Satellite Derived Primary Productivity Estimates for Lake Michigan

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A new Case II water color satellite algorithm to estimate primary production (PP) has been generated and evaluated for Lakes Michigan, Huron, and Superior. The Great Lakes Primary Productivity Model (GLPPM) is based on a mechanistic model developed by Fee (1972), and following the methods of Lang and Fahnenstiel (1995), that utilizes remotely sensed observations as input for model variables. The Color Producing Agent Algorithm (CPA-A) is a full spectrum three color component retrieval approach used to derive chlorophyll *a* values and the diffuse attenuation coefficient (Kd) for Photosynthetically Active Radiation (PAR). The GLPPM was validated in all three Lakes using an independent in-situ data set. MODIS derived PP estimates were used to quantify annual primary production for Lakes Michigan, Huron, and Superior in the post-*Dreissenid* invasion period from 2010-2013. Significant differences in chlorophyll distribution were noted between Lakes, however similar differences in lakewide areal production were not observed. Significant differences in mid-summer lake surface temperature among Lakes, and therefore phytoplankton photosynthesis efficiency, contribute substantially to the observed trends. Annual total carbon fixation was calculated for each Lake at 4.9, 4.7, and 6.6 Tg C/year for Lakes Michigan, Huron, and Superior respectively. There were no significant trends in PP observed in the four year analysis period, indicating Lake PP has stabilized post- *Dreissenid* invasion.

The GLPPM can be used to generate PP time series estimates dating back to 1997 and will contribute to improved assessment of Great Lakes PP changes resulting from *Dreissenid* mussel invasion and climatic change.

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