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Quantifying uncertainty in the ESA Ocean Colour – Climate Change Initiative dataset for assimilation of total chlorophyll and phytoplankton functional types

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Monitoring biogeochemistry in shelf seas is of great significance for the economy, ecosystems understanding and climate studies. Data assimilation can aid the realism of marine biogeochemistry models by incorporating information from observations. An important source of information about phytoplankton groups and total chlorophyll is available from the ESA OC-CCI (ocean colour - climate change initiative) dataset.

For any assimilation system to be successful it is important to accurately represent all sources of data uncertainty. For the ocean colour product, the propagation of errors throughout the ocean colour algorithm makes the characterisation of the uncertainty challenging. However, the problem can be simplified by assuming that the uncertainty is a function of optical water type (OWT), which characterises the water column of each observed pixel in terms of their reflectance properties.

Within this work we apply the well-known Desrozier et al. (2005) consistency diagnostics to the Met Office's NEMOVAR 3D-VAR DA system used to create daily biogeochemistry forecasts on the North-West European Shelf. The derived estimates of monthly ocean colour error covariances stratified by OWT are compared to previously derived estimates of the root mean square errors and biases using in-situ data match ups (Brewin et al. 2017). It is found that the agreement between the two estimates of the error variances have a strong seasonal and OWT dependence. The error correlations (which can only be estimated with the Desrozier's method) in some instances are found to be significant out to a few 100km particularly for more turbid waters during the spring bloom. The reliability and limitation of these two estimates of the ocean colour uncertainty are discussed along with the implications for the future assimilation of ocean colour products and for ecosystem and climate studies.