance Kd(λ) in six wavebands between 412 nm and 667 nm were recovered with mean percentage errors below 3% and standard deviations of around 6%. When compared to in situ data, the algorithms tended to overestimate a(λ) and under estimate bb(λ), but the practical difficulty of measuring optical properties accurately in turbid waters appeared to be a contributing factor.Values of Kd(λ), however, were highly correlated with those measured in situ, with regression slopes in the best-performing bands of 1.05 at 442 nm (r2=0.91) and 0.92 at 488 nm (r2=0.96). A strong linear relationship (r2>0.95, mean relative difference 5.4%) was found between Kd(490) and the reciprocal of the depth of the midpoint of the euphotic zone (z10% PAR). This allowed euphotic depths to be predicted by remote sensing with an RMS error of 1.25 m over the 2.5–25.0 m range covered by our data set. Application of this approach to a decade of satellite data made it possible to observe dynamic changes in the optical characteristics of a complex shelf-sea region with spatial and temporal coverage that greatly exceeds that available from in situ observations, and to derive links between optical variability and mixing processes in the water column.