

ESA Climate Change Initiative Maturity Index

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WGClimate #3

Geneva

Consensus Maturity Matrix

- **The CCI shall be an example of an exercise to Develop a consensus maturity matrix**
- **By the end of 2013 (end of CCI Phase 1), we should have a first example spanning across at least 10 of the 13 CCI projects.**
- **The exercise will be repeated and reviewed during CCI Phase 2 (2013 – 2016)**

Goal: CCI applicable maturity index

- **ESA CCI aims to realise the full potential of long-term EO archives from past 30 years in response to GCOS needs and as required by the UNFCCC.**
- **ESA CCI will establish long-term and transparent access to results with emphasis on fully described, error characterized, consistent satellite-based ECV records.**
- **In that context, CCI Science leaders were requested to investigate the applicability of the Maturity Indexes proposed by Bates et al. to the ECVs produced by the CCI Projects**

- **The scientific community involved in CCI dataset production provided feedback about how well the existing Bates and Barkstrom maturity index describes CCI product strengths and weaknesses:**
 - Some strengths of the ESA CCI datasets and products are not adequately described by current index – mainly down to differences between operational and research and development focussed approaches.
 - Suggestions on possible ways forwards for the development of a maturity index at ESA CCI are in discussion.

- **Bates and Barkstrom v4.0 considered as possible template for ESA CCI index.**
- **CCI product and dataset self-assessment exercises have helped identify where Bates does and does not work for CCI.**

Maturity	Software Readiness	Metadata	Documentation	Product Validation	Public Access	Utility
1	Conceptual development	Little or none	Draft Climate Algorithm Theoretical Basis Document (C-ATBD); paper on algorithm submitted	Little or None	Restricted to a select few	Little or none
2	Significant code changes expected	Research grade	C-ATBD Version 1+ ; paper on algorithm reviewed	Minimal	Limited data availability to develop familiarity	Limited or ongoing
3	Moderate code changes expected	Research grade; Meets int'l standards: ISO or FGDC for collection; netCDF for file	Public C-ATBD; Peer-reviewed publication on algorithm	Uncertainty estimated for select locations/times	Data and source code archived and available; caveats required for use.	Assessments have demonstrated positive value.
4	Some code changes expected	Exists at file and collection level. Stable. Allows provenance tracking and reproducibility of dataset. Meets international standards for dataset	Public C-ATBD; Draft Operational Algorithm Description (OAD); Peer-reviewed publication on algorithm; paper on product submitted	Uncertainty estimated over widely distributed times/location by multiple investigators; Differences understood.	Data and source code archived and publicly available; uncertainty estimates provided; Known issues public	May be used in applications; assessments demonstrating positive value.
5	Minimal code changes expected; Stable, portable and reproducible	Complete at file and collection level. Stable. Allows provenance tracking and reproducibility of dataset. Meets international standards for dataset	Public C-ATBD, Review version of OAD, Peer-reviewed publications on algorithm and product	Consistent uncertainties estimated over most environmental conditions by multiple investigators	Record is archived and publicly available with associated uncertainty estimate; Known issues public. Periodically updated	May be used in applications by other investigators; assessments demonstrating positive value
6	No code changes expected; Stable and reproducible; portable and operationally efficient	Updated and complete at file and collection level. Stable. Allows provenance tracking and reproducibility of dataset. Meets current international standards for dataset	Public C-ATBD and OAD; Multiple peer-reviewed publications on algorithm and product	Observation strategy designed to reveal systematic errors through independent cross-checks, open inspection, and continuous interrogation; quantified errors	Record is publicly available from Long-Term archive; Regularly updated	Used in published applications; may be used by industry; assessments demonstrating positive value

- **Main specific points raised by CCI science leaders:**
 - **need to generalise** standards from US (NOAA) to global,
 - **Use weighting**, especially higher weight for utility, extensive software documentation rather than public access requirement, relax software portability/security requirements (no transfer of production), product validation levels extended and shifted.

Second Adequacy Report (GCOS-82)

Effective monitoring systems for climate should adhere to the following principles:*

- 1. The impact of new systems or changes to existing systems should be assessed prior to implementation.*
- 2. A suitable period of overlap for new and old observing systems is required.*
- 3. The details and history of local conditions, instruments, operating procedures, data processing algorithms and other factors pertinent to interpreting data (i.e., metadata) should be documented and treated with the same care as the data themselves.*
- 4. The quality and homogeneity of data should be regularly assessed as a part of routine operations.*
- 5. Consideration of the needs for environmental and climate-monitoring products and assessments, such as IPCC assessments, should be integrated into national, regional and global observing priorities.*
- 6. Operation of historically-uninterrupted stations and observing systems should be maintained.*
- 7. High priority for additional observations should be focused on data-poor regions, poorly observed parameters, regions sensitive to change, and key measurements with inadequate temporal resolution.*
- 8. Long-term requirements, including appropriate sampling frequencies, should be specified to network designers, operators and instrument engineers at the outset of system design and implementation.*
- 9. The conversion of research observing systems to long-term operations in a carefully-planned manner should be promoted.*
- 10. Data management systems that facilitate access, use and interpretation of data and products should be included as essential elements of climate monitoring systems.*

Coverage of GCOS climate monitoring principles

Bates category	Software readiness	Metadata	Documentation	Product validation	Public access	Utility
GCOS principle		3: metadata 17: system	3: metadata 10: data management	4: quality 20: noise, bias	10: access 17: system	10: access

- **Assessment criteria for the following areas could potentially be extended**
 - Overlap between instrument time series (GCOS 2, 12)
 - User requirements (GCOS 7, 8)
 - Sampling requirements (GCOS 11)
 - Calibration (GCOS 14, 15)
- **ESA CCI mechanism for user feedback is in place (cycle of user requirements specifications, algorithm development, model user assessment, which then feeds back into algorithm development)**
- **Continual user feedback cycle means we do not envisage reaching static software status at full maturity.**
- **Potential to assess intrinsic properties of datasets relative to user requirements in maturity index.**

Analysis of CCI documents

CCI deliverables go beyond the Bates index for user requirements and system.

CCI document	GCOS principle	Bates category
User Requirements Document	7: high priority observations 8: long-term requirements	-
Product Specification Document	3: details and history	Documentation
Data Access Requirements Doc.	3	Documentation
Detailed Processing Model	3	Software
Input/output Data Description	3	Documentation
Algorithm Theoretical Baseline	3	Documentation, Software
Product User Guide	17: facilitate user access	Documentation
Product Validation Plan	4: assess data quality	Validation
Product Validation and Algorithm Selection Report	4,20: error characterisation	Validation
Product Validation Report	4,20	Validation
Climate Assessment Report	17	Utility
System Requirements Document	10: data management systems	-
System Specification Document	10	-
System Prototype Description	10	-

Conclusions

- **Main goal is to have a CCI applicable maturity index**
- **First analysis of Bates and Barkstrom index by CCI science leaders**
 - A CCI applicable index is needed.
 - This should embody the GCOS requirements whilst still acknowledging the research environment product development model.
- **Consolidation process for CCI applicable maturity index will be conducted during second phase of CCI program.**
- **In the long-term, an integration of NOAA and CCI maturity indices would be beneficial.**