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Evaluating cell size dependent nutrient uptake and exudation - a first approach and its results

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Observations and model studies suggest that parameters that regulate phytoplankton growth vary in space and time, reflecting changes in either functional types, or size classes, or both.

To include this variability in biogeochemical models we can either increase the explicit model resolution with respect to the components it is meant to represent, or we can try to improve the model with respect to its implicit parameterization of autotroph processes. The latter method has the advantage that it does not much increase the computational demand of the model, and that it does not require a huge and diverse data base to calibrate the model and thereby constrain its often poorly known ecological parameters.

We have extended a one dimensional NPZD model by an implicit representation of phytoplankton size distribution, and investigated its interplay with possible size dependent processes such as nutrient uptake and exudation, which were derived from theoretical considerations. Running the model at various oceanic locations, we find that growth of small cells is favoured by oligotrophic, well-lit regimes, whereas large cells dominate the high-latitudes and deeper layers. Future important extensions include size dependent grazing of zooplankton and the direction and magnitude of other loss terms.