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## Development of a multimodal approach to monitoring of coastal waters

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The levels of monitoring quality and quantity for environmental factors present continuous challenges for engineers, scientists, and related decision-making bodies. This is particularly highlighted in complex ecosystems such as coastal areas and estuaries with the pronounced intersection of numerous natural gradients. On the other hand, constant technological advances of different measurement equipment, including the remotely operated vehicles and their modular design, are introducing vast opportunities for gathering various data. Furthermore, readily available open-source solutions for hardware and software domains present additional potential in developing the framework for multipurpose monitoring. We are developing a multimodal approach to monitoring coastal zones, particularly in estuarine waters, which comprises using commercially available measurement equipment (multisensory probes) and, more importantly, building task-oriented drifters with relevant sensors. Furthermore, we are implementing the usage of remotely operated vehicles, both areal and underwater, which present a suite of measurement devices for data amplification (metadata), collection, and verification, especially when coupled with satellite data. Moreover, the use of drones has additional value in reducing the disturbance of natural conditions and improving the safety of researchers. So far, the monitored data include conductivity, temperature, pressure, wave heights, water velocity, dissolved oxygen, chlorophyll, colored dissolved organic matter, turbidity, hyperspectral properties, and further research including thermal camera and LIDAR technology. Different measurement approaches also contain several issues such as temporal and spatial scale comparability and interoperability, while drone use implicates some concerns about privacy, noise, and the general social attitude. These issues are currently being investigated, generating some challenges for future progress. Through current multiple research projects, we are testing the presented multimodal approach on the case study of the river Jadro estuary near the city of Split (Croatia), aiming to develop a field laboratory with the potential to be replicated in any similar hydrological monitoring.