

## ECV INVENTORY

# GAP ANALYSIS GUIDELINES

## [Inventory Version 2.1]

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# 1 Introduction

## 1.1 Context

The three main objectives of the CEOS/CGMS Climate Working Group (extracted from the Terms of Reference) are depicted in Figure 1.

The first objective is primarily fulfilled by the creation and maintenance of the ECV inventory, together with appropriate viewing and navigation tools.

The second and third objectives require, amongst other things, the application of a gap analysis process to the ECV Inventory to identify gaps, shortfalls and improvement possibilities for both current and future climate data records. The applicable process for this gap analysis is the subject of this document.

The over-arching goal of the CEOS/CGMS Working Group on Climate (WG Climate) will be to improve the systematic availability of Climate Data Records through the coordinated implementation, and further development of the architecture for climate monitoring from space.

More specifically, the coordination shall be designed to achieve three main objectives:

- Provision of a structured, comprehensive and accessible view as to what Climate Data Records are currently available from satellite missions of CEOS and CGMS members or their combination;
- Creation of the conditions for delivering further Climate Data Records, including multi-mission Climate Date Records, through best use of available data to fulfil GCOS requirements (e.g. by identifying and targeting cross-calibration or re-processing gaps/shortfalls );
- Optimisation of the planning of future satellite missions and constellations to expand existing and planned Climate Data Records, both in terms of coverage and record length, and to address possible gaps with respect to GCOS requirements.

Figure 1: Three Main Objectives of CEOS/CGMS Climate WG

## 1.2 Purpose

The purpose of this document is to provide guidance on the implementation of a gap analysis on the current and future components, and is limited in applicability to Version 2.1 of the ECV Inventory.

## 1.3 Overview

- Chapter 1:** This introduction describes the purpose of the document, provides a document overview and document references;
- Chapter 2:** Defines the gap typologies and hierarchies for the current and future components of the ECV Inventory;
- Chapter 3:** Provides guidance on the implementation of the gap analysis;
- Chapter 4:** Provides guidance on the documentation of the results of the gap analysis
- Chapter 5:** Lists issues to be potentially considered in future gap analyses (out-of-scope of the version 2.1 gap analysis)

## 1.4 References

- [RD-1] GCOS-143, 2010: Guideline for the Generation of Datasets and Products Meeting GCOS Requirements, An update of the "Guideline for the Generation of Satellite-based Datasets and Products meeting GCOS Requirements" (GCOS-128, WMO/TD-No. 1488), including in situ datasets and amendments. May 2010, Available at: <http://www.wmo.int/pages/prog/gcos/Publications/gcos-143.pdf>, 12 pp.
- [RD-2] GCOS-154, 2011: Systematic Observation Requirements for Satellite-Based Products for Climate, 2011 Update, December 2011, 139 pp.
- [RD-3] ECV Inventory: Questionnaire Guide ECO-WGCL-EOPS-TN-16-0022, 53 pp, available at WGClimate web page (TBC)
- [RD-4] CORE-CLIMAX Deliverable D222, Climate Data Record Assessment Instruction Manual – Available at: [http://www.coreclimax.eu/sites/coreclimax.itc.nl/files/documents/Deliverables/WP\\_Reports/Deliverable-D222-CORECLIMAX.pdf](http://www.coreclimax.eu/sites/coreclimax.itc.nl/files/documents/Deliverables/WP_Reports/Deliverable-D222-CORECLIMAX.pdf)

## 2 Gap Typologies and Hierarchies

The ECV inventory is a repository for the characteristics of two types of ECV record:

- Records that already exist (current component of the inventory);
- Records that do not currently exist, but are planned to be produced as part of an already approved programme (future component of the inventory).

The level of information stored in the inventory is more detailed for the current component compared to the future component noting, however, that there are some common elements.

For each of these components, a questionnaire (see Appendices A and B) has been formulated which has been submitted to the current/future holders of the records to be populated {see [RD-3]}. This population activity provides the content of the ECV Inventory and, for each question in the questionnaire, there is a corresponding field in the ECV inventory.

The necessary differences between these two inventory components, means that two distinct gap analysis approaches are required, and this distinction is also reflected in the need to establish 2 separate "gap trees".

As will be noted in the following sections, there is a direct correlation between the 2 gap trees and the contents of the current and future questionnaires (which in turn are directly related to the fields in the ECV inventory).

The gap trees make the assumption that entries exist in the inventory for a particular ECV product. If this is not the case then a "complete" gap will be flagged in any gap analysis results.

### 2.1 Gap Tree for the Current Component of ECV Inventory

As the gap analysis will be done initially at "individual question/inventory field" level and, as there are a relatively large number of such questions/fields (see Appendices A and B), there is a need to group the results around topics. The starting point for the breakdown into topical areas is already available in the "Area" column of the tables in Appendices A and B, and this has been used for the topical breakdown adopted for the gap analysis for the current component, i.e.:

- a) **Stewardship** of the record - with questions aimed at exposing both the administrative and technical arrangements for the stewardship of the record;
- b) **Generation Process** of the record - with questions aimed at exposing the degree to which this generation process complies with the provisions described in [RD-1];
- c) **Record Characteristics** - with questions aimed at ensuring (*inter alia*) that there is sufficient information to establish whether the record satisfies the technical requirements defined in [RD-2];
- d) **Documentation** of the record - with questions aimed at ensuring that the minimum documentation needs defined in [RD-1] are met;
- e) **Accessibility** of the record - with questions aimed at ensuring that appropriate access to the data set is available, as defined in [RD-1];
- f) **Applications** of the record - with questions aimed at exposing the envisaged usage of the record.

It is highlighted that, from a requirement perspective, topic c) is different in nature to the other topics as the related requirements are specific to each ECV product and stem from [RD-2], whereas the requirements associated with all other topics are common across all ECV products and stem from [RD-1].

Figure 2 illustrates the gap tree and provides a link to the questions in Appendix A.

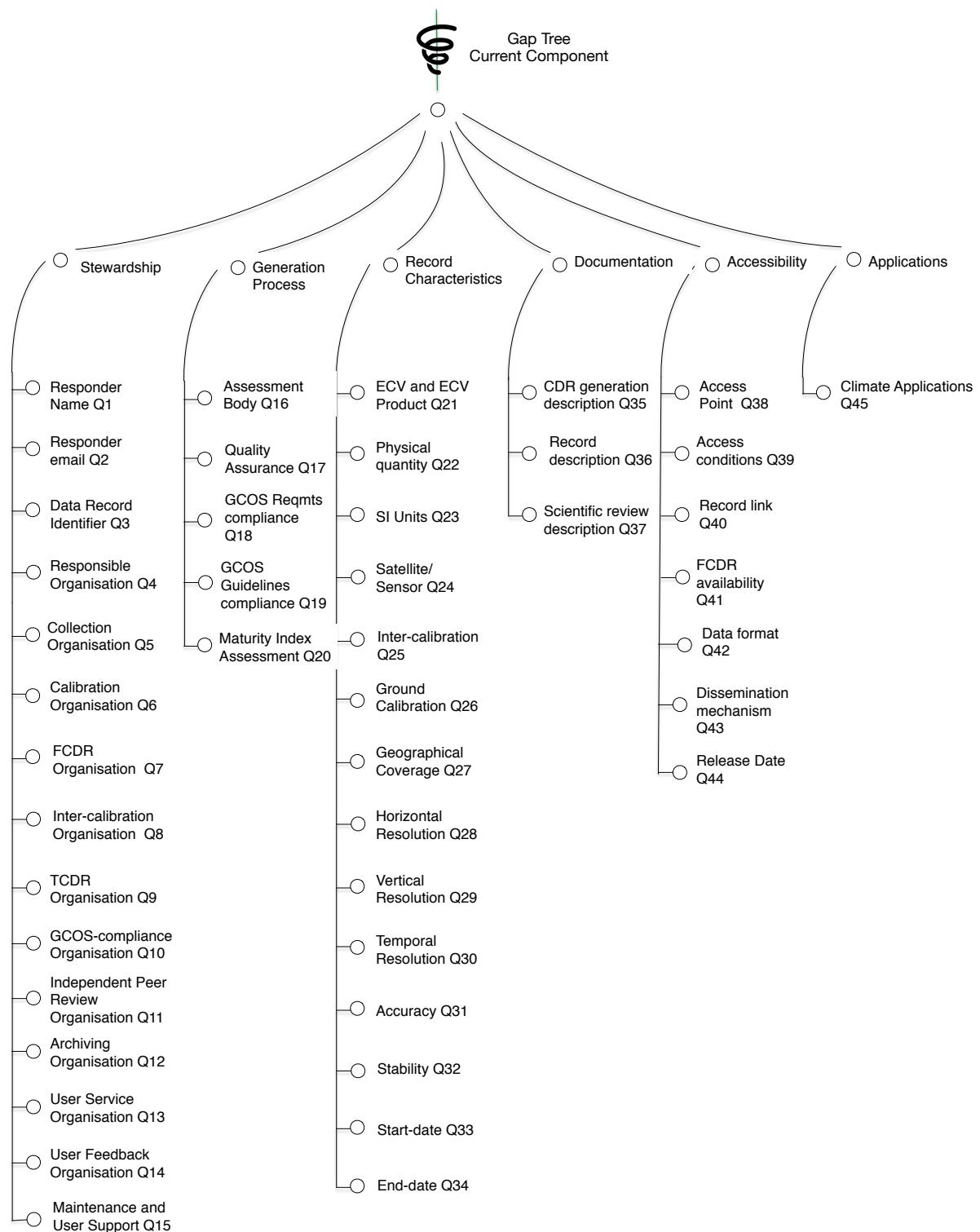


Figure 2: Gap Tree - Current Component

## 2.2 Gap Tree for the Future Component of the ECV Inventory

As the questionnaire structure for the future component of the ECV inventory has a similar structure and content to that of the current component, a comparable breakdown is proposed but with a reduced number of topical areas, as illustrated in Figure 3.

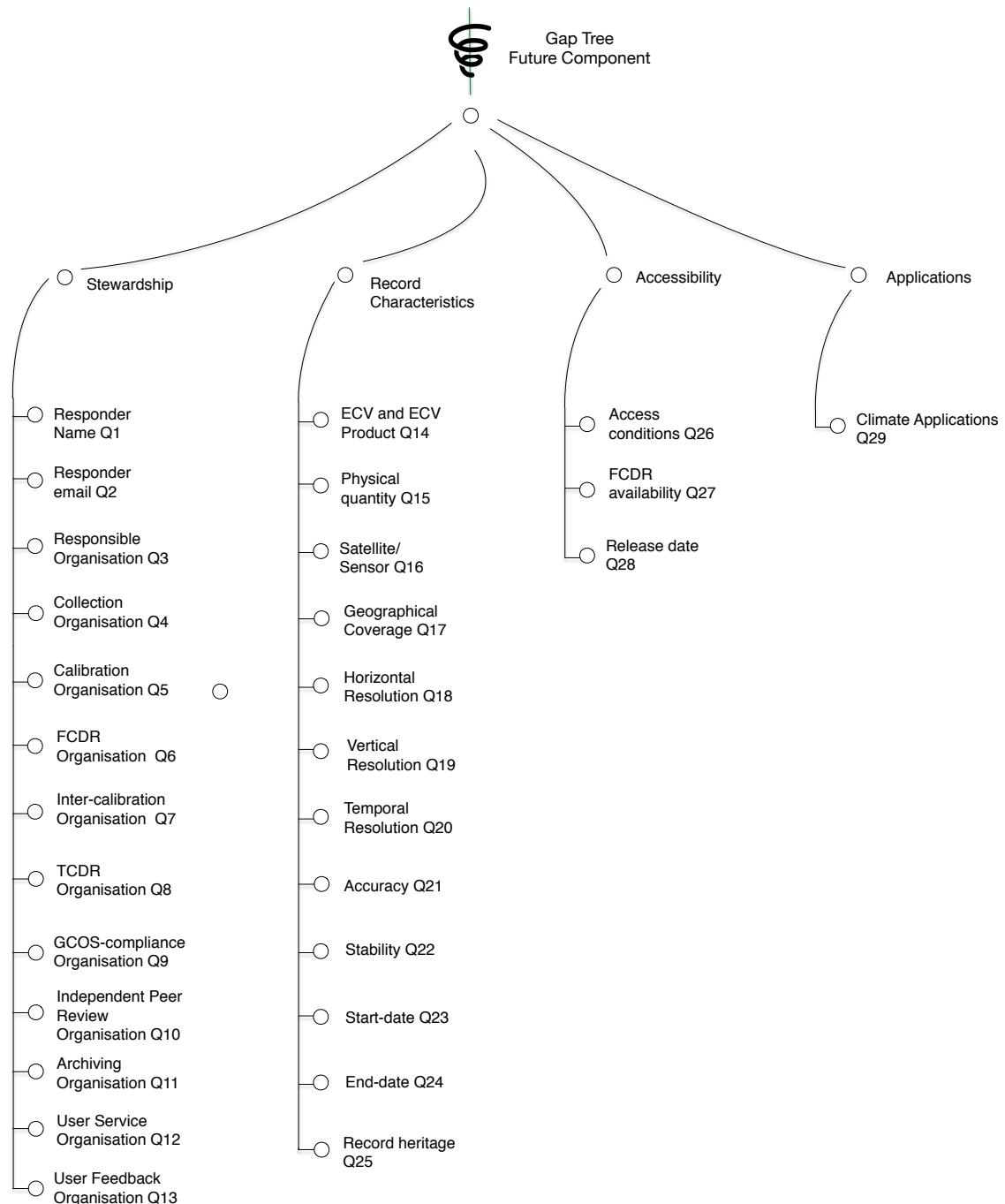


Figure 3: Gap Tree - Future Component

# 3 Implementation of the Gap Analysis

## 3.1 General Considerations

### 3.1.1 Completeness and Consistency of the Inventory

Although the inventory will have been checked for completeness and consistency prior to the start of the gap analysis, it is probable that clarifications will be needed from the questionnaire responders during the implementation of the gap analysis.

If such clarifications are received a log should be maintained of the information received and whether such information was taken into account during the gap analysis. This is important for two reasons:

- The source information used for the gap analysis is under configuration control to ensure that the basis for the gap analysis is controlled and visible;
- The clarifications could be of relevance for the preparation of the next version of the inventory (the inventory will not be updated during the course of the gap analysis).

### 3.1.2 Maintaining a Log of the Gap Analysis Experiences and Lessons Learnt

The gap analysis process sits within a cycle of activities consisting of:

- a) Update of the Inventory to reflect:
  - Evolutions in the requirements baseline (e.g. stemming from GCOS);
  - Changes to the Climate Data Record holdings (typically captured via the population of the current and future versions of the questionnaire by Space Agencies);
- b) Completeness and consistency checking of the updated Inventory;
- c) Implementation of a Gap Analysis on the updated Inventory (the subject of this document);
- d) Generation and implementation monitoring of a coordinated action plan to address gaps, shortfalls and improvement opportunities revealed by the gap analysis.

Given the cyclical nature of the activity, and the opportunities to introduce improvements for each new cycle, it is important that a log of the experiences of the gap analysis process is maintained so that improvement suggestions can be extracted in at least the following areas:

- The content and formulation of the requirements baseline {e.g. as reflected in [RD-1] and [RD-2]};
- The structure/content of the ECV Inventory and Questionnaires (e.g. possible need for a better backwards link from TCDRs to FCDRs);
- The completeness and consistency checking of the ECV Inventory entries;
- The gap analysis process (as described in this document);
- The selected implementation approach (e.g. the breakdown of the gap analysis activities into thematic areas and their allocation to teams).

### 3.1.3 Inputs to the Coordinated Action Plan

As noted in section 3.1.2, the output of the gap analysis process feeds into the generation of a coordinated action plan to address gaps, shortfall and improvement opportunities.

However, already during the gap analysis process it is likely that actions will be identified for possible inclusion in the coordinated action plan, and therefore all such proposals for actions should be included in the gap analysis report (see section 4).

### 3.1.4 Groupings of ECV Products

To take maximum benefit from the available expertise, it may prove beneficial to organise the implementation of the gap analysis around domains (i.e. atmospheric, oceanic or terrestrial) or thematically-connected ECV products (e.g. biosphere, cryosphere, water cycle, etc).

It is anticipated that teams assigned to a particular group of ECV products would be responsible for the implementation of the gap analysis on both the current and future components of the inventory.

### 3.1.5 Standardisation of Approach

Given that the Gap Analysis will probably be implemented by a set of teams (rather than one team) covering different groupings of ECV products (see section 3.1.4) there is a need to ensure consistency of approach and this will be the responsibility of a Gap Analysis Coordinator who will:

- a) Liaise with the individual teams during the course of the gap analysis to respond to queries and provide guidance as necessary;
- b) Review the individual gap analysis reports from the various teams to ensure consistency of reporting as well as being responsible for consolidating the individual reports into one overall report (see section 4).

### 3.1.6 Use of Tools

For version 2.1 of the inventory, the gap analysis process will be primarily carried out manually, with the support of some basic visualisation tools to illustrate the degree of compliance with the performance requirements identified in [RD-2], and addressed under the topic "Record Characteristics".

### 3.2 Generic Gap Analysis

In order to illustrate the degree of responsiveness to the generic requirements (i.e. covering all topics except the Record Characteristics) overall statistics shall be provided that show the degree of responsiveness to each individual question for all inventory entries, but with separate statistics to be produced for the current and future components of the inventory.

GCOS Guideline	Atmosphere	Oceanic	Terrestrial
1. Full description of all steps taken in the generation of FCDRs and ECV products, including algorithms used, specific FCDRs used, and characteristics and outcomes of validation activities	71%	75%	75%
2. Application of appropriate calibration/validation activities	74%	55%	66%
3. Statement of expected accuracy , stability and resolution (time, space) of the product, including, where possible, a comparison with the GCOS requirements	73%	72%	56%
4. Assessment of long-term stability and homogeneity of the product	50%	44%	48%
5. Information on the scientific review process related to FCDR/product construction (including algorithm selection), FCDR/product quality and applications	50%	48%	48%
6. Global coverage of FCDRs and products where possible	88%	92%	91%
7. Version management of FCDRs and products, particularly in connection with improved algorithms and reprocessing	100%	73%	95%
8. Arrangements for access to the FCDRs, products and all documentation	66%	69%	67%
9. Timeliness of data release to the user community to enable monitoring activities	47%	46%	52%
10. Facility for user feedback	100%	69%	77%
11. Application of a quantitative maturity index if possible	4%	0%	0%
12. Publication of a summary (a webpage or a peer-reviewed article) documenting point-by-point the extent to which this guideline has been followed	68%	52%	61%

Figure 4: Example of Summary Statistics on Response to Generic Requirements - Current Component

### 3.3 Gap Analysis on the Current Component of the ECV Inventory

The gap analysis is carried out for each ECV product and is repeated until all ECV products have been assessed.

#### 3.3.1 Existence of Records

The first question to be answered is "Do record entries exist for the ECV product in question?"

To answer this question an assessment shall be made as to whether each record entry (assuming an entry exists) constitutes a Climate Data Record or not.

If the answer is "No" then the next steps are:

- a) Review [RD-2] to determine what type of FCDRs are required for the generation of this ECV product;
- b) Review the MIM (<http://database.eohandbook.com>) and OSCAR (<http://www.wmo-sat.info/oscar/>) databases to assess if there is the potential to create FCDRs, that might be used for the generation of this ECV product;
- c) Document the results of a) and b).

If the answer is "Yes" then proceed to section 3.3.2.

#### 3.3.2 Analysis of Record Entries

For each record entry associated with the ECV product, the degree of compliance with the relevant GCOS requirements {i.e. [RD-1] and [RD-2]} shall be assessed according to the following categorisation:

- Stewardship
- Generation Process
- Record Characteristics
- Documentation
- Accessibility
- Applications

As noted in the following sections, a textual description of the compliance status shall be accompanied by a pictorial representation using the spiral diagram illustrated in Figure 2, overlaid with compliance indicators given in Table I.

LEGEND	
Symbol	Denotes
⊗	"no information provided"
○	"information provided but not compliant with requirements"
○	"information provided - partially compliant with requirements"
●	"information provided - fully compliant with requirements"

Table I: Legend for Pictorial Representation of GCOS Compliance of Record

This analysis may be informed by consulting the System Maturity Matrix Approach [RD-5] that provides information on aspects such as record characteristics, documentation, accessibility and applications.

##### 3.3.2.1 Stewardship

The applicable questions for this topic are identified in Figure 2 (with full versions of the questions given in Appendix A), which focus on exposing the stewardship arrangements for the record (i.e. through the responses to Q1 - Q15). Guidance on the admissible range of responses to these questions is contained in [RD-3].

Based on the guidance given in [RD-3], a textual assessment of the compliance shall be provided (addressing each question) together with a pictorial summary of the assessment using the "Stewardship" component of Figure 2 and applying the compliance legend given in Table I.

If any deficiencies are detected, pointers to the appropriate rectification approach should be identified (if not obvious).

### 3.3.2.2 Generation Process

The applicable questions (i.e. Q16 to Q20) for this topic are identified in Figure 2 (with full versions of the questions given in Appendix A) which mainly address the compliance of the process used for generating the records with the provisions described in [RD-1]. Guidance on the admissible range of responses to these questions is contained in [RD-3].

Based on the guidance given in [RD-3], a textual assessment of the compliance shall be provided (addressing each question) together with a pictorial summary of the assessment using the "Generation Process" component of Figure 2 and applying the compliance legend given in Table I.

If any deficiencies are detected in the assessment, pointers to the appropriate rectification approach should be identified (if not obvious).

### 3.3.2.3 Record Characteristics

The applicable questions (i.e. Q21 to Q34) for this topic are identified in Figure 2 (with full versions of the questions given in Appendix A) which mainly address the input data used for the construction of the record, together with the record producer's views of the technical characteristics of the record (accuracy, resolution, stability, etc.). Guidance on the admissible range of responses to the various questions is contained in [RD-3].

The following points should be noted:

- a) The physical quantity being measured and the associated units (Q22 and Q23) have no explicit GCOS requirement counterparts but they are necessary attributes of the record, and indicate if the data provider adheres to the SI system;
- b) Satellite/sensor combination (Q24) is a fundamental property of the record, and the response to this question should point at the relevant FCDR(s);
- c) The coverage requirement (Q27) is implicitly assumed to be global, as GCOS requirements are defined on a global scale. When considering potential gaps in coverage, this global coverage requirement should be borne in mind. However, continental-scale data records (e.g., as derived from single geostationary orbit position sometimes forming an input to a global data record) have their own distinct value;
- d) Q28 to Q32 are designed to obtain the performance characteristics (as seen by the record provider) in key areas and, to assist in the comparison of these characteristics with the specific ECV product requirements in [RD-2], comparison/visualisation tools are available to support the assessment;
- e) The record length attributes (covered by Q33 and Q34) have no counterpart in the GCOS requirements and have been included in the questionnaire because they have an important bearing on the usability of the record (the minimum usable length of a record generally depends on the application under consideration and the accuracy of the measurement).

The main questions to be answered under this topic include:

- a) Has the supporting information about the record (i.e. responses to Q21-Q26) been provided in accordance with [RD-3]?
- b) What is the length of the record (Q33 to Q34)?
- c) Does the record make appropriate use of available FCDRs (a cross-check with [RD-2] and the MIM and OSCAR databases may be needed to answer this question)?
- d) Are there any gaps in the geographical coverage of the record (Q27)?
- e) How well does the record meet the GCOS requirements on spatial and temporal resolution, accuracy and stability (Q28 to Q32)?

The answers to the questions on accuracy and stability require a good understanding of the GCOS requirements and should have an interpretative part considering how the uncertainty information provided relates to the GCOS requirement (e.g., is given in the same way, e.g., as global average, etc.) and if it is sufficient for the stated applications of the data record whilst not meeting the GCOS requirements.

If any deficiencies are detected, pointers to the appropriate rectification approach should be identified (if not obvious).

A textual assessment of the compliance shall be provided (addressing each question) together with a pictorial summary using the "Record Characteristics" component of Figure 2 and applying the compliance legend given in Table I.

#### 3.3.2.4 Documentation

The applicable questions (Q35 to Q37) for this topic are identified in Figure 2 (with full versions of the questions given in Appendix A), which address the documentation relating to:

- The process used for generating the record;
- The associated scientific review of the record generation process;
- The delivery of the record.

Guidance on the admissible range of responses to the related questions is contained in [RD-3].

Based on the guidance given in [RD-3], a textual assessment of the compliance shall be provided (addressing each question) together with a pictorial summary of the assessment using the "Documentation" component of Figure 2 and applying the compliance legend given in Table I.

#### 3.3.2.5 Accessibility

The applicable questions (Q38 to Q44) for this topic are identified in Figure 2, which address the access provisions for the record (with full versions of the questions given in Appendix A).

Guidance on the admissible range of responses to the related questions is contained in [RD-3].

Based on the guidance given in [RD-3], a textual assessment of the compliance shall be provided (for each question) together with a pictorial summary of the assessment using the "Accessibility" component of Figure 2 and applying the compliance legend given in Table I.

#### 3.3.2.6 Applications

The applicable question (Q45) for this topic is identified in Figure 2 and addresses the linkage to applications for the record (the full version of the question is available in Appendix A).

Guidance on the admissible range of responses to the related questions is contained in [RD-3].

Based on the guidance given in [RD-3], a textual assessment of the compliance shall be provided together with a pictorial summary of the assessment using the "Applications" component of Figure 2 and applying the compliance legend given in Table I.

### 3.3.3 Gap Analysis Results for Each ECV Product

The gap analysis results for each ECV product should be described at two levels:

- a) A summary of Gap Analysis Results for the individual records (assuming records exist for the ECV Product - see section 3.3.1) and based on the assessments described within sections 3.3.2.1 to 3.3.2.6);
- b) The overall status for the ECV Product taking into account all the available records, including:
  - The records currently available for the ECV product;
  - If no records exist, a set of possible options for generating the missing records;
  - The degree to which "best use" has been made of the available FCDRs in the construction of the records;
  - Any temporal and/or coverage gaps in the ECV product once all the available records have been taken into account;
  - Any supplementary information received from the questionnaire responders received during the course of the gap analysis;
  - Any suggested actions to address gaps, shortfalls and improvement possibilities.

For information, a sample gap analysis output for one ECV Product is attached as Appendix C.

## 3.4 Gap Analysis on the Future Component of the ECV Inventory

### 3.4.1 Existence of Records

The first question to be answered is "Do record entries exist for the ECV product in question?"

If the answer is "No" then the next steps are:

- a) Review [RD-2] to determine what type of FCDRs are required for the generation of this ECV product;
- b) Review the MIM (<http://database.eohandbook.com>) and OSCAR (<http://www.wmo-sat.info/oscar/>) databases to assess if there is the potential to create FCDRs, that might be used in the future for the generation of this ECV product;
- c) Document the results of a) and b).

If the answer is "Yes" then proceed to section 3.4.2 and repeat for each record.

### 3.4.2 Analysis of Record Entries

For each record entry associated with the ECV product, the degree of compliance with relevant GCOS requirements {i.e. [RD-1] and [RD-2]} shall be assessed according to the following categorisation:

- Stewardship
- Record Characteristics
- Accessibility
- Applications

As noted in the following sections, a textual description of the compliance status shall be accompanied by a pictorial representation using the spiral diagram illustrated in Figure 3, overlaid with compliance indicators given in Table I.

#### 3.4.2.1 Stewardship

The applicable questions (i.e. Q1 to Q13) for this topic are identified in Figure 3 (with full versions of the questions given in Appendix B). These questions focus on exposing the planned stewardship arrangements (both administrative and technical) for the record. Guidance on the admissible range of responses to these questions is contained in [RD-3].

If any deficiencies are detected, pointers to the appropriate rectification approach should be identified (if not obvious).

Based on the guidance given in [RD-3], a textual assessment of the compliance shall be provided (addressing each question) together with a pictorial summary of the assessment using the "Stewardship" component of Figure 3 and applying the compliance legend given in Table I.

#### 3.4.2.2 Record Characteristics

The applicable questions (i.e. Q14 to Q25) for this topic are identified in Figure 3 (with full versions of the questions given in Appendix B). These questions mainly address the anticipated input data that will be used for the construction of the record, together with the record producer's views of the likely technical characteristics of the record (accuracy, resolution, stability, etc.). Guidance on the admissible range of responses to the various questions is contained in [RD-3].

The following points should be noted:

- a) The record length attributes (covered by Q23 and Q24) have no counterpart in the GCOS requirements and have been included in the questionnaire because they have an important bearing on the usability of the record (the minimum usable length of a record generally depends on the application under consideration and the accuracy of the measurement);
- b) The physical quantity being measured (Q15) also has no explicit GCOS requirement counterpart but is a necessary attribute of the record;
- c) Satellite/sensor combination (Q16) is a fundamental property of the record, and the response to this question should point at the relevant FCDR(s);
- d) The geographical coverage requirement (Q17) is implicitly assumed to be global, as GCOS requirements are defined on a global scale. When considering potential gaps in coverage, this global coverage requirement should be

bome in mind. However, continental-scale data records (e.g., as derived from single geostationary orbit position sometimes forming an input to a global data record) have their own distinct value;

- e) Q18 to Q22 are designed to obtain the anticipated performance characteristics (as seen by the record provider) in key areas and, to assist in the comparison of these characteristics with the specific ECV product requirements in [RD-2], comparison/visualisation tools are available.

The main questions to be answered under this topic include:

- a) Has the supporting information about the record (i.e. responses to Q14 - Q16) been provided in accordance with [RD-3]?
- b) Will there be any gaps in the temporal continuity of the record?
- c) Will the record make appropriate use of FCDRs (a cross-check with [RD-2] and the MIM and OSCAR databases may be needed to answer this question)?
- d) Will there be any gaps in the geographical coverage of the record (Q17)?
- e) How well will the record meet the GCOS requirements on spatial and temporal resolution, accuracy and stability (Q18 to Q22)?
- f) Will the record be a successor to a record existing in the "current" component of the ECV inventory (Q25)?

If any deficiencies are detected, pointers to the appropriate rectification approach should be identified (if not obvious).

Based on the guidance given in [RD-3], a textual assessment of the compliance shall be provided (addressing each question) together with a pictorial summary of the assessment using the "Record Characteristics" component of Figure 3 and applying the compliance legend given in Table I.

#### 3.4.2.3 Accessibility

The applicable questions (i.e. Q26 to Q28) for this topic are identified in Figure 3 (with full versions of the questions given in Appendix B). These questions address the access provisions for the record.

Guidance on the admissible range of responses to the related questions is contained in [RD-3].

Based on the guidance given in [RD-3], a textual assessment of the compliance shall be provided together with a pictorial summary of the assessment using the "Accessibility" component of Figure 3 and applying the compliance legend given in Table I.

#### 3.4.2.4 Applications

The applicable question (i.e. Q29) for this topic is identified in Figure 3 (with a full versions of the question given in Appendix B). This question addresses the linkage to applications for the record.

Guidance on the admissible range of responses to this question is contained in [RD-3].

Based on the guidance given in [RD-3], a textual assessment of the compliance shall be provided together with a pictorial summary of the assessment using the "Applications" component of Figure 3 and applying the compliance legend given in Table I.

### 3.4.3 Gap Analysis Results for Each ECV Product

The gap analysis results for each ECV product should be described at two levels:

- a) A summary of Gap Analysis Results for the individual records (assuming records exist for the ECV Product - see section 3.4.1) and based on the assessments described within sections 3.4.2.1 to 3.4.2.4);
- b) The overall status for the ECV Product taking into account all the available records, including:
  - The records planned to be available for the ECV product and, if no records are planned, a set of possible options for generating the records;
  - The degree to which "best use" will be made of the available FCDRs in the construction of the records;
  - Any anticipated temporal and/or coverage gaps in the ECV product once all the available records have been taken into account (e.g. microwave imaging);
  - Any supplementary information received from the questionnaire responders received during the course of the gap analysis;
  - Any suggested actions to address gaps, shortfalls and improvement possibilities.

For information, a sample gap analysis output for one ECV Product is attached as Appendix C.

## 4 Documentation of the Gap Analysis Results

At the conclusion of the gap analysis activities, a consolidated Gap Analysis Report shall be produced, under the leadership of the Gap Analysis Coordinator, with the following structure/contents.

Section	Title	Contents
1	Introduction	Purpose and Scope, Applicable Documents
2	Implementation Approach	Describes the approach adopted for implementing the Gap Analysis, including schedule of activities and allocation of work to teams (see section 3.1.4)
3	Generic Gap Analysis	<ul style="list-style-type: none"> <li>a) Generic Gap Analysis Statistics (separated into current and future - see section 3.2)</li> <li>b) Percentage of Records Produced as a Result of International Coordination (separated into current and future - see section 3.2)</li> </ul>
4	Gap Analysis per ECV Product	<p>Gap analysis summary results for each ECV product, with one sub-section for each ECV product and separated between current and future components - see sections 3.3.3 and 3.4.3 for the required content of the sub-sections.</p> <p>Note: the detailed gap analysis results shall be included in appendices</p>
5	Improvement Suggestions	<p>As described in section 3.1.2, this section shall include a consolidated list of improvement suggestions, covering at least:</p> <ul style="list-style-type: none"> <li>a) The content and formulation of the requirements baseline {e.g. as reflected in [RD-1] and [RD-2]};</li> <li>b) The structure/content of the ECV Inventory and Questionnaires (e.g. possible need for a better backwards link from TCDRs to FCDRs);</li> <li>c) The completeness and consistency checking of the ECV Inventory entries;</li> <li>d) The gap analysis process (as described in this document);</li> <li>e) The selected implementation approach (e.g. the breakdown of the gap analysis activities into thematic areas and allocation to teams).</li> </ul>
Appendix A	Detailed Gap Analysis Results	Detailed gap analysis results for each ECV product, with one sub-section for each ECV product and separated between current and future components - see sections 3.3.2 and 0 for the required content of the sub-sections.
Appendix B	Recommendations for Coordinated Actions	This section shall include an extract of all recommendations for coordinated actions from the main body of the report (for potential inclusion in a coordinated action plan) to address gaps, shortfalls and improvement opportunities

## 5 Issues for Future Gap Analyses

The following is a list of issues to be potentially addressed as part of a future gap analysis (i.e. beyond inventory version 2.1):

- What is the status of uncertainty characterisation of the records?
- What are the arrangements for the interoperability of archives? [could address a gap in coordination of archives including following internationally agreed meta data standards];
- What applications are generally covered by current ECVs and which known needed applications are not?
- Potential extrapolation to unapproved (Phase-A) missions.

**APPENDIX A: Questionnaire for Current Component of ECV Inventory**

Area	Subject index	Subject	Question number current	Question
STEWARDSHIP	1	Responder name	1	Who is the individual populating the questionnaire?
	2	Responder e-mail	2	Please state the e-mail address of the individual populating the questionnaire.
	3	Data Record identifier	3	What is the Data Record Identifier of the TCDR? In case this TCDR is part of a "family" of products, please provide the TCDR family name.
	4	Responsible organisation	4	What is the name of the organisation with overall responsibility for the data record?
	5	Collection organisation	5	Which organisational entity is responsible for collecting the satellite observations?
	6	Calibration organisation	6	Which organisational entity is responsible for calibrating the satellite observations?
	7	FCDR organisation	7	Which organisational entity is responsible for generating and maintaining the FCDR (i.e. correcting, geolocating and applying calibration parameters to the satellite observations)?
	8	Inter-calibration organisation	8	Which organisational entity is responsible for inter-calibrating the satellite observations?
	9	TCDR organisation	9	Which organisational entity is responsible for generating and maintaining the TCDR (i.e. conversion of the FCDR to geophysical parameters)?
	10	GCOS requirements organisation	10	Which organisational entity is responsible for checking if the resultant TCDR(s) meet the relevant GCOS requirements, and identifying any required processing updates?
	11	Peer-review organisation	11	Which organisational entity is responsible for organising the peer review of the data record? Please describe the status of the peer review.
	12	Archiving organisation	12	Which organisational entity is responsible for collating, archiving and maintaining the resultant climate data records (e.g. archiving observations, FCDRs, TCDRs and all ancillary information such as processing configurations used in their generation, comparison with GCOS requirements, peer reviews, external reference data, etc)?
	13	User-service organisation	13	Which organisational entity is responsible for servicing user requests for the data record?
	14	User-feedback organisation	14	Which organisational entity is responsible for responding to user feedback on the use of this data

Area	Subject index	Subject	Question number current	Question
GENERATION PROCESS				record?
	15	Maintenance and user support commitment	15	Until when are firm commitments in place to continue to maintain and provide user support for this data record?
	16	Assessment body	16	If the data record has been produced in conjunction with any external domain-specific generation and assessment body, then please identify the external domain-specific bodies engaged in the generation of the data record.
	17	Quality Assurance Process	17	Please describe the quality assurance process which has been implemented for the data record generation process. If it has been done in conjunction with a relevant international coordination body, then please indicate which international organisation or coordination body covered this aspect for the data record considered.
	18	GCOS-requirements compliance assessment	18	If the compliance status of the TCDR with the GCOS requirements has been assessed, then please provide a link to the document describing the results of the assessment.
	19	GCOS-guidelines peer-review compliance assessment	19	If the degree of compliance with the GCOS guidelines has been assessed through a peer-review process, then please provide links to the documents describing the results of the assessment.
	20	Quantitative maturity index assessment	20	If a quantitative maturity index assessment has been performed for the data record, then please provide a link to the document describing the results of this assessment.
	21	ECV and ECV Product	21	To which ECV does the data record contribute? Which ECV Product is addressed by the data record?
	22	Physical quantity	22	Which physical quantity does the data record provide?
	23	SI units	23	What are the SI units of the data record?
RECORD CHARACTERISTICS	24	Satellite/sensor combination	24	Which satellite/sensor combination is used to generate the data record? For each pair satellite/sensor, please specify the level of data used, as well as the corresponding period of time of data usage (start- and end-date).
	25	Inter-calibration satellite/sensor combination	25	Against which satellite/instrument combination has the data record been inter-calibrated? For each pair satellite/sensor, please specify the level of data used, as well as the corresponding period of time of data usage (start- and end-date).

Area	Subject index	Subject	Question number current	Question
DOCUMENTATION	26	Ground-base network calibration	26	If this data record is utilising a ground-based network for calibration purposes, then please specify the network and provide a link to the source.
	27	Geographical coverage	27	What is the geographical coverage of the TCDR? If not global, please specify the geographical extent. Please specify which domains (land, inland water, ocean, ice) are covered by the TCDR.
	28	Horizontal resolution	28	What is the horizontal resolution of the TCDR (in km)?
	29	Vertical resolution	29	What is the vertical resolution of the TCDR (in km)?
	30	Temporal resolution	30	What is the temporal resolution of the TCDR (in days)?
	31	Accuracy	31	What is the accuracy of the TCDR?
	32	Stability	32	What is the stability of the TCDR?
	33	Start date	33	What is the start-date of the continuous data record?
	34	End date	34	What is the end-date of the continuous data record?
ACCESSIBILITY	36	CDR-generation documentation (link)	35	Please provide the links to the documents describing all the steps taken in the generation of FCDRs and TCDRs, including algorithms used, on-board calibration, specific FCDRs used, version management system used, and characteristics and outcomes of validation activities.
	37	Data documentation (link)	36	Please provide link(s) to documentation provided with the data record.
	38	Scientific-review process (link)	37	Please provide link to a document describing the scientific review process related to FCDR/TCDR construction (including algorithm selection), FCDR/TCDR quality and applications.
	39	Access point	38	Please provide information on the access point (e.g. contact e-mail) for access to data records.
	40	Access conditions	39	What are the data-access conditions? Please state whether access is made through an ordering system and if registration is required.
	41	Data record (link)	40	Please provide link(s) to the data record.
	42	FCDR availability	41	In case the FCDRs are also available to the user community, please provide a link to that data record.
	43	Data format and meta data standard	42	What formats are available for the data record and what standard has been used for the meta-data?

Area	Subject index	Subject	Question number current	Question
APPLICATIONS	44	Dissemination mechanisms	43	What dissemination mechanisms are available for the data record?
	45	Release date	44	When was the data record released to the user community (year)?
APPLICATIONS	46	Climate applications	45	What specific climate applications does this data record support?

**APPENDIX B: Questionnaire for Future Component of ECV Inventory**

Area	Subject index	Subject	Question number future	Question
STEWARDSHIP	1	Responder name	1	Who is the individual populating the questionnaire?
	2	Responder e-mail	2	Please state the e-mail address of the individual populating the questionnaire.
	4	Responsible organisation	3	What is the name of the organisation with overall responsibility for the planned data record?
	5	Collection organisation	4	Which organisational entity will be responsible for collecting the satellite observations?
	6	Calibration organisation	5	Which organisational entity will be responsible for calibrating the satellite observations?
	7	FCDR organisation	6	Which organisational entity will be responsible for generating and maintaining the FCDR (i.e. correcting, geolocating and applying calibration parameters to the satellite observations)?
	8	Inter-calibration organisation	7	Which organisational entity will be responsible for inter-calibrating the satellite observations?
	9	TCDR organisation	8	Which organisational entity will be responsible for generating and maintaining the TCDR (i.e. conversion of the FCDR to geophysical parameters)?
	10	GCOS requirements assessment organisation	9	Which organisational entity will be responsible for checking if the resultant TCDR(s) meet the relevant GCOS requirements, and identifying any required processing updates?
	11	Peer-review organisation	10	Which organisational entity will be responsible for organising the peer review of the data record?
	12	Archiving organisation	11	Which organisational entity will be responsible for collating, archiving and maintaining the resultant climate data records (e.g. archiving observations, FCDRs, TCDRs and all ancillary information such as processing configurations used in their generation, comparison with GCOS requirements, peer reviews, external reference data, etc)?
	13	User-service organisation	12	Which organisational entity will be responsible for servicing user requests for the data record?
	14	User-feedback organisation	13	Which organisational entity will be responsible for responding to user feedback on the use of the data record?

Area	Subject index	Subject	Question number <i>future</i>	Question
RECORD CHARACTERISTICS	21	ECV and ECV Product	14	To which ECV will the data record contribute? Which ECV Product will be addressed by the data record?
	22	Physical quantity	15	Which physical quantity will the data record provide?
	24	Satellite/sensor combination	16	Which satellite/sensor combination will be used to generate the data record? For each pair satellite/sensor, please specify the intended level of data to be used, as well as the corresponding planned period of time of data usage (start- and end-date).
	27	Geographical coverage	17	What is the geographical coverage of the planned TCDR? If not global, please specify the geographical extent. Please specify which domains (land, inland water, ocean, and ice) will be covered by the TCDR.
	28	Horizontal resolution	18	What is the anticipated horizontal resolution of the TCDR (in km)?
	29	Vertical resolution	19	What is the anticipated vertical resolution of the TCDR (in km)?
	30	Temporal resolution	20	What is the anticipated temporal resolution of the TCDR (in days)?
	31	Accuracy	21	What is the anticipated accuracy of the TCDR?
	32	Stability	22	What is the anticipated stability of the TCDR?
	33	Start date	23	What is the planned start-date of the continuous data record?
	34	End date	24	What is the planned end-date of the continuous data record?
	35	TCDR heritage	25	If the TCDR is a new release/extension of an existing TCDR, for which existing TCDR is the planned one an extension or a new version/release?
ACCESSIBILITY	40	Access conditions	26	What are the planned data-access conditions?
	42	FCDR availability	27	Will FCDRs as well as TCDRs be available to the user community?
	45	Release date	28	What is the planned date for releasing the data record to the user community (year)?

Area	Subject index	Subject	Question number <i>future</i>	Question
APPLICATIONS	46	Climate applications	29	What specific climate applications will this new data record support?

**APPENDIX C: Sample of a Gap Analysis Output (to be included in the next draft)**