Report for 2002VT5B: Detection of cyanobacterial blooms using remote sensing

- unclassified:
  - None

Report Follows:

Detection of cyanobacterial blooms using remote sensing

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Progress To Date:

This was a small ($6K) pilot study to investigate the feasibility of tracking and quantifying cyanobacterial blooms in Lake Champlain and small Vermont lakes using remote sensing. Methods were developed for accurately describing bloom intensity across grids representing the pixels detected by satellite detectors, as well as the light spectra reflected from such regions. Flow-through fluorometry was used for chlorophyll *a* and phycocyanin measurement along transects (the latter pigment is specific to cyanobacteria), while examination of reflected light spectra and cyanobacterial cell densities occurred at 10 point-sites along the transects. Two bays within Lake Champlain and two small eutrophic lakes were studied. The results suggested that algal biomass is best detected by near-infrared reflection, a conclusion also reached by other researchers investigating near-surface reflection through spectroradiometry (Arenz et al. 1996, Gitelson et al. 2000). One LandSat image of Lake Champlain was purchased to investigate whether image analysis at these wavelengths would detect blooms. Figure 1 shows three bloom areas on the image obtained, two of which were verified through ground observations. The high spatial heterogeneity of the blooms confirms the desirability of aerial or satellite monitoring rather than the single station sampling now carried out by the State of Vermont in these regions.

This project has been funded at a higher level ($30K) during 2003. The additional money will allow us to rent a boat large enough to reach more open regions of Lake Champlain, purchase of probes that allow simultaneous measurement of biomass indicators (in 2002, transects were traversed twice as pigments were measured with the same instrument set up with different lamps and filters), and purchase several satellite images. The impacts of suspended particles and dissolved organics, waves, and algal distribution in the water column, on light reflectance also will receive more attention, as these factors may influence the algorithms developed to predict algal biomass from satellite imagery. Because this project was strictly preliminary in 2002, its results have not been published or presented at conferences.

References

Arenz, R.F. Jr, W.M. Lewis, Jr and J.F. Saunders, III. 1996. Determination of chlorophyll and dissolved organic carbon from reflectance data for Colorado reservoirs. Int. J. Remote Sensing 17: 1547-1566.

Gitelson, A.A., Y.Z. Yacobi, J.F. Schalles, D.C. Rundquist, L. Han, R. Stark and D. Ettzion. 2000. Remote estimation of phytoplankton density in productive waters. Arch. Hydrobiol. Spec. Issues Advanc. Limnol. 55: 121-136.