Interactive effects of temperature and light during deep convection: a case study on growth and condition of the diatom Thalassiosira weissflogii - DTU Orbit (09/11/2017)

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Aim of this study was to expose phytoplankton to growth conditions simulating deep winter convection in the North Atlantic and thereby to assess
changes in physiology enabling their survival. Growth rate, biochemical composition, and photosynthetic activity of the diatom Thalassiosiraweissflogii
were determined under two different light scenarios over a temperature range of 5–158C to simulate conditions experienced by cells during winter deep convection. These metrics were examined under a low light scenario (20 mmol m22 s21, 12/12 h light/dark), and compared with a scenario of short light pulses of a higher light intensity (120 mmol m22 s21, 2/22 hlight/dark). Both experimental light conditions offered the same daily light dose. No growth was observed at temperatures below 88C. Above 88C, growth rates were significantly higher under low light conditions compared with those of short pulsed light exposures, indicating a higher efficiency of light utilization. This could be related to (i) a higher content of Chl a per cell in the lowlight trial and/or (ii) a more efficient transfer of light energy into growth as indicated by constantly low carbohydrate levels.In contrast, pulsed intense light led to an accumulation of carbohydrates, which were catabolized during the longer dark period for maintaining metabolism. Light curves measured via Chl a fluorescence indicated low light assimilation for the algae exposed to short pulsed light. Wepostulate
that our trial with short light pluses did not provide sufficient light to reach full light saturation. In general, photosynthesis was more strongly affected by temperature under pulsed light than under low light conditions. Our results indicate that model estimates of primary production in relation to deep convection, which are based on average low light conditions, not considering vertical transportation of algae will lead to an overestimation of in situ primary production.

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