Introduction

The Deep Chlorophyll Maximum (DCM) is the formation of a sub-surface chlorophyll-a peak.

A DCM was observed in Onondaga Lake from May 16th till June 9th 2010.

The DCM is most commonly observed in stratified, oligotrophic systems.

Manifestation of the DCM in Onondaga Lake may be an indication of a shift in trophic state.

Research on the DCM in Lake Superior can enhance our understanding of its dynamics in Onondaga Lake and the possible reasons for its formation.

Mechanisms and Parameters

What parameters and mechanisms drive formation of the DCM? Is it:

• Growth f(I,N,T)
  Algal growth is a function of light, temperature and nutrients.

• Settling f(d, ρ, μ)
  Settling is a function of the viscosity of the water and the size and density of the cell in relation to the density of the water. Stokes law results in a depth differentiated settling velocity caused by stratification of the water column.

• Reduced losses f(T, Gz)
  Algal loss is a function of a temperature dependent respiration rate and zooplankton grazing.

• Photo adaptation f(I,N,T)
  Algae form additional chlorophyll to compensate for diminished photo-synthetically active radiation (PAR), reaching a maximum near the compensation point and decay at depth.

Modeling the Mechanisms

Modeling is used to evaluate the impact of each mechanism on DCM formation.

Observations

Which mechanisms seem dominant?

Algal growth at the DCM depth is marginal due to low temperature and lack of PAR.

Model simulation indicates that density/viscosity mediation of settling can yield sub-surface biomass peaks.

Modeling shows that DCM is not sensitive to grazing and respiration.

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Contact information

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References available upon request.

Acknowledgements

Onondaga Lake data provided by UFI.

Onondaga Lake data visualization by Tom Auer.

Integrating the Mechanisms

The model predicts formation of a sub-surface peak in carbon (biomass).

Conclusion

Although settling contributes to the formation of a sub-surface chlorophyll maxima the dominant mechanism in DCM formation appears to be photo-adaptation.

The model predicts a subsurface chlorophyll maximum due to photo-adaptation.