

COMPREHENSIVE REGIONAL LAKE WATER QUALITY MEASUREMENTS BY SATELLITE REMOTE SENSING: CAPABILITIES AND LIMITATIONS WITH CURRENT AND UPCOMING SATELLITE SYSTEMS

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ABSTRACT:

This presentation will review advances over the past decade that have enabled use of satellite imagery for regional scale-measurement of lake characteristics, such as clarity, chlorophyll, total suspended solids (TSS), and colored dissolved organic matter (CDOM). For example, in the Midwest U.S.A. historic and recent Landsat water clarity assessments have been conducted on >25,000 lakes to investigate spatial and temporal patterns and explore factors that affect water quality. Due to the spectral characteristics of Landsat assessments of all lakes (>4 ha) have been largely limited to water clarity. European Space Agency (ESA) MERIS imagery with spectral bands that were selected for water has been used to assess chlorophyll for ~900 of Minnesota's large lakes (>150 ha). Improvements of the recently launched Landsat-8 and upcoming ESA Sentinel-2 and 3 satellites will expand our capabilities to assess other optically-related water quality characteristics (e.g., chlorophyll, CDOM, mineral suspended solids (MSS)). Landsat 8 and Sentinel-2 for all lakes and Sentinel-3 for large lakes more often. To explore the potentials and limitations of these systems a field campaign to measure optical water quality characteristics (e.g. chlorophyll, TSS, turbidity, dissolved organic carbon (DOC) and CDOM) and in situ reflectance spectra nearly contemporaneously with imagery from Hyperspectral Imager for the Coastal Ocean (HICO) and Landsat 8 was conducted in the summers of 2013 and 2014. Sites in Minnesota and Wisconsin were selected to obtain a wide range of concentrations of CDOM, chlorophyll, Fe, and MSS, the primary factors that affect reflectance. This presentation will discuss the improved spectral, radiometric, spatial and temporal characteristics of Sentinel and Landsat 8 sensors and use simulated Sentinel and Landsat 8 bands to evaluate improvements in sensing important variables, such as chlorophyll, turbidity, MSS, DOC and CDOM, for comprehensive regional assessments of lake water quality.