

UAW2026 Session on Availability of geodetic products for the Essential Geodetic Variables

Summary

Objective: to gather recommendations on how to characterise the geodetic products required for quantifying and monitoring the Essential Geodetic Variables (EGVs).

Main recommendations:

- In addition to the initial proposed product characteristics (uncertainty, spatial and temporal resolution, timeliness, and data sources), it should be evaluated whether additional characteristics can be included, such as variance/covariance matrices, reliability, repeatability, stability, robustness, time-series correlations, etc.
- The proposed characteristics are not known for all products, and no inventory of this kind exists yet. The first step is to establish the current values of these characteristics in order to ascertain what is available. The next step is to define target values: what is desired but not yet achieved.
- The product characterisation should be as simple as possible for communication with non-geodetic experts. Additional expert-level information should be added in the form of “notes” or “comments”.
- The characterisation of geodetic products should include a brief description of the data limitations.
- The catalogue of EGVs can be extended to include other geodetic products, such as those related to lunar reference frames or solid Earth modelling.
- The data/product providers should be identified first, followed by potential stewards for the EGVs.

Action item:

The GGOS Bureau of Products and Standards (GGOS-BPS) will provide the framework for implementing these recommendations. The first step will be to reconvene the Committee on EGVs, comprising representatives from all IAG services and other IAG components, to begin characterising the products they make available. Once all geodetic products provided by the IAG have been covered, the GGOS-BPS will initiate a similar process with data and product providers outside the IAG.

A first progress report will be presented at the GGOS Days 2026 (5-7 October, Gävle, Sweden).

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Detailed Report

General comments on the definition and adoption of Essential Geodetic Variables (EGVs)

Preamble: Within the context of the Global Observing Systems, the concept of “variable” does not adhere to the traditional mathematical or physical definitions. In this context, a variable can be an observation, a parameter, a quantity, etc. that contributes to describing the status of a system. In the case of GGOS, the EGVs serve as the main classification framework for geodetic products. These are defined based on an inventory of operational products from the IAG Services, as well as operational and non-operational products from other sources and short-term research studies. The aim is to define as few EGVs as possible that are flexible enough to cover all available geodetic products.

Feedback from the panellists and the audience:

- In general, the EGVs are recognised as an efficient tool for raising awareness of geodesy within other Earth Observation communities. However, concerns have been raised about how the EGVs should be communicated outside of the field of geodesy. **Answer:** GGOS is implementing the GGOS Portal, a one-stop shop for geodetic products, and is exploring various approaches to engage with other Observing System communities, particularly the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS), and the Group on Earth Observations (GEO).
- A roadmap for the EGVs is missing. **Answer:** The roadmap for the EGVs is described in the GGOS Implementation Plan, Phase 2024 – 2027, p. 40, <https://doi.org/10.5281/zenodo.13785103>.
- The term “Essential Geodetic Variables” is misleading; it should be “Essential Geodetic Products”. **Answer:** In the other Observing Systems, “products” are input to describe the “essential variables”. The products represent a second category below the essential variables. If the term is changed to “Essential Geodetic Products”, GGOS will not be on the same level as the other Observing Systems. In particular, GEO and WMO are initiating calls for participation to joint communities working on “essential variables”. If GGOS uses the term “essential products”, these initiatives will exclude it from the outset.
- Classifying geodetic reference frames as an essential variable is misleading, since reference frames should remain stable over time. **Answer:** The concept of essential variables within Global Observing Systems, and particularly within GGOS, is explained in the EGVs white paper: <https://doi.org/10.5281/zenodo.18313946>. The main objective is to raise awareness. Reference frames are one of the main contributions of geodesy to Earth Observation, but this is not widely recognised. Classifying “reference frames” as geodetic products or as prerequisites for geodetic data analysis may diminish their importance, as they may be perceived as being necessary only for geodesy and not for other Earth Observation disciplines. One way to support their classification as “essential geodetic variables” is that there are different solutions/versions of reference frames. While the definition of the reference systems remains unchanged, the realisation (i.e. the frames) does change.
- Including “Geodetic Standards and Conventions” as an essential geodetic variable is misleading. **Answer:** As with the previous point, this is explained in detail in the EGVs white paper: <https://doi.org/10.5281/zenodo.18313946>. There are background models

and Earth parameters (standards) that can only be provided by geodesy. This is not recognised outside of geodesy, and the ultimate objective is to communicate this to other Earth system research disciplines. Classifying geodetic standards and conventions at a lower level may imply that they are only necessary for geodesy and not for other Earth Observation disciplines.

- The catalogue of EGVs can be extended to include other geodetic products, such as those related to lunar reference frames or solid Earth modelling. **Answer:** GGOS will contact the colleagues who proposed this, asking for further feedback and defining concrete actions in this regard.

Characterisation of geodetic products

Preamble: Following the practices of GCOS and GOOS, it is proposed to characterise the geodetic products by the following:

- Uncertainty: expressed in terms of standard deviation (unless stated otherwise).
- Spatial Resolution: horizontal and vertical (if needed).
- Temporal resolution (or frequency): the frequency of the product e.g. hourly, daily, annual, etc.
- Timeliness: The time expectation for accessibility and availability of the product.
- IAG Service / Data sources

Feedback from the panellists and the audience:

- One perspective is that the standard deviation is insufficient for describing a geodetic product. It argues that variance/covariance matrices, reliability, repeatability, stability, robustness (rapid versus final products), time series correlations, etc. should also be included. Another perspective is that the characterisation of products should be as simple as possible to avoid confusing non-geodesists. It is better to use the same terminology as the other Global Observing Systems. **Answer:** The GGOS proposal is to summarise in factsheets the general characterisation of geodetic products using similar characteristics to those employed by the GCOS and GOOS. References to additional expert-level information (if available) will be added as “notes” or “comments” in the factsheets. A detailed description of each product should be included in the GGOS portal.
- Consistency should be also considered in the product characterisation. **Answer:** Consistency is one of the prerequisites for the EGVs. This is extensively explained in the EGVs white paper: <https://doi.org/10.5281/zenodo.18313946>.
- The characterisation of the products should include guidance for users, i.e. depending on the accuracy of the products, GGOS should indicate which applications this level of accuracy is sufficient for. **Answer:** This could be an endless task. GGOS staff cannot cover the full range of applications and their requirements. Suggesting fields of application without the necessary background information on the applications themselves may be misleading. Users of geodetic products should be aware of their requirements and decide whether the products are appropriate for their applications.
- The characterisation of geodetic products should include a brief description of the limitations of the data. **Answer:** GGOS will address this issue when conducting the product characterisation survey among the data/product providers.
- For UAW preparation, two examples of product characterisation were presented: GNSS orbits, clocks and biases; and global gravity field models. It is recommended that the sub-products remain very general, without going into too much detail. **Answer:** GGOS will follow this recommendation.

Quantifying the characteristics of geodetic products

Preamble: When characterising the Essential Climate Variables (ECVs) by GCOS, the following criteria are considered for the values of product characteristics:

- Goal (G): An ideal requirement above which further improvements are not necessary.
- Breakthrough (B): An intermediate level between threshold and goal which, if achieved, would result in a significant improvement for the targeted application. The breakthrough value may also indicate the level at which specified uses within climate monitoring become possible. It may be appropriate to have different breakthrough values for different uses.
- Threshold (T): The minimum requirement to be met to ensure that data are useful.

The question was whether the geodetic products should be characterised in the same way.

Feedback from the panellists and the audience:

- The general recommendation is to take an inventory of the current situation. The proposed characteristics are not known for all products, and an inventory of this kind does not exist yet. The first step is to establish what we have. The next step is to define the target values. **Answer:** Following this recommendation, GGOS will manage two categories: Current values and target values. The former should be determined through a survey of data/product providers. The latter can be established in agreement with the updated publication of the GGOS 2020 book.

Identification of stewards for the EGVs

Preamble: A main requirement of the EGVs is that they are sustainable. They should be provided on a long-term basis, and their reliability and consistency should be ensured. In this context, stewards must be identified who will take responsibility for safeguarding the long-term integrity, functionality, and resilience of the EGVs. These stewards should act on behalf of broader stakeholders to ensure responsible management, transparency, and continuous improvement. The question was how the stewards for the EGVs should be identified.

- This question was not discussed during the session due to lack of time. However, during the break after the session, it was generally recommended that the data/product providers be identified first, and then potential stewards for the EGVs.

Other topics discussed during the session

- The concept of EGVs and product-based characterisation is very complicated for users outside of geodesy. **Answer:** GGOS is preparing a dedicated webpage, outreach material, and factsheets for each EGV. This should make it easier to present and communicate the EGVs.
- The essential geodetic variables that are also essential climate or ocean variables should be defined in the same way as GCOS and GOOS did. **Answer:** A literature review was performed, and agreement was ensured before initiating the EGVs definition process. Differences arise when geodetic products are not recognised by the other Observing System. In this case, the specific geodetic products are added to the EGVs description. These can easily be identified in the supporting literature for climate, ocean and geodetic variables.
- New geodetic technologies are not included in the EGVs document. **Answer:** The EGVs document includes “Geodetic Infrastructure”, which is divided into the categories

“Geodetic Space Infrastructure (GSI)” and “Geodetic Terrestrial Infrastructure (GTI)”. Current and new technologies are included in the description of these two categories (see pp. 29–30 of <https://doi.org/10.5281/zenodo.18313946>).

- To raise awareness of geodesy and its products, the description of geodetic products must be improved. User handbooks should be made available within the IAG Services.

Answer: GGOS will pass this recommendation on to the IAG Services.