

# GLOBCOLOUR - THE EUROPEAN SERVICE FOR OCEAN COLOUR

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## Abstract

The GlobColour project has been initiated and funded by the ESA Data User Element Programme to develop a satellite based ocean colour data service to support global carbon-cycle research and operational oceanography. It aims to satisfy the scientific requirement for a long (10+ year) time-series of consistently calibrated global ocean colour information with the best possible spatial coverage. In order to cover the long time span necessary for climate monitoring purposes, the required ocean colour data set can only be built by merging together observations made with different satellite systems. To that purpose, MERIS products are merged with MODIS and SeaWiFS and a Full Data Set (FPS) covering more than 10 years of observation has been built and made available to the scientific community ([www.globcolour.info](http://www.globcolour.info)) and in particular to the key users of the project: IOCCP, IOCCG and UKMO. Prior to the delivery, a very thorough calibration and validation exercise covering the entire spatial and temporal extent of the data set has been performed. This exercise provided a deep understanding of the different input data streams, and led to the prototyping of three different merging methods: simple averaging, error-weighted averaging and an advanced retrieval based on fitting an in-water bio-optical model to the merged set of observed normalised water-leaving radiances (nLw's). This third technique is also being utilised by the NASA Ocean Color Time-Series Project, and is termed GSM because it originates from the Garver et al. (1997) bio-optical model (Maritorena & Siegel, 2005). Error statistics from the initial sensor characterisation are also used as an input to both the weighted averaging and GSM merging methods, and propagate through the merging process to provide error estimates on the output merged products. These error estimates are a key component of GlobColour as they are invaluable to the users; particularly the modellers who need them in order to assimilate the ocean colour data into their ocean simulations. The service is distributing global data sets of chlorophyll-a concentration, normalised water-leaving radiances, diffuse attenuation coefficient, coloured dissolved and detrital organic materials, total suspended matter or particulate backscattering coefficient, turbidity index, cloud fraction and quality indicators. New demonstration products are available online too: Photosynthetic Available Radiation, Depth of the Heated Layer, Secchi Disk Depth.

## 1. DEVELOPMENT OF THE PROJECT

The three year project was kicked-off in November 2005 under the leadership of ACRI-ST (France). The objective is to produce a global daily ocean colour data set with the best possible coverage by merging together data from the three most capable sensors: SeaWiFS on GeoEye's Orbview-2 mission, MODIS on NASA's Aqua mission and MERIS on ESA's ENVISAT mission.

In setting up the GlobColour project, three user organisations were invited to help. Their roles are to specify the detailed user requirements, act as a channel to the broader end user community and to provide feedback and assessment of the results. The International Ocean Carbon Coordination Project (IOCCP) based at UNESCO in Paris provides direct access to the carbon cycle modelling community's requirements and to the modellers themselves who will use the final products. The UK Met Office's National Centre for Ocean Forecasting (NCOF) in Exeter, UK, provides an understanding of the requirements of oceanography users, and the IOCCG bring their understanding of the global user needs and valuable advice on best practice within the ocean colour science community.

The first year was a feasibility demonstration phase that was successfully concluded at a user consultation workshop organised by the Laboratoire d'Océanographie de Villefranche, France, in December 2006. Error statistics and inter-sensor biases were quantified by comparison with in-situ measurements from moored optical buoys and ship based campaigns, and used as input to the merging. The second year was dedicated to the production of the time series. In total more than 25 Tb of input (level 2) data have been ingested and 14 Tb of intermediate and output products created, with 4 Tb of data distributed to

the user community. Quality control (QC) is provided through the Diagnostic Data Sets (DDS), which are extracted sub-areas covering locations of idata collection or interesting oceanographic phenomena. The Full Product Set (FPS) covers global daily merged ocean colour products in the time period 1997-2008 and is freely available for use by the worldwide science community at <http://hermes.acri.fr/>.

The GlobColour service distributes global daily, 8-day and monthly data sets at 4.6 km resolution for, chlorophyll-a concentration, normalised water-leaving radiances (412, 443, 490, 510, 531, 555 and 620 nm, 670, 681 and 709 nm), diffuse attenuation coefficient, coloured dissolved and detrital organic materials, total suspended matter or particulate backscattering coefficient, turbidity index, cloud fraction and quality indicators. Error statistics from the initial sensor characterisation are used as an input to the merging methods and propagate through the merging process to provide error estimates on the output merged products. These error estimates are a key component of GlobColour as they are invaluable to the users; particularly the modellers who need them in order to assimilate the ocean colour data into ocean simulations. See the Product User Guide (PUG) for further details on the GlobColour products [http://www.globcolour.info/CDR\\_Docs/GlobCOLOUR\\_PUG.pdf](http://www.globcolour.info/CDR_Docs/GlobCOLOUR_PUG.pdf).

An intensive phase of validation has been undertaken to assess the quality of the data set. In addition, inter-comparisons between the different merged datasets will help in further refining the techniques used. Both the final products and the quality assessment were presented at a second user consultation in Oslo on 20-22 November 2007; presentations are available on the GlobColour WWW site ([www.globcolour.info](http://www.globcolour.info)).

The NRT service was started mid-2008, with a global daily delivery of merged MERIS and MODIS ocean colour data to primarily support operational oceanography. From spring 2009, the GlobColour service will feed into the European Community funded Marine Core Service, MyOcean, which starts to provide, in 2009, a suite of services to support Europe's decision makers. GlobColour's merged ocean colour dataset are provided from April 2009 by the Global Ocean Colour Thematic Assembly Centre (OC G-TAC) whose main objective is to bridge the gap between space agencies providing ocean colour data and GMES marine applications.

## 2. PRESENT STATUS

As demonstrated during the third GlobColour workshop, that was held in Frascati, on November 19-20 2008, the user community (scientists, but also end user organisations interested in the products and near-real time service for activities such as new primary production to monitor halieutic stocks, data assimilation into local and global oceanographic models) is growing fast, with 256 users registered in November 2008.

An easy access to GlobColour services is provided by the [Hermes](#) data server:

- the GlobColour archive. The GlobColour Archive data consists of daily, weekly and monthly Level-3 ocean colour products generated at day+15. Also called Full Product Set (FPS), the archive data is based on the merging of MERIS, SeaWiFS and MODIS level-2 data over the whole globe. The best resolution of the FPS products is 4.6km. Extraction over user defined areas is available.
- the GlobColour global NRT data service. The GlobColour Near Real Time (NRT) data consists of daily and weekly Level-3 ocean colour products generated at day+1. The NRT service is based on the merging of MERIS and MODIS level-2 data over the whole globe. The best resolution of the FPS products is 4.6km. Extraction over user defined areas is available.
- the GlobColour NRT subscription service. The Subscriptions Service allows any user to systematically obtain NRT products at 1 km resolution (or more) over any local area. Requests can be updated a-posteriori thanks to an identifier send to the user by email.
- the GlobColour global NRT data rolling archive. Near Real Time products can also be downloaded from a 15-days rolling archive.

Key features of the GlobColour Service will be presented at IGARSS 2009, Invited session Water Monitoring with MERIS and AATSR in Africa, with a dedicated focus on GlobColour users in Africa.

## 3. REFERENCES

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