A mathematical model of an *Emiliania huxleyi* coccolithophore bloom in a mesocosm experiment

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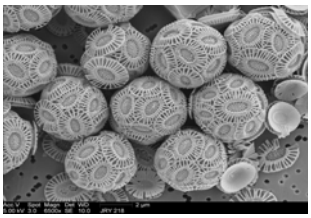
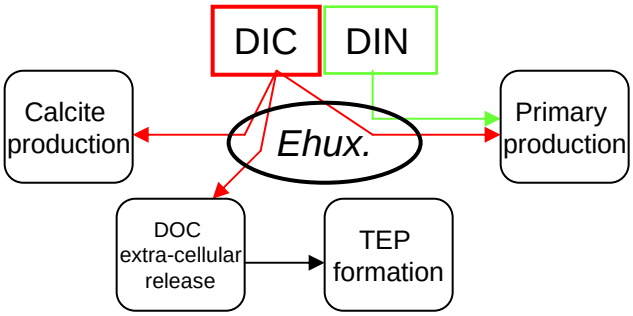


Introduction

A dynamic model has been developped to represent a bloom of the coccolithophore *Emiliania huxleyi* induced in a mesocosm experiment. This algal is characterised by its intense blooming capacity as well as the production of calcite and TEP. These features make coccolithophores one of the major actors involved in the oceanic carbon export.

Material and method

The mesocosm experiment conducted in Bergen 2001 studied the impact of varying pCO_2 on algal calcification and primary production. A complete data set was prodived over the 23-day monitored period. The present model has been calibrated to represent *Emiliania huxleyi* bloom for the present day pCO_2 treatment (410 µatm).

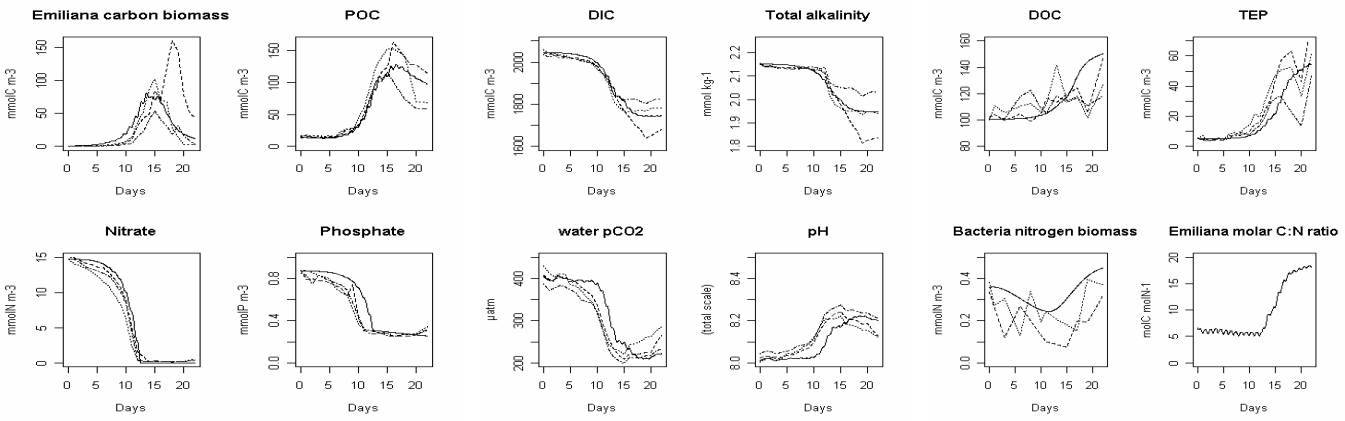


Features of model

Zero dimensional model involving 26 state variables. Description of Carbon, Nitrogen and Phosphorous cyclings through *Emiliania huxleyi* biomass and the microbial loop. Unbalanced model for algal growth : DIN and DIC uptakes are decoupled. Balanced model for bacterial growth. DIC and total alkalinity are explicitly represented. Calcification rate based on biomass and primary production. TEP production is controlled by DOC extra-cellular release. Cellular mortality involves impact on algal bloom due to viral lysis occuring in confined environments.

Results

Simulation over the 23-days duration of the mesocosm experiment. Continuous line is model. Dotted, dashed, dotted-dashed lines are measurements from the three replicates submitted to actual pCO_2 treatment.



Conclusions of the modelling study

1. Convenience of the unbalanced growth to represent *Emiliania huxleyi* bloom.
2. Fine representation of TEP formation via the DOC extra-cellular release.
3. Representation of calcification is improved when rate is based on cellular biomass and primary production.
4. Virus-cells interaction has to be considered in case of applications in confined environments.
5. An explicit representation of the attached and detached calcite pools is not necessary if the model is applied in environments where calcite does not dissolve.

Acknowledgments

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