DESIS and EnMAP imaging spectroscopy data in support of the FLEX Mission

Authors: Emiliano Carmona[1], Martin Bachmann[1], Uta Heiden[1], Laura La Porta[2], Miguel Pato[1]

[1] German Aerospace Center (DLR), Earth Observation Center (EOC), Germany
[2] German Aerospace Center (DLR), German Space Agency, Germany

In 2026, the ESA FLEX mission will provide global measurements of sun-induced fluorescence (SIF), offering insights into plant photosynthetic activity as well as plant health and stress. In this context, data from existing space-borne hyperspectral missions can play a complementary role by helping with the preparation of commissioning activities, contributing to the validation of FLEX mission products, and, more generally, supporting the analysis and interpretation of FLEX data. This contribution presents the DESIS and EnMAP hyperspectral missions, emphasizing the complementary aspects that can support the FLEX scientific objectives.

The DESIS mission is a collaboration between the German Aerospace Center (DLR) and the U.S. company Teledyne Brown Engineering. DESIS is an imaging spectrometer with 30 m spatial resolution, operating in the VNIR range (400 – 1000 nm) and located on the International Space Station (ISS), which allows observations of targets in the latitude range from 55° North to 52° South. With a spectral full width half maximum (FWHM) of 3.5 nm, DESIS has a relatively high spectral resolution compared to similar missions. This has allowed the use of DESIS data for SIF retrieval, as presented in another contribution at this workshop.

EnMAP is a German satellite operated by DLR. EnMAP observes from a Sun-synchronous orbit with a 27-day repeat cycle, which allows re-observing a target approximately every four days by varying the off-nadir tilt angle. The instrument consists of two spectrometers: a VNIR spectrometer operating in the range 420–1000 nm and a SWIR spectrometer operating in the range 900–2450 nm. The average spectral FWHM of EnMAP is 8.1 nm in the VNIR and 12.1 nm in the SWIR, while the spatial resolution is 30 m.

In terms of calibration, EnMAP is equipped with several on-board calibration devices, which allow very precise monitoring of instrument performance, while DESIS relies on vicarious calibration and shows higher spectral variability. Both missions use similar processing chains that provide products at three different levels: L1B (at-sensor top-of-atmosphere radiance), L1C (orthorectified and geolocated top-of-atmosphere radiances), and L2A (orthorectified and geolocated bottom-of-atmosphere reflectances). These data can be accessed via the DLR EOWEB portal (https://eoweb.dlr.de/) and are also available for direct download from the EOC-Geoservice (https://geoservice.dlr.de/) after user registration for each mission. The EnMAP mission catalogue dates back to April 2022, while the DESIS catalogue extends back to October 2018.

In this contribution, we discuss characteristics of EnMAP and DESIS data that are relevant for FLEX, including acquisition strategies, spectral coverage, radiometric performance, spatial resolution, geolocation accuracy, and data access. Potential use cases are presented, such as the identification of suitable validation areas as well as validation and intercomparison activities. The contribution highlights how EnMAP and DESIS data can complement FLEX observations by offering independent hyperspectral radiance and reflectance measurements with higher spatial resolution.