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Multi-scale synergy products for advanced coastal water quality monitoring: the Multi-Sync project.

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High-quality satellite-based ocean colour products can provide valuable support and insights in management and monitoring of coastal ecosystems. Today's availability of Earth Observation (EO) data is unprecedented including traditional medium resolution ocean colour systems (e.g. SeaWiFS, MODIS-AQUA, MERIS, Sentinel-3/OLCI), high resolution land sensors (e.g. Sentinel-2/MSI, Landsat-8/OLI, Pleiades) and geostationary satellites (e.g. SEVIRI). Each of these sensors offers specific advantages in terms of spatial, temporal or radiometric characteristics. The Multi-Sync project aims at performing the necessary research to develop advanced ocean colour products (i.e. remote sensing reflectance, turbidity, and chlorophyll a concentration) through synergetic use of multi-scale EO data taking advantage of spectral characteristics of traditional medium resolution sensors, the high spatial resolution of some land sensors and the high temporal resolution of geostationary sensors.

Among the activities being performed within the Multi-Sync project, we will present an analysis of 20 years of cloud-free chlorophyll-a daily data over the North Sea, calculated using DINEOF (Data Interpolating Empirical Orthogonal Functions) from SeaWiFS, MODIS-Aqua, MERIS and Sentinel-3/OLCI data. The main spatial and temporal modes of variability, as well as the interannual variability and trends in the total concentration of chlorophyll over the Belgian coastal zone, will be described.

As an example of use of Sentinel-2 data, a technique to detect and remove cloud shadows from high resolution satellite imagery over the Belgian coastal zone will be presented. The approach is based on DINEOF and provides a pixel-by-pixel outlier index based on the departure of each data point to a truncated EOF basis calculated by DINEOF. This approach proves efficient for very small shadows, such as those resulting from offshore wind farm turbines, and medium-sized shadows, such as those from cumulus clouds. Larger shadows, from stratus-type clouds, cover large domains and cannot be considered as outliers by the EOF index. In these cases, a multi-scale detection approach will be investigated to effectively remove them. The suggested approach does not depend on the satellite sensor used, and can also be used on land data.