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reconstruction of high resolution ocean colour images under clouds using neuronal methods

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Mesoscale and sub-mesoscale phytoplankton variability significantly contributes to global primary production budgets. High-resolution modelling studies suggest that incorrect representation of mesoscale and sub-mesoscale variability in ocean global circulation models (OGCM) can result in errors of about 30% in primary production estimations. Thus, characterizing mesoscale and sub-mesoscale phytoplankton variability is important for the parameterization and validation of the OGCM.

Ocean colour sensors allow a global observation of small scale chlorophyll variability patterns. However, the frequent presence of clouds in ocean colour remotely sensed imagery, prevents space and time continuity and limits its exploitation. The aim of this study is to propose a new statistical processing approach for the reconstruction of areas covered by clouds in a time sequence ocean colour images. We used a classification methodology consisting in a neural network topological map.

Considering a cloud-contaminated image of the sequence, missing data are reconstructed through an unsupervised statistical process that reproduces the local spatio temporal relationships of the cloudy image. The unsupervised process is trained with a selected subset of ocean colour temporal images surrounding the cloudy images. As phytoplankton variability is partly driven by oceanic dynamics, we added a set of satellite-derived dynamic ocean products (sea surface temperature, altimetry, ocean waves) influencing strongly the phytoplankton production.

To develop the under cloud reconstruction method, we began by using high resolution (about 2 Km) simulated data (output of the OPA OGCM coupled with the Lobster biogechemical model). We focused on the North Atlantic ocean which is characterized by a strong mesoscale and sub-mesoscale phytoplankton variability. When applied over two seasons(spring and winter),the method was able to reproduce the statistical characteristics of the missing data with a good accuracy. We then tried to assess the ability of the method for reconstructing high resolution real data.