

Monitoring Spatial Distribution of Blue-Green Algae Blooms with Underwater Drones

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Abstract : Blue-green algae blooms (cyanobacteria) is currently a relevant ecological problem that is being addressed by most water authorities in the Netherlands. These can affect recreation areas by originating unpleasant smells and toxins that can poison humans and animals (e.g. fish, ducks, dogs). Contamination events usually take place during summer months, and their frequency is increasing with climate change. Traditional monitoring of this bacteria is expensive, labor-intensive and provides only limited (point sampling) information about the spatial distribution of algae concentrations. Recently, a novel handheld sensor allowed water authorities to quicken their algae surveying and alarm systems. This study converted the mentioned algae sensor into a mobile platform, by combining it with an underwater remotely operated vehicle (also equipped with other sensors and cameras). This provides a spatial visualization (mapping) of algae concentrations variations within the area covered with the drone, and also in depth. Measurements took place in different locations in the Netherlands: i) lake with thick silt layers at the bottom, very eutrophic former bottom of the sea and frequent / intense mowing regime; ii) outlet of waste water into large reservoir; iii) urban canal system. Results allowed to identify probable dominant causes of blooms (i), provide recommendations for the placement of an outlet, day-night differences in algae behavior (ii), or the highlight / pinpoint higher algae concentration areas (iii). Although further research is still needed to fully characterize these processes and to optimize the measuring tool (underwater drone developments / improvements), the method here presented can already provide valuable information about algae behavior and spatial / temporal variability and shows potential as an efficient monitoring system.

Keywords : blue-green algae, cyanobacteria, underwater drones / ROV / AUV, water quality monitoring

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