Title

Seasonal and long-term phytoplankton trait dynamics during trophic change and a regime shift in phytoplankton biomass

TraitShift

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Summary

The project combines data analysis and data based modeling to study the implications of seasonal and long-term changes in community traits for the productivity of phytoplankton and the performance of the dominant grazers. Based on over 40 years of data from Lake Constance, we investigate how the traits of the phytoplankton community change seasonally and with trophic change. We use statistical models to relate community traits and traits of functional groups to environmental conditions and analyze the temporal changes in the statistical distributions of the traits. Particular focus is on the regime shift in phytoplankton biomass that occurred in response to trophic change in Lake Constance (Jochimsen et al. 2013). We will investigate the role of trait dynamics for the occurrence of the regime shift, and examine moments of the trait distribution before, during and after the regime shift. The statistical analysis of the changes in the traits of the phytoplankton community is complemented by numerical modeling of the phytoplankton community comparing model approaches that consider functional groups with time constant traits and model approaches using aggregated functional groups with time varying traits determined from data. With the modeling we test whether the mechanistic connection between the traits of the functional groups and environmental conditions results in the observed biomasses and assess the potential of aggregation of functional groups with time varying traits to describe the seasonal development of phytoplankton community dynamics at different trophic states in the same system. Further, the models are vertically resolved and thus provide insights into the vertical distribution of the community traits. The modeling profits from the excellent data set from Lake Constance that allows taking most of the forcing factors directly from the data thus reducing the number of state variables. Numerical experiments will be performed to investigate how changes in community traits at different trophic states affect the performance of phytoplankton and grazers and whether the compensatory dynamics during trophic change in Lake Constance can be explained by changes in the community traits.