

Introduction

Space-borne optical sensors often provide global coverage of a variety of surface parameters that are utilised by a large scientific community. There is a consistent high demand for products of sufficient quality – especially Near-Real-Time (NRT), and this need has resulted in a stable and integrated approach to Quality Control (QC). A general overview and description of the protocols and procedures carried out by the MERIS, MODIS, SeaWiFS and Landsat Sensor Performance Product and Algorithm (SPPA) Teams is provided in order to encourage QC knowledge transfer for space-borne sensors.

The Instrument Data quality Evaluation and Analysis Service (IDEAS) consortium, lead by VEGA, provides a service to ESA for a number of sensors. Support and Quality Control is maintained through a number of instrument specific SPPA Teams supported by instrument experts; for MERIS, MODIS & SeaWiFS, and Landsat these are Ludovic Bourg (ACRI-ST), Samantha Lavender (ARGANS) and Sebastien Saunier (Gael Consultant) respectively.

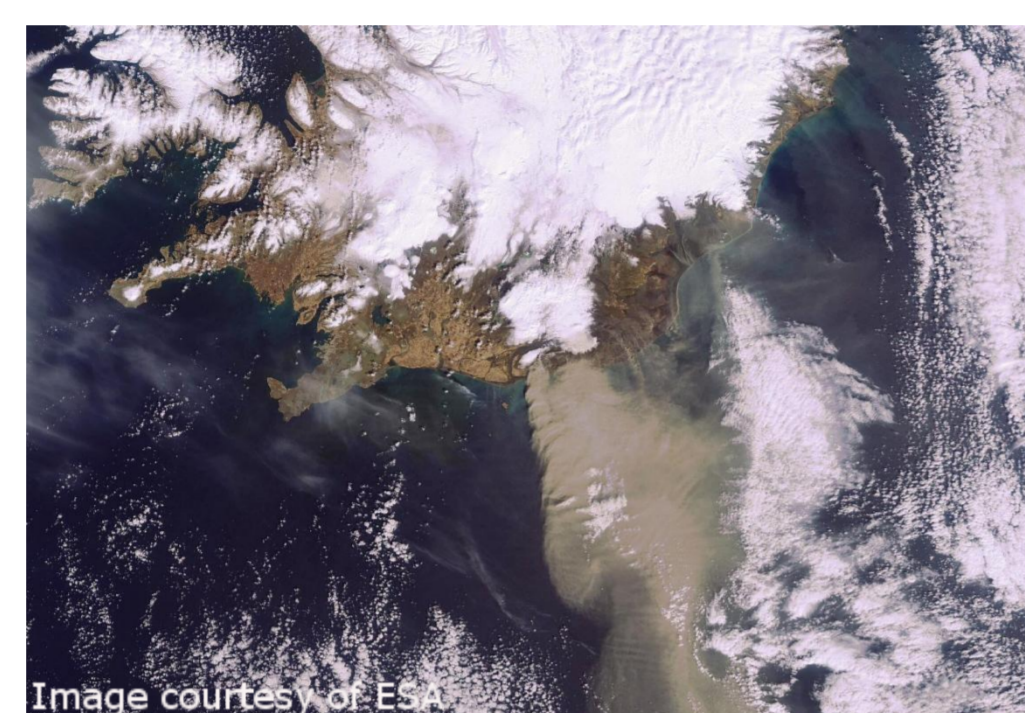
The role of the SPPA Team is to perform a variety of QC activities including analysis and checking of products, long loop sensor analysis, software and hardware update validations, general monitoring of product catalogues, and support to User forums and FAQs.

MERIS SPPA

Daily production status is monitored and summarised in a **Daily Report** generated at ACRI-ST, whilst Browse Products are retrieved at ARGANS and form part of a daily Quicklook webpage allowing **NRT visual assessment of product quality**.

Following validation activities performed by the MERIS SPPA Team, the first operational Linux based MERIS IPF was implemented during September 2009. This change was completely invisible to Users, and has resulted in an **increase in processing performance**. In addition to European and North America NRT products, Full Resolution processing over Africa is now possible.

In order to allow the entire MERIS end-to-end processing chain to be Linux based, efforts are now focused on the Level 0 processor and consolidator.

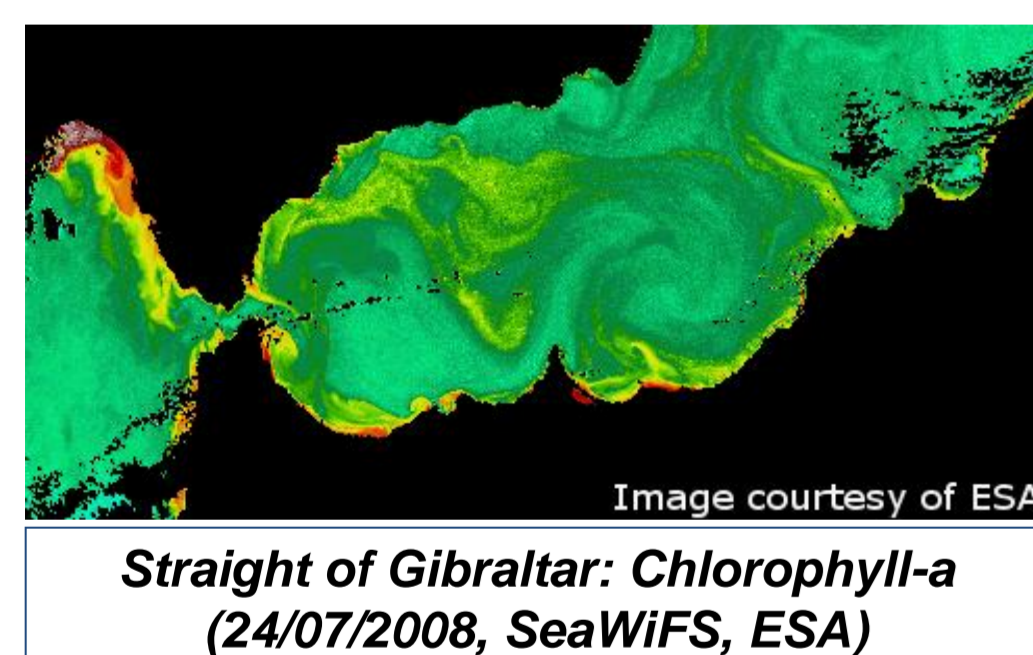


The Eyjafjallajökull Volcano, Iceland (19/04/2010, MERIS, ESA)

SeaWiFS & MODIS SPPA

SeaWiFS & MODIS Products are monitored on two ESA Archives:

- The **GMES MyOcean FTP Rolling Archive** provides Level 1A 1 km MODIS products and Level 0 for SeaWiFS. All products are routinely downloaded and processed at ARGANS to determine product quality.
- The **MERCI MODIS** online catalogue provides systematic Level 1B products. These are assessed via Quicklooks, and any erroneous products interrogated using bespoke software developed at ARGANS.



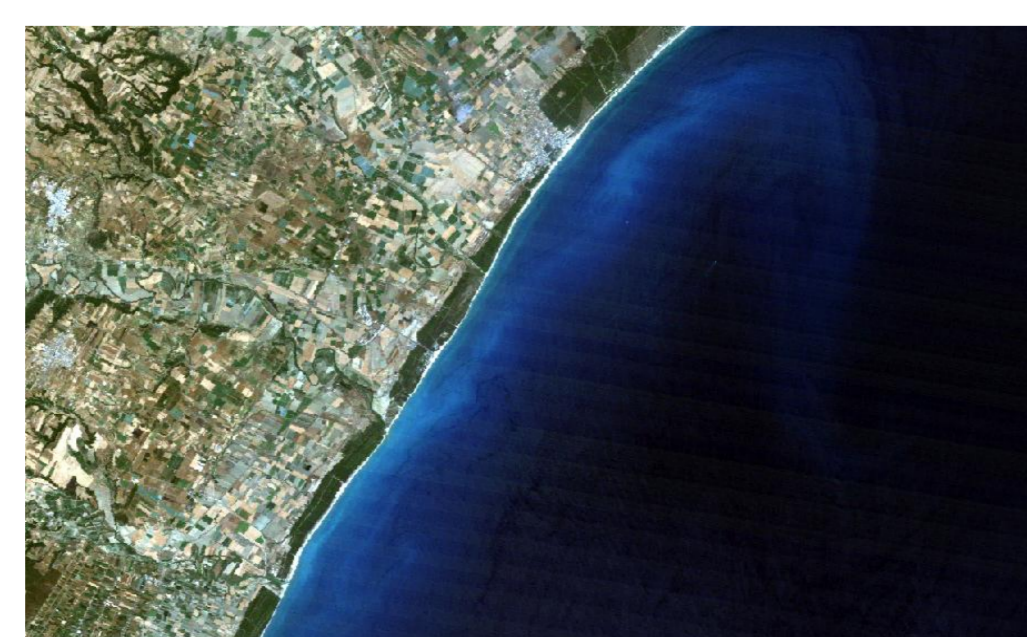
Strait of Gibraltar: Chlorophyll-a (24/07/2008, SeaWiFS, ESA)

Daily monitoring by the MODIS SPPA Team found a high occurrence of missing frames in data products. Investigations carried out in coordination with ESA resulted in a change of acquisition angle for the receiving antennae and processing procedure and a large increase in product quality.

Landsat SPPA: TM and ETM+

The TM (Thematic Mapper) sensor onboard LANDSAT 5, and the ETM+ (Enhanced Thematic Mapper) sensor onboard LANDSAT 7, launched in 1984 and 1999 respectively, are still active providing up to 26 years of data. The Landsat SPPA Team perform QC activities and support for ESA European coverage products as an **ESA Third Party Mission (TPM)**.

In 2009 the Landsat SPPA Team at Gael Consultant performed validation of a new radiometric calibration model known as the **Lifetime Model (LTM)**. This new model is based on **in-flight** (instead of pre-flight) radiometric calibration and represents a large increase in product radiometric quality; the LTM products became operational in June 2009.



Calabria region of south Italy: RGB (15/07/1993, Landsat 5 TM, ESA)

Scientific Community Support

QC Teams provide expertise & support to scientists and other users, to assist in data usage data and ensure confidence in ESA products.

The SPPA Teams aim is to help Users understand the data via:

- **Support Documentation:** FAQs, Product Handbooks and scientific documents (e.g. ATBDs).
- **Responding to Helpdesk Requests;** coordination with ESA EOHelp to provide instrument-specific responses to the User.
- **Monitor and feed into online forums** such as ODESA and BEAM for MERIS, and the Ocean Color Forum for SeaWiFS and MODIS.
- **Provide access to high-quality data** via the ESA Webportal information and links.
- **Routine daily monitoring** of product catalogues and archives.
- **Issuing Product disclaimers** and information notifications.

Assessment of general data quality:

Sensor performance is monitored via online portals to forestall any gaps in product dissemination, and is subsequently reported in performance reports.

The SPPA Teams are also part of instrument Quality Working Groups (QWGs), and attend scientific meetings such as the MERIS Validation Team and NASA Ocean Color Research Team meetings.

Reporting Activities

Outcomes of Quality Control (QC) activities are documented through a series of regular reports, compiled on a daily, monthly, cyclic and yearly basis.

- **Daily Reports (DRs)** serve to document product quality information including product generation and instrument health. These highlight any anomalous behaviour such as geolocation discrepancies or missing data.
- **Monthly Reports (MRs)** contain information on the state of the QC activities for each instrument, summarising the resolution of User queries during the reporting period and any ongoing or resolved investigations as well future evolutions of the service. These Reports feed back into the IDEAS SPPA framework, and provide ESA with a regular update of activities.
- **Cyclic Reports (CRs)** contain information to ensure the User community is kept informed of any modification regarding the processor, updates of auxiliary products, behavioural anomalies of the instrument, data acquisition and processing, and the status of the Calibration, Validation, and Quality Control activities.

Reports are circulated internally/externally depending on the mission and the level of QC coverage performed.



Sea of Japan: Phytoplankton bloom (31/10/2009, MERIS, ESA)

Quality Control Tools

The SPPA Teams utilise a large number of both open source and bespoke tools developed for each instrument.

Through using open source tools such as **BEAM VISAT** and **SeaDAS**, the SPPA Teams have concurrent knowledge and expertise to draw upon when answering User queries, and can relate QC reports to the interfaces used by Users; therefore making the QC activities as fully transparent as possible.

Due to the detailed nature of some QC activities on product formats not available to Users, the SPPA Teams also utilise a number of bespoke tools, developed at ACRI-ST, Gael Consultant and ARGANS. These tools include **MERISDOC** and **MERLOT** (ACRI-ST); **QUISS**, **FRAME** and **timEditProduct** (Gael Consultant); **M_PHAT**, **M_PARC**, and **MOAC** (ARGANS).

In addition, automated QC tools operated by ESA Ground Stations also form part of the overall product QC; such as **AMALFI** for MERIS products. This is the offline QC system assessing all products as they are prepared for postal delivery to Users. Any products which fail the test are the subject to in-depth investigation to determine if the product is suitable for distribution



Service Evolution: GMES and QA4EO

Within the **Global Monitoring for Environment and Security (GMES)** programme, ESA is responsible for developing a harmonised system that facilitates access to **Earth Observation (EO)** data; this is achieved through the GMES Space Component Data Access (GSCDA) system. This includes the development and operational service of the **Coordinated Quality Control (CQC)** which ensures full traceability and accessibility of the Quality Information Items (e.g. documents, reports, auxiliary information).

The **CQC** is also tasked to coordinate anomaly investigations, detailed quality control and quality assurance analysis for **GMES Contributing Missions (GCMs)**; this is currently being achieved through coordination with the relevant instrument SPPA Teams.

QA4EO has been established by the **Committee on Earth Observation Satellites (CEOS)** to facilitate the Group on Earth Observations (GEO) vision for a Global Earth Observation System of Systems (GEOSS). The aim is to provide a global infrastructure that generates comprehensive near-real-time environmental data, information and analysis for a wide range of users. **QA4EO** is based on the adoption of guiding principles, which are implemented via guidelines derived from best practices. Evolution activities are currently ongoing to ensure all **GCMs are QA4EO compliant**

