

## Remote sensing of euphotic depth in shallow tropical inland waters of Lake Naivasha using MERIS data

Nobuhle P. Majozi [a,b](#), [□](#), Mhd. Suhyb Salama [b](#), Stewart Bernard [a](#), David M. Harper [c](#), Mussie Ghirmai Habte [b](#)

[a](#) CSIR, Natural Resources and Environment, Ecosystem Earth Observation, Box 395, Pretoria 0001, South Africa

[b](#) Faculty of ITC, University of Twente, Box 217, 7500 AA Enschede, The Netherlands

[c](#) Department of Biology, University of Leicester, University Road, Leicester LE1 7RH, England, United Kingdom

### Abstract

Freshwater resources are deteriorating rapidly due to human activities and climate change. Remote sensing techniques have shown potential for monitoring water quality in shallow inland lakes, especially in data-scarce areas. The purpose of this study was to determine the spectral diffuse attenuation coefficient ( $K_d(\lambda)$ ) of the water column, in order to map the euphotic depth ( $Z_{eu}$ ) of Lake Naivasha, Kenya using the Medium Resolution Imaging Spectrometer (MERIS). Intensive in situ radiometric and limnological data collection was undertaken at Lake Naivasha. Atmospheric correction was done on the MERIS images using MERIS Neural Network algorithms, Case 2 Waters (C2R) and Eutrophic Lakes processors and the bright pixel atmospheric correction algorithm (BPAC). The Eutrophic Lakes processor gave the most accurate atmospherically corrected remote sensing reflectances at 490 nm compared to the other processors, with mean absolute percentage error (MAPE) of 47% and a root mean square error (RMSE) 43%, with BPAC giving negative reflectances in the blue spectral range. In situ  $K_d$  and  $Z_{eu}$  models were calibrated and validated using above- and under-water radiometric measurements, and tested on the Neural Network atmospheric correction processed MERIS images. The Eutrophic Lakes estimates were the most accurate, with an RMSE of  $0.26 \text{ m}^{-1}$  and MAPE of 18% for  $K_d(490)$  and RMSE of 0.17 m and MAPE of 14% for  $Z_{eu}$ . The  $Z_{eu}$  maps produced from MERIS images clearly show the variation of euphotic depth both in space and time. These results indicate the suitability of MERIS to monitor euphotic depth and other water quality parameters of shallow inland water bodies.