RECOLOUR Project
REconstruction of COLOUR scenes

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Context - The project RECOLOUR is a spin-off project from BELCOLOUR.

Introduction - Optical remote sensing data archives generally have many gaps caused by clouds or other retrieval problems. Space-time filling of these gaps is an important step for the improvement of various marine ecosystem studies such as forcing of physical and biological models, algae bloom detection, establishment of precise climatologies and trend analysis. For parameters exhibiting strong spatial or temporal correlations, the missing data can be estimated by use of statistical techniques. The Data Interpolation with Empirical Orthogonal Functions methodology (DINEOF) allows calculating missing data in geophysical datasets without requiring a priori knowledge about statistics of the full data set.

The North Sea. Monovariate treatment - This study demonstrates the reconstruction of complete space-time information for 4 years of surface chlorophyll a (CHL), total suspended matter (TSM) and sea surface temperature (SST) over the Southern North Sea and English Channel from the BELCOLOUR archive. Although the very high proportion of missing data (70%), the variability of original signals explained by the EOF synthesis reached 93.5 % to 98 % of the input signal variability. Validation of the method is achieved by comparing reconstructed data with excluded input information below artificial clouds. Precise weekly and monthly averaged climatologies were derived from daily regular reconstructions and provided to modellers to test the impact of light attenuation on phytoplancton blooms. Embedded in the DINEOF associated error calculation scheme, a new methodology was implemented to produce maps of outliers, allowing to visualise how unusual or suspicious are some data in regards to the global dynamic of the dataset. Diverse type of known algorithms artefacts (undetected cloud egdes, haze areas, contrails, cloud shadows) could be associated with higher values in the outlier maps. Thus, the DINEOF becomes also a very efficient tool for assisting the fast analysis of large databases and opens the way to potential applications in the quality control of optical remote sensing data, as in the improvement of retrievals by adding statistical information to the conventional spectral processing.

MERIS TSM 13/4/2003 original data mg/l

outliers field coef.

filled data mg/l

Multivariate treatment - Here, the MODIS TSM images of year 2005 were reconstructed in a multivariate DINEOF approach using complementary hydrodynamical fields from the Channel and Southern North Sea (C&SNS) model. Reconstruction qualities obtained by multivariate treatment of satellite and modelled data were compared with those obtained by monovariate DINEOF treatment of TSM, by validation of extracted data under artificial clouds. This confirmed the interest of the multivariate approach. The best improvement of reconstruction quality was obtained when using the mean depth current U and V components (12 EOFs accounting for 99,1% of the total input signal variability, showing less filtration of smaller structures).

The Mediterranean Sea - The RECOLOUR upgraded version of DINEOF methodology is applied on a Pathfinder SST database (1985-2005) remapped at 1/16° over the whole Western Mediterranean. General objective of this study is the comparison of various DINEOF multitemporal averages, climatologies and trends obtained with those produced by 2 other geophysical softwares developed at the GHER: (1) interpolated field produced by DIVA from in situ data and (2) surface layer temperature computed by the GHER 3D hydrodynamical model. More specifically, the weekly based DINEOF reconstructions are also providing a basis of validation for the modelling studies on going at GHER within the context of other projects (Concerted Action RACE). Moreover, the outlier detection scheme was also demonstrated on Mediterranean SST data.
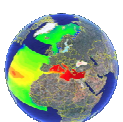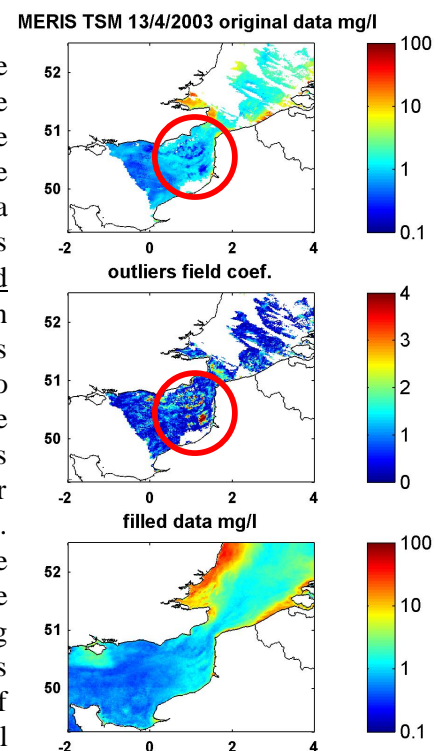
Download reconstructed TSM, CHL and SSTproducts and see more on RECOLOUR at :
http://modb.oce.ulg.ac.be/projects/2