The improved representation of underwater radiances and its impact on simulated physics and biogeochemistry in the North Sea

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In the presented work we advanced our modelling of in-water optics on the North-West European (NWE) Shelf, with important implications for how we model stratification of the water column, primary productivity, and the underwater radiances. We implement a stand-alone bio-optical module into the existing coupled physical-biogeochemical model configuration. The advantage of the bio-optical module, when compared to the pre-existing light scheme is that it resolves the underwater irradiance spectrally and distinguishes between direct and diffuse downwelling streams. The changed underwater irradiance compares better with both satellite and in-situ observations. We show that both underwater irradiance and model biogeochemistry can be further improved by assimilating suitable ocean-color derived satellite products into the model. We use the light module to introduce feedback from biogeochemistry to physics and demonstrate that the two-way coupled model tends to outperform the one-way coupled model in both physics and biogeochemistry. We discuss the implications of our developments for future modelling of the NWE Shelf.