



EC Framework 7: QA4ECV

Quality Assurance for Essential Climate Variables

Joanne Nightingale, Nigel Fox and
Tracy Scanlon



QA4E

A QUALITY ASSURANCE
FRAMEWORK FOR
EARTH OBSERVATION



QA4ECV Project



- 4-year EU FP7 project (2014 – 2017)
- Led by KNMI with 16 contributing institutions

<http://www.qa4ecv.eu/>

Develop a prototype of an internationally accepted QA framework that provides free and open access to quality information along with traceable processing steps for deriving uncertainties associated with data records used for climate services



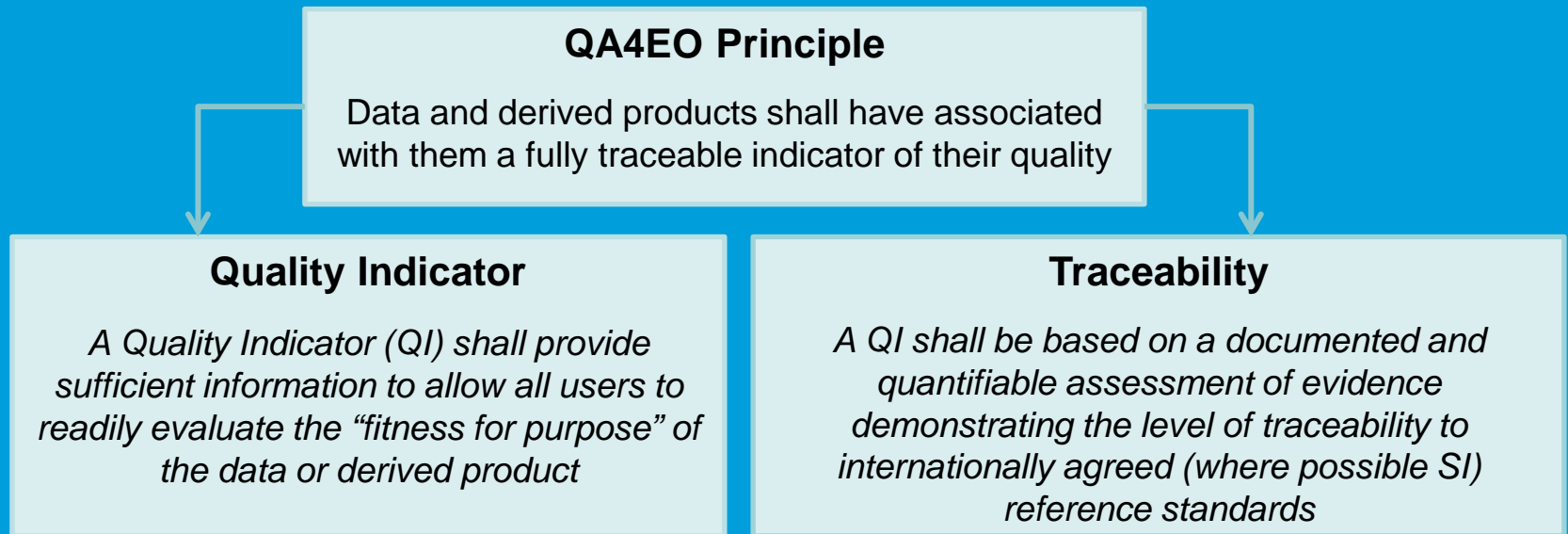
QA4ECV Aims

1. Develop a robust generic system for the QA of satellite and in situ algorithms and data
 - Multi-use QA tools with a verification framework
 - Prototype QA system for the Copernicus Climate Change Service
2. Generate quality-assured multi-decadal CDRs for 3 atmospheric and 3 land ECVs, with full uncertainty metrics for every pixel
 - **Atmosphere:** NO₂, HCHO, CO
 - **Land:** Albedo, LAI, FAPAR
3. Engage with stakeholders, governance bodies and end-users to demonstrate how trusted satellite data and a reliable means of interoperability can facilitate users in judging the fitness-for-purpose of the ECV CDRs





- Quality Assurance for Earth Observation
- Support GEO in the delivery of comprehensive and timely “knowledge / information” to meet the needs of its Societal Benefit Areas





User Engagement

- Survey on **User** Requirements for QA in satellite-derived CDR's
 - Data users want QA information, however it is often not readily available
 - Product uncertainty and processing traceability information are the least accessible QA components
 - Although basic quality flags are contained in many products, they are often insufficient for the users application
 - Current QA in atmospheric products appears much more substantial and readily available than for land and ocean products



User Engagement

- Survey of **Producers/Supplier** Views on QA in satellite-derived CDR's
 - Phone interviews with six individuals responsible for developing and/or providing ECV data sets to the community
 - Three land and three atmosphere data suppliers within the EU and North America were contacted
 - In all cases, these data suppliers felt their products **contained adequate QA information** and the dissemination of this information to the data users was effective
- Report available on QA4ECV webpage



QA4ECV & Copernicus CCS

- European Union Framework 7 has the fundamental goal in support of the Copernicus Climate Change Service

“to develop rigorous quality assurance methodologies for satellite-derived ECV products.”

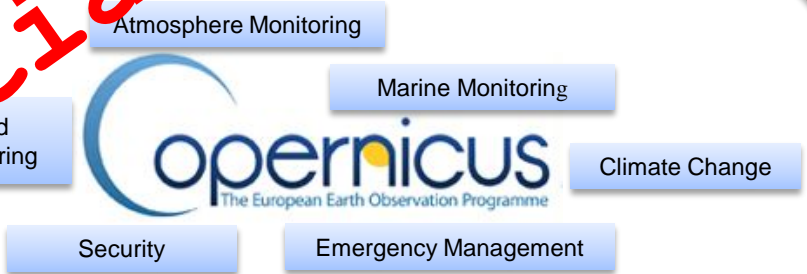
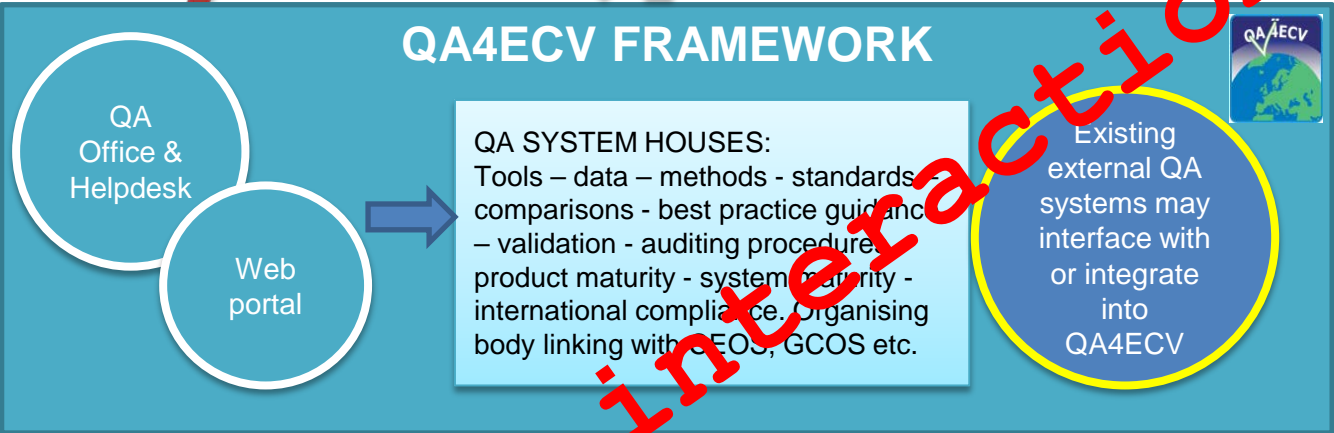
“traceable approaches that allow evaluation of the quality of satellite-derived and in-situ measured ECV products and algorithms ... via an unbroken chain of comparisons to certified reference standards”

“as it is used in metrology” and

“wherever possible be traced to reference standards of SI derived units”



Satellite-derived ECV and CDR Developers / Data suppliers



Data Users
Providing Scientists, Public, Commercial, Government, Policy-makers access to trustable EO data and derived products

Potential interaction



QA Service Specification

1. Provide ECV data product **producers** / science teams with the necessary resources to develop “QA compliant” products
2. Provide data **users** with robust QA information and a means to quantitatively assess confidence and uncertainty, *presented in a common way throughout the community*

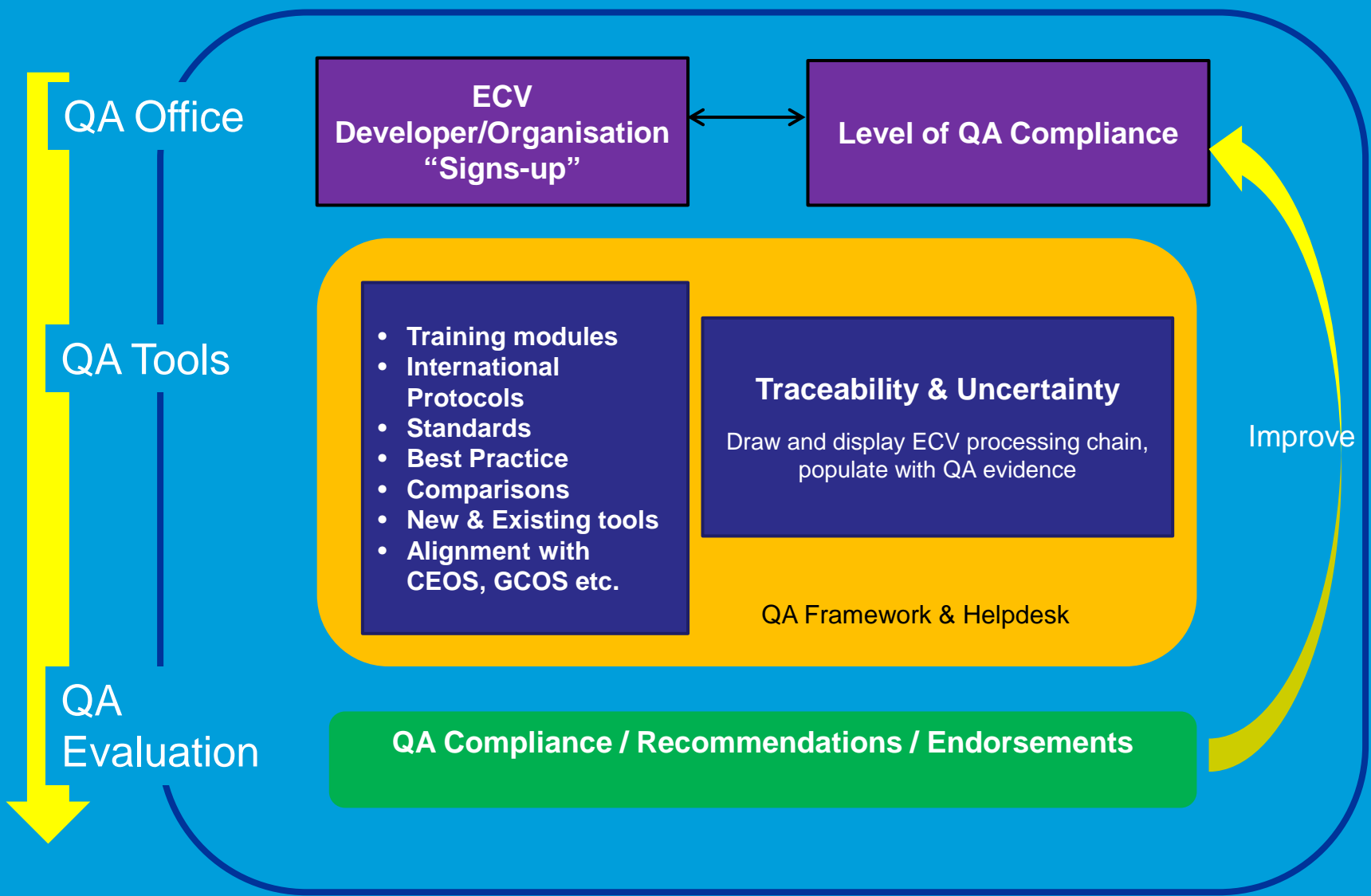


How?

ECV Producers	ECV Users
Access to community best practice	Providing confidence in ECV data records
Access to SI traceability/standards	Providing independent evaluation of QA of ECV data records
Tools to support practical QA implementation	Consistency, transparency and standardisation of QA approaches
Facilitating demonstration of QA metrics	Translating complicated uncertainty/error metrics
Instilling a culture of recording, documenting and self-assessment	Data provenance
Access to QA helpdesk/specialist staff	Access to QA helpdesk/specialist staff



QA Process

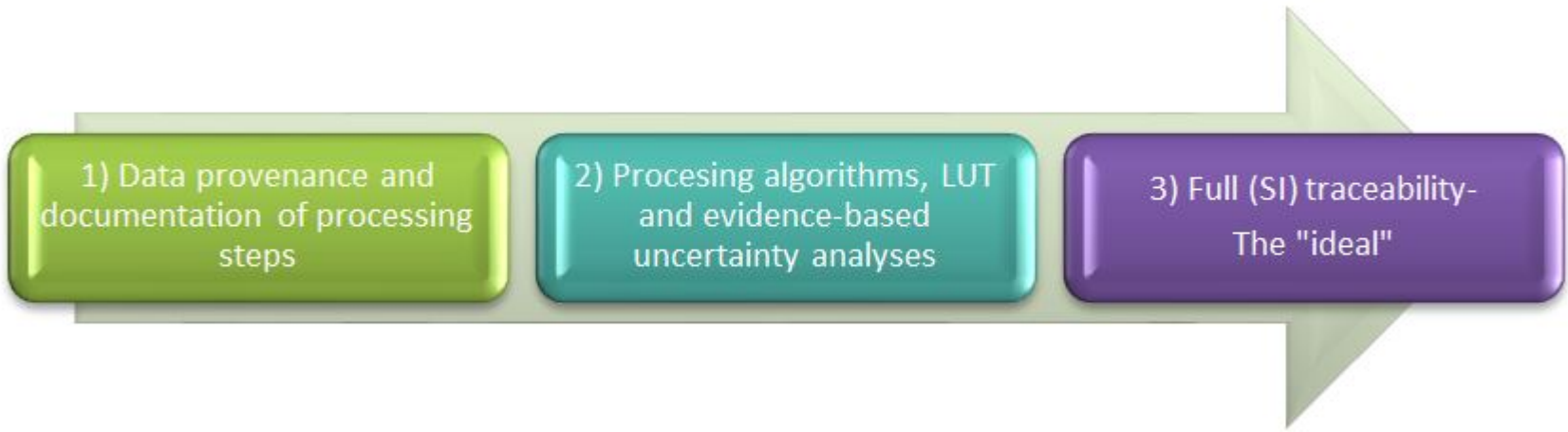




QA Information Considered

- Traceability & Uncertainty
- Quality Flags
- Validation
- Fitness-for-purpose (i.e. Product & System Maturity, maturity matrix)

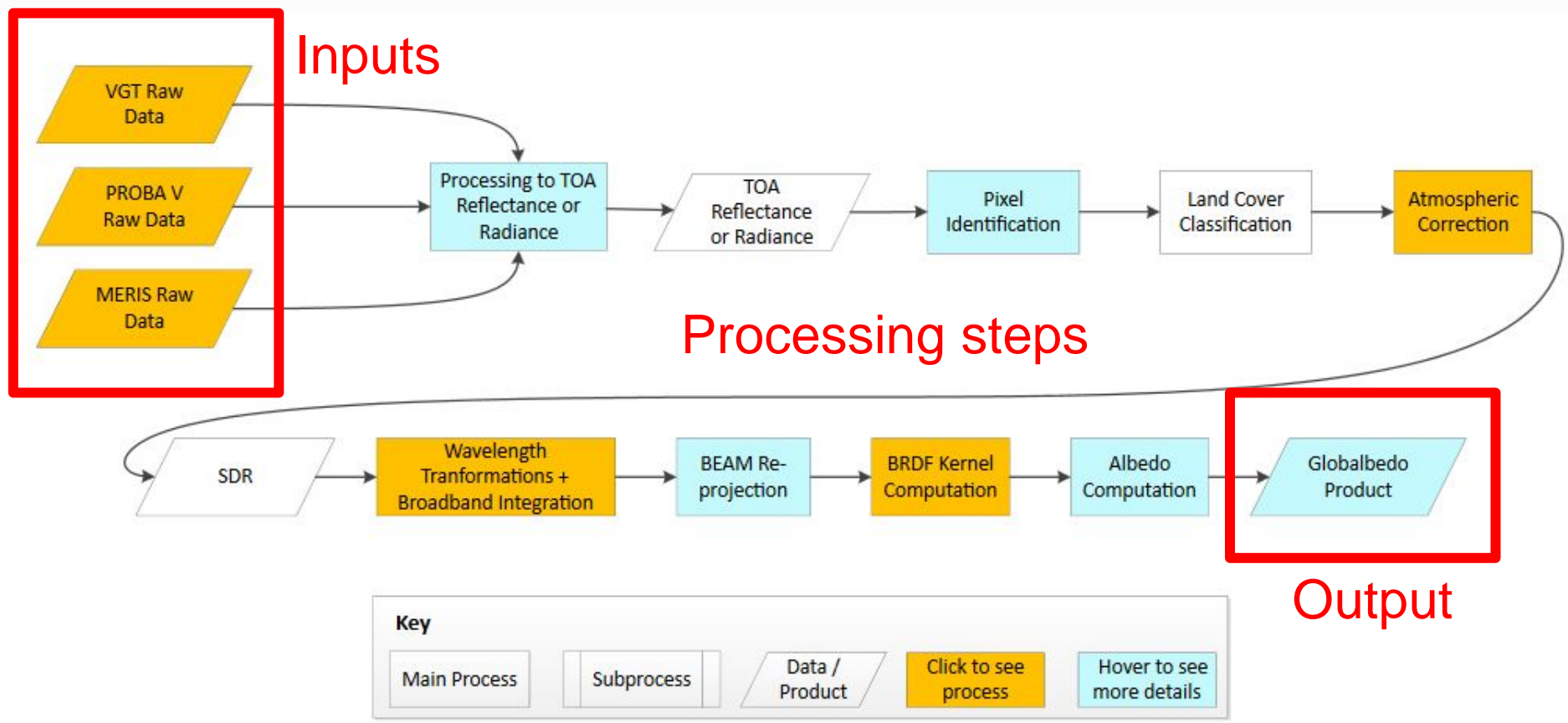
Traceability & Uncertainty



- Traceability diagrams of processing steps
- Documentation at each step (i.e. CHARMe)
- Uncertainty propagation through processing chain
- Development of common tools, methods
- Same for validation data and processes

Traceability Diagrams

GlobAlbedo - Broadband Albedo Product

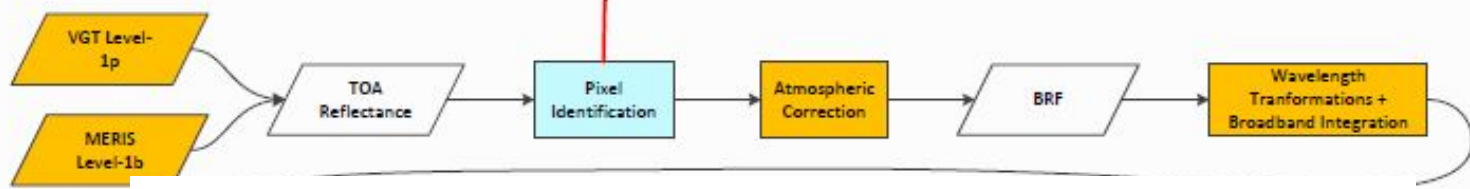


Traceability Diagrams

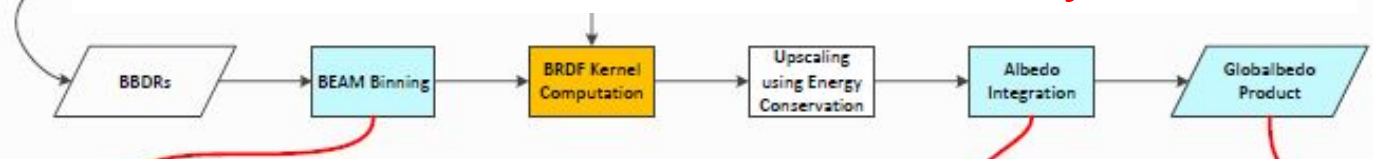
NEWS MEETINGS PROJECT INFO PUBLICATIONS QA SYSTEM ECVS CONTACT

ECVs/ Traceability Chains/ Albedo/ Main Traceability Chain

Pixel Identification
 The GlobAlbedo Pixel Identification processor (see GlobAlbedo_PixID_ATBD_V3.0 (2011)) classifies each pixel to be processed according to a series of pixel categories, which include cloud, clear-land, clear-water and clear-snow. Cloudy pixels are not processed in GlobAlbedo, while land, water and snow pixels must be distinguished because of the particular processing steps associated to each surface type. In particular, water pixels must be separated from land surfaces even in the case of continental water bodies, as these are flagged in the final albedo product. Snow and snow-free surfaces will also be considered separately in the albedo product.



As little or as much detail / info as you like!



BEAM Re-projection
 Data are projected on to a MODIS sinusoidal grid and binned. Details are given in the product user guide (Part 6) and the ATBD (Section C).
 The process uses a BEAM re-projection. Details are given at the Brockmann Consult website.

Albedo Computation
 Bi-Hemispherical Reflectances (BHR, sometimes known as "white-sky" albedo) and Direct Hemispherical Reflectances (DHR, sometimes known as "black-sky" albedo) are integrated from the BRDF for a particular solar angle range every 8 days.

Globalbedo Product
 The globalbedo product is provided at 0.05° and 0.5° in monthly time-steps.

Log in



CCI Interaction

- Develop documentary traceability chains to be included in QA framework tool and on webpage
- Understand current level of uncertainty propagation through algorithms
- Identify gaps in knowledge and where to focus research and tool development
- CCI support is paramount to the utility of the QA4ECV service development