

Project acronym: ROSSA

Project title: Reactive Oxygen Species as a Stressor in the Arctic

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Discipline: Earth Sciences & Environment

Station(s): GINR

The study was conducted in Kobbefjord (GINR field site) to collect freshwater samples from a broad range of environments (pro-glacial streams, lakes, meltwater, snow, rain and ponds) in order to investigate the range of reactive oxygen species concentrations and the response of biological community to perturbations in H₂O₂. H₂O₂ concentrations were determined at the field-station and a short term incubation was conducted to investigate the response of biota to H₂O₂ additions. Complimentary chemical samples were preserved and shipped back to GEOMAR for analysis.

The overall goal was to investigate the two-way interaction between H₂O₂ and microbial functioning. H₂O₂ may both cause community structure changes through its role as a stressor, and also through its accelerating effect on DOC degradation. The net effect may vary between micro-environments however as in some environments complex interactions between trophic levels regulate extracellular H₂O₂ concentrations- for example in seawater bacteria appear to be a strong H₂O₂ sink, whereas most phytoplankton are a net source, and some 'helper' bacteria facilitate the growth of organisms with no known capacity to enzymatically destroy H₂O₂.

A total of 140 samples at different locations around the catchment were collected and analysed. H₂O₂ ranged from below detection (in cold meltwater streams) to micromolar concentrations in rainwater and rain-filled ponds. A short-term incubation experiment, where nutrients (N/P) were added to lake water showed a reduced change in chlorophyll a concentrations when high concentrations of H₂O₂ (comparable to those experienced after heavy rainfall) were added to lake/meltwater.

The results tentatively support the hypothesis that H₂O₂, or potentially other ROS, exert a direct influence on primary production in these freshwater, high-latitude environments. The underlying cause is yet to be confirmed. In marine environments the negative effect of H₂O₂ is thought to relate to its negative effect on the bioavailability of Fe, yet Greenlandic catchments have generally high Fe concentrations. It could be the case that the majority of this Fe has relatively low bioavailability, or possibly the negative effect of H₂O₂ here is different.