Remote sensing by laser and satellite for the biogeochemical characterization of the Southern Ocean during Austral summer

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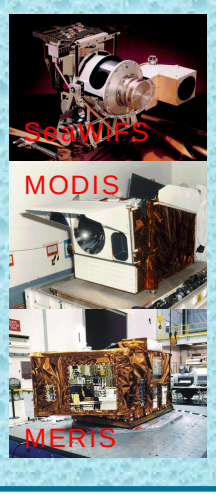
RADIOMETERS

Three ocean color satellite radiometers stand out at the beginning of the 21st century: SeaWiFS aboard OrbView-2 (Orbital Sciences and NASA), MODIS aboard Aqua and Terra (NASA) and MERIS aboard ENVISAT (ESA). Their chlorophyll-a imagery is based on the passive remote sensing of the water-leaving radiances in the visible bands and thus needs atmospheric corrections and *in situ* calibrations.



LIDAR

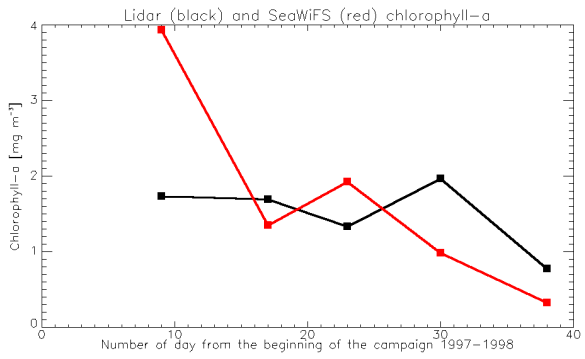
The lidar fluorosensor developed at ENEA has been conceived for the Italian Antarctic oceanographic campaigns aboard the research vessel *Italica*. The system is hosted in a container and consists mainly of a laser, transmitting a pulse at 355 nm to the water surface, and a telescope, collecting the fluorescence of chlorophyll-a at 680 nm.

RADIOMETERS + LIDAR = COVERAGE & ACCURACY

The lidar measurements can be used for validation and calibration of radiometer data, thus merging lidar accuracy and satellite coverage. This information has been used to estimate the primary production in the Southern Ocean during the Austral summer 1997-1998.

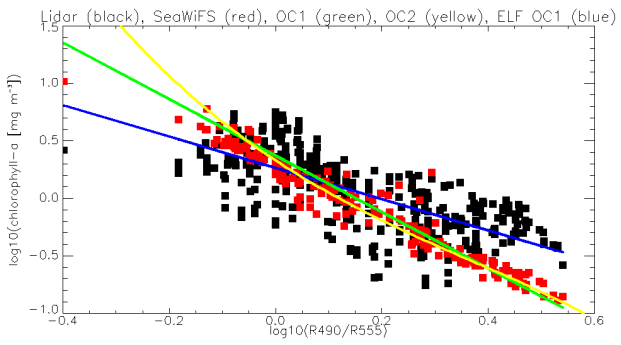
Validation

Comparison between lidar and SeaWiFS measurements during the campaign 1997-1998 (1st day: 07/12/1997). The lidar spatial and temporal resolutions have been considerably degraded in order to fit the SeaWiFS granules. SeaWiFS tend to overestimate chlorophyll-a in the southern Ross Sea (spanned in the first days of the campaign).



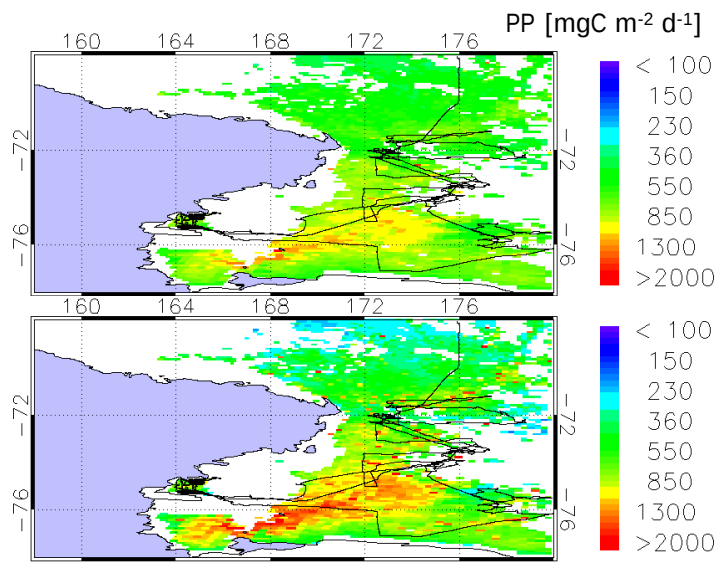
Calibration

Calibration by lidar of the SeaWiFS chlorophyll-a bio-optical algorithm (ELF OC1) relating chlorophyll-a to the remote sensing reflectances at 490 and 555 nm. Standard SeaWiFS algorithms (OC1 and OC2) and data are also shown.



Primary production

Estimation of primary production based on lidar-calibrated (top) and standard (bottom) chlorophyll-a. It is confirmed that SeaWiFS tends to overestimate in the southern Ross Sea.



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