Ultraviolet radiation and copepod pigments: a seasonal approach

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Scope

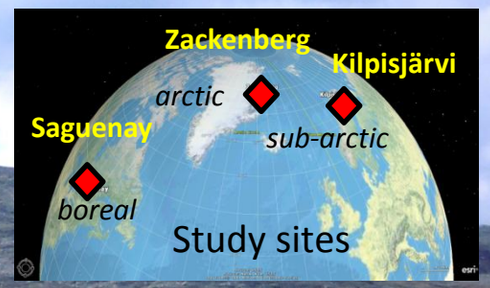
One open question regarding the long ice-covered period in high-latitude freshwater ecosystems is why some copepods show high concentrations of photo-protective compounds in absence of light.

In this study, we compare seasonal patterns of copepod pigmentation in respect to UV exposure and C-DOM properties among arctic, subarctic and boreal water bodies.

Eudiaptomus laciniatus

PUV-2500 profiler radiometer

Lac Simoncouche, Québec



UV and C-DOM Glossary

- UVR = ultraviolet radiation (200–400 nm)
  UV-A: 320–400 nm, UV-B: 280–320 nm, UV-C < 280 nm
- K_d = diffuse attenuation coefficient
- C-DOM = chromophoric dissolved organic matter, simply the coloration of water.

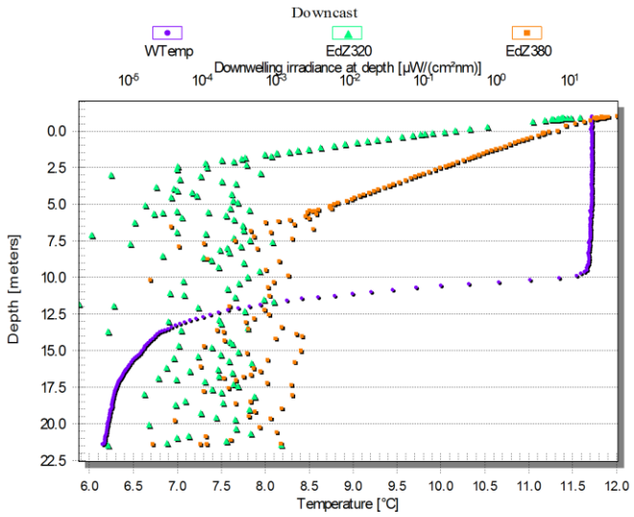
Saanajärvi, NW Finland

Background:

Method

UVR attenuation

- in-situ UVR measurement with submersible profiler radiometer (PUV-2500)
- Calculation of attenuation coefficients from slope of UV intensity vs. depth



UV attenuation and temperature profile on 10 August in Lake Saanajärvi (NW Finland – see background)

Carotenoids – photoprotective compounds?

Carotenoids reduce oxidative stress via quenching of reactive oxygen species (ROS) produced during UVR exposure. As carotenoids must be accumulated from primary producers (phytoplankton), their availability in the diet may limit (or enhance) copepod pigmentation. However, observation of intensely pigmented copepods during polar winter suggests a more complex functioning.

Carotenoids could be coupled with storage lipids to prevent oxidation of fatty acids. Alternatively, copepods might pass lipids and carotenoids on to their eggs to provide early larval stages with energy and photo-protection.

Ultraviolet radiation and C-DOM

UV intensity in the water depends on:

(1) how much UVR reaches the Earth's surface (can be calculated when we know location, time, an d weather)

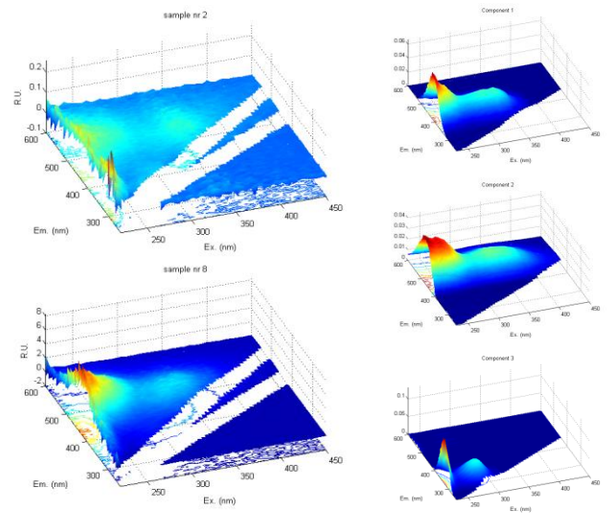
(2) attenuation of UVR in the water column by particles (–> scattering) and dissolved compounds (–> absorption)

C-DOM (colored dissolved organic matter) is a major factor for the optical environment in lakes. Understanding the composition of the C-DOM may allow us to better model UV exposure of planktonic organisms.

Method

C-DOM components

- 3D fluorescence scans of filtrated lake water –> excitation-emission matrices (EEMs)
- Rund parallel factor analysis (PARAFAC) on large number of samples



Left: EEMs of two C-DOM samples from NW Finland; Right: fluorescence components obtained by PARAFAC analysis of 16 samples.