Ocean acidification as one of multiple stressors: Response of *Thalassiosira weissflogii* (diatom)

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Abstract

The increase in partial pressure of CO_2 (pCO_2) is causing ocean acidification, which impacts the growth rates and elemental composition of phytoplankton. Here, shifts in growth rates and cell quotas of *Thalassiosira weissflogii* grown under a variety of different temperatures, irradiances, and pCO_2 conditions are discussed. The presented data suggest that acclimatization times of exponentially growing diatoms to environmental perturbations may be weeks to months, rather than days to weeks. The response of acclimatized *T. weissflogii* to pCO_2 depended on irradiance and temperature and was highly interactive, non-linear, and non-uniform. A very significant negative effect of pCO_2 was observed under growth conditions that were light-, and temperature-limited; a smaller, but still significant negative response was seen under light-limiting growth conditions, whereas pCO_2 did not affect growth rates of *T. weissflogii* under light-saturated growth conditions. Cell quotas of organic carbon, nitrogen, or chlorophyll *a* were linked to growth rate. The cell-normalized production of transparent exopolymer particles (TEP) was positively correlated with POC cell quotas, with some minor impact of irradiance and pCO_2 on the relationship. This correlation of TEP production with carbon cell quotas is consistent with the hypothesis that extracellular release is an inherent component of cell metabolism. Results suggest that elevated pCO_2 functions as an (additional) metabolic stressor for *T. weissflogii* and that the interaction of different stressors determines growth rates and cell characteristics in a complex, non-linear relationship.