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HIGH RESOLUTION INTEGRATED LAKE MONITORING: FROM PHYSICS TO FISH

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ABSTRACT

Numerous lakes around the world have been monitored manually for many years. However, the staffing resources required for such monitoring restrict its spatial and temporal extents to typically single locations within each lake and low frequencies. Such restrictions greatly limit scientific understanding and ultimately management. Recent developments in hydroacoustics, sensor technology and cloud computing offer step changes in the spatial and temporal resolution of lake monitoring. Here we review two new such approaches to lake monitoring: a hydroacoustics system including an automated mapping of lake bathymetry, bottom types, macrophytes and potentially fish (BioBase) and a multi-sensor remote profiler system facilitating the high frequency measurement of water quality. BioBase uses inexpensive consumer hydroacoustic hardware, suited to deployment through Citizen Science, to collect hydroacoustic data which are then analysed by simple uploading of data to central servers. Although originally conceived as a bathymetry and macrophytes surveying system (Valley et al., 2015), the analytical capabilities of BioBase have now been extended to include bottom typing with applications such as studies of the spawning grounds of lithophilic fish species (Winfield et al., in press). Advances in instrumentation are now also permitting high resolution in situ monitoring of meteorological measurements and in-lake temperature profiles to be supplemented with profiles of biological and chemical parameters. Furthermore, ongoing software development (e.g. Read et al., 2011) is enabling the fast collation and processing of data, paving the way for the production of management tools including real-time forecasting of algal blooms. We illustrate this development with examples including a forecasting technique using a combination of real-time data and the lake phytoplankton model PROTECH (Reynolds et al., 2001). Finally, we briefly discuss the future potential for combining hydroacoustic and high resolution profile data to facilitate the real-time study and management of abiotic and biotic features of lakes.

References

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