The Ocean Colour Climate Change Initiative: version 5 and preview of version 6

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Aims

The ESA Ocean Colour CCI aims to:

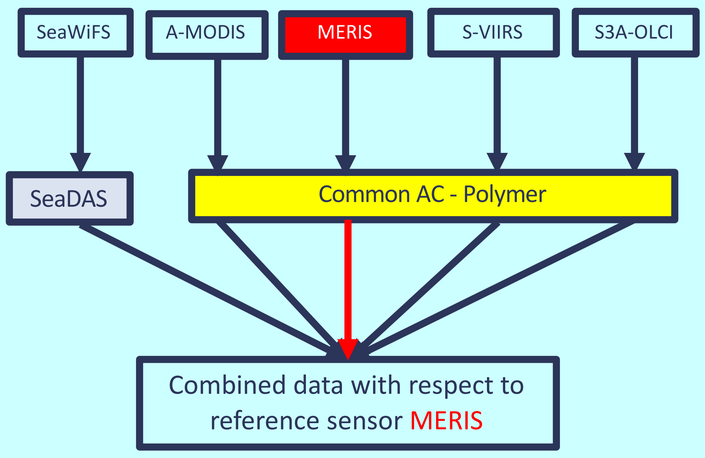
- develop & validate algorithms to meet the GCOS ECV requirements for consistent, stable, error-characterised global satellite data products from multi-sensor data archives;
- produce and validate, the most complete and consistent possible time series of multi-sensor global satellite data products for climate research and modelling;
- strengthen inter-disciplinary, international cooperation on Earth observation, climate research and modelling, in pursuit of scientific excellence.

Summary of status

- OC-CCI undertakes regular re-processing, typically annually, to extend the time series and use on-going research and developments in atmospheric correction, in-water algorithms and bias correction. This requires flexibility and rapid turn-around of processing for extensive ocean colour datasets from multiple ESA and NASA missions.
- Version 5 of the data set was made available to the scientific community in Nov 2020 covering the period 1997-2020. This has since been extended into 2021.
- OLCI A data are now included in the merged product.

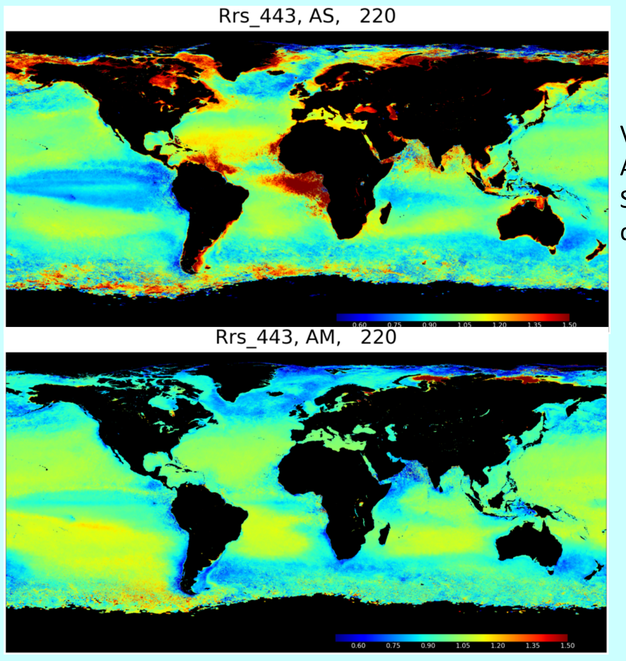
1. Atmospheric Correction and reference sensor

OC CCI uses a reference sensor to compare between different sensors in the ocean colour record. In previous versions this was SeaWiFS and in v5 was changed to MERIS given its similarity to the OLCI series of sensors. In previous versions we utilised the best individual atmospheric correction (AC) but we are increasingly using the same AC to provide consistency.



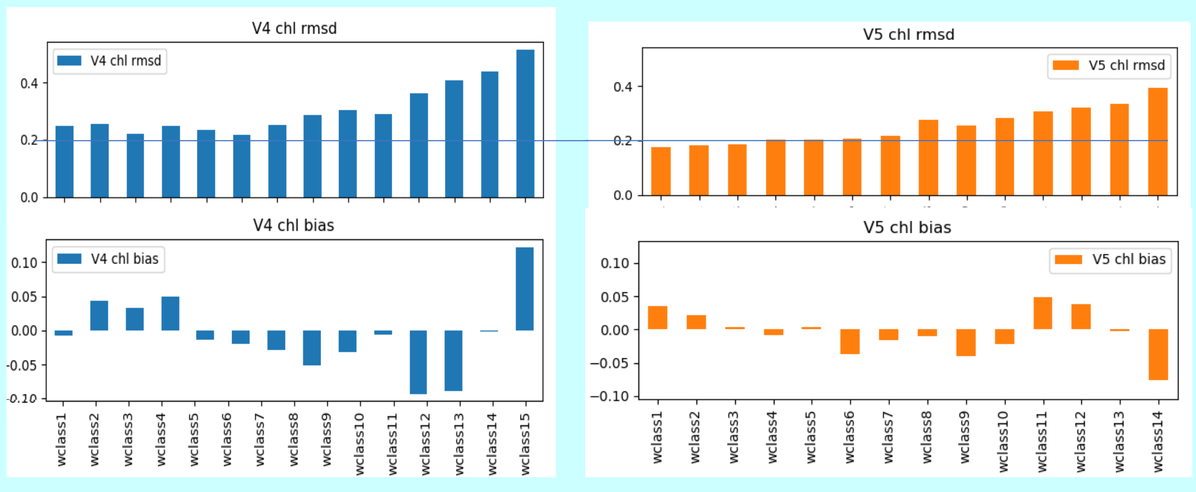
2. Bias Correction

Data from the different satellite sensors, processed with different AC, retain biases from their processing history. Bias correction removes consistent biases between the datasets and is carried out by generating climatologies and deriving per-pixel maps of bias between sensors with respect to a reference sensor (MERIS).



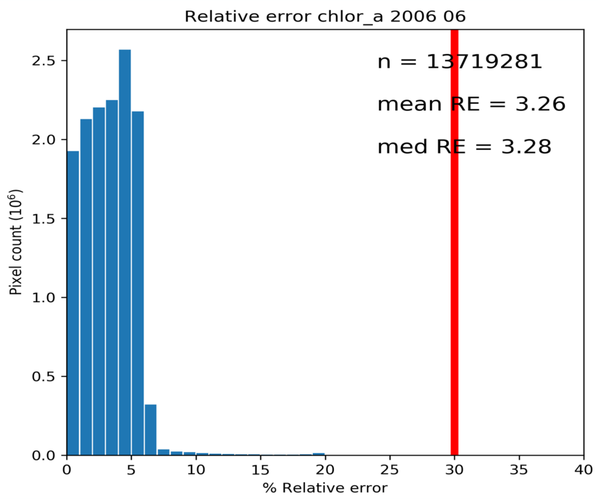
3. Uncertainty Analysis

Per-pixel uncertainty is based on the identification of optical water type classes using a fuzzy c-means (FCM) clustering algorithm (Jackson et al. 2017). Each optical water type has uncertainty statistics derived from match ups between *in situ* and satellite derived chl-a, IOP and R_{rs} match ups. These class statistics are then used to compute daily per-pixel uncertainty.



RMSD and bias are improved for v5 (right) compared to v4 (left)

GCOS provide requirements for climate quality ECV datasets such as chlorophyll and ocean colour. If we use the bias (m) in $\log_{10}$(chl) to calculate the absolute per-pixel relative error (ϵ) in the OC-CCI chlorophyll product, where:
$\epsilon = |100[1 - (1/10^{m})]|$, and compare this with the GCOS accuracy requirement of 30%, we can see that the V5 product is performing well against this criterion.

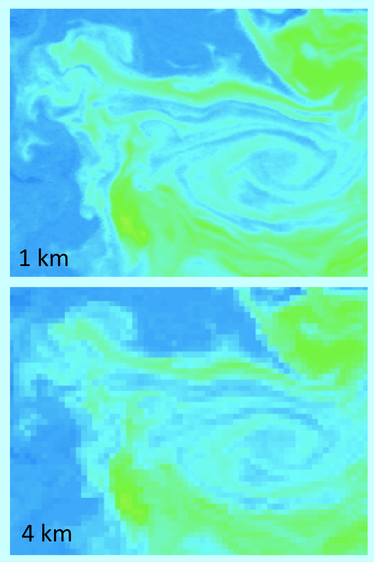


V5.0 chl-a relative error compared to GCOS requirements for June 2006.

4. Plans for Version 6

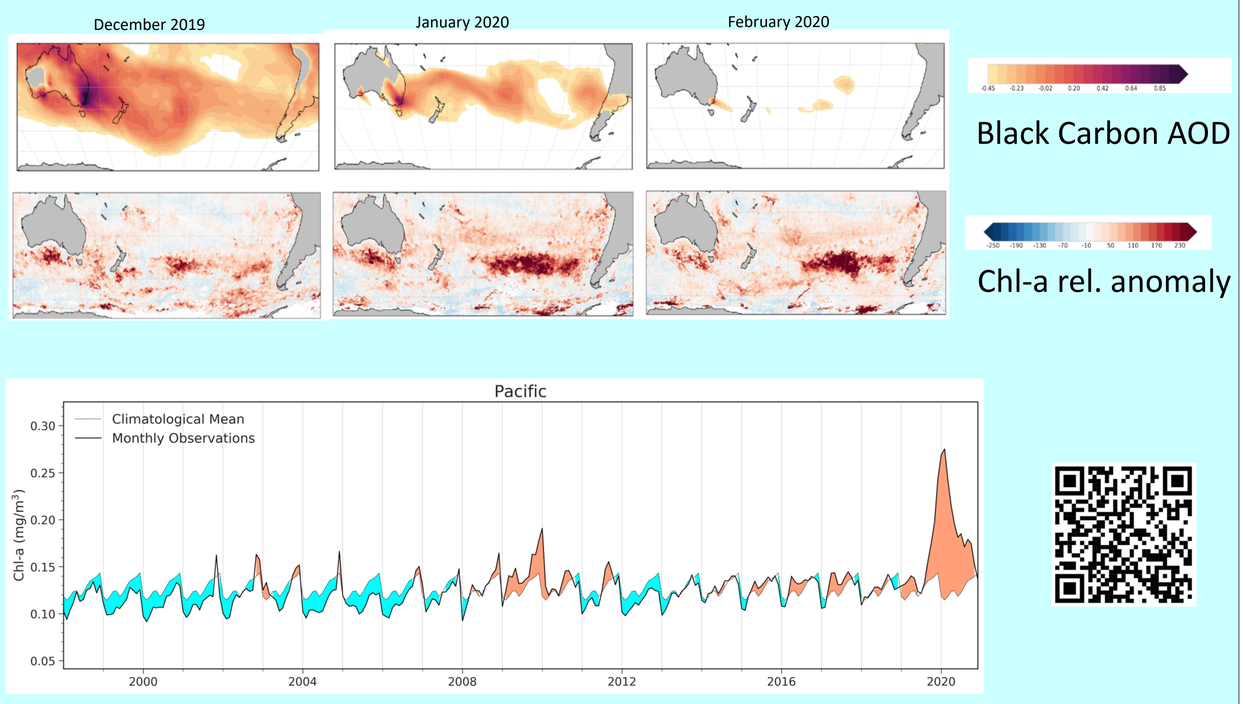
Processing is underway for OC-CCI Version 6, due to be released late 2021/early 2022. The updates from V5 to V6 include:

- Updated Polymer AC processor.
- Addition of OLCI 3B data.
- Updated Idepix pixel flagging,
- MERIS 4th reprocessing data.
- New System Vicarious Gains for OLCI and MERIS.
- New optical water class set.
- Complete1-km variables i.e., chl-a, Rrs, IOPs



5 . Nature paper

OC-CCI V5 data were used for a recent paper in Nature linking aerosol deposition from the 2019/2020 Australian wildfires with unprecedented blooms in the south Pacific.



Modified figure (extended time series) from Tang et al. 2021, Nature

Ocean colour products are available via ftp, THREDDS, OPeNDAP, Web-GIS integration portals at **https://www.oceancolour.org**

European Space Agency