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Abstract

How Intelligent ASVs Can Help Us to Support Cyanobacteria Blooms Detection, Predictions, and Early Warning? †

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Abstract: The automation revolution provides access to robotized water-surface vehicles, which support behaviors of different autonomy and intelligence levels, ranging from those achieved by Remotely Piloted Surface Vehicle (RPSV) to those supported by Autonomous Surface Vehicles (ASVs) and Intelligent ASVs (IASVs). In short, the staff in charge of the RPSVs makes all the decisions and drives them from the shore, while ASVs and IASVs can take control of the situation and move themselves autonomously. Equipped with probes, all of them can be used to collect information about physical parameters and substances, and therefore to monitor water bodies where there is a high probability of Cyanobacteria Blooms (CBs). These vehicles are especially useful for this purpose, as CBs are dynamic biological processes that can occur inside many locations of the water body and become only visible when they emerge into the water surface. In addition, as they produce toxic metabolites that threaten the life of multiple species and limit the recreational use and human consumption of water, the authorities should anticipate their evolution or detect them as soon as possible to minimize the exposure of the population and animals to their harmful effects. Early warning systems in use today cannot capture the temporal-space evolution of CBs, because their fixed probes do not provide information from any Point of Interest (POI) of the water body. In addition, taking personnel to the POIs with boats is an expensive impractical solution to frequently monitor enough water-body locations in order to understand the current state of the CB. An alternative solution consists of: (1) frequently sending the ASVs on their own to any POI of the water body, (2) making them systematically explore Regions of Interest (ROIs), or (3) asking them to intelligently search for relevant information within the water body. In the third option, IASV displacements can adapt themselves to different circumstances, such as the information provided by simulators of the CBs evolution, by the IASVs onboard sensors, or by both. Finally, the diurnal vertical cyanobacteria displacements in the water column can be investigated by attaching the probe to an automatic winch that can also be remotely, automatically or intelligently controlled to be able to explore the water body in its third dimension. During this presentation we will discuss different possibilities that ASVs and IASVs can open in the field of cyanobacteria management.

Keywords: autonomous surface vehicles; artificial intelligence; modelling & simulations; early warning systems

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