Geophysical Research Abstracts
Vol. 13, EGU2011-13065, 2011
EGU General Assembly 2011

Effect of temperature and light intensity on diatoms growth rate: impact on biogeochemical cycles

Sophie Chollet, Erik Buitenhuis, and Corinne Le Quere
University of East Anglia, School of Environmental Sciences, Norwich, United Kingdom (s.chollet@uea.ac.uk)

Understanding the effects of climate change on marine ecosystems is one of the biggest current issues for ecologists. Modelling plankton abundance and its diversity, coupled with physical processes and environmental conditions is an important tool to predict the effect of climate change on the planktonic communities and on biogeochemical cycles.

Our model includes several plankton functional types (PFTs), including diatoms which play a major role and dominate the export of carbon. Phytoplankton distribution and abundance are closely linked with environmental conditions such as temperature, irradiance and nutrients concentration. To improve the model, we tested first the dependence of diatoms growth rate to the temperature. Literature suggests that the increase of phytoplankton growth rate with the temperature is either linear or exponential. A database of diatoms maximum growth rates as a function of temperature (500 data, representing 63 species) was compiled from the published literature. Linear, exponential and optimal functions were fitted to the data. Statistical analyses show the exponential relation best fits to the data.

Then we improved the relation of diatoms growth rate with the light intensity. Our photosynthesis model is based on three parameters: the initial slope of the Photosynthesis versus Irradiance (PI) curve, the maximum rate of photosynthesis and the Chlorophyll: Carbon ratio. In an attempt to best represent the diatoms photosynthesis, laboratory experiments were carried out on different species (2 polar species, 2 from temperate waters and 2 from warm waters). Sub-cultures of each of them were grown at different light intensities. Oxygen production was measured with an Oxygraph (Hansatech) to build PI curves. Parameters extracted from those experiments were implemented into the model. Comparison of the model outcomes using different growth parameters shows the importance of experimentally validating the model parameters.