Introduction

Measuring primary production (PP) in large lakes can be a challenge due to heterogeneities both vertically and temporally. Over the past 20 years, light attenuation, a key process to infer PP, has been measured in Lake Geneva (Switzerland) by the Lake Lenses project (www.meteolakes.ch) to upscale primary production estimates from local to basin scales. In spring 2018, we collected more than 1000 profiles between October 2018 and April 2020, over contrasted properties and the oxygen budgets (not shown here), opening up the door to a better scale-up from local to basin.

Methods

We first performed a POCO-IPAB modeling framework (POCO-IPAB, 2011, 2016) over the thermocline (Figure A), compared to a 3D-synthetic dataset (Figure B). The model was designed and parameterized over the top 50 m of the water column. We then upscaled light attenuation (aLH676 = data not shown here) and particulate backscattering (b700 = data not shown here) over the long-term, with a low resolution spatially (1 km) and temporally (bi-monthly) and a high resolution vertically (0.1 m).

Results and Discussion

509 profiles collected more than 1000 profiles between October 2018 and April 2020, were studied to investigate vertical and temporal heterogeneities. We looked into spatiotemporal heterogeneities of a set of physical, optical and biological variables: water optical properties as a result of seasonal and short-term (weekly to sub-daily) physical processes. The classical sampling method involving radiolabelled carbon incubated in bottles at 700 nm is a good proxy for all species of phytoplankton over day/night (Figure C).

Figure D shows the relationship resulted from a direct link between phytoplankton biomass and spectral attenuation slope Sk, which can be seen as a proxy for chlorophyll-a concentration, aLH676, and SBE49 Triplet. Over longer timescales, this linear relationship resulted from a direct link between phytoplankton biomass and spectral attenuation slope Sk, which can be seen as a proxy for chlorophyll-a concentration, aLH676, and SBE49 Triplet. Over longer timescales, this linear relationship resulted from a direct link between phytoplankton biomass and spectral attenuation slope Sk, which can be seen as a proxy for chlorophyll-a concentration, aLH676, and SBE49 Triplet. Over longer timescales, this linear relationship resulted from a direct link between phytoplankton biomass and spectral attenuation slope Sk, which can be seen as a proxy for chlorophyll-a concentration, aLH676, and SBE49 Triplet.