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# Cyanobacterial Bloom Detection based on Coherence between Ferrybox Observations

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**Abstract**

Cyanobacterial bloom detection from flow-through optical sensors on ships-of-opportunity ('ferryboxes') is challenging in periods of strong stratification and due to varying cell physiology and phytoplankton community composition. Wavelet coherence analysis between ferrybox parameters (chlorophyll-*a* fluorescence, phycocyanin fluorescence, turbidity) was used to delineate blooms in a dataset of ten ferrybox transects, recorded during the 2005 cyanobacterial bloom season in the Baltic Sea. Independent wind speed and sea-surface temperature data were used to classify areas of cyanobacterial dominance as mixed, stratified, or surfacing bloom. These classified subsets of ferrybox observations were compared against remotely sensed chlorophyll-*a* concentrations, which resulted in a scheme for the interpretation of surface water phytoplankton biomass from multi-source observations.

Ferrybox optical signals were significantly coherent from the onset until the end of the cyanobacterial bloom period under both stratified and mixed conditions. This suggests that the coherence analysis is sensitive to high-level community composition. Strongly stratified and suspected surfacing bloom was associated with unrealistically high remotely sensed chlorophyll-*a* estimates, indicating the need to flag stratified bloom areas when interpreting remote sensing imagery. The ferrybox fluorescence and turbidity signals at the 5-m sampling depth were, paradoxically, low under these conditions, suggesting that direct comparison between remote sensing and flow-through observations is not useful for stratified blooms. Correlations between ferrybox measurements and remotely sensed observations improved consistently when stratified or surfacing cyanobacterial bloom was excluded from the

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