

## Intelligent ASVs to explore water bodies and support HABs detection, prediction and early warning

José María Girón Sierra, Eva Besada-Portas, Juan Francisco Jiménez, José Luis Risco-Martin, José Antonio López-Orozco

*Universidad Complutense de Madrid, Ciudad Universitaria s/n 28040 Madrid, Spain.*

[gironsi@fis.ucm.es](mailto:gironsi@fis.ucm.es)

Harmful Algae Blooms (HABs) are dynamic biological processes that occur inside many water bodies and become visible as they expand into the water surface. They should be anticipated/detected as soon as possible, to warn the authorities about dangerous situations. Early warning systems in use today, are not enough to capture HAB temporal-space evolution, because their probes, placed at fixed locations, cannot provide the quantity and distributed data required to understand what is happening. Autonomous Surface Vehicles (ASVs, a kind of robotized boats) can be used instead as mobile sensor platforms to take measurements of the variables of interest at different locations and depths of the water body. Our research goes one step beyond and aims to develop an Artificial Intelligent aLERT (AILERT) system based on intelligent ASVs capable of deciding where and how to take measurements for building models that predict HABs evolution and alert the authorities about them. Our ASVs are equipped with on-board computers and software designed for mixed-initiative work, which lets human operators intervene when desired, while ASVs usually function autonomously as a fleet, performing coordinated exploration tasks supported by different principles. For instance, these tasks can be achieved from a systematic water covering/monitoring perspective, by pre-planning ASV and probe trajectories using the information provided by the simulations and/or the probability distribution of the HABs, or with data-driven controllers that adapt ASVs displacements to the information extracted in real-time from the measurements taken by on-board probes. During our presentation, we will provide an overall view of our system, with details of the already-developed elements.

