

EQC Status Overview

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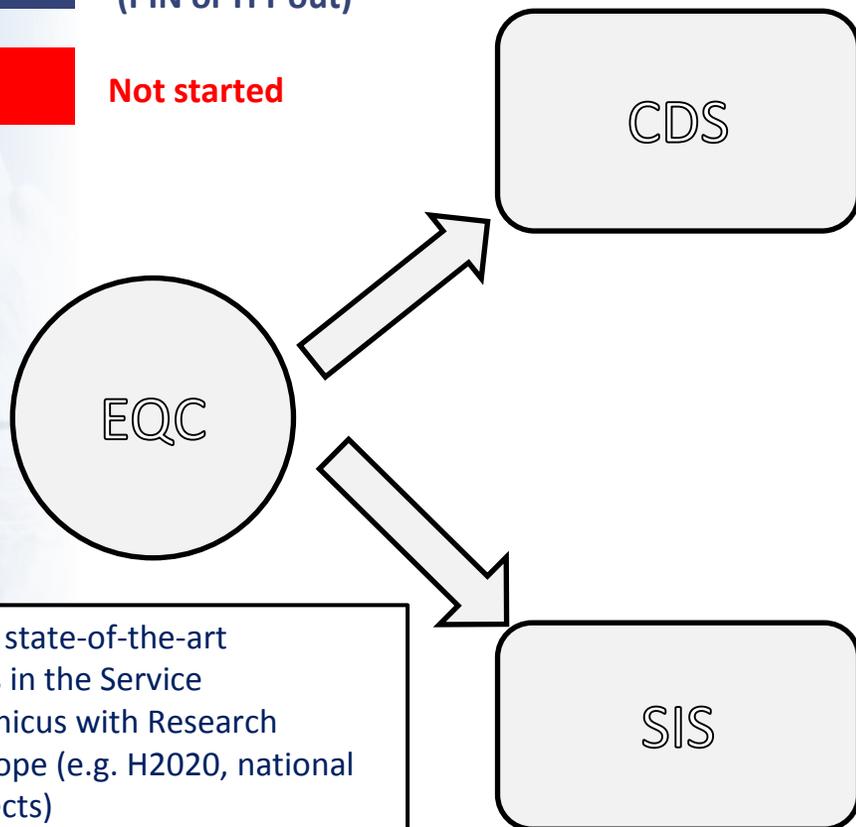




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EQC: Engaged and future activities

- Action engaged
- In preparation (PIN or ITT out)
- Not started



- Ensures C3S is state-of-the-art
- Identifies gaps in the Service
- Bridges Copernicus with Research Agenda in Europe (e.g. H2020, national research projects)
- Monitors continually, quality of C3S products and services
- “Quality Assurance” body
- Contributes and develops URDB/SES/etc documents

J.N. Thépaut (ECMWF)





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Challenges of the EQCs

- **Address adaptation:** it must provide information for all kind of services including adaptation, taking advantage that many users are already familiar with the climate-change problem.
- **Provide consistency:** it must build trust, ensuring a high degree of coherence across products, underlying data sets, processing methods, communication, etc.
- **Provide innovation:** it should make recent developments from research operational to answer real-world issues.
- **Address efficiency:** the EQC information should be timely, e.g. respond to users' queries with a delay as short as possible, which imposes conditions on the algorithms considered.
- **Define the target:** data, products, communication, etc.



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Framework for collaboration

C3S EQC Workshop
12-14 June 2017

C3S_34aLot1
WP1: Management
WP2: Data Management
WP3: Data Node Software
WP4: Compute Node Software
WP5: Interfaces and Tools
WP6: System Integration

C3S_34aLot2
WP1: Management
WP2: Workshop
WP3: Technical implementation
WP4: Metrics
WP5: Multi model Products
WP6: Time Series
WP7: Tailored Products

C3S_51Lot4
WP0: Management
WP1: User requirements
WP2: Data inventory
WP3: Assessment/gap analysis
WP4: CDS requirements
WP5: EQC framework

C3S_51Lot3
WP1: Assessment of user requirements
WP2: Climate data inventory
WP3: Scientific assessments/gap analysis
WP4: CDS requirements
WP5: EQC framework
WP6: Management and communication

C3S_52Lot2 !
WP1: State of the art
WP2: Initial user engagement & strategy
WP3: Future Climate Impact Indicators
WP4: Implementation plan
WP5: Management & Recommendations



SAVE THE DATE

Copernicus Climate Change Service – Evaluation and Quality Control workshop

Date: 12-14 June 2017

Location: Barcelona Supercomputing Center, Barcelona, Spain

Register: <https://climate.copernicus.eu/events/evaluation-and-quality-control-workshop>

C3S EQC workshop

The event will focus on:

- Progress to date for each of the contracts (Observations, Seasonal, Climate and User Requirements)
- Identification of any gaps that we should address
- How the EQC function should work once C3S is operational

H. Gregow (FMI)



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What is EQC information?

Some examples:

- Observations are expected to provide accuracy estimates.
- Reanalyses should come along with a validation against independent observations.
- Forecasts have no real value without an estimate of quality based on past performance.
- Projections require a scientific validation of the models used (e.g. IPCC WGI Ch. 9).

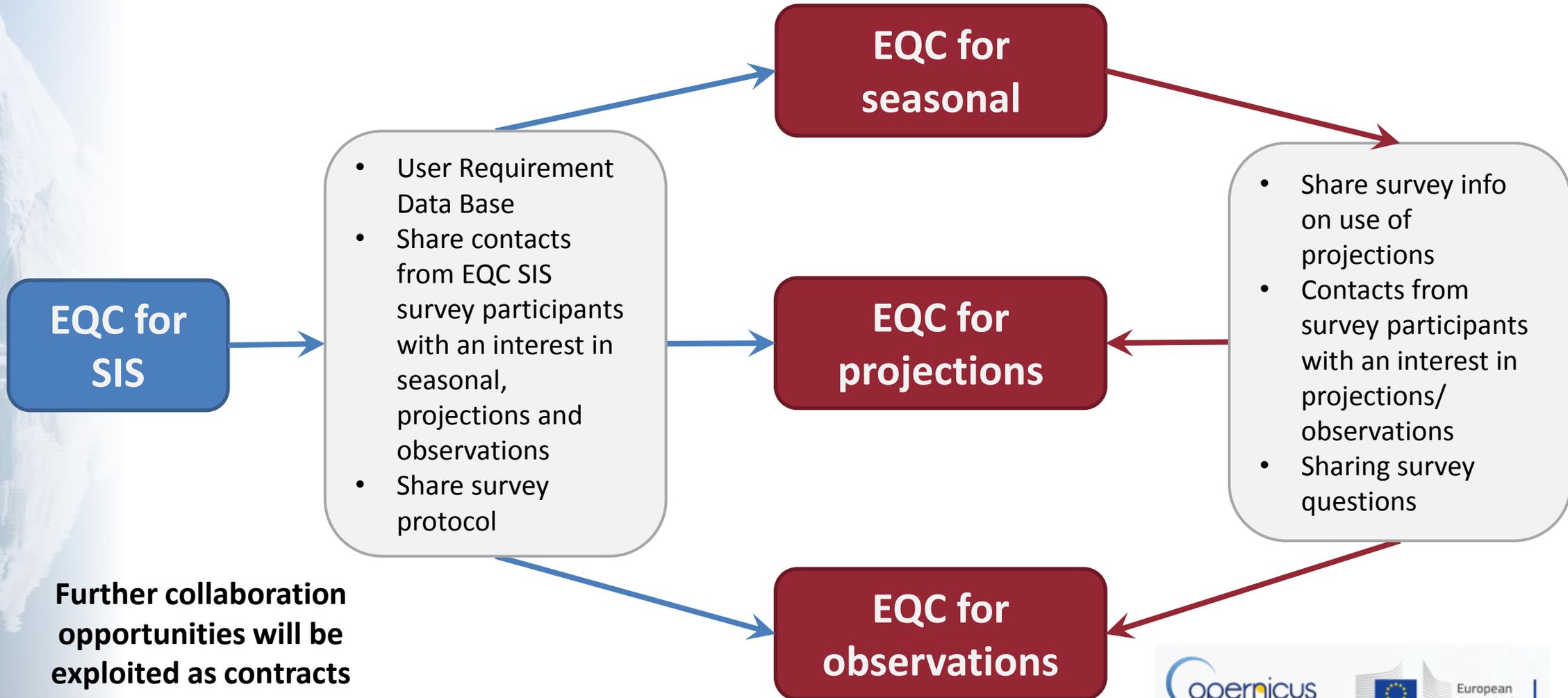
But quality information is much more complex than this.



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Collaboration between EQCs

User engagement and assessment of needs



M. Soares (Univ. Leeds)

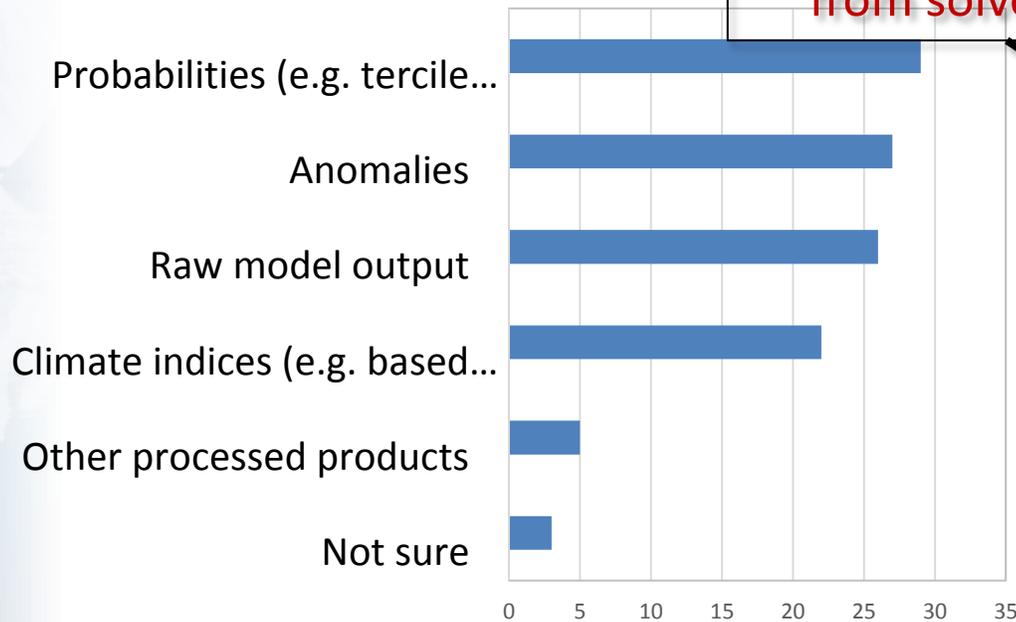


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Users' requests

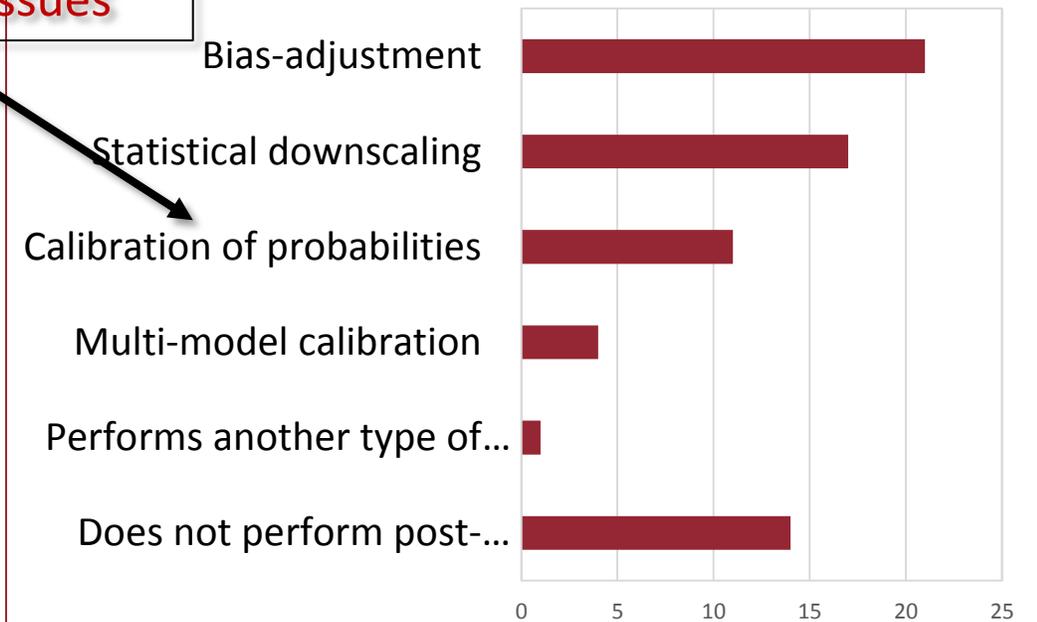
Results from a [survey](#) where 42 out of 53 respondents receive seasonal forecast information, with a large majority of NMHSs.

"What kind of data from global seasonal forecast models do you use?"



Note that these are far from solved issues

"What type of adjustment post-processing do you perform on the SCF data before using it?"





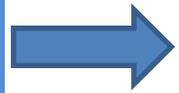
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Data inventories

Evaluation matrices for the different aspects

		RCM-GCM chains																			
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		CNRM-CM5	CNRM-CM5	MPI-ESM-LR	EC-EARTH	EC-EARTH	HadGEM2-ES	CanESM2	CNRM-CM5	CSIRO-Mk3-6-0	EC-EARTH	IPSL-CM5A-MR	MIROC5	HadGEM2-ES	MPI-ESM-LR	NorESM1-M	GFDL-ESM2M	MPI-ESM-LR	IPSL-CM5A-MR	Total number	
		ALADIN52	ALADIN53	CCLM4-8-17	HIRHAM5	RACMO22E					RCA4						REMO2009	WRF331F	Total number		
EUR-44	Type of grid																				
	Output frequency																				
	EUR-44	3-hourly																		0	
	EUR-44i	6-hourly																		0	
	EUR-11	daily	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	18
	EUR-11i	monthly	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	18
EUR-11	seasonal	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	16	
	invariant (fx)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	18	
	Spatial resolution																				
	Output frequency																				
	0.44°	3-hourly																		5	
	0.11°	6-hourly																		5	
Land area fraction available	daily	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	15	
	monthly	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	15	
	seasonal	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	13	
	invariant (fx)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	15	

Temporal resolution available on both EUR-44 and EUR-11



Multiplied criteria:
resolution, data frequency,
available variables and scenarios



Narrow ensemble



Proposal to CDS



Once the data are identified and available, a critical question is which of the available data will be used as the data use will depend on, among other things, the quality information.

C3S51_Lot4 considers two criteria:

- Inadequate sources for the user's application should be omitted (e.g. discard "bad" models).
- The sources retained should be diverse enough to still adequately represent all uncertainties (e.g. has the solution enough spread?)

What does "bad"
mean?



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Scientific assessment and gap analysis

Definitions are important:

- **Diagnostics** can be derived from any geophysical data set, independently of any reference (e.g. Arctic sea-ice area).
- **Metrics** reflect the agreement of a diagnostic from a system with respect to the same diagnostic computed from a reference.
 - Performance: RMSE of Arctic sea-ice area in a historical run.
 - Predictability: spread of Arctic sea-ice area in a multi-model.
 - Forecast quality: explained variance of Arctic sea-ice area.
 - Process-based: heat budget analysis of Arctic sea ice.
- A **constraint** is a metric applied to an ensemble of simulations displaying relationships between two diagnostics, one of which can be observed.
- **Diagnosis** is an integrated statement for an EQC purpose. It involves the use of diagnostics and different metrics, together with prior knowledge about the system itself and its underlying physics.
- The **CRISTO** framework for evaluation might help: **completeness, rationale, interpretability, stability, transparency, observability.**

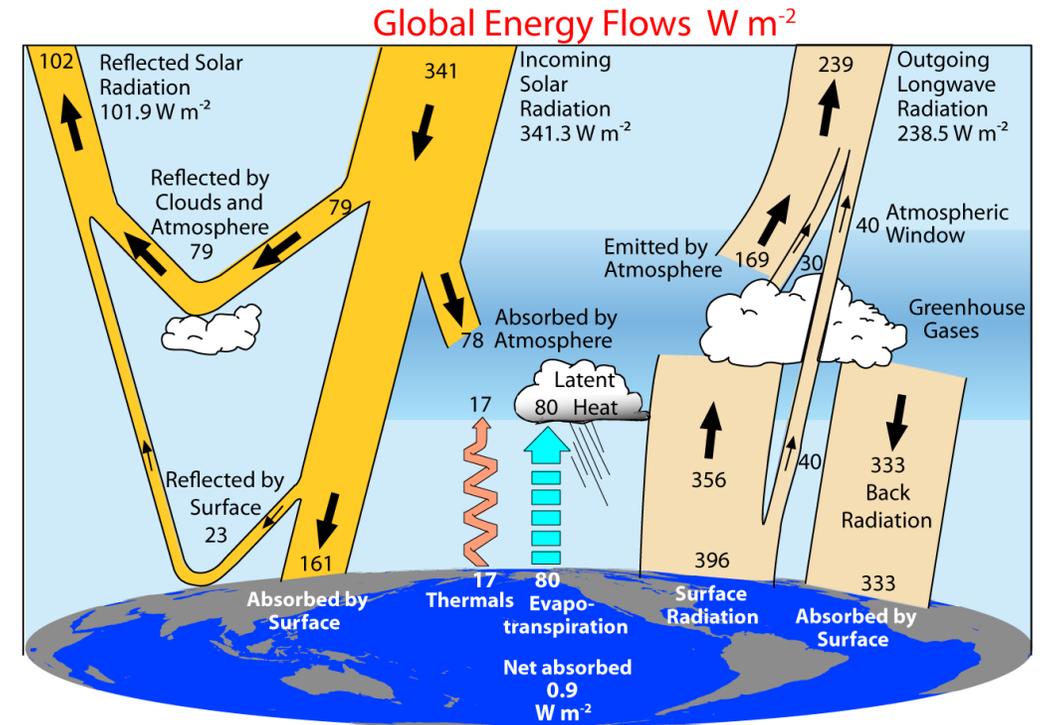
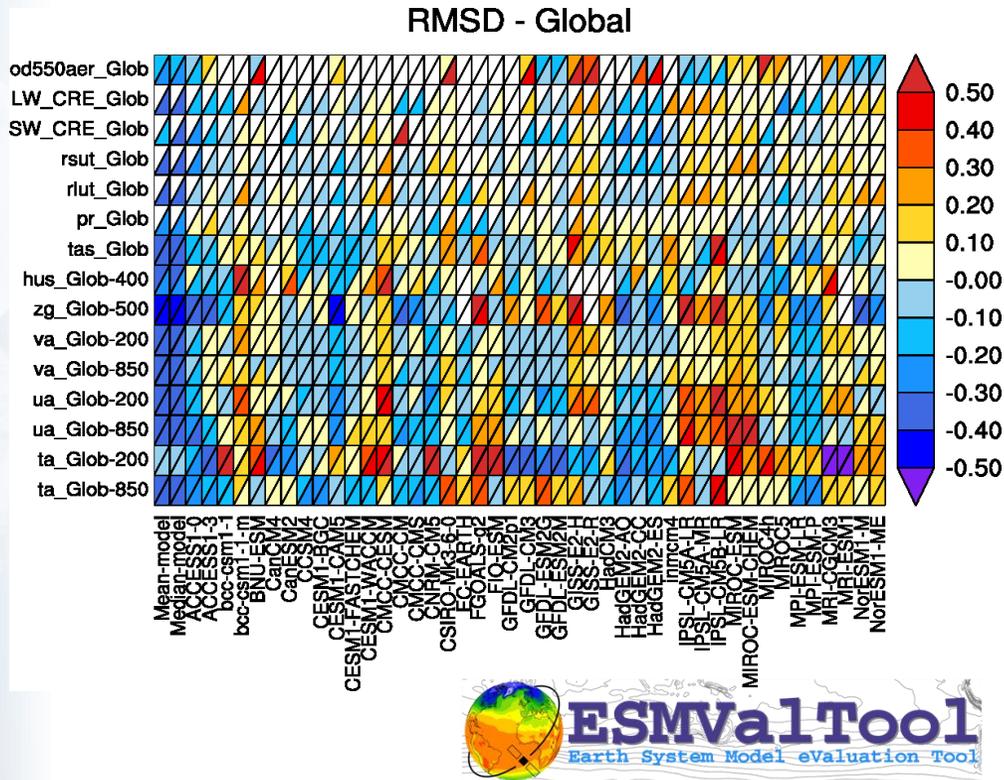




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Scientific assessment and gap analysis

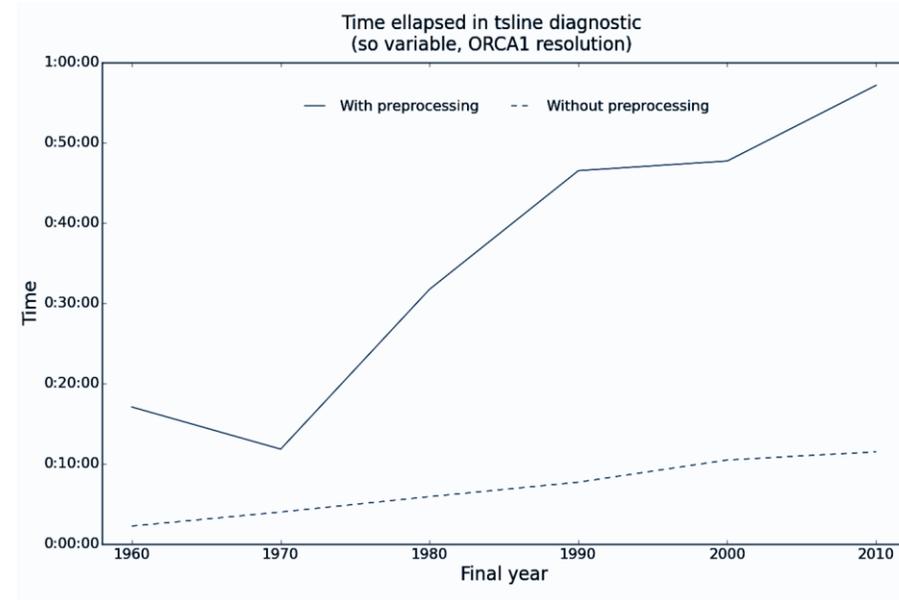
Diagnostics and metrics for climate projections: ESMValTool, CVDP (NCAR), AutoAssess (Met Office), s2dv (BSC), Freva (FUB), PMP (PCMDI).





The example of ESMValTool:

- Recoding all the diagnostics and metrics that it contains is prohibitive and prone to errors. **Benefit from the community.**
- A rewrite of the backend is taking place as we speak: migration to python, communication in-memory, common pre-processing, parallelisation, etc.
- Data provenance to be moved from being stored in the output file plus a logfile to full provenance approach.
- But waiting for C3S to define requirements !!

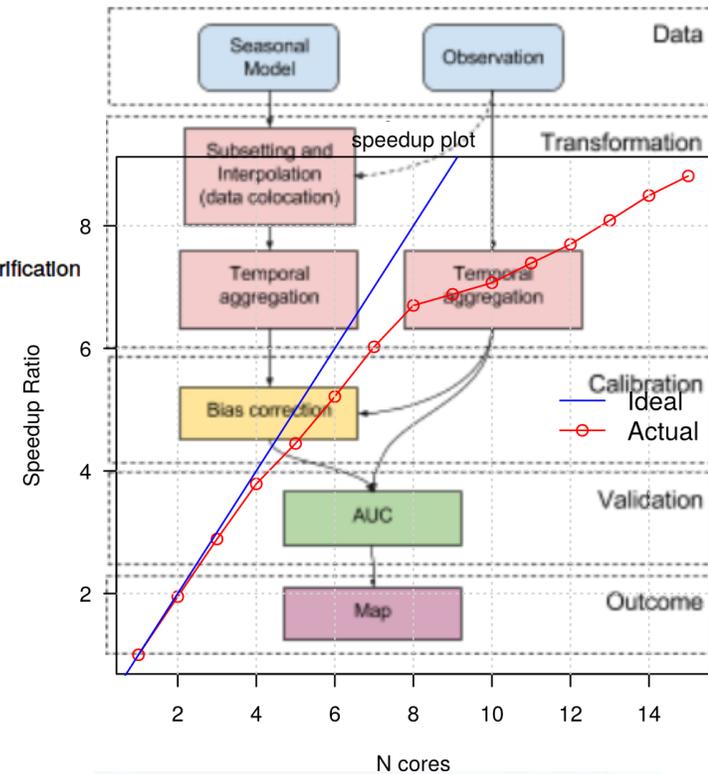
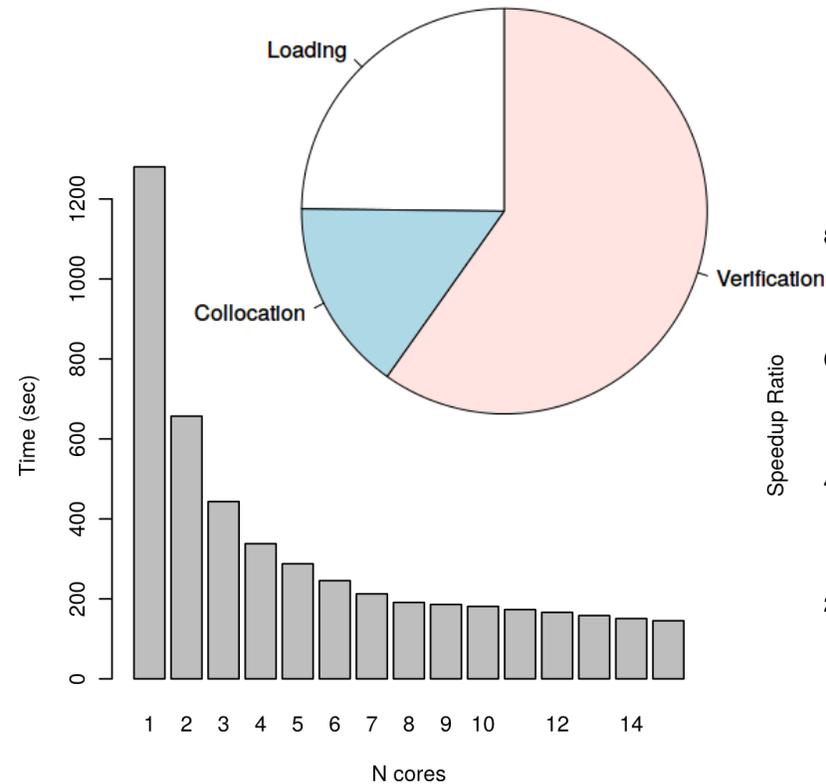
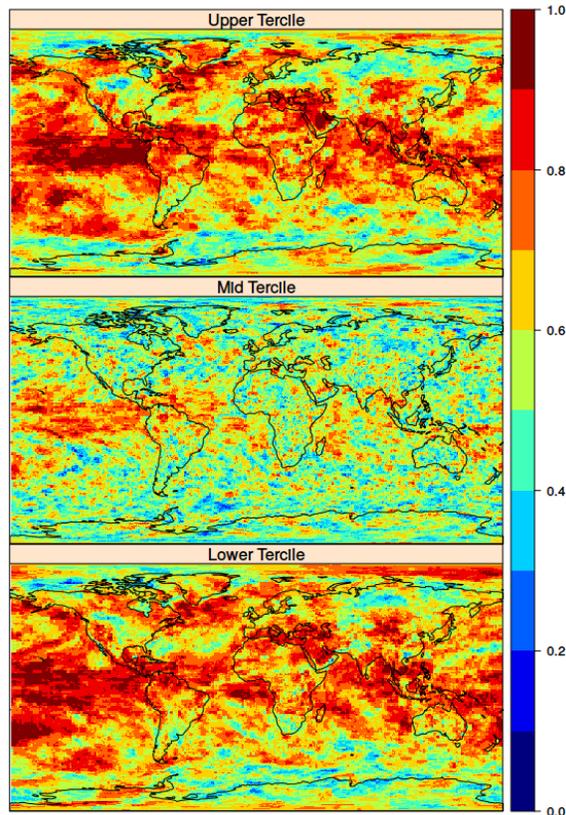




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Scientific assessment and gap analysis

More on performance: example of multi-model seasonal verification, with performance analysis of a ROC area estimate using loadeR, SpecsVerification and easyVerification



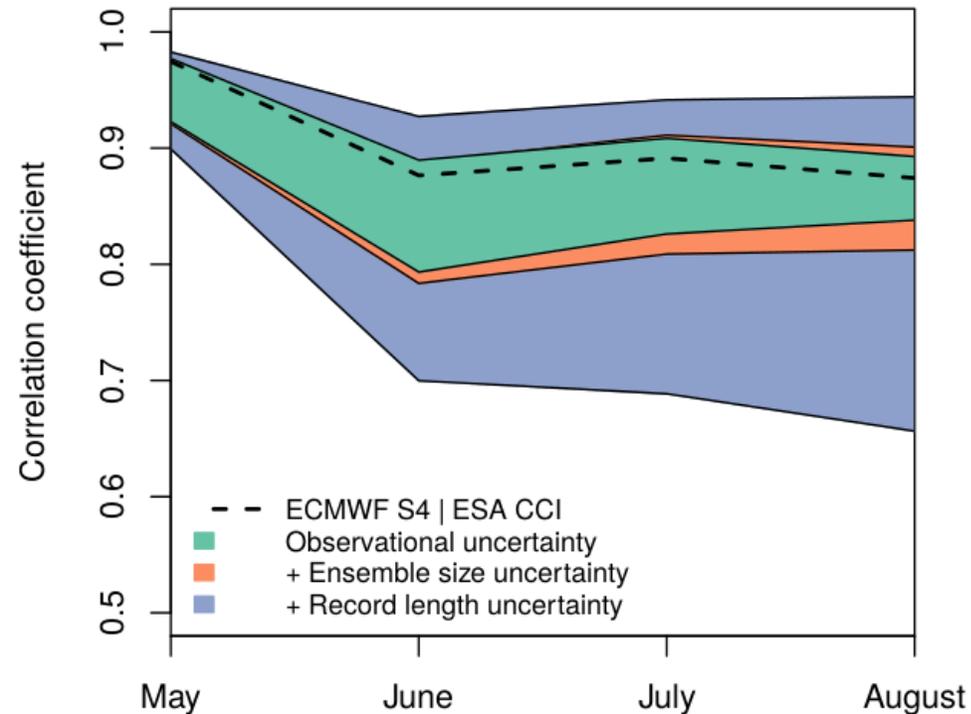
J. Bedia (Predictia)



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Making the most of C3S: bringing in observational and reference uncertainty in the EQC process.

Niño 3.4 SST correlation of the ensemble mean for EC-Earth3.1 (T511/ORCA025) predictions with ERAInt and GLORYS2v1 ics, and BSC sea-ice reconstruction started every May over 1993-2009



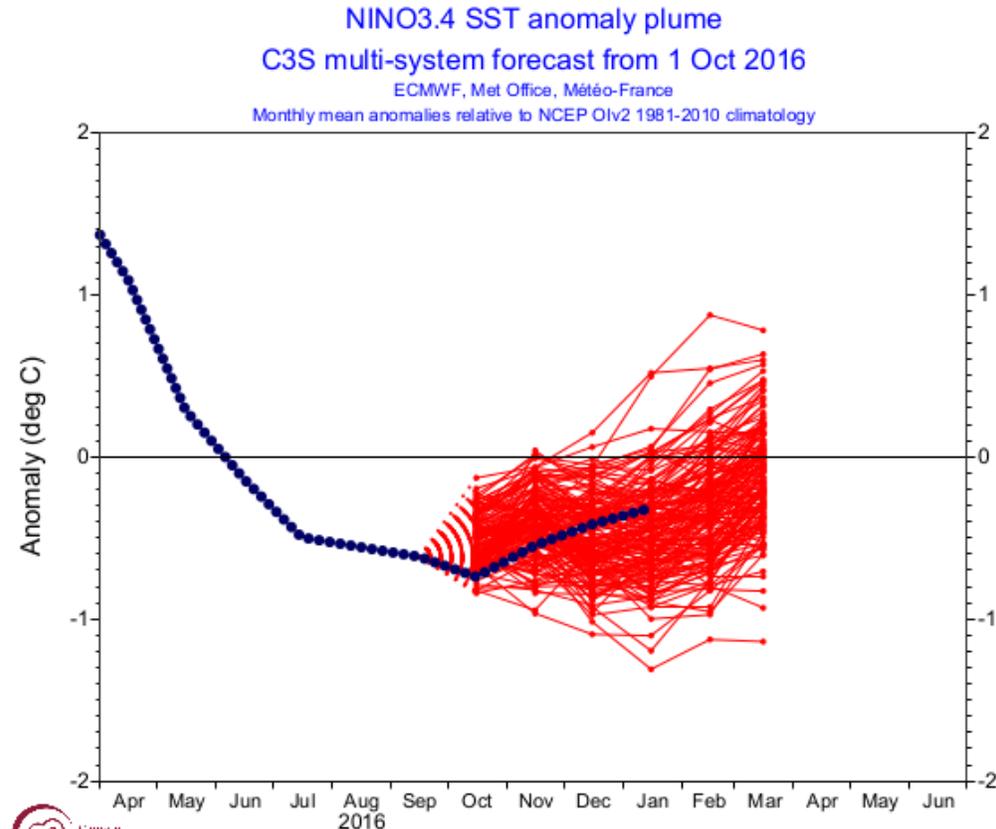
O. Bellprat (BSC)



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How to identify data/products to ensure a minimum quality?

- Reproducibility: ability of an entire process to be duplicated.
- Traceability: ability to verify the history, location, or application of an item by means of documented recorded identification.





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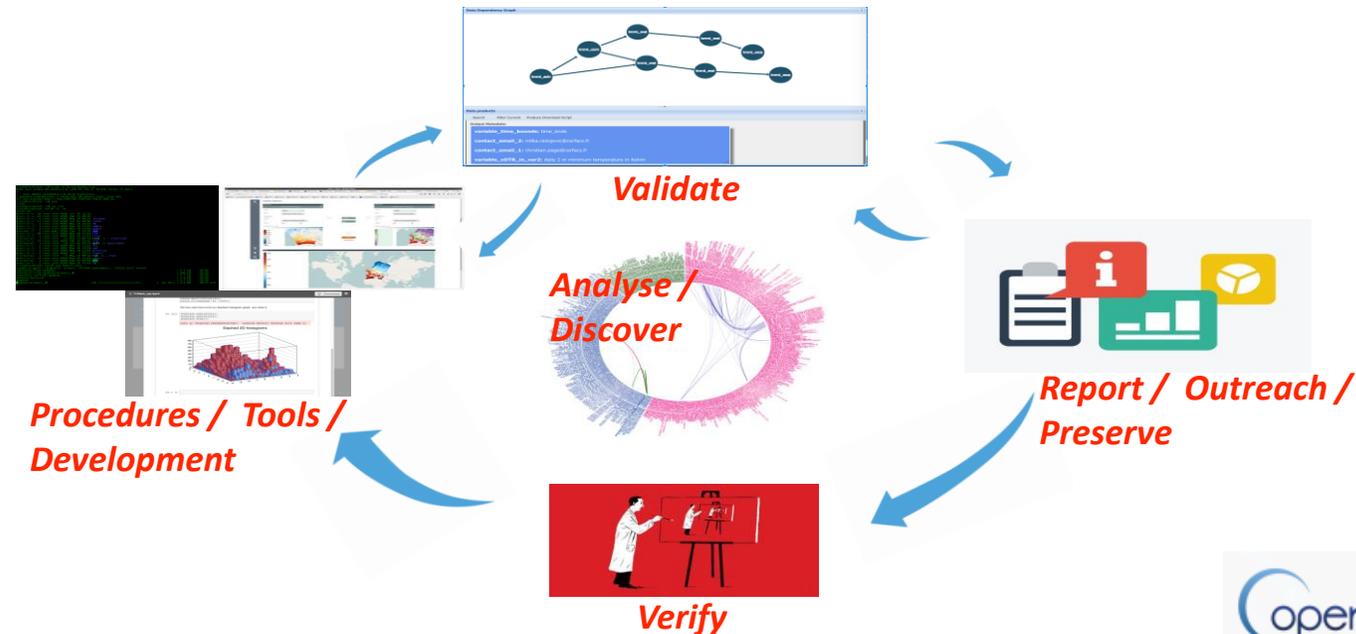
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[Seasonal forecasts of wind speed](#)



How to identify data/products to ensure a minimum quality?

- Generalised metadata and provenance information are key elements of all the components of the service.
- Two approaches for product provenance are under discussion: S-PROV and Resource Description Framework (RDF). They are not mutually exclusive.



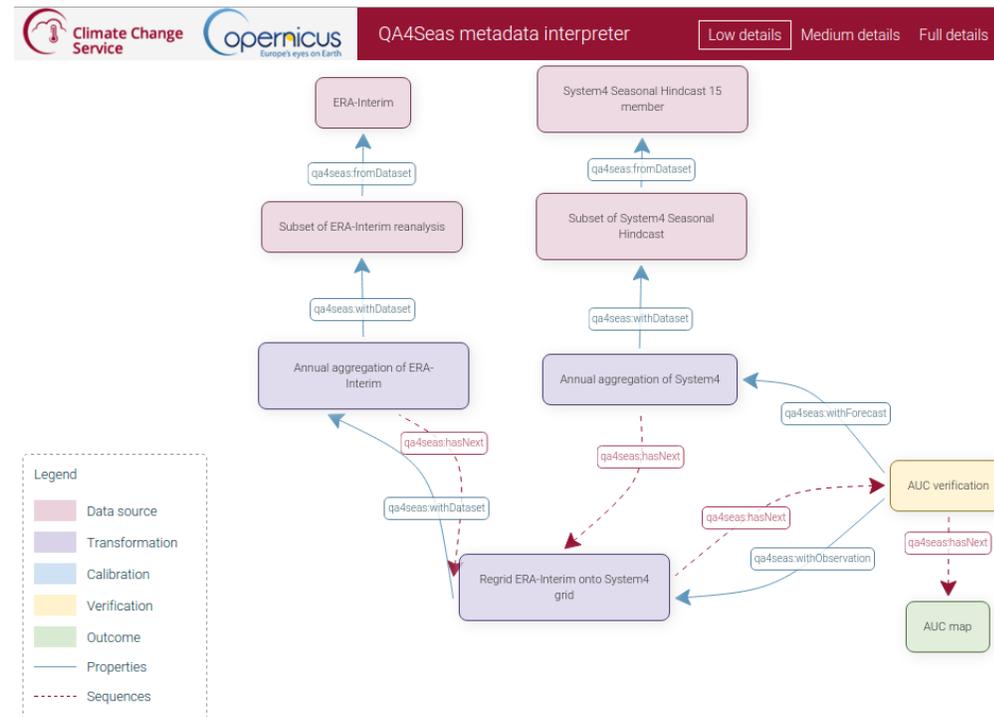


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CDS requirements and EQC framework

How to identify data/products to ensure a minimum quality?

- The [RDF-based approach](#) aims at the reproducibility of objects (NetCDF file, image) with human and machine-readable solution.
- It uses a semantic metadata model that builds the vocabularies on existing initiatives (e.g. VALUE for downscaling).



D. San Martín (PREDICTIA)



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Provenance and metadata challenges:

- Engage the (expert) users.
- Define the level of granularity to describe the objects.
- Inform about and display different levels of abstraction.
- Define the curation of elements other than raw data.
- **Which components of the C3S are involved and where does the governance reside?**



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S u m m a r y

- EQC is user driven, but not all users are feeding in yet.
- Data inventories help identifying gaps.
- EQC information is not neutral, precise definitions are necessary.
- Existing packages are an invaluable source of solutions, but should be considered within a framework.
- Handling metadata and provenance information require a generic, common approach for all the EQC (and other components) work in C3S.