THE ENMAP MISSION: CURRENT STATUS, UPDATES, AND PERSPECTIVES

Emiliano Carmona[1], Sabine Baumann[1], Sabine Chabrillat[2,3], Rupert Feckl[4], Martin Habermeyer[1], Vera Krieger[5], Laura La Porta[5], Akpona Okujeni[2], Miguel Pato[1], Nicole Pinnel[1], Daniel Schulze[6]

Author Affiliation(s)

[1] German Aerospace Center (DLR), Earth Observation Center (EOC), Wessling, Germany
[2] GFZ Helmholtz Centre for Geosciences, Potsdam, Germany
[3] Leibniz University Hannover, Hannover, Germany
[4] OHB System AG, Wessling, Germany
[5] German Aerospace Center (DLR), German Space Agency, Bonn, Germany
[6] German Aerospace Center (DLR), German Space Operations Center (GSOC), Wessling,

The German EnMAP satellite mission was launched in April 2022 and has since been delivering imaging spectroscopy data to an increasing number of users. The main goal of the mission is to provide high-quality hyperspectral data to scientific users for a wide range of applications, including vegetation and ecosystem monitoring, agriculture, inland and coastal water quality, geology and mineral mapping, and soil characterization. Over the years, the mission has matured, with operational updates improving data availability and overall performance. This contribution provides an overview of EnMAP's operational status, performance stability, and scientific impact, offering insights relevant for current users and future hyperspectral missions.

The EnMAP data products (L1B, L1C, L2A, and L2A-water) are made available to all registered users. These users are globally distributed, with rising interest outside Europe over the last two years. EnMAP users have access to the complete data catalogue and can task the instrument after the successful approval of a proposal by the Science Team. Since 2025, data acquisition has also been open to commercial users. Recent operational updates include changes in tasking and data access, such as the direct download of pre-processed L2A ARD (Analysis Ready Data) products. This possibility complements on-demand processing with user-selectable options. In terms of scheduling, the introduction of the Foreground Mission for high-priority targets or areas with a high number of competing orders, as well as further optimizations introduced in recent years, have allowed a tasking success rate of 66% for user-submitted orders. In addition, several processing and calibration updates have been implemented in the processors, along with recent updates to the handling of cloud limits for tasking.

The instrument performance has been very stable over these years and consistently above its requirements. Radiometric calibration varies in the range of 0.1–0.5% between quarterly assessments for the VNIR, and almost no variations are observed in the SWIR sensor (requirement: 2.5% for both sensors). For spectral calibration, changes between consecutive calibrations are always within ±0.2 nm (requirement: ±0.5 nm). The geometric performance is also well above the requirements, showing a geometric accuracy of 0.5-pixel RMSE (requirement: 1.0 pixel) and a VNIR–SWIR co-registration accuracy of approximately 0.05-pixel RMSE (requirement: 0.20 pixel), with no significant variations over time. Radiance comparisons with in-situ calibration data and measurement campaigns show that EnMAP radiance data (L1B/L1C products) have a relative RMSE of 3–4% in the 550–1300 nm interval and around 5% in the 1500–1750 nm range (mission requirement: 5%). Reflectance comparisons with in-situ data show RMSE values of around 2% for both VNIR and SWIR across most of the spectral range (420–2450 nm). These performances have allowed the use of EnMAP data for high-accuracy retrievals of surface composition in fields such as vegetation traits, soil health, and raw materials. EnMAP has also demonstrated high accuracy for water quality assessments and for measuring emissions of methane, NO_2, and CO_2.

The mission was originally designed for a minimum operational lifetime of five years. Recent assessments by the space and ground segments do not indicate limitations for an extension of the operational period, and a mission extension is currently under consideration. An extension would allow overlap with the future ESA CHIME mission, with plans to harmonize products and processing for improved integration of EnMAP and CHIME data, along with further updates to processing chain, data access services, and the instrument planning portal.