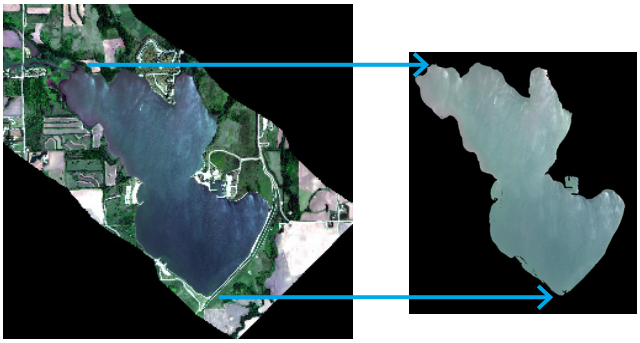
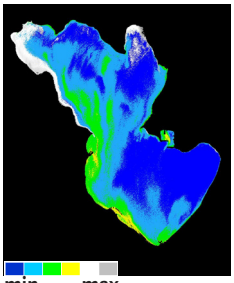
WATER QUALITY MONITORING

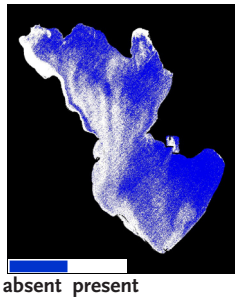
Hyperspectral imaging is becoming an efficient tool in various environmental monitoring applications. It makes possible rapid and timely monitoring of large areas at high spatial resolution.



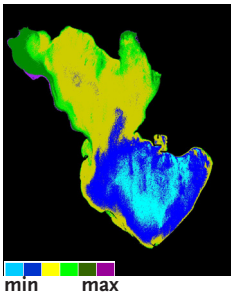
Pawnee lake, Lincoln, NE
6th June 2006



Chlorophyll Map



Phycocyanin Map



Total Suspended Solids Map (TSS)

Figure 1

QUALITY MONITORING IN INLAND WATERS

In this water monitoring example, University of Nebraska flew an AisaEAGLE system over inland waters and collected hyperspectral image data in 400 - 1000 nm to study the distribution of cholorophyll and total suspended solids concentration as well as presence of phynocyanin in the waters.

DATA PROCESSING

The first step in a spectroscopic application typically is to define and evaluate a calibration model, i.e. how the target parameter(s) of interest can be predicted from the hyperspectral data. A quantitative application requires calibration process where representative samples from specified places in the target are taken while airborne hyperspectral data is also collected over a target. The samples, water samples from a lake in this case, are analyzed with well established (laboratory) methods for the application parameters, chlorophyll and solid concentration and phycocyanin presence in this case. A calibration/prediction model is created by analyzing the correlation between the hyperspectral data from the places where samples were taken, and the data from the laboratory characterizations.

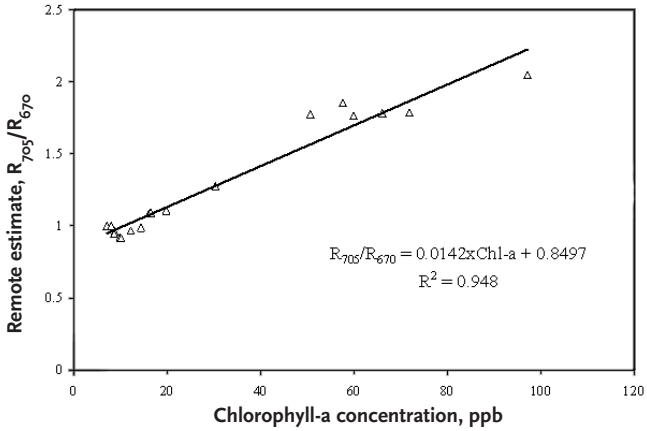


Figure 2

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When a parameter of interest has kown and distinct absorption features in the spectrum, a simple regression between reflectance (R) signal at these wavelengths and the laboratory results may create a well working calibration, like shown for chlorophyll in Figure 2. Some applications may require the use of more sophisticated methods, like Principal Component Analysis (PCA) or Spectral Angle Mapping (SAM) with Partial Least Squares (PLS) regression to build the calibration/model.

Once the prediction models for the parameters of interest are created and evaluated, they can be applied across the whole lake area, like shown in the prediction maps of the lake in Figure 1. The models can be applied as a routine method for mapping other similar water areas once hyperspectral image data is collected. Figure 3 below shows an example where the development in chlorophyll concentration and presence of phycocyanin was monitored in a lake area during the summer time.

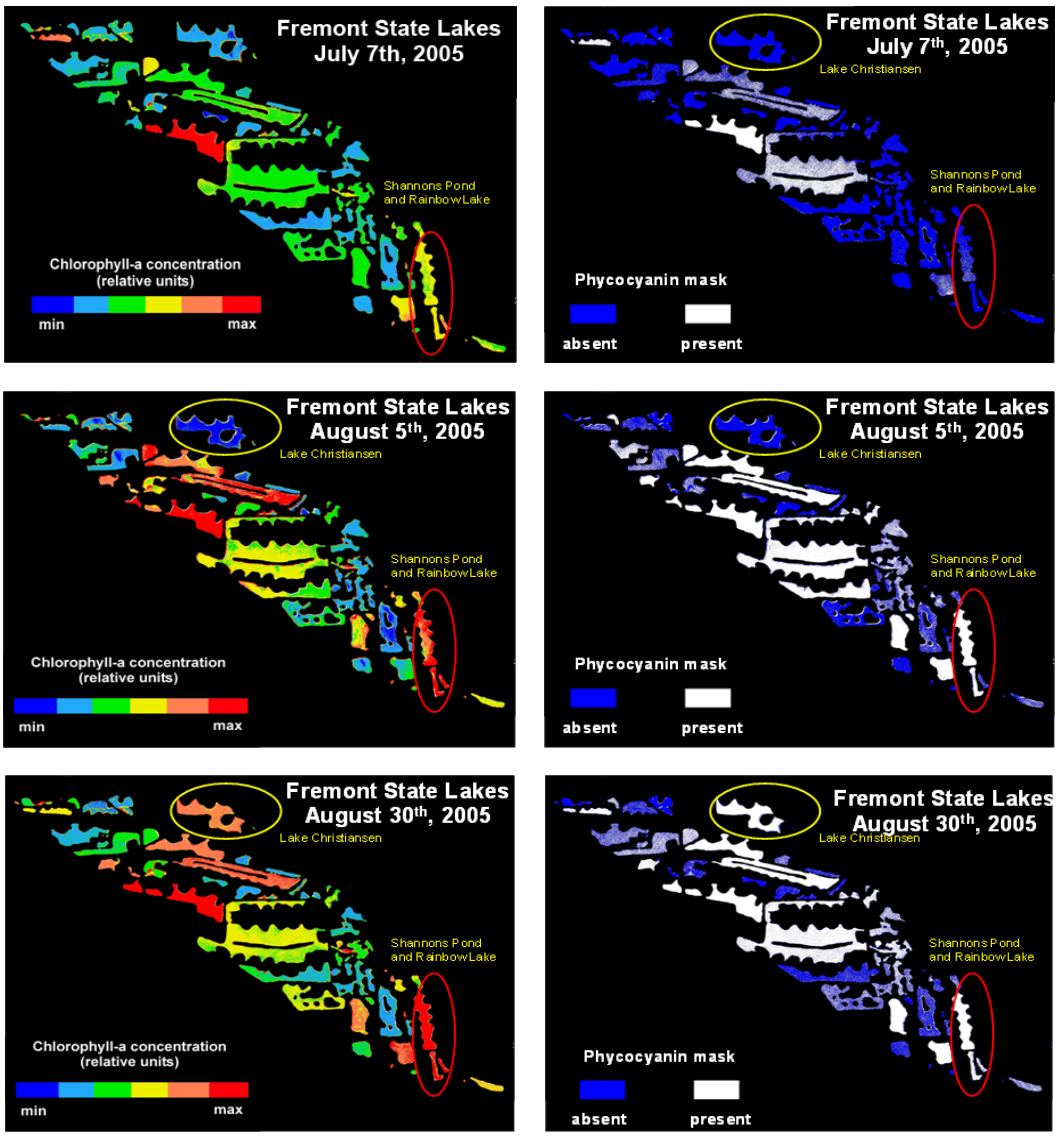

Figure 3

All images by the University of Nebraska, Lincoln