



Climate Change

Evaluation and Quality Control function of the CDS

Pre-ESIP workshop

C3S_512 team





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COPERNICUS CLIMATE CHANGE SERVICE (C3S)



Copernicus is the European Union's Earth observation programme coordinated and managed by the European Commission

Copernicus provides a unified system through which vast amounts of data are fed into a range of ***thematic information services***, designed to benefit the environment, the way we live, humanitarian needs and support effective policy-making for a more sustainable future



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One of the thematic services, namely the **Copernicus Climate Change service (C3S)**, aims at providing comprehensive information about past, present and future climate to a wide range of users

Target users are policy makers, scientists and business operators to achieve a more sustainable future

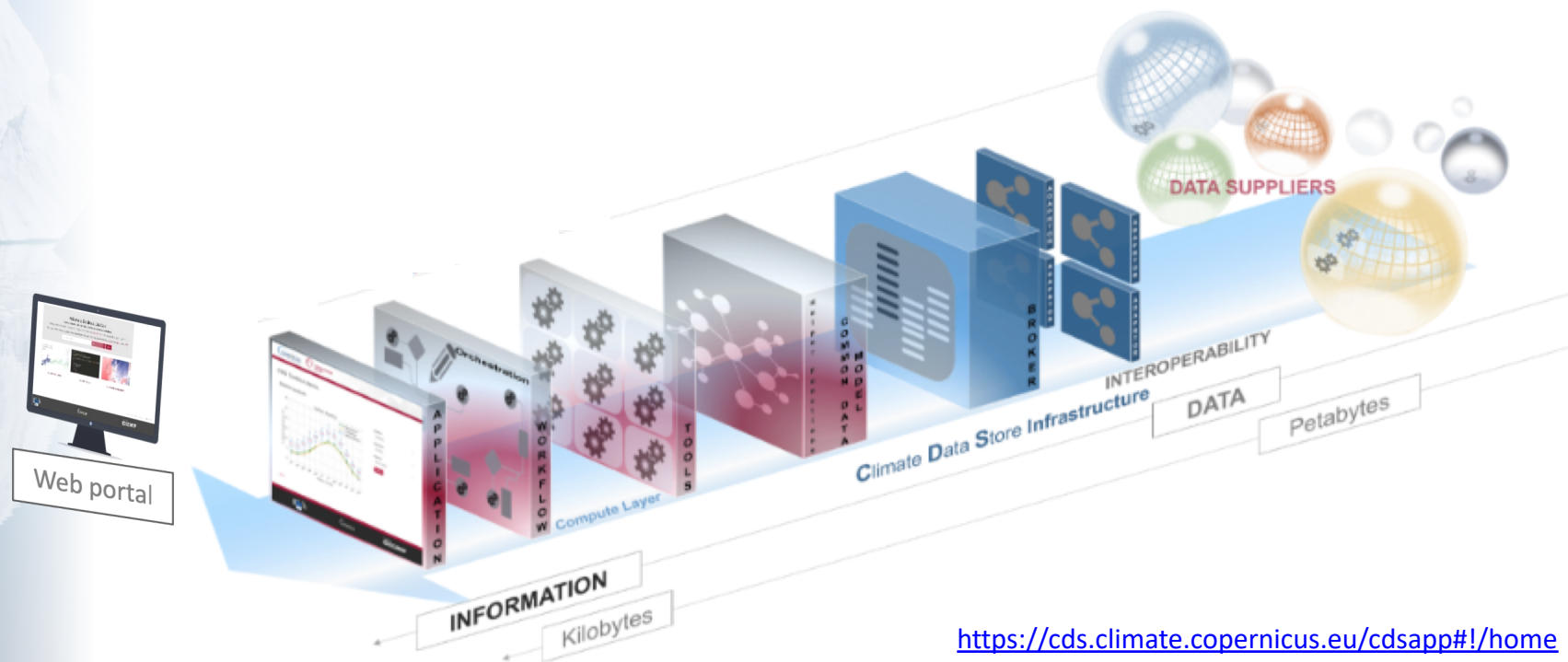
All this information is collected and made available in the **Climate Data Store (CDS)**, the cornerstone of the C3S



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CLIMATE DATA STORE (CDS)

At the heart of the **C3S** infrastructure is the cloud-based **Climate Data Store (CDS)**. It provides a single point of access to a wide range of climate datasets, namely satellite and in-situ observations, reanalyses, seasonal forecasts and climate projections





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EVALUATION & QUALITY CONTROL OF THE CDS

Such a complex infrastructure requires an ***Evaluation and Quality Control (EQC)*** function providing an overarching quality assurance service for the whole CDS:



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



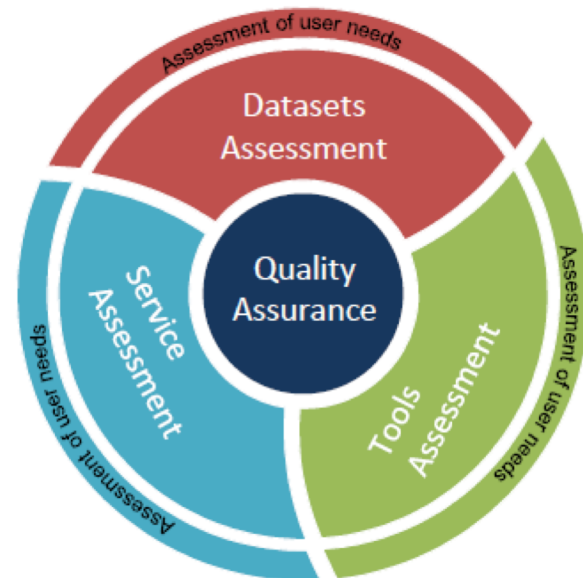
CDS Toolbox: assessment of maturity and fitness for purpose of the software provided to explore the datasets



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



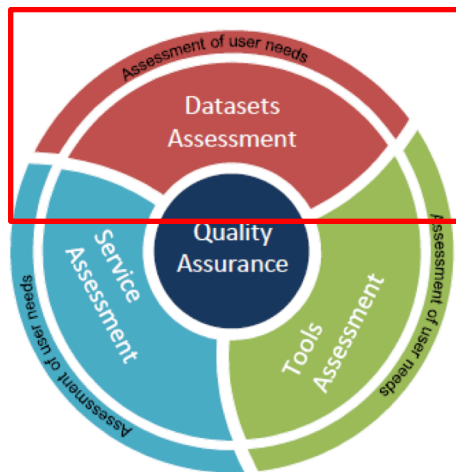
CDS users: user requirement assessment to measure users' satisfaction with the CDS. Map evolving user needs into viable user requirements to ensure a user-oriented evolution of the CDS





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EQC OF THE CDS DATASETS





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EQC OF THE CDS DATASETS

The EQC function builds a two-steps workflow to assess the quality of the CDS datasets, leading to the publication of Quality Assurance Reports (QARs)

EQC update

Fast
assessment

- Compliance with a set of minimum requirements

In-depth
assessment

- Includes both technical and scientific assessments

QAR available
in the CDS

- The QAR is organized in a table integrated in the CDS web portal, giving access to detailed EQC information according to user selections

User
feedback

- User needs are analysed for improvement and expansion of the CDS datasets and related EQC information





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EQC OF THE CDS DATASETS

QAR available
in the CDS

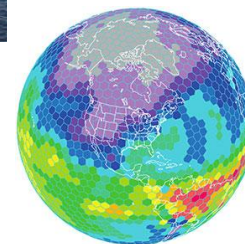
The quality assessment of the CDS datasets is collected in **Quality Assurance Reports (QARs)**. The QAR is made of dataset documentation, according to provider indications and reviewed during the EQC process, and an independent assessment conducted by the EQC team

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

- ☐ Satellite observations
- ☐ In-situ observations
- ☐ Reanalysis
- ☐ 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 integrated in the CDS web portal





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SYNTHESIS TABLE

Based on information obtained by providers and reviewed by EQC

Based on results of EQC assessment

INTRODUCTION

Dataset overview

Temporal and
spatial coverage

Providers

Dataset version

Record update

USER DOCUMENTATION

User guide

Scientific
methodology

Uncertainty
quantification

Validation

Inter-comparison

ACCESS

Toolbox
compatibility

Archive

INDEPENDENT ASSESSMENT

Data check

Expert evaluation

Dataset maturity

Summary of
independent
assessment

- ☐ The synthesis table is a tool to organise and homogenize the EQC information in a single entry point to guide the users
- ☐ Its layout is agnostic of the dataset type selected
- ☐ Each box gives the specific EQC information of interest



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INDEPENDENT ASSESSMENT framework

INDEPENDENT ASSESSMENT

Data check

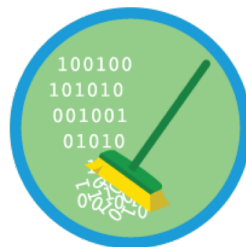
Expert evaluation

Dataset maturity

Summary of
independent
assessment

Data check

Data and metadata completeness, consistency, physical plausibility and compliance with community standards



Expert evaluation,

through scientific analyses and diagnostics

Means & variability

Trend detection

ESM evaluation

Performance metrics

Cross-comparison



Dataset Maturity

Independent maturity assessment.

Implement and adapt EU-framework Quality functions and methods (QA4ECVs, Core-Climax, GAIA-CLIM ...)



Summary of independent assessment

Concluding remarks, key strengths and limitations, methodology and operations performed



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EQC TAB demo example

The synthesis table is available through the EQC tab in the Catalogue

Home Search Datasets Applications Your requests Toolbox FAQ Live

EQC Seasonal forecast monthly statistics on single levels from 2017 to present

Overview Download data Quality assessment Documentation

This entry covers single-level data aggregated on a monthly time resolution.

Seasonal forecasts provide a long-range outlook of changes in the Earth system over periods of a few weeks or months, as a result of predictable changes in some of the slow-varying components of the system. For example, ocean temperatures typically vary slowly, on timescales of weeks or months; as the ocean has an impact on the overlying atmosphere, the variability of its properties (e.g. temperature) can modify both local and remote atmospheric conditions. Such modifications of the 'usual' atmospheric conditions are the essence of all long-range (e.g. seasonal) forecasts. This is different from a weather forecast, which gives a lot more precise detail - both in time and space - of the evolution of the state of the atmosphere over a few days into the future. Beyond a few days, the chaotic nature of the atmosphere limits the possibility to predict precise changes at local scales. This is one of the reasons long-range forecasts of atmospheric conditions have large uncertainties. To quantify such uncertainties, long-range forecasts use ensembles, and meaningful forecast products reflect a distributions of outcomes.

Given the complex, non-linear interactions between the individual components of the Earth system, the best tools for long-range forecasting are climate models which include as many of the key components of the system and possible; typically, such models include representations of the atmosphere, ocean and land surface. These models are initialised with data describing the state of the system at the starting point of the forecast, and used to predict the evolution of this state in time. While uncertainties coming from imperfect knowledge of the initial conditions of the components of the Earth system can be described with the use of ensembles, uncertainty arising from approximations made in the models are very much dependent on the choice of model. A convenient way to quantify the effect of these approximations is to combine outputs from several models, independently developed, initialised and operated.

To this effect, the C3S provides a multi-system seasonal forecast service, where data produced by state-of-the-art seasonal forecast systems developed, implemented and operated at forecast centres in several European countries is collected, processed and combined to enable user-relevant applications. The composition of the C3S seasonal multi-system and the full content of the database underpinning the service are described in the documentation. The data is grouped in several catalogue entries (CDS datasets), currently defined by the type of variable (single-level or multi-level, on pressure surfaces) and the level of post-processing applied (data at original time resolution, processing on temporal aggregation and post-processing related to bias adjustment).

The variables available in this data set are listed in the table below. The data includes forecasts created in real-time (since 2017) and retrospective forecasts (hindcasts) initialised at equivalent intervals during the period 1993-2016.

More details about the products are given in the Documentation section.

DATA DESCRIPTION

Data type	Grid
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Contact

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Licence

Licence to Use Copernicus Products

Publication date

2018-06-14

Related data

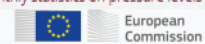
Seasonal forecast anomalies on pressure levels from 2017 to present

Seasonal forecast anomalies on single levels from 2017 to present

Seasonal forecast daily data on pressure levels from 2017 to present

Seasonal forecast daily data on single levels from 2017 to present

Seasonal forecast monthly statistics on pressure levels

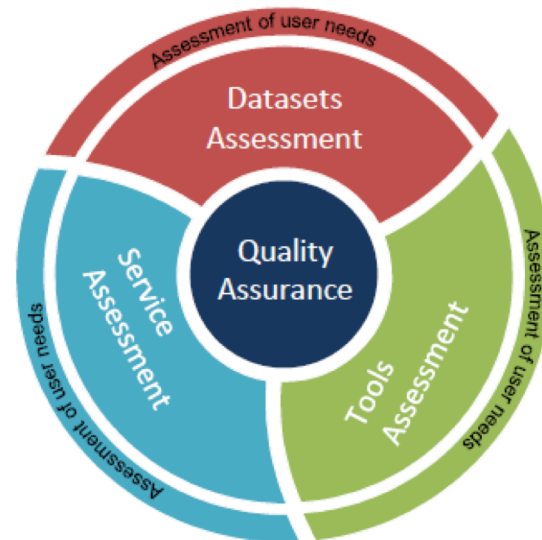




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CONCLUSIONS

- ❑ The EQC function of the C3S provides an **overarching quality assurance service for the whole CDS**: datasets, Toolbox, infrastructure, users
- ❑ The EQC function performs an **independent quality assessment** of a wide variety of datasets: satellite and in-situ observations, reanalysis, seasonal forecasts, global and regional climate projections
- ❑ Users can fully understand status and purpose of data product, with **all relevant information in one place**, based on the matters the user deems most important
- ❑ The **homogenization of the EQC information** across all datasets allows to directly compare several different products
- ❑ The EQC function helps **data producers** to understand which information they need to deliver and how to be compliant
- ❑ The EQC framework is **defined and implemented** in the C3S environment
- ❑ **Users are central** for the development and expansion of the C3S





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THANK YOU

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Deutscher Wetterdienst
Wetter und Klima aus einer Hand

