WATER QUALITY MONITORING  
LAKE VICTORIA

Project
Development of an operational system for monitoring and predicting the aquatic plants proliferation in Lake Victoria, Kenya

Project Progress
This project aims to demonstrate the use of time series of multispectral satellite images to improve management of water bodies through the monitoring of the area covered by aquatic plants and optical remote sensing indicators of water quality. The approach has been demonstrated by a case-study on Lake Victoria. This lake is one of the largest freshwater bodies of the world where, during the last few years environmental challenges and human impact have perturbed the ecological balance affecting the biodiversity.

The approach includes:
• retrieval of the water compounds concentration by using an inversion technique of a physically based model of the radiative transfer equation for the water;
• estimate of the abundance of weed species using multispectral satellite images in combination with in-situ measurements of the spectral characteristics of the weeds;
• change detection analysis of time series of image data to evaluate the correlation of the area occupied by aquatic plants with observed water quality indicators.

The products, if provided with an appropriate time frequency, are useful to identify the preconditions for the occurrence of hazard events like abnormal macrophyte proliferation and to develop an up-to-date decision support system.

Results and further steps
MERIS FR data is suitable for monitoring aquatic plants in Lake Victoria because its spatial and spectral resolution is sufficient to obtain cover maps, useful in identifying vegetation infested areas. Spectral unmixing as a supervised classification technique is very suitable for application with relatively low spatial resolution multi-spectral data. Together with the image derived endmembers, the algorithm performed very well, producing a mean classification accuracy of 98.82% based on RMSE.

The results showed, for the Winam Gulf section, a generally increasing abundance which peaked at 146 km² in the year 2007 before decreasing again. It is evident from the cover maps that the Winam Gulf, which is highly eutrophicated, is prone to aquatic weed infestation.
There was very low relationship between vegetation abundance and TSM, Chl-a and rainfall. A linear relationship, however, exists between TSM and Chl-a, with correlation coefficient, \( R^2 > 0.59 \).