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Seasonal and interannual variabilities of coccolithophore blooms in the Bay of Biscay and the Celtic Sea observed from a 18-year time-series of non-algal Suspended Particulate Matter images

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Coccolithophores belong to the nano-phytoplankton size-class and produce $CaCO_3$ scales called coccoliths which form the «shell» of the algae cell. Coccoliths are in the size range of a few μm and can also be detached from the cell in the water. This phytoplankton group has an ubiquitous distribution in all oceans but blooms only in some oceanic regions, like the North East Atlantic ocean and the South Western Atlantic (Patagonian Sea). At a global scale coccolithopore blooms are studied in regard of $CaCO_3$ production and three potential feedback on climate change: albedo modification by the way of dimethylsulfide (DMS) production and atmospheric CO_2 source by calcification and a CO_2 pump by photosynthesis. As the oceans are more and more acidified by anthropogenic CO_2 emissions, coccolithophores generally are expected to be negatively affected. However, recent studies have shown an increase in coccolithophore occurrence in the North Atlantic. A poleward expansion of the coccolithophore Emiliana Huxleyi has also been pointed out.

By using a simplified fuzzy method applied to a 18-year time series of SeaWiFS (1998-2002) and MODIS (2003-2015) spectral reflectance, we assessed the seasonal and inter-annual variability of coccolithophore blooms in the vicinity of the shelf break in the Bay of Biscay and the Celtic Sea After identification of the coccolith pixels by applying the fuzzy method, the abundance of coccoliths is assessed from a database of non-algal Suspended Particulate Matter (SPM). Although a regular pattern in the phenology of the blooms is observed, starting south in April in Biscay and moving northwards until July in Ireland, there is a high seasonal and interannual variability in the extent of the blooms. Year 2014 shows very low concentrations of detached coccoliths (twice less than average) from space and anomalies point out the maximum level in 2001. Non-algal SPM, derived from a procedure defined for the continental shelf, appears to be well related to the calcite concentration provided by NASA, and correlates better with coccolith than coccosphere in-situ data.