**Image processing techniques applied to the study of Lake Trasimeno, Italy**

Paolo Villa(1), Mariano Bresciani(1), Claudia Giardino(1), Angiolo Martinelli(2)

(1) - Optical Remote Sensing Group, CNR-IREA, Email: villa.p@irea.cnr.it, via Bassin 15, 20133 Milano (Italy), Tel. +39-02-23694556; Fax: +39-02-23699300,
(2) - Regional Environmental Agency, ARPA Umbria, Email: a.martinelli@arpa.umbria.it; Tel. +39-075-51596211; Fax: +39-075-51596235

**ABSTRACT**

This study presents the contribution of remote sensing to improve the environmental knowledge of Lake Trasimeno (Central Italy) and surrounding basin, in order support the local authorities (ARPA Umbria) in implementing the basin management plan. Remote sensing data were acquired to analyze water quality and coastal vegetation status, together with their interactions and connection with land cover and use dynamics of the surrounding areas through the last 30 years. Different satellite sensors have been considered in this study: (1) high revisiting time sensors as MERIS and MODIS for coarse scale regular monitoring of the lake water quality (2005-2008); and (2) high/medium spatial resolution satellite sensors (e.g., Landsat) for intermediate/fine scale studies on aquatic vegetation and surrounding lands (1979-2008).

**LAND COVER CHANGE**

A multisource mid to high resolution dataset, ranging from Landsat MSS to Landsat TM/ETM+ to Terra ASTER and ALOS AVNIR-2 scenes, has been exploited for multitemporal study of land cover change covering the period from 1979 to 2008. Satellite scenes were subjected to radiometric normalization and then analyzed to map land cover changes through time. The analysis was focused over agricultural areas in order to investigate the consequences of changing on the water quality status of the lake.

**COASTAL AREAS and WATER QUALITY**

Costal vegetation (2003-2008) was investigated by means of one ASTER image (22/06/2003) and two AVNIR-2 images (08/07/2007-23/06/2008). The images were atmospherically corrected and classified with Supervised-Maximum Likelihood. NDVI was computed for coastal vegetation classes. Time-series MERIS data from 2005 to 2008 were processed to retrieve water quality parameters according to physically based approaches (calibrated using in situ data from 2008). MERIS level-1 data (120 images) were used to derive chlorophyll-a, yellow substances, total suspended matter and transparency. Image processing was performed using the BEAM 4.2 processor (Brockmann Consult) with the C2R Lake Water Algorithm, that includes atmospheric correction and the plug in ICOLs for correction the adjacency effects. The image-derived water quality trends were in agreement with in situ measurements (>0.8). Time-series MODIS product 11A from 2005 to 2008 (1000 images) were used to map the lake surface water temperature, as an indicator of the ecological seasonal dynamics.

**CONCLUSIONS**

This study showed the capabilities of multi-sensor satellite data to derive practical data about the complex and heterogeneous environment of Lake Trasimeno. We expect that the presented study may be useful to the project, developed by ARPA Umbria, aiming to refine the environmental knowledge of the study area and hence to define a conceptual model for the basin management plan.