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Hydrological variables play a remarkable role in temporal dynamics of daily sampled diatom community in a German lowland river

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Temporal dynamics of diatom community with relation to abiotic factors is an important part of water quality monitoring and water resource management. However, the contribution of hydrological variables to temporal diatom variation has been rarely reported, especially at a short-interval sampling scale. Based on daily riverine diatom samples over a 1-year period (25 April 2013 – 30 April 2014) at the outlet of a German lowland river, we aimed to examine the temporal variation patterns of diatom community and to compare the relative importance between chemical and hydrological variables of affecting the temporal diatom community variation.
Among the 339 samples, a total of 113 diatom taxa from 45 genera were identified. Sampling dates with similar species composition and structure were classified into five clusters by a Kohonen Self-Organizing Map (SOM) method within Matlab software. These five groups were distinct with respect to species composition, density, richness, and indicator species, as well as environmental variables. Redundancy analysis (RDA) and variance partitioning techniques were used to explain the relationships between environmental variables and diatom community dynamics. For the whole dataset, chemical and hydrological variables could jointly explain 50.17% of the diatom community variation including chemical variables with 36.45% and hydrological variables with 12.89%. The most important chemical variables were Phosphate-Phosphorus (PO4-P) and Silicon (Si) concentrations, while the most significant hydrological variable was antecedent precipitation index (API), indicating the importance of nutrient and hydrological factor in shaping diatom structure. In general, the relative importance of chemical and hydrological factors to diatom communities varied among seasons (or SOM clusters). Partial RDAs revealed that 3.60%, 11.96%, 7.10%, 10.4% and 7.11% of diatom variation can be explained by hydrological variables from cluster 1 to 5, while 52.71%, 47.35%, 8.2%, 19.92% and 23.21% by chemical variables.
We conclude that although chemical variables contributed a larger proportion to diatom variations, hydrological variables showed remarkable effects on the temporal diatom community variation, especially during wet condition (e.g., cluster 3 and 4: 08.2013-01.2014). A key implication of our findings for freshwater management is that future bio-monitoring protocols should take hydrological variables into consideration. Furthermore, this study included only very local scale variables, and impacts from the catchment scale were missing. Therefore the further research may go to investigate the hydrological impact from a larger scale.

Key words: temporal dynamics, diatom community, hydrological variables, chemical variables, Redundancy analysis (RDA)