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SEMI-AUTOMATED, PULSE-SHAPE SCANNING FLOW CYTOMETRY FOR THE MONITORING OF PHYTOPLANKTON AT FINE SPATIO-TEMPORAL SCALES

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The ecology of phytoplankton remains elusive at the finest scales (hourly to daily variations), due to technical limitations. Our understanding of its dynamics is limited to broad spatio-temporal definitions. Because phytoplankton is significantly involved in CO_2 uptake, this lack of understanding increases greatly the uncertainty of biogeochemical models. Quasi-continuous sampling of the whole phytoplankton community along the track of a ship, or from a fixed platform, has become possible with the advent of the semi-automated pulse-shape recording flow cytometers CytoSense (Cytobuoy B.V., the Netherlands). This instrument is specialized for the study of phytoplankton cells and its large dynamical size range (1 µm to 1 mm) opens to the possibility of describing phytoplankton dynamics at an unprecedented resolution in terms of optically-defined functional groups. Two high-frequency phytoplankton data sets generated with a CytoSense will be presented, in different contexts. The first data set has been generated during a 2-days long sampling, with a frequency of 10 minutes, from the Acqua Alta oceanographic platform located 8 miles from Venice in the Northern Adriatic Sea. Few changes were observed at the community level, but a significant variability of optical parameters was observed depending on the light field and the vertical movements of the water masses, also dependent upon the tide. The second dataset has been generated during an oceanographic cruise from the Azores to Sicily, sampling every 4 minutes while the ship was cruising through different water masses. Phytoplankton patchiness was observed down to the sub-mesoscale. Significant differences in phytoplankton functional group assemblages were assessed, dependent on the physico-chemical characteristics of the water masses crossed during the track. High-frequency sampling helps to understand phytoplankton ecology at a finer scale than before, highlighting changes occurring at different time and space scales in terms of functional traits (fluorescence, size of cells) and population dynamics. The large data sets generated will need powerful statistical analyses to fully appreciate the large optical diversity present in phytoplankton and to relate it reliably to environmental parameters.