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The BIOPTIMOD Project: Integration Of Novel Satellite And In Situ Optical Observations In CMEMS Biogeochemical Models

Paolo Lazzari (1), Gianpiero Cossarini (1), Stefano Salon (1), Anna Teruzzi (1), Cosimo Solidoro (1), Fabrizio D'Ortenzio (2), Vincenzo Vellucci (2), and Emanuele Organelli (2)

(1) Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS, Via Beirut 4, 34151 Trieste, Italy , (2) Sorbonne Universités, UPMC Université Paris 06, CNRS, LOV, Villefranche-sur-Mer, 06230, France

We present the development of a multi-spectral bio-optical radiative transfer (RT) model for the Copernicus Marine Environment Monitoring System (CMEMS) Mediterranean biogeochemical model system to be integrated with optical data provided by novel observations platforms such as the biogeochemical Argo (BGC-Argo) floats and the multi-spectral new satellite sensors. The aim is to improve the quality and reduce the uncertainty of paramount CMEMS biogeochemical products such as phytoplankton biomass and primary production. Moreover, the new bio-optical model will allow the development of multi-platform data assimilation of radiometric optical measurements from satellite and BGC-Argo floats.

Both the atmospheric and the in-water RT models developed in the BIOPTIMOD project will be illustrated. The atmospheric radiative transfer model is based on the OASIM model and it is offline coupled with ECMWF model products, and calculates direct and diffuse planar downward irradiance just below the sea surface with 25 nm resolution in the visible range (400nm to 700nm). The results are validated using in situ data from the BOUSSOLE buoy (North Western Mediterranean Sea) and BGC-Argo floats, showing a good model skill in reproducing PAR and measured single spectral components (i.e. BOUSSOLE: 412.5 nm, 442.5nm, 490nm, 510nm, 555nm, 560nm, 665nm, 670nm, 681.25nm; BGC-Argo Float: 380nm, 412nm, 490nm). Numerical experiments indicate that results are especially sensitive to cloud cover and aerosol thickness parameter.

The in-water model is based on the three stream approach that accounts for three irradiance streams: direct, downward diffuse planar and upward diffuse planar. Results of the in-water component validation at BOUSSOLE site and with BGC-Argo Float vertical profiles will be presented focusing on the implications for bio-optical models linking inherent optical properties with biogeochemical properties (plankton functional types, plankton size classes and CDOM).

Major foreseen impacts of the novel parameterization relate to the improvement of the photosynthesis formulation and to the dynamics of optically active substances. These improvements together with a novel multi-data assimilative scheme will allow to better represents the 3D variability of optical properties and consequently water quality in the Mediterranean Sea.