Surface water reflectance and water quality retrieval using a lightweight spectrometer and UAV platform

* Chuiqing ZENG¹, Murray RICHARDSON¹, Douglas J. KING¹

1. Department of Geography and Environmental Studies, Carleton University. 1125 Colonel By, Dr, Ottawa, ON K1S 5B62. (email: {Chuiqing.Zeng, Murray.Richardson, DougJ.King}@carleton.ca)

* Corresponding Author

ABSTRACT

Remote sensing methods to study spatial and temporal changes in water quality using satellite or aerial imagery are limited by surface scattering effects such as sun glint as well as by atmosphere effects. These factors combine with the low water reflectance signal to adversely affect the precision with which water quality parameters can be estimated. This study exploits the low altitude high-resolution remote sensing capabilities of UAV platforms to examine the major factors that affect water reflectance acquisition without the confounding influence of atmospheric effects typical of higher-altitude platforms. Specifically, a UAV-based system fitted with a spectrometer and a multispectral camera system is presented and its capability for estimating water reflectance is assessed. Preliminary regression analysis of the relationships between collected water spectra and water quality parameters including Chlorophyll-a, colored dissolved organic matter (CDOM) and turbidity, for lakes shows R² values to be 0.74 on average with a maximum of 0.87 for chlorophyll-a. The RMSE in parameter estimation using the resulting regression equations ranged from 0.08 to 2.35 or an average of 30% of in-situ measured chlorophyll value. The presented methods and results contribute to better understanding of water reflectance acquisition using remote sensing, and can be applied in UAV-based water quality assessment or to aid in validation of higher altitude imagery.