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Remote Sensing of Phytoplankton in Case II Waters Using Optically Active Pigments, Chlorophyll *a* and Phycocyanin

Nuisance blue-green algal blooms occur seasonally in the Indianapolis drinking water reservoirs. These blooms can lead to aesthetic degradation and can potentially produce toxins. Current methods for detecting blooms are costly and time consuming, delaying management decisions. Remote sensing techniques which utilize the optical properties of blue-green algal pigments (chlorophyll *a* and phycocyanin) can provide rapid detection of blue-green algal distribution. On September 6, 2005 a calibration dataset of *in-situ* field reflectance spectra were collected at 87 sampling sites on the reservoirs using ASD Fieldspec (UV/VNIR) and Ocean Optics USB2000 (V/NIR) spectroradiometers. A validation dataset consisting of 60 samples was collected on five dates throughout the 2006 growing season across varying water conditions. Groundtruth samples were analyzed for Chlorophyll *a*, phycocyanin, TSS, and other water quality constituents. *In-vitro* chlorophyll a and phycocyanin concentrations were measured flourometrically and spanned a range of 20 to 120 ppb and 2 to 150 ppb, respectively. Algorithms by Gitelson *et al.* (1986, 1994), Mittenzwey (1991), Dekker (1993), Schalles *et al.* (1998), and Simis *et al.* (2005) and Dall'Olmo and Gitelson (2006) were applied to field spectra to predict pigment concentrations. Algorithm accuracy was tested through a least squares regression and residual analysis. Algorithm prediction of chlorophyll *a* within the range of 20 to 150 ppb, yielded coefficients of determination as high as 0.92, RMSE 8.85 ppb, for Morse Reservoir (n=24, p<0.001) and 0.54, RMSE 17.59 ppb for Geist (n=27, p<0.001). Algorithm application for estimation of phycocyanin concentrations for Morse and Geist reservoirs resulted in r^2 values of 0.92, RMSE 13.55 ppb, (n=25, p<0.001) and 0.80 (n=25, p<0.001), RMSE 18.64 ppb, respectively.