# The Future Earth Observation Programme FutureEO-1

# Call for Earth Explorer 12 Mission Ideas

14 February 2023

## Executive Summary

The European Space Agency is soliciting the Earth observation community for proposals for a scientific research mission addressing the ESA Earth science challenges and to be launched in the 2036 timeframe. The programmatic context for the call is described in Section 1, the scientific objectives in Section 2, and the boundary conditions are provided in Section 3. Full proposals need to be submitted in different phases, see Section 4. The evaluation approach is explained in Section 5. Selection criteria are listed in Section 6. The mission idea will be implemented according to the timeline indicated in Section 7.

# 1. Programmatic background

As part of its *Future Earth Observation Programme (FutureEO-1) Segment-2*, the European Space Agency (ESA) announces an opportunity for scientists from the Earth Observation (EO) community in ESA Member States[1], and Canada, Lithuania, Slovenia or Slovakia, to prepare proposals for ideas to be evaluated as potential *Earth Explorer Missions*. These missions will provide data with which to conduct research in the field of EO and/or to demonstrate the potential of new innovative EO techniques of relevance to both the scientific and the application-oriented user communities.

The Research Mission element of FutureEO-1 consists of a series of missions addressing critical Earth science issues. To-date, ten Earth Explorer missions have been selected for implementation, namely GOCE (Gravity field and steady-state Ocean Circulation Explorer), Aeolus (Atmospheric Dynamics Mission), CryoSat (polar ice monitoring), SMOS (Soil Moisture and Ocean Salinity), Swarm (Earth's magnetic field and environment), EarthCARE (Clouds, Aerosols and Radiation Explorer), Biomass (Forest Carbon mission), FLEX (Fluorescence Explorer), FORUM (new insight into planet's radiation budget and climate), and Harmony (fine-scale motion occurring at or near Earth's surface). In addition, four Earth Explorer 11 candidates are currently being studied in Phase 0 (CAIRT, Nitrosat, SEASTAR, and WIVERN).

Additionally, the Research Mission element of *FutureEO-1* includes Missions of Opportunity developed in partnerships with space agencies outside ESA Member States, and the more agile development of small-satellite based Scout missions, separately from Earth Explorer Calls. Two Scout Small Satellite based missions are currently being implemented (CubeMAP and HydroGNSS), whilst the Next Generation Gravity Mission (NGGM) is being prepared as a Mission of Opportunity in cooperation with NASA to realise the joint MAss change and Geosciences International Constellation (MAGIC).

The motivation behind this Call is the Agency's wish to engage the scientific community as far as possible in determining and advancing the content of *FutureEO-1*. The Earth Observation Strategy and accompanying Future Challenges (see Earth Observation Science Strategy for ESA: A New Era for Scientific Advances and Societal Benefits,

[1] Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, and the United Kingdom.

ESA SP-1329/1 and ESA's Living Planet Programme: Scientific Achievements and Future Challenges – Scientific Context of the Earth Observation Science Strategy for ESA, ESA SP-1329/2, European Space Agency, Noordwijk, the Netherlands, 2015) outline the wide-ranging and ambitious Earth science challenges to be addressed by this Call.

Taking into account the experience from previous calls, and in line with the spirit of the programme, the Agency is soliciting bold, innovative ideas to be implemented as ESA-led Earth Explorer missions. Mission candidates will be selected from the proposed ideas on the basis of their innovation and scientific excellence and fulfilment of the boundary conditions of the call.

A response to the Call may be made by scientists from ESA Member States, and Canada, Latvia, Lithuania, Slovenia or Slovakia, or teams of scientists, where proposing teams may also include scientists from non-ESA member states.

Copies of this announcement and key reference documents will be found linked from the Agency's Earth Observation Proposal website https://eopro.esa.int/.

## 2. Scientific Objectives

Responses to the Call are open to address any Earth Science topics relevant to the FutureEO Programme, in accordance with the Earth Observation Science Strategy for ESA (ESA, 2015a) and scientific challenges (ESA, 2015b). Proposals shall demonstrate scientific novelty and excellence and are encouraged to rely on innovative technologies by employing new approaches or observation techniques by which to deliver new scientific insights into the Earth system.

The Call is open to all thematic domains within Earth science, and the mission ideas will be selected on the basis of their scientific merit and their technical/programmatic readiness to enter into Phase 0 (see selection criteria in Section 5). Addressing innovative and novel observation approaches is encouraged as part of this Call, such as satellite formations and constellations, taking advantage of existing and future space infrastructure, e.g. flying in coordinated manner with a long-term operational mission, in order to address new science issues.

## 3. Boundary conditions

The boundary conditions to which proposals will have to comply to be considered feasible under the present Call are spelled out in the present section.

### *3.1 Cost*

The present Call solicits proposals for a mission with a cap of **[550] M€ Cost at Completion (CaC)** to ESA at 2022 economic conditions (e.c.) covering the whole development of the mission after selection up to the end of the commissioning phase once the satellite is in orbit (i.e. from Phase B1 to E1).

This implies that a strict target of **310 M€, e.c. 2022**, has been set for all industrial development costs (comprising Phase B1, B2/C/D and E1) for the space segment, including Level 1 Ground Processor Prototype (GPP). This excludes the Flight Operations Segment (FOS) adaptations, Payload Data Ground Segment (PDGS) adaptations, launch services, in-orbit operations (Phase E2 and Phase F), development of the Operational Processors and the development of the End-to-end performance simulator.

With respect to the launcher selection, the Payload Allocation Policy for European Institutional missions launched on Ariane 6 or Vega shall be followed, see Section 2.4 for further detail.

Annex 1 contains Cost Estimate Breakdown guidelines.

### *3.2 Technology and Scientific Readiness level*

To achieve the targeted launch date with the attendant short preparation phase, the mission concept and the spacecraft design must rely on demonstrated basic technologies and scientific readiness.
Proposal level: Evidence for the current Science Readiness Level (SRL) and Technology Readiness Level (TRL) shall be provided in the proposal as well as a roadmap to achieve higher readiness levels in the next Phases until end of Phase B1.
End of Phase 0: By the end of Phase 0, compliance with SRL of 4 (ESA, 2015c) and compliance with programmatic aspects needs to be assessed to progress to the next phase.
End of Phase A: A minimum of SRL 5 must be achievable by the end of Phase A. Evidence shall be provided that TRL of 5 can be achieved at the end of phase B1.

### *3.3 In-kind contributions from ESA Member States and Partners*

In-kind contributions from ESA Member States and ESA Cooperating States are outside the scope of this Call. Mission ideas with in-kind contributions of international partners outside ESA Member States and ESA Associated or Cooperating States (Canada, Lithuania, Slovenia or Slovakia), are considered by definition Missions of Opportunity, and as such are outside the scope of this Call.

### *3.4 Launcher and launch timeframe*

With respect to the launcher selection, the Payload Allocation Policy for European Institutional missions launched on Ariane 6 or Vega (i.e. Chapter II within the ESA Council “Resolution on the Institutional Exploitation of ESA-Developed Launchers and supporting Competitiveness”, ref. ESA/C(2019)48”) shall be followed. For the proposal, only Vega-C and Ariane 6 can be considered, as per the User Manuals. In case the mission would require an Ariane 6 launcher, the additional launcher cost shall be offset by a corresponding reduction of the space segment industrial cost.

The Agency foresees a launch of the EE12 mission in the 2036 timeframe.

### *3.5 ESA rules and standards*

The mission selected as EE12 will be implemented in accordance with the tailored approach of the ESA rules and standards (see Section 8) as applied in previous ‘Earth

Explorer' Missions, with particular regard to the approaches for project reviews and documentation, applicable standards, industrial organisation with a cost-effective structure.

### *3.6 Commitment required from proposing teams*

The team identified in each proposal shall be in a position, and ready, willing and able to commit a significant amount of time and effort to provide detailed mission advice and/or to conduct ESA-funded science studies in support of the early development of the mission concept, should the mission idea be selected to proceed to Phase 0.

## 4. Proposal submission phases

Concerning the proposals for Earth Explorer mission ideas, submission will be performed according to the following compulsory steps:

1. Submission of a Letter of Intent and list of team members
2. Letter of Intent Workshop
3. Submission of a full Proposal

### *4.1 Submission of a Letter of intent and list of team members*

Prospective proposers are required to submit, by the deadline reported in Section 6, a Letter of Intent (LoI) stating their intention to submit a proposal in response to the present Call. It shall provide a brief overview of the scientific objectives of the mission idea and its assessment containing evidence that the concept of the proposed mission idea has been scientifically validated.

LoIs are accepted exclusively in electronic form, in PDF format (unlocked), using the interface available from the Call web site.

The LoIs shall have a maximum length of four (4) A4 pages, minimum font size 11 pt.

The LoIs shall contain:

a) the name and contact information of the Lead Proposer;
b) the proposal title;
c) the names and institutions of the team members. The entire team **shall not exceed 12 persons** (the LoI may not contain additional names from industry nor names mentioned through support or endorsement statements);
d) Executive Summary, summarising the mission idea and its objectives;
e) Scientific Objectives of the mission idea, describing the research objectives of the mission together with their relevance to ESA's EO Science Strategy and expected deliverables;
f) Characteristics of the mission idea, identifying the main features, as well as an indication of the related scientific and application-oriented user demands, and of scientific novelty and technological innovation together with a brief assessment of its expected feasibility;
g) References.

Submission of a LoI is mandatory. Proposals not preceded by a corresponding LoI will not be considered. The purpose of the LoI is to allow ESA to make the necessary

preparation for the proposal evaluation process. No support or endorsement letters may be attached to the LoIs.

Proposers shall indicate their involvement and role in the proposed idea, using the Excel spread-sheet that can be downloaded from the Call web site. Lead Proposers may identify qualified independent candidates for the scientific peer review of their proposals to ESA in the LoI.

The Lead Proposer, the listed proposal team and the proposal's title identified in the LoI shall remain the same throughout the complete Earth Explorer Call process.

Any further communication between ESA and the proposing team will only take place through the Lead Proposer.

### *4.2 Letter of Intent Workshop*

Up to two members of the proposal team, including the Lead Proposer, will be required to attend a mandatory Letter of Intent Workshop, see Section 6 for the schedule. The workshop is an opportunity to present the mission idea. The workshop will also provide detailed information on the Call and selection process, and an opportunity to answer related questions as well as on the various elements that should be addressed in a proposal. Furthermore, scientific matters can be clarified and potential industrial/scientific partners working in the same domain can be identified with whom a joint proposal could be prepared (if applicable). In addition to improving the possibilities for proposal consolidation, at this workshop the Executive, supported by ESA's Advisory Committee for Earth Observation (ACEO) members, may provide suggestions to the proposers for showing compliance with the scientific, technical and programmatic criteria.

### *4.3 Proposal Submission*

The following guidelines for the proposal shall be followed, further guidelines may be provided at the Letter of Intent Workshop:

- Proposals shall identify the Lead Proposer, who is a national from one of the Agency's Member States or ESA Associated or Cooperating States (Canada, Lithuania, Slovenia or Slovakia). The proposal shall be prepared by scientists (individually or in cooperation with other individuals and/or scientific institutes), and supported by technical experts from space industries in ESA's Member States or ESA Cooperating States, with relevant experience in space hardware development.
- The team members listed on the proposal shall be justified by their respective contribution to the content of the proposal. The entire team shall not exceed 12 persons and shall not differ from the team members listed in the LoI.
- No support or endorsement letters may be attached.
- The proposal shall be submitted in English language.
- The proposal format shall be in Adobe Acrobat PDF (unlocked), A4 page format, single-line spacing, font to be used: Times New Roman or Times, font size 11. All proposals must be submitted via the Call website.

The proposal shall have the following structure (not exceeding 30 pages, excluding references):

- Cover Page (1 page) is the title page of the Response to the Call with name and full address and affiliation (plus phone and e-mail) of the Lead Proposer plus list (names and affiliations) of associated team members. The reference number provided by ESA (following registered submission of the LoI) shall be entered on the top right corner of the proposal cover page.
- Executive Summary (1-2 pages) describing the mission idea in a nutshell.
    - A concise resumé describing: the scientific objectives, the science context and requirements in terms of the geo-biophysical variables or parameters to be retrieved, the targeted accuracy and the relevant spectral, spatial and temporal scales, as well as a broad justification for the realisation of the mission.
    - An outline of the envisaged mission implementation concept addressing the required observation concepts and the associated main requirements, together with the main elements of the mission idea.
    - The Agency shall be allowed to use the Executive Summary for public distribution. The rest of the proposal will be treated confidentially.
- Scientific Objectives, Requirements and Justification (<10 pages) is a description of the mission objectives with justification.
    - A description of the objectives of the mission and their rationale, classified in priorities, including the status of the scientific knowledge and the identification of the gaps and open issues that the mission intends to respond to.
    - The required mission duration and the relation to other planned or existing missions.
    - The identification of the geophysical variables and data products required to fulfil the objectives of the mission and the relevant observation requirements (e.g. accuracy, spatial and temporal scales), clearly defined. A list of observation requirements is provided in Annex 2 as guideline to support the proposal preparation.
    - The SRL status in the associated area and the status of potentially available geophysical retrieval algorithms. Supporting peer-reviewed references, or preliminary end-to-end performance simulations, or campaign results from ground and airborne payloads validating the concept idea, shall specifically refer to the details of the proposed concept, and include the methods for achieving the required geophysical measurement in relation to the specific instrumentation and observation technique proposed.
    - A prioritised and justified list of recommended scientific developments to be addressed during Phase 0, required to reach SRL 4. The list should detail recommendations on study topics to further mature science and mission requirements, ground and airborne campaign activities to mature the science, sensing and mission usage concepts and – as needed – to support Phase 0 mission studies.

- Technical Concept (<15 pages) is an outline of envisaged technical concept with some indication of its heritage and potential feasibility. For more details please refer to Annex 2:
    - Description of the observation techniques relevant to the mission idea and associated instrument(s) concept.
    - General technical characteristics of the mission (satellite, launcher and critical Ground Segment features) and the associated measurement requirements, including a justification of how these allow the fulfilment of the scientific objectives of the mission and a clear description of the baseline technical concept:
        - The relevant observation requirements (e.g. observation geometry, required observing conditions, temporal, spatial, spectral and radiometric requirements, spatial and temporal co-registration requirements, measurement accuracy requirements).
        - Other general requirements (e.g. synergy with, or dependence on other missions, and relevant co-registration requirements).
    - TRL roadmap, including assessment and justification of current TRL, estimated schedule and high-level cost estimation of technology pre-developments to achieve higher readiness levels in the next Phases, in order to provide evidence that TRL of 5 can be achieved at the end of Phase B1.
    - Engineering and performance budgets (including, but not limited to, mass, power and data rate budgets, including identification of maturity margins and system margin).
    - A high-level estimated cost breakdown, addressing the cost of the space segment development (Phase B1 and B2/C/D/E1) including contingency and of the Level 1 Ground Processor Prototype, to be presented following the guidelines provided in Annex 1.

- Relevance to Evaluation Criteria (<5 pages) is a response to the selection criteria outlined in Section 5.
- References - relevant publications shall be included.

## 5. Evaluation approach

The following steps will be performed in the evaluation of proposals:

Valid proposals (i.e., those received by the deadline indicated in Section 7 and having submitted a LoI and participated in the LoI workshop, and compliant with the required structure of the proposal) will be subject to a detailed scientific, technical and programmatic assessment, aiming at ascertaining the compatibility of the proposed mission idea with the Call's boundary conditions and Selection Criteria (see Section 6).

Proposals will be submitted to a scientific peer review process conducted under the responsibility of the ACEO according to the Selection criteria in Section 6. For the scientific evaluation, scientific panels will be established. Each scientific panel will be

chaired by members of ACEO and comprises non-ACEO, non-ESA independent scientific experts, and ESA internal scientific experts. Each scientific panel will be asked to scientifically assess a sub-set of proposals. Technical and programmatic panels will be set up by the ESA Executive, involving technical experts and senior staff from the Directorate of Earth Observation Programmes and the Directorate of Technology, Engineering and Quality, who will perform the technical and programmatic evaluation of the proposals. The technical panels will provide support to the scientific panels in the preparation of the evaluation reports.

Based on the evaluations of the individual proposals, ACEO will then undertake an overall evaluation and recommend to the Director of Earth Observation Programmes **up to four candidate missions** for study at Phase 0 level, without any order of priority. The candidate mission ideas recommended for Phase 0 will be submitted by the ESA Executive to the Programme Board for Earth Observation (PB-EO) for approval.

A written debriefing will be provided to all proposers, comprising in all cases a scientific, technical and programmatic assessment of the proposal. No face-to-face debriefing meetings are foreseen.

A Mission Advisory Group (MAG) will be established through a dedicated Announcement of Opportunity (AO) for each candidate mission selected for assessment, and all contributors to an idea will, in principle, be regarded as candidates for the respective MAG membership, but still need to apply through the AO MAG Call. This MAG will be tasked with presenting the scientific maturity (ESA, 2015c) and feasibility of the mission concept at the end of Phase 0 as well as preparing a Mission Requirements Document (MRD), as necessary to start Phase A.

At the end of the Phase 0 a Report for Mission Assessment for each candidate mission will be prepared by ESA Executive, with the support from the MAG for scientific matters and results will be presented at a User Consultation Meeting (UCM) to support the independent evaluation of ACEO. ACEO will review the scientific aspects of each mission concept (including compliance with SRL 4) whilst the ESA Executive will review the technical maturity and programmatic aspects (including cost and schedule). ACEO will rank the mission concepts according to the selection criteria and formulate a recommendation on scientific grounds. Taking into account the ACEO scientific recommendation and outcome of the technical and programmatic assessment, the ESA Executive will make a proposal to PB-EO for the decision on up to two mission concepts to proceed to Phase A.

At completion of the Phase A, a Report for Mission Selection for each candidate mission will be prepared by ESA Executive, with the support from the MAG for scientific matters. The intention is to present the results of the studies to the community in a User Consultation Meeting (UCM), which will contribute to the recommendation of one mission to be implemented as EE12.

Upon demonstration that the mission respects all the necessary conditions, supported by the above-mentioned public User Consultation Meeting (UCM) and scientific review under the auspices of ACEO, a decision on the full implementation (Phase B1 and B2/C/D/E1) of one of the two missions is foreseen to be taken by PB-EO at the end of

Phase A in September 2028. The decision will be based on ACEO scientific recommendation, and the proposal from the ESA Executive taking into account technical and programmatic aspects.

***Commended Missions***
It should be noted that mission proposals which are not recommended for Phase 0 may still be further investigated and matured through Agency programmes, if ACEO commends their scientific relevance. Commended mission ideas will be reviewed by the ESA Executive to identify potential new science or technology activities required to further develop and mature the mission concept. The Agency foresees to initiate relevant maturation activities for up to 4 commended mission ideas.

# 6. Selection criteria

Following PB-EO's acknowledgement of the new Earth Observation Science Strategy for ESA – A new Era for Scientific Advances and Societal Benefits (ESA-SP-1329/1) and ESA's Living Planet Programme: Scientific Achievements and Future Challenges – Scientific Context of the Earth Observation Science Strategy for ESA (ESA-SP-1329/2) and discussion at PB-EO level, the applicable Earth Explorer selection criteria are as follows (ESA/PB-EO(2015)44, Rev.1):

1. **Relevance to the ESA research objectives for Earth Observation** – for this criterion reference must be made to the general and specific objectives and scientific challenges set forth in the document Earth Observation Science Strategy for ESA – A New Era for Scientific Advances and Societal Benefits and 'ESA's Living Planet Programme: Scientific Achievements and Future Challenges' – Scientific Context of the Earth Observation Science Strategy for ESA (ESA SP-1329/1+2, 2015). Here account shall be taken of how scientific advances anticipated from the mission contribute to addressing major societal issues.
2. **Need, usefulness and excellence** – this must take account not only of scientific requirements and/or the importance of a mission viewed as a precursor but also the extent to which the requirements, including those of space/time sampling, can be met by the proposed mission.
3. **Uniqueness and complementarity** – this must take account of other (i.e. not space) means of addressing the mission requirements as well as the activities and plans of other national and international bodies for space missions.
4. **Degree of innovation and contribution to the advancement of European Earth Observation capabilities** – this relates to technical/industrial aspects as well as to user interests.
5. **Feasibility and level of maturity** – this encompasses the technical constraints with a particular emphasis on the technology readiness and the scientific readiness, as well as the status of the associated user community within ESA member states and the maturity of its requirements.
6. **Timeliness** – this must take account not only of the timeliness of a mission from the point of view of user needs but also with regard to implementation constraints.
7. **Programmatics** – in addition to the considerations of development schedule, cost, risk, etc., (set within the overall Earth Explorer Programme) this

addresses the implications of possible cooperation with other bodies, including synergies with other national and international developments, and taking account of the planned availability of relevant data from other observing systems.

## 7. Deadlines and Schedule

| Activity | Date |
|---|---|
| Release of the EE12 Call | 20 February 2023 |
| Letter of Intent deadline | 28 April 2023, 12:00 CEST |
| Letter of Intent Workshop | 10-11 May 2023 |
| Proposal submission deadline | 1 September 2023, 12:00 CEST |
| Evaluation of submitted proposals via peer-review panels | September 2023-December 2023 |
| ACEO EE12 candidate selection recommendation | January 2024 |
| PB-EO – selection of up to 4 EE12 candidates to enter Phase 0 | February 2024 |
| EE12 User Consultation Meeting (at the end of Phase 0) | Q3 2026 |
| ACEO EE12 recommendation | Q3 2026 |
| PB-EO – selection of up to two candidates to enter Phase A | Q3 2026 |
| EE12 User Consultation Meeting (at the end of Phase A) | July 2028 |
| ACEO EE12 recommendation | Q3 2028 |
| PB-EO – selection for implementation | September 2028 |
| EE12 launch timeframe | 2036 |

**Any proposal response that misses the submission deadline, or which is incomplete at the deadline will be discarded.**

## 8. References

ESA (2015a) Earth Observation Science Strategy for ESA: A New Era for Scientific Advances and Societal Benefits, ESA SP-1329/1.
ESA (2015b) ESA's Living Planet Programme: Scientific Achievements and Future Challenges – Scientific Context of the Earth Observation Science Strategy for ESA, ESA SP-1329/2.
ESA (2015c). Scientific Readiness Levels (SRL) Handbook. Mission Science Division. Reference EOP-SM/2776/MDru-mdru.
ESA (2017). Technology Readiness Level (TRL) Guidelines. ECSS-E-HB-11A, March 2017
VEGA C User's Manual, Is. 0.0 – Arianespace May 2018
Ariane 6 User's Manual Is. 2.0 – Arianespace February 2021

**Annex 1** – Cost Estimate Breakdown guidelines

| Cost Element | Cost [M€] |
|---|---|
| **Spacecraft Level** | |
| Project Office (1) | |
| AIV/T | |
| Facilities/GSE | |
| **Platform Level** | |
| Project Office | |
| AIV/T | |
| Facilities/GSE | |
| Platform HW/SW (2) | |
| Subsystem 1 | |
| …. | |
| Subsystem n | |
| **Instrument Level** | |
| Project Office | |
| AIV/T | |
| Facilities/GSE | |
| Instrument HW/SW (2) | |
| Subsystem 1 | |
| …. | |
| Subsystem n | |
| **Level 1 Ground Processsor Prototype** | |
| **Contingency** | |
| **Total Cost Estimate** | |

General: at least the level 1 and level 2 cost elements shall be provided;
(1) Management, Product Assurance, Engineering
(2) Breakdown per main subsystems, mission specific or critical subsystems shall be outlined (e.g. “standard” subsystems Hardware/Software (HW/SW) cost can be grouped under “other”)

**Annex 2** – Example list expressing typical observation requirements for Earth Observation missions during early mission phases.

| Observation Requirement | Description |
|---|---|
| **Geographical coverage** | Description of the geographical extent and/or volume to be sensed by the mission to address the science objectives of the mission. |
| **Instantaneous geographical coverage** | This corresponds to the minimum area or volume that should be sensed during a single acquisition. It will depend on the science objectives of the mission and the spatial characteristics or geographical extent of the processes to be captured during a single observation from the satellite(s). Often this requirement will be translated into the swath width or access range of a satellite. |
| **Temporal revisit** | Temporal resolution or sampling/sensing of the geophysical processes by the EO mission traced and justified in terms of the mission objectives. |
| **Mission duration** | The minimum duration of mission operations required to achieve the science objectives of the mission, often expressed in years of operation. This may also include a preliminary allocation of the mission operations to different mission phases |
| **Mission geophysical information products** | A list of the main geophysical information products to be generated by the mission including a description of the information product and its relation to the mission objectives, including latency (as relevant). |
| **Geophysical (Level 2) product resolution** | The spatial or volumetric resolution of each geophysical information product, justified with respect to the geophysical processes to be sensed and the mission objectives. Resolution requirements should be expressed for each of the main geophysical information products identified above. The resolution may be expressed in terms of goal (e.g. the desired or optimal resolution) and threshold at which point the objectives of the mission may be compromised. |
| **Geophysical (Level 2) product accuracy** | The accuracy that needs to be achieved for each geophysical information product, justified with respect to the geophysical processes to be sensed and the mission objectives. Product |

| | |
|---|---|
| | accuracy requirements should be expressed for each of the main geophysical information products identified above. The accuracy may be expressed in terms of goal (e.g. the desired or optimal resolution) and threshold at which point the objectives of the mission may be compromised. Product accuracy requirements are related to the achievable accuracy and performance of the Level-1 products used to derive geophysical information. |
| **Mission Level-1 products** | A list of the main level-1 products to be generated by the mission including a description of each product and its relation to the geophysical information products of the mission. Level-1 products are typically expressed in engineering units. |
| **Level-1 product resolution** | The spatial or volumetric resolution of each mission level-1 product. The resolution may be expressed in terms of goal (e.g. the desired or optimal resolution) and threshold at which point the objectives of the mission may be compromised. |
| **Level-1 product accuracy** | The accuracy that needs to be achieved for each mission level-1 product. The accuracy may be expressed in terms of goal (e.g. the desired or optimal resolution) and threshold at which point the objectives of the mission may be compromised. The level-1 product accuracy should be justified and related to accuracy requirements of the geophysical information products. |
| **Ancillary data requirements** | Ancillary data are those not collected by the EO mission itself but are required to transform and process the mission level-1 products into geophysical information products. |