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Study of glaciers melting impacts on physical and biological processes through the application of cost-effective technology in the Kongsfjorden (Svalbard).

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The Arctic region is greatly affected by climate change, with evident alterations in both physical and biological processes: temperatures are changing at a rate that is twice the global average and phytoplankton productivity is directly affected by ice melting. The continuous monitoring of this ecosystem is fundamental to understand the impact of changes on the natural environment, but the Global Ocean Observing System has a lack of coverage in these extreme areas, which are particularly difficult to reach. Technological progresses in oceanographic measurement capabilities are indispensable for the implementation of marine observatories, especially in these remote regions. In this context in the last years autonomous systems and cost-effective technologies have proved to be valuable tools for increasing the spatial and temporal coverage of data. In particular the innovative ArLoC (Artic Low-Cost) probe was designed and developed to be easily integrated into various types of platforms, enabling continuous measurement of temperature, pressure and fluorescence of chlorophyll a. This work reports the results of two scientific campaigns carried out in the Kongsfjorden (Svalbard Islands) in 2017 and 2018 in the framework of the UVASS (Unmanned Vehicles for Autonomous Sensing and Sampling) research project. The ArLoC probe was integrated onboard the PROTEUS (Portable RObotic TEchnology for Unmanned Surveys) unmanned semi-submersible vehicle which allowed to collect important data in the stretches of sea near the glacier fronts. The acquired data showed some fundamental effects of glacier melting such as: extreme temperature and salinity gradients that cause a strong variation on water masses stratification; increasing of turbidity and chlorophyll a concentrations that directly affects the primary productivity and the trophic chain. During the surveys ArLoC demonstrated to be an easily integrable and very reliable instrument that permitted to investigate, at high spatial resolution, ecological processes during glaciers melting as never studied before.