The potential use of geostationary MTG/FCI to retrieve Chlorophyll-a concentration at high temporal resolution for the open oceans

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In a few years, the Flexible Combined Imager (FCI) on-board Meteosat Third Generation (MTG) will provide images of European Seas, the Atlantic Ocean and the Mediterranean Sea every 2.5 minutes (regions above 30°N) or 10 minutes (full disk). Although dedicated to meteorological applications, this sensor has blue, green and red spectral bands allowing to consider the adaptation of a band-ratio algorithm to retrieve chlorophyll-a concentration (Chl-a). However, the radiometric specification of the FCI sensor is far from the minimum requirement recommended for ocean colour sensors and the validity of FCI data for oceanic applications is not clear. We try to determine if, and under which conditions, Chl-a could be estimated from FCI data. From the NOMAD in situ dataset, a blue green band-ratio algorithm adapted to FCI spectral characteristics is proposed. Then, the impact of FCI radiometric noise on Chl-a estimations is investigated in detail. Results show that noise-induced Chl-a error increases with Chl-a and solar zenith angle. For a Chl-a estimation based on a unique pixel, this error ranges between 20% and 100% which prevents any direct utilisation and suggests that it is necessary to degrade the spatio-temporal resolution to obtain an acceptable noise-related uncertainty on Chl-a. With a spatial (9 pixels) and temporal (1 hour) averaging process, Chl-a can be estimated with a noise-induced error less than 10% for Chl-a up to 5 mg m-3 and solar zenith angle lower than 60°. Our analysis also showed that the noise-related error associated to the atmospheric correction process can be neglected compared to the radiometric noise of the visible bands themselves if it is assumed that aerosol type is uniform over large areas (9kmx9km boxes).