

OCEAN OPTICS XXIV

Valamar Lacroma Dubrovnik Hotel | Dubrovnik, Croatia | October 7–12, 2018

<https://oceanopticsconference.org>

Wednesday, October 10

Poster Session 3

16:00–18:00

Poster 95

RADIATIVE TRANSFER SIMULATIONS BRING TO LIGHT SPECTRAL NICHES FOR CYANOBACTERIA

The radiation field incident on the water surface offers a continuum of colors that could be exploited by aquatic phototrophs. However, with increasing depth the incident radiation field weakens in an exponential fashion. The inherent optical properties of water and dissolved and particulate substances within the water column impose a wavelength depended attenuation. Based on HydroLight modelling we demonstrate that the molecular characteristics of pure water have a clear effect on the photosynthetic energy availability near the euphotic depth. The resonance structure of water molecules shows as enhanced areas of absorption in the visible part of the spectrum. These so called vibrational stretching modes of the water molecule are referred to as the 7th, 6th and 5th harmonics and can be identified at 449, 514 and 605 nm respectively. In addition, vibrational transitions modes can be discerned at 550 and 605nm which are known as the 5.1st and 6.1st subharmonics. The (sub)harmonics constrain the energy availability of phytoplankton growth and we argue that cyanobacteria that harbor phycobilin-pigments are optimally tuned to the prevailing light conditions. The absorption peaks of phycobilin-pigments bridge that gaps between the absorption peaks of chlorophyll-a and we show that they conveniently occupy the spectral niches that are demarcated by the (sub)harmonics of the water molecule.

Tadzio Holtrop, IVM, VU University, Amsterdam, tadzio.holtrop@vu.nl, <https://orcid.org/0000-0002-8607-7345>

Hendrik Jan van der Woerd, IVM, VU University, h.j.vander.woerd@vu.nl

Jef Huisman, University of Amsterdam, J.Huisman@uva.nl