

New technologies on the route to decode the optical signal of harmful phytoplankton species from lab to coastal waters

Accurate observations of phytoplankton are challenging in coastal areas, where the spatial and temporal variability of these microorganisms changes rapidly. Optical technology for phytoplankton detection, such as satellites, have been employed for decades (Moisan et al., 2017; Gernez et al., 2023). However, limitations related to spatial-temporal resolution, the number of spectral bands, satellite orbit cycles, or cloud cover at higher latitudes persist (Muller-Karger et al., 2018; Schaeffer and Myer, 2020).

In this work, we seek illustrate the great potential of hyperspectral technology and the usefulness of UAV systems in supporting and improving both satellite and in situ monitoring in complex coastal waters, such as the Patagonian fjords. Our results show that, despite limitations relate to technical aspects such as the battery life, or the size and high-cost of the camera, the hyperspectral technology is a promising option for phytoplankton and HAB monitoring in coastal areas with aquaculture activities, including fjords, bays and estuaries. The advantage observed of this technical approach are the high resolution (2.1 nm between 400-1000 nm) of the sensor, and low flight altitudes (< 100 m), which allows reflectance to be captured under cloud cover, and plot routes on demand. Furthermore, machine-learning algorithms could help to identify and differentiate phytoplankton blooms at a high spatial-temporal resolution, but also non-biological particles (suspended materials and sediment) and other water characteristics.

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