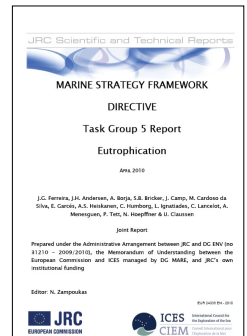


Chlorophyll\_a is a key element to assess the sea ecological status and for marine monitoring, as it is an index of phytoplankton biomass. Within the Water Framework Directive (2000/60/EC) one of the biological quality elements is "composition, abundance and biomass of phytoplankton" (parameter chlorophyll\_a – Dlgs 2010/260), and in the Marine Strategy (2008/56/EC) one of the qualitative descriptors for the determination of Good Environmental Status is Eutrophication (D5). Specific algorithms estimate the concentration of chlorophyll\_a in the sea surface from satellite data (MODIS AQUA NASA, ESA Envisat MERIS) in the visible spectrum. LaMMA Consortium, in collaboration with the Dipartimento di Ecologia Vegetale - University of Florence - CIBM and Ifremer, is evaluating the performances of four algorithms estimating chlorophyll\_a (OC3M, MedOC3, OC5 and SAM\_LT) through the comparison with Chlorophyll\_a *in situ* data obtained during oceanographic campaigns (Momar, MELBA, Milonga) conducted within the Momar EU project.



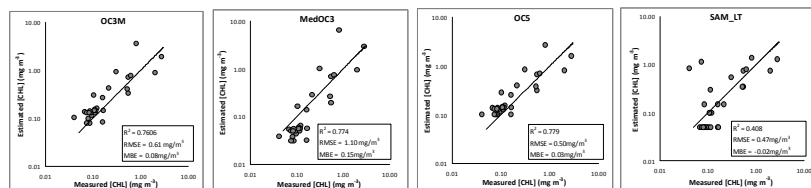
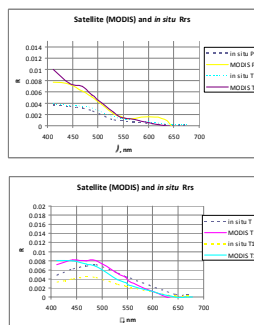
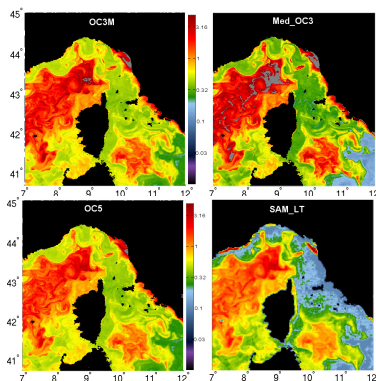
## Chlorophyll\_a data *in situ* and estimated by algorithms

**OC3M** Bio optical empirical MODIS global algorithm, Case 1 waters. O'Reilly, J.E., and 24 Coauthors, 2000: SeaWiFS Postlaunch Calibration and Validation Analyses, Part 3. NASA Tech. Memo. 2000-206892, Vol. 11, S.B. Hooker e E.R. Firestone, Ed. NASA Goddard Space Flight Center, 49 pp.

**MedOC3** Bio optical empirical MODIS algorithm, OC3 regionally adapted on North Western Mediterranean, Case 1 waters. Santoleri R., Volpe G., Marullo S., Buongiorno Nardelli B., "Open waters optical remote sensing of the Mediterranean Seas", Remote sensing of the European Seas, 103-116, Springer Netherlands, 2008

**OC5** Bio optical empirical MODIS (MERIS and SeaWiFS) algorithm, suited for Biscay Bay and the English Channel, Case 1 and Case 2 waters. Gohin F., Bruon J.N., Lampert L., A five channel chlorophyll concentration algorithm applied to SeaWiFS data processed by SeaDAS in coastal waters. J. Remote Sensing, 2002, vol. 23, no. 8, 1639-1661.

**SAM-LT** Bio optical semi-analytical MODIS algorithm, locally tuned for Tyrrhenian-Ligurian sea, Case 2 waters. Maselli F., Massi L., Piarì M., and Santini C., Spectral Angle Minimization for the Retrieval of Optically Active Seawater Constituents from MODIS Data Photogrammetric Engineering & Remote Sensing, Vol. 75, No. 5, May 2009, pp. 595-605.



The algorithms that estimate MODIS Chlorophyll\_a from ocean color are known to overestimate in the Mediterranean area. The scatter plots above show comparisons with *in situ* Chlorophyll\_a data obtained from a Case 1 waters subsample collected within the Momar oceanographic campaigns. OC3M and MedOC3 show a slight overestimation. OC5 shows the best performance, the correlation is good and the overestimation is extremely low (moreover, unlike the first two, is also suited for Case 2 waters). SAM\_LT shows a slight underestimation and a scarce sensitivity to low Chlorophyll\_a concentrations, as it is locally tuned for Tyrrhenian - Ligurian sea Case 2 waters.

Campaign	Period	Number of stations	Institution
MOMAR	April 2010 July 2011	28	CIBM
MELBA	May 2011	11	LaMMA, Ifremer, CIBM
MILONGA	September October 2011	18	LaMMA, Ifremer, CIBM, ARPAT

***In situ* data**  
 -CIBM and Laboratorio di Ecologia e Fisiologia Vegetale, Dipartimento di Biologia Evoluzionistica Università degli Studi di Firenze  
 -Ifremer - Institute français de recherche pour l'exploitation de la mer  
 -LaMMA  
 -ARPAT