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In situ sampling in coastal waters – in search for an adequate spatial resolution for chlorophyll monitoring

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Shallow coastal archipelagos give rise to highly dynamic water quality patterns. In situ sampling inevitably loses detail of this spatio-temporal variation, regardless of the spatial and temporal resolution of the monitoring. In the shallow coastal areas of SW Finland in the Baltic Sea, the spatio-temporal variation of water properties is especially high due to the complexity of the archipelago environment and its bathymetry. Water quality monitoring is traditionally carried out in situ on a point network with 5-20 km distance between the sampling stations. Also the temporal coverage is irregular and often focused to the high summer (late July to early August) to capture the highest algal occurrences resulting from eutrophication. The amount of phytoplankton may have irregular vertical variation caused by local prevailing conditions, and therefore the biomass within the productive layer is usually measured by the amount of chlorophyll as a collective sample of the single vertical profile per station. However, the amount of phytoplankton varies also horizontally over short distances in the coastal water that may be homogenous in temperature and salinity. We tested the representativeness of the traditional single sampling station method by expanding the measurement station into six parallel sampling points within a 0.25 km2 area around the station. We measured the chlorophyll content in depth profiles from 1 m to 10 m depth using an optical water quality sonde. This sampling scheme provides us with a better understanding of the occurrence and distribution of phytoplankton in the water mass. The data include three six-point stations in different parts of the coastal archipelago. All stations were sampled several times during the growing season of 2007. In this paper, we compare the results of the established one-point collective depth sampling with the locally extended sampling scheme that portrays also the small-scale horizontal variation of phytoplankton. We calculate the overall chlorophyll content of the surface layer as a volume instead of one depth profile. Based on the results, we discuss the representativeness of the current chlorophyll sampling in the estimation of phytoplankton biomass in coastal waters, and the implications to future in situ monitoring programs.