

EnMAP Mission Operations Status and Future Plans

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Abstract

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Challenge

The EnMAP mission is designed to provide the imaging spectroscopy user community with high-quality space-borne data. Since the start of operations, more than 190,000 products (or tiles of 30 km × 30 km) have been acquired. At the same time, these data are well within the different mission, instrument, and operational requirements, as is regularly shown in mission reports and scientific publications.

As a user-driven tasking mission with an ever-increasing number of user registrations, unevenly distributed tasking requests across the globe, and a growing demand for products, the EnMAP Ground Segment (GS) adapts its operations to the users' needs. The GS has introduced several operational updates that have improved the availability, the access to, and the quality of the EnMAP data since launch.

Methodology

EnMAP's operations are performed by the GS under the responsibility of the German Aerospace Center (DLR). The GS operations involve a wide range of activities that are organized into three systems:

- **Mission Operation System.** Responsible for controlling the satellite and the instrument
- **Payload Ground System.** Responsible for receiving, processing, and archiving the mission data, as well as for data access
- **Processor and Calibration/Validation System.** Responsible for calibration, maintenance of the processing chain and data quality control

In addition, the Application Support (ASP) team has extended its activities to address challenges related to observation requests. The ASP team manually schedules high-priority observations known as *EnMAP Foreground Mission (FGM)* and supports in situ campaigns, especially during summer in the Northern Hemisphere. The FGM observations and the requests from the users are complemented with lower-priority observations from the *Background Mission (BGM)*.

The high quality of EnMAP data is ensured by continuously monitoring and calibrating the instrument response. Equipped with different on-board calibration methods, the EnMAP instrument is regularly monitored with high accuracy, performing calibration updates when the mission requirements may be affected. The excellent instrument stability makes such updates only occasionally necessary: spectral and geometric calibration are not in need of updates since 2023. Radiometric calibration updates are more frequent, but in 2025 the update frequency was reduced by half, to one calibration every two months.

Study area and data

EnMAP products are acquired based on the orders created by the users and the GS through the FGM and BGM requests. With the BGM, the goal is to create time series over targets selected by the Science Team and map large areas of the Earth's surface. The GS also plans the FGM observations based on feedback from the user community or ground campaigns. The user's observations are typically shorter and often over the same areas (e.g. central Europe). To address the inefficiencies that this may create, the GS changed the minimum number of tiles per datatake to three in 2025.

The FGM observations represent around 10% of all the acquisitions and 13% of the products. The remaining acquisitions are performed by users, around 43% of acquisitions and 15% of products, and by the BGM program, 46% of acquisitions and 72% of products. The success rate of the users' observations largely depends on the target area and selected time period, but on average, it has reached 66% in 2025 (45% within the requested cloud limit).

Products from the complete EnMAP catalogue are available after on-demand processing in EOWEB (<https://eoweb.dlr.de>). In addition, Analysis Ready Data (ARD) products pre-processed to L2A are available for direct download via the EOC-Geoservice (<https://geoservice.dlr.de>) and EOLab (<https://eo-lab.org/>) platforms. Currently, ARD products created with older versions are being updated to **V01.05.02**.

Discussion and Conclusions

The EnMAP operations have reached a stable state, but the mission continues to adapt to the users' needs. To improve observations in 2026, the cloud-handling strategy was updated at the end of 2025. It is expected that this will help to reduce the percentage of clouds. In addition, an update of the radiometric calibration is planned for 2026 that is expected to improve the VNIR and SWIR consistency. It is also expected that in 2026 L1B and L1C ARD products will become available at EOC-Geoservice.

Looking ahead, the mission is currently preparing for the possibility of an extension. The GS has completed an assessment, concluding that an extension of operations beyond 2027 is entirely feasible. The GS also has started to plan various improvements for this new phase of the mission. Among the upgrades, it is proposed to update the solar model to TSIS-1, improve atmospheric correction over water, and update the web interfaces for tasking and data ordering.

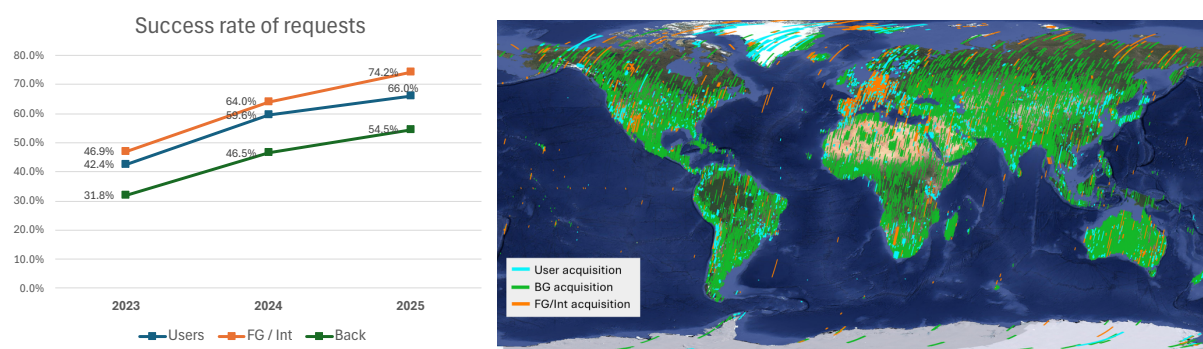


Figure (left) Success rate of the requests entered in the planning system (right) EnMAP acquisitions by Users, FGM and BGM requests since 2023.