



Feedbacks of phytoplankton surface mats on ocean physics

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The effects of phytoplankton on ocean physics through the feedback by light absorption have been investigated repeatedly. In contrast, additional feedback mechanisms involving positively buoyant phytoplankton have been largely ignored. However, extensive surface mats of buoyant cyanobacteria, as they occur regularly in the Baltic Sea in summer, may have significant effects on wind drag and albedo. Using an ecosystem model that is embedded in a water column or an ocean circulation model, we study the relative importance of all three feedback mechanisms. We show that surface floating cyanobacteria substantially alter their environment. The light absorption and wind drag feedbacks, however, are stronger than the albedo feedback. Overall, we find that the increase of sea surface temperatures and cooling subsurface mediated by cyanobacteria also modify ocean circulation patterns. Since the abundance of surface floating cyanobacteria is expected to increase in future, we recommend to include these biological-physical feedback mechanisms in the next generation of ocean climate models.