Evaluation and Quality Control Function for the CDS

Climate Change

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on behalf of the C3S EQC for CDS team

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Evaluation and quality control of the CDS

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The CDS requires an ***Evaluation and Quality Control (EQC)*** function that provides an overarching quality assurance service. It **polices all aspects of the CDS** and includes:

CDS datasets: provide information about the technical and scientific quality and fitness-for-purpose, along with independent assessment of the datasets

CDS Toolbox: assessment of maturity and fitness for purpose of the software provided to explore the datasets

CDS service: performance assessment of the CDS infrastructure (e.g. speed, responsiveness, system availability)

CDS users: user requirement assessment to measure users' satisfaction with the CDS. Map evolving user needs into viable user requirements to ensure a user-oriented evolution of the CDS

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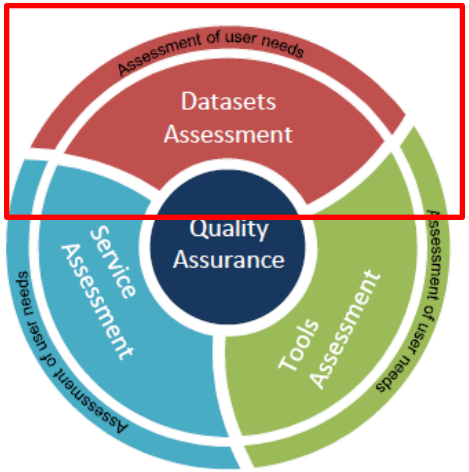
EQC OF THE CDS DATASETS



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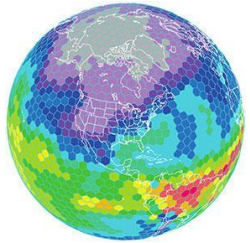
EQC of the CDS datasets

QAR available in the CDS

The quality assessment of the CDS datasets is collected in **Quality Assurance Reports** (**QARs**). The QAR includes a variety of dataset documentation, according to provider indications, that is independently reviewed by the EQC team, including an independent assessment of the data

A challenge: the CDS datasets encompass a wide variety of data types:

- ❑ Satellite observations
- ❑ In-situ observations
- ❑ Global and regional reanalyses
- ❑ Seasonal forecasts
- ❑ Global and regional climate projections



This poses challenges to provide a ***seamless and homogeneous EQC information*** for the whole CDS datasets

To overcome this issue a ***synthesis table*** is published in the CDS web portal

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EQC of the CDS datasets

The EQC information is made of dataset documentation according to provider indications and reviewed during the EQC process plus an independent assessment conducted by the EQC team

Fast assessment

- Compliance with a set of minimum requirements

- ❑ Documentation: e.g. quantity name, units, format, resolution, provider, version, description of processing, uncertainty characterization
- ❑ Data checker: e.g. space/time completeness of data and metadata, physical ranges of plausability

In-depth assessment

- Includes expert evaluation and maturity matrix

- ❑ Documentation: e.g. quality flags, product traceability chain, validation report, inter-comparison activities
- ❑ Independent assessment: e.g. compliance with community standards, maturity matrix (whether best practises have been followed), fitness for purpose (weather the dataset is robust and sufficient for the user's specific application), performance metrics, data strong and weak points

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Synthesis table

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Based on information obtained by providers and reviewed by EQC

Based on results from the EQC assessment

INTRODUCTION	USER DOCUMENTATION	ACCESS	INDEPENDENT ASSESSMENT
Dataset overview	User guide	Toolbox compatibility	Data check
Temporal and spatial coverage and resolution	Scientific methodology	Archiving	Expert evaluation
Providers	Uncertainty quantification		Maturity matrix
Dataset version	Validation		Summary of the independent assessment
Record update	Inter-comparison		

- The synthesis table is a tool to organise and homogenize the EQC information
- Its layout is shared by all data types
- Each box has a link to display the specific EQC information of interest

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Display of the dataset EQC information

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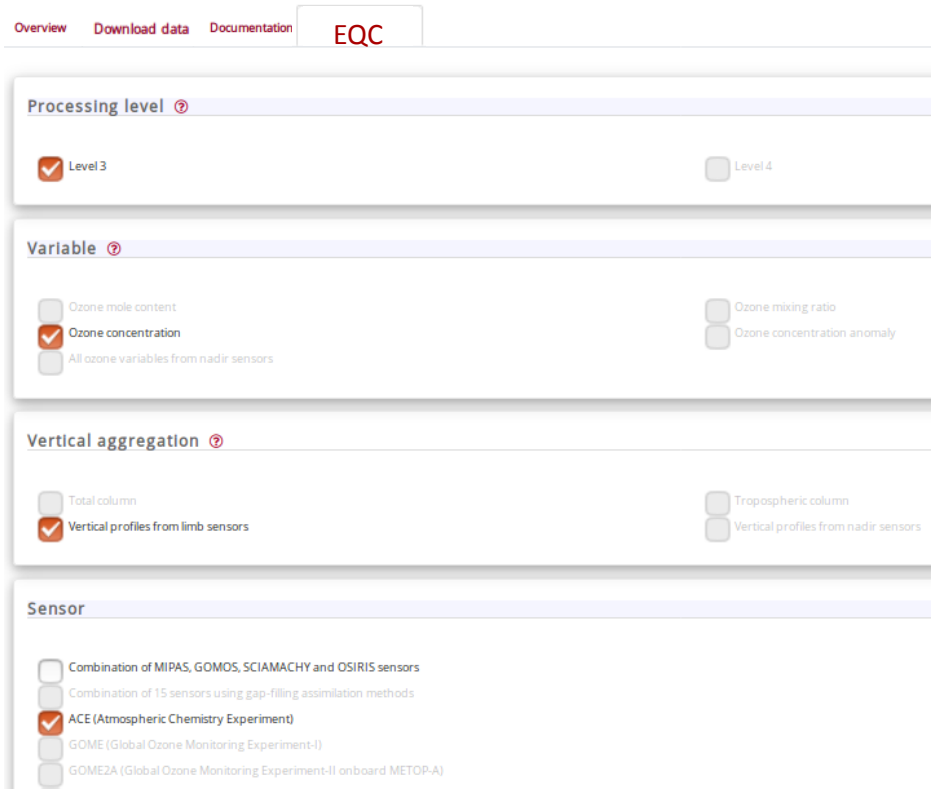

- User selects the dataset and variable of interest
- The user is then offered the option to access the related EQC information by clicking on the appropriate link
- The information is presented through a web page displaying the synthesis table; the webpage is created dynamically using the most recent information available in a database

Show EQC information

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Display of the dataset EQC information

Based on information obtained by providers and reviewed by EQC

Based on results from the EQC assessment

INTRODUCTION

- Dataset overview
- Temporal and spatial coverage and resolution
- Providers
- Dataset version
- Record update

USER DOCUMENTATION

- User guide
- Scientific methodology
- Uncertainty quantification
- Validation
- Inter-comparison

ACCESS

- Toolbox compatibility
- Archiving

INDEPENDENT ASSESSMENT

- Data check
- Expert evaluation
- Maturity matrix
- Summary of the independent assessment

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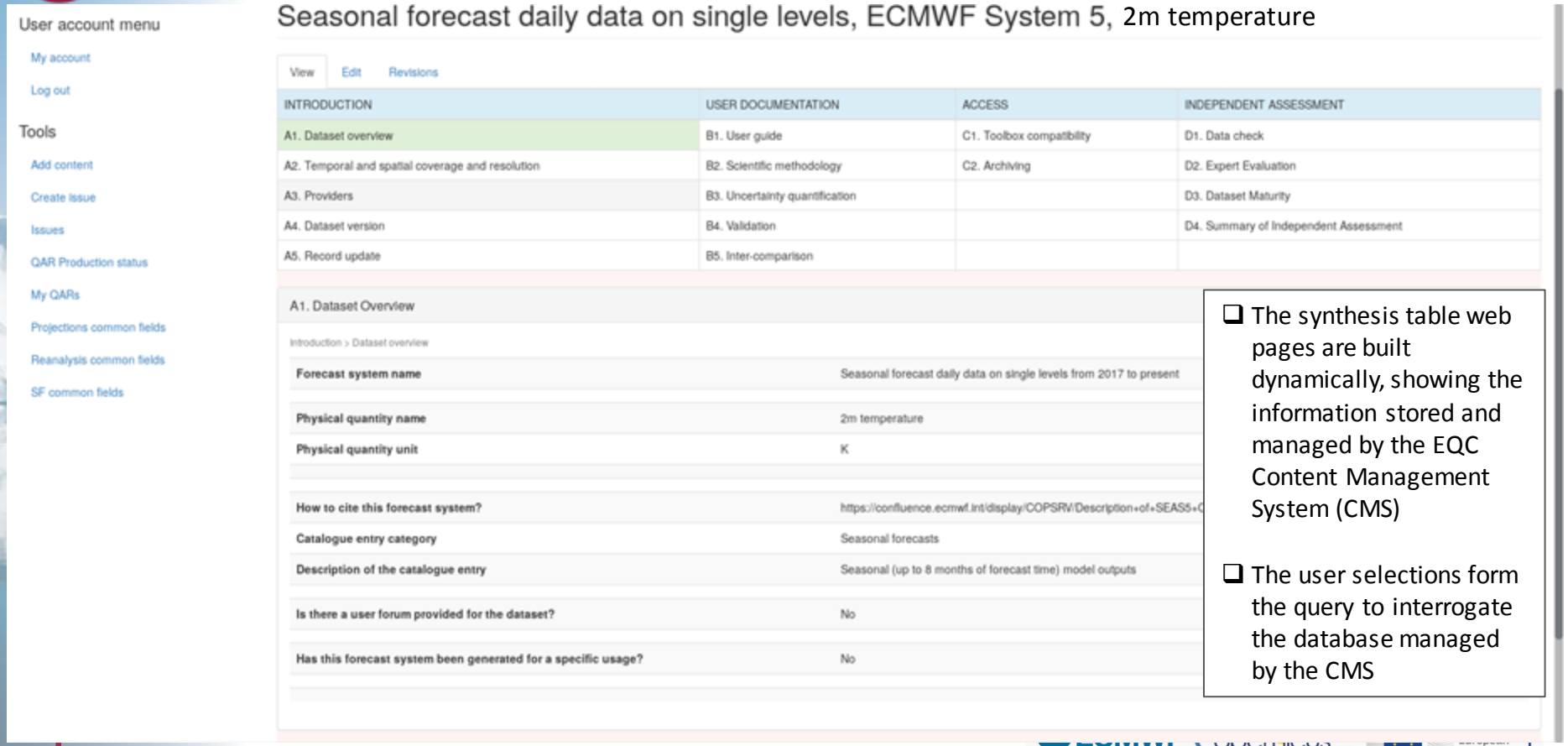
Content management system: Seasonal QAR



- The synthesis table web pages are built dynamically, showing the information stored and managed by the EQC Content Management System (CMS)
- The user selections form the query to interrogate the database managed by the CMS

Display of the dataset EQC information

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Based on information obtained by providers and reviewed by EQC

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Seasonal QAR: expert evaluation

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Level

-Select

Start Month

March

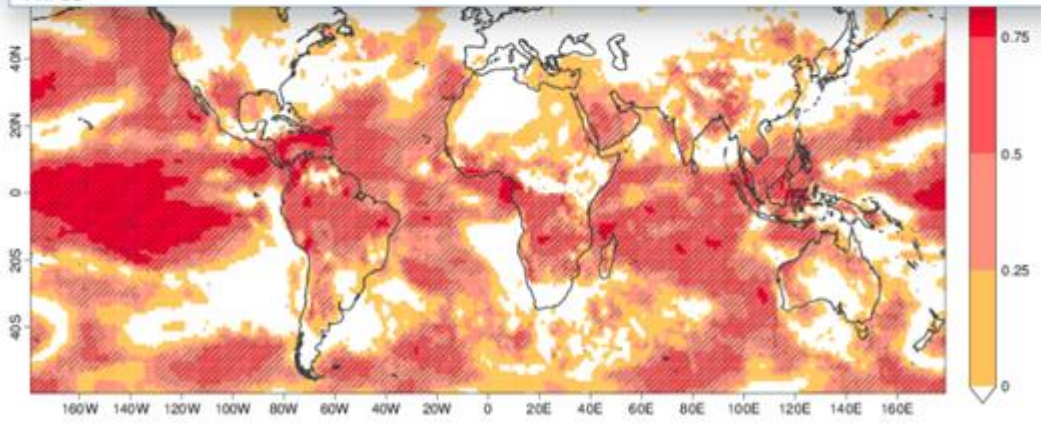
Forecast Month

3

Metric

Correlation

-Select
Bias
Correlation
FCRPSS
FRPSS



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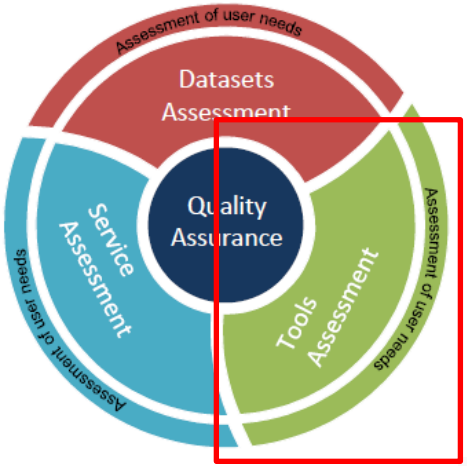
EQC OF THE CDS TOOLBOX



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EQC of the CDS Toolbox

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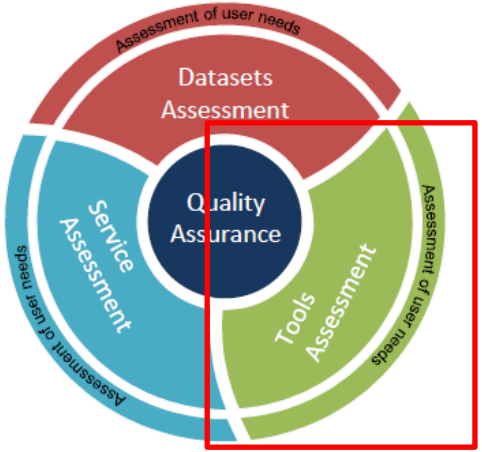
The EQC function assesses the quality of the CDS Toolbox from multiple angles: tools, workflows, Common Data Model (CDM), application editor, provenance tracking system.



Software quality assessment is based on the internationally-recognized standard ISO/IEC *9126* and extensions (e.g. ISO/IEC *25010*:2011)

The EQC framework of the Toolbox aims to:

- ❑ Assess the maturity of the software tools: robust in terms of code versioning and testing and well documented
- ❑ Evaluate the fitness-for-purpose of the software through use cases identified together with the users, assessing the applicability of the Toolbox to specific operations

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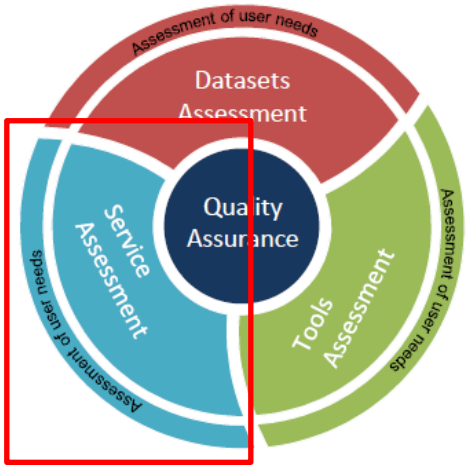
EQC OF THE CDS SERVICE



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EQC of the CDS service

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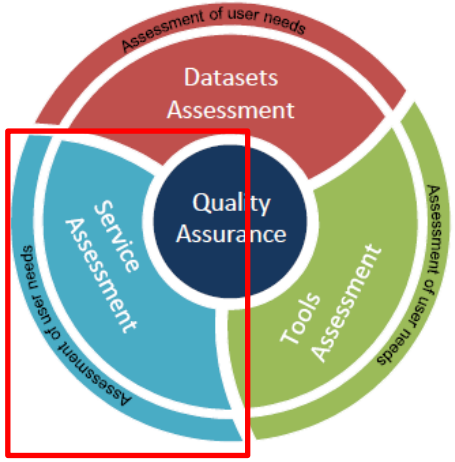
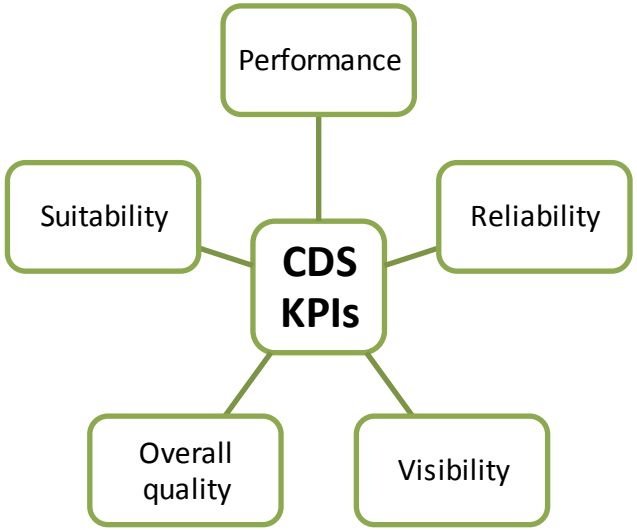
The EQC function measures and reports the technical quality of the CDS service (e.g. system availability, response time).



In particular, monitoring of the CDS infrastructure is based on:

- ❑ A set of Key Performance Indicators (KPIs)
- ❑ On-line rating widgets to monitor user satisfaction
- ❑ A web dashboard hosting the KPIs and widget statistics for information of the operators

The KPIs have been inspired by the internationally-recognized standard ISO/IEC *25010* and *25011*



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USER NEEDS

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User engagement

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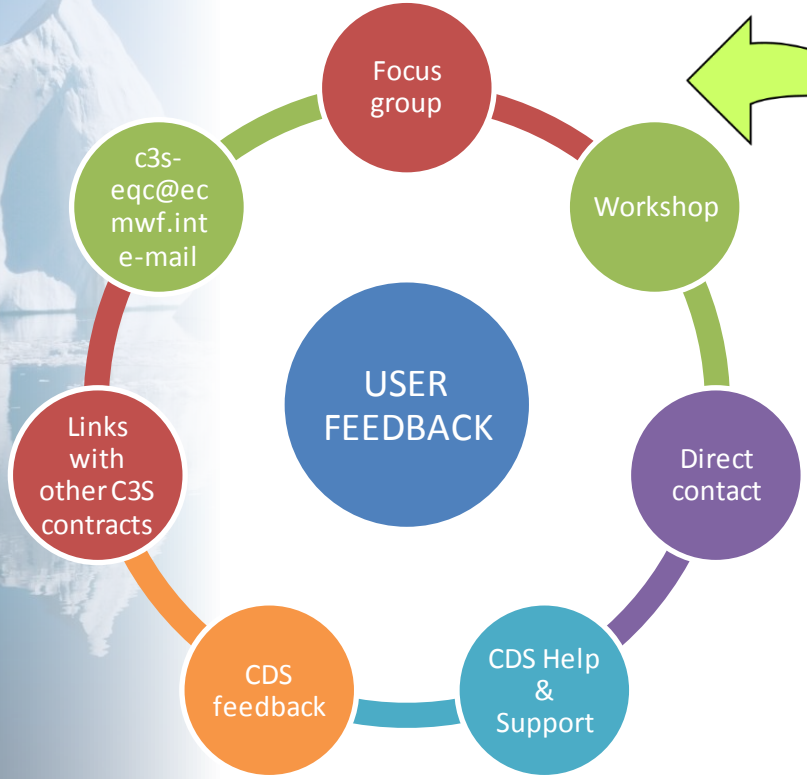
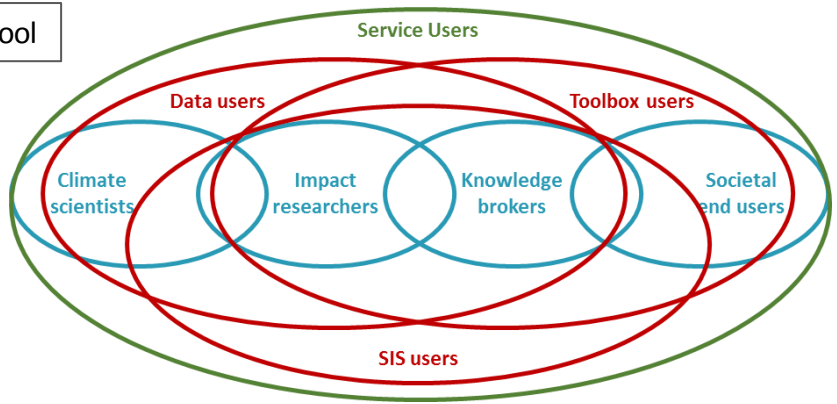
As the C3S is a user-driven climate service, user feedback is central to develop recommendations for improvement and expansion of the overall C3S (CDS data, Toolbox and SIS products)



User pool



Harvesting user requirements in a database

URDB

Analysed in a report for further development of the C3S

URAD

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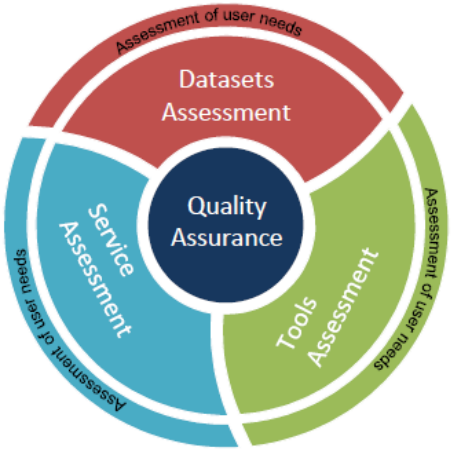
OTHER SERVICES



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Marine service

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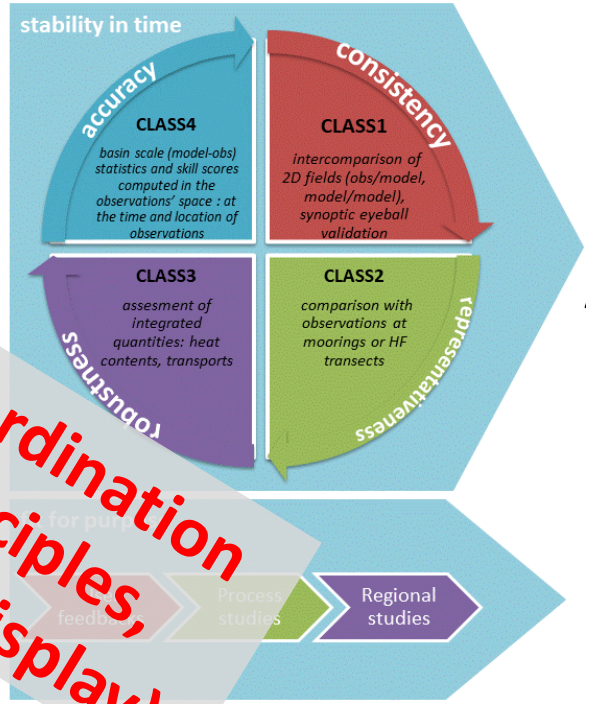
CMEMS has a well-developed product quality control system **performed mainly by the providers** and coordinated by Mercator that **focuses on the scientific quality of the datasets**

Need for a cross-service coordination group in EQC activities (principles, vocabularies, methodologies, display)

A working group of ~40 people:

- Meet each year
- Agree on actions:
  1. evolution of validation/verification standards
  2. evolution of the documentation
  3. evolution of the central website
- Exchange regularly

on topics/actions 1-2-3
on new reference observations
on common scientific issues …



A coordination team of 3+ people (1,5 FTE):

- Organization of meetings, animation of working group
- Reviewing documentation and reporting
- Draft roadmaps for topics 1-2-3
- Development and maintenance of central website

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Conclusions

- The EQC function of the C3S provides an **overarching quality assurance service for the whole CDS** and **SIS** components
- Users can fully understand the status and purpose of data and products, with **all relevant information in one place, with a unified language and look-and-feel**, based on the aspects the user deems most important
- The **homogenization of the EQC information** across all datasets allows to directly use several different datasets
- The EQC function is run by **independent actors** and helps **data producers** to understand which information they need to deliver for their datasets to be usable
- **Applications** (e.g. energy, water) **will inherit the EQC information** and propagate it to their end-user indicators
- There is a **plethora of EQC functions across Copernicus services** (mainly CAMS, CMEMS and C3S), with different principles, vocabularies and methodologies that would benefit from some level of coordination