Overview of the EnMAP Hyperspectral Mission

Henning Buddenbaum

on behalf of Luis Guanter and the EnMAP team

GFZ Helmholtz Centre Potsdam

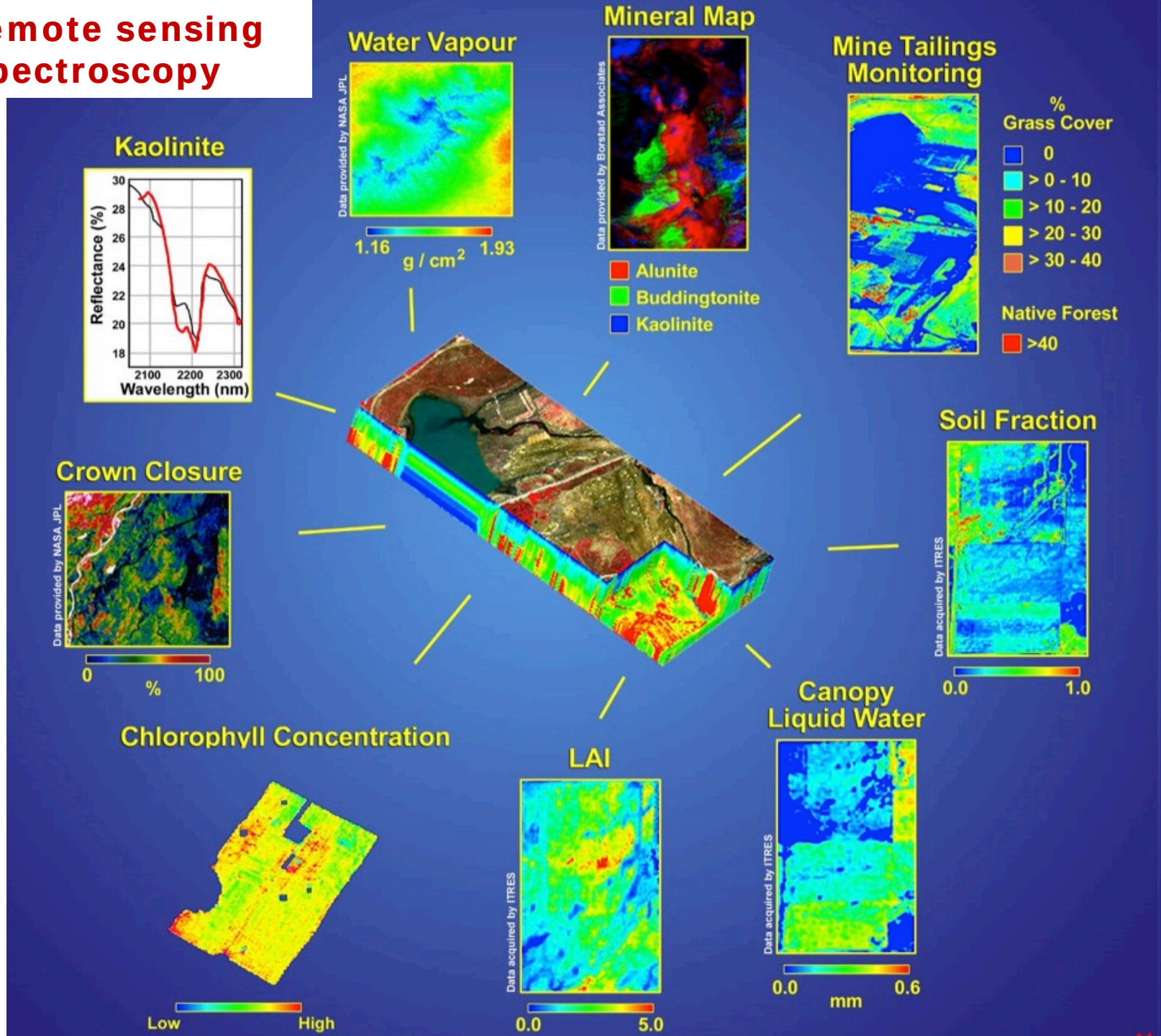
HELMHOLTZ ASSOCIATION

Hyperspectral remote sensing a.k.a Imaging Spectroscopy

→Quantitative mapping for a wide range of research fields

→Great potential for new (and unexpected!) applications

(see session Fachsession 4b)



Scientific Principal Investigator
GFZ Potsdam

EnMAP Science Team

Project Management
DLR Space Administration

Space Segment

Sensor | Platform

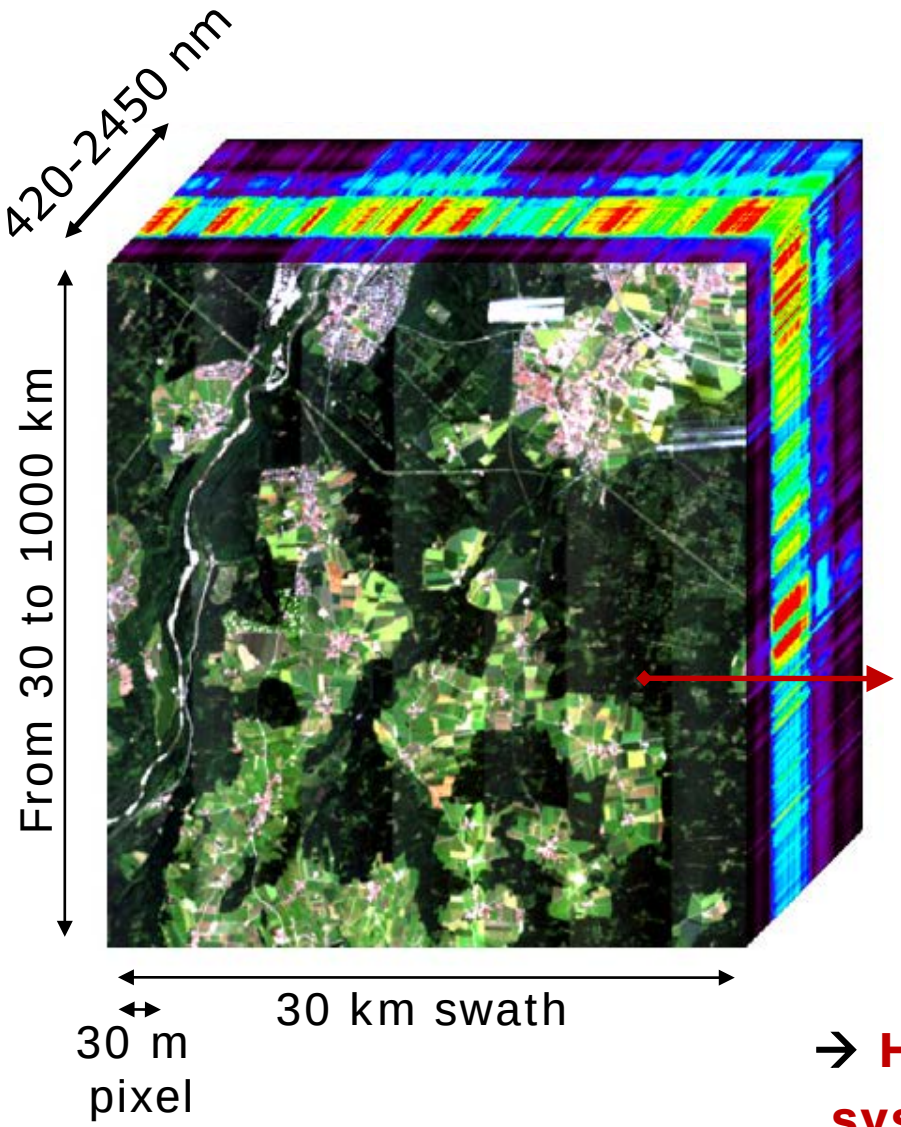
Ground Segment

Operations *DLR-GSOC* | Payload *DLR-DFD* | Processing *DLR-IMF*

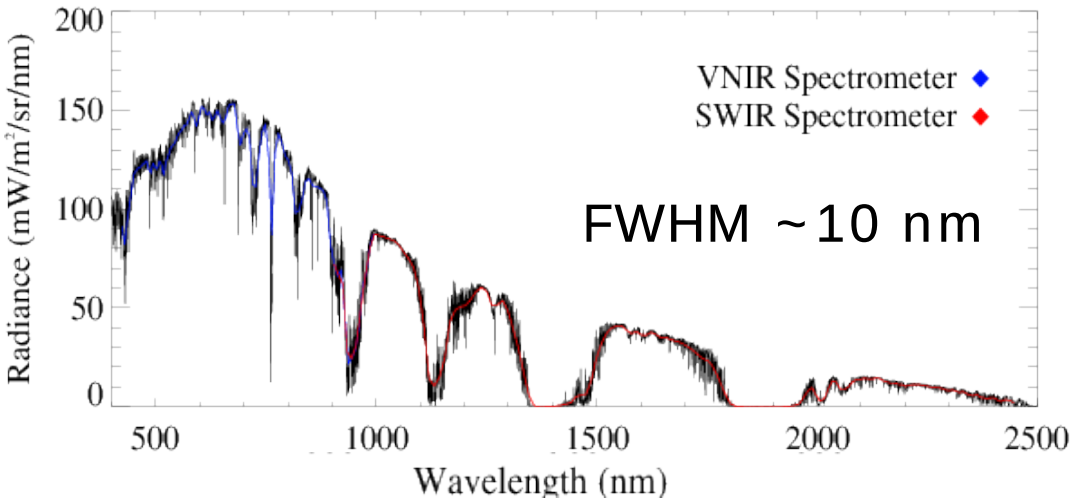
- EnMAP: Environmental Mapping and Analysis Program → Imaging spectroscopy for Earth observation
- Conceived as a high performance scientific mission

- Core funding from the German Federal Ministry of Economics and Technology
- Currently under construction phase (D), launch ~end 2020

Key mission characteristics for scientific use of EnMAP



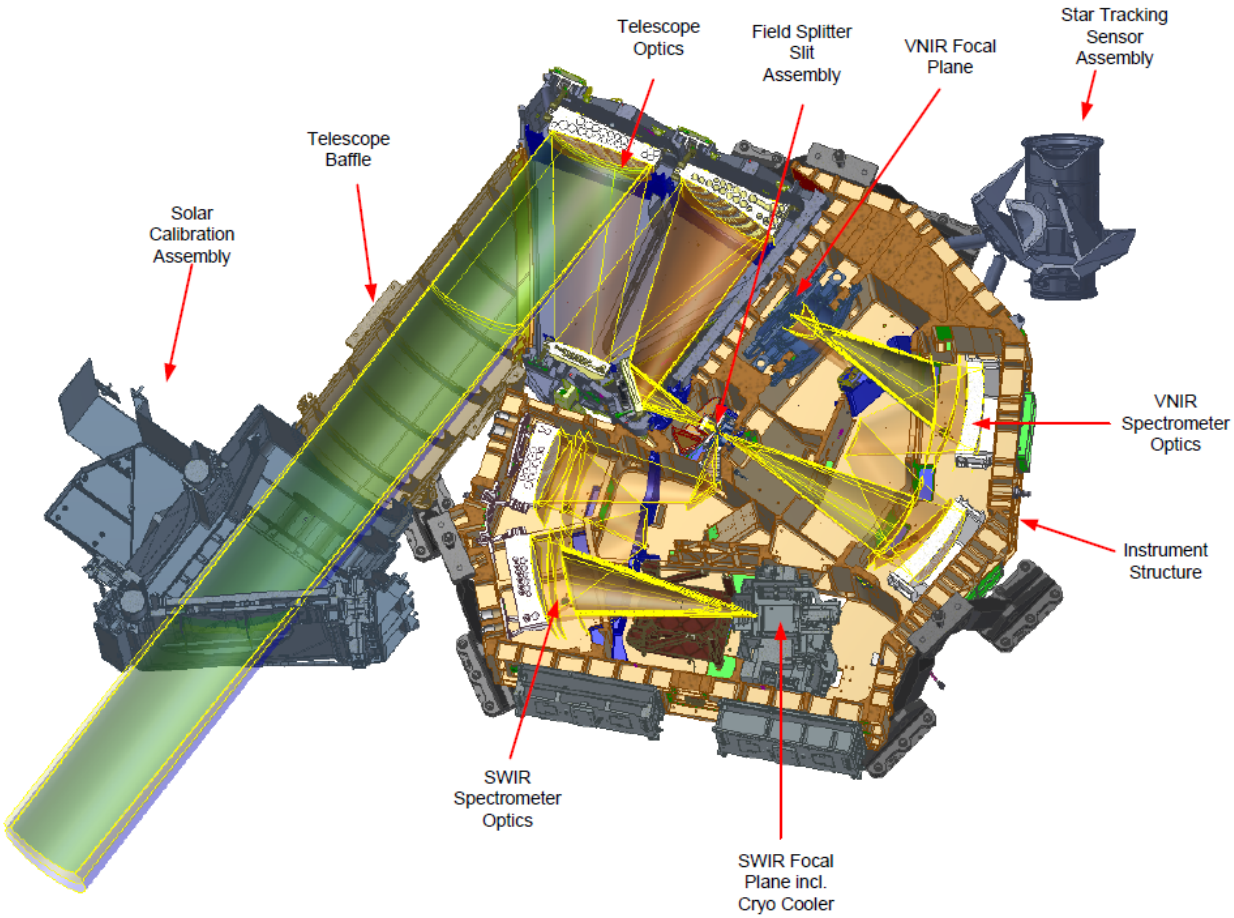
- Up to 4 days revisit time with tilted obs.
- Ground segment distributing geometrically-corrected reflectance data
- Co-existence with Sentinel-2 & Landsat-8
- Open data policy for scientific use



→ **High-performance imaging spectroscopy system for Earth observation**

EnMAP space segment

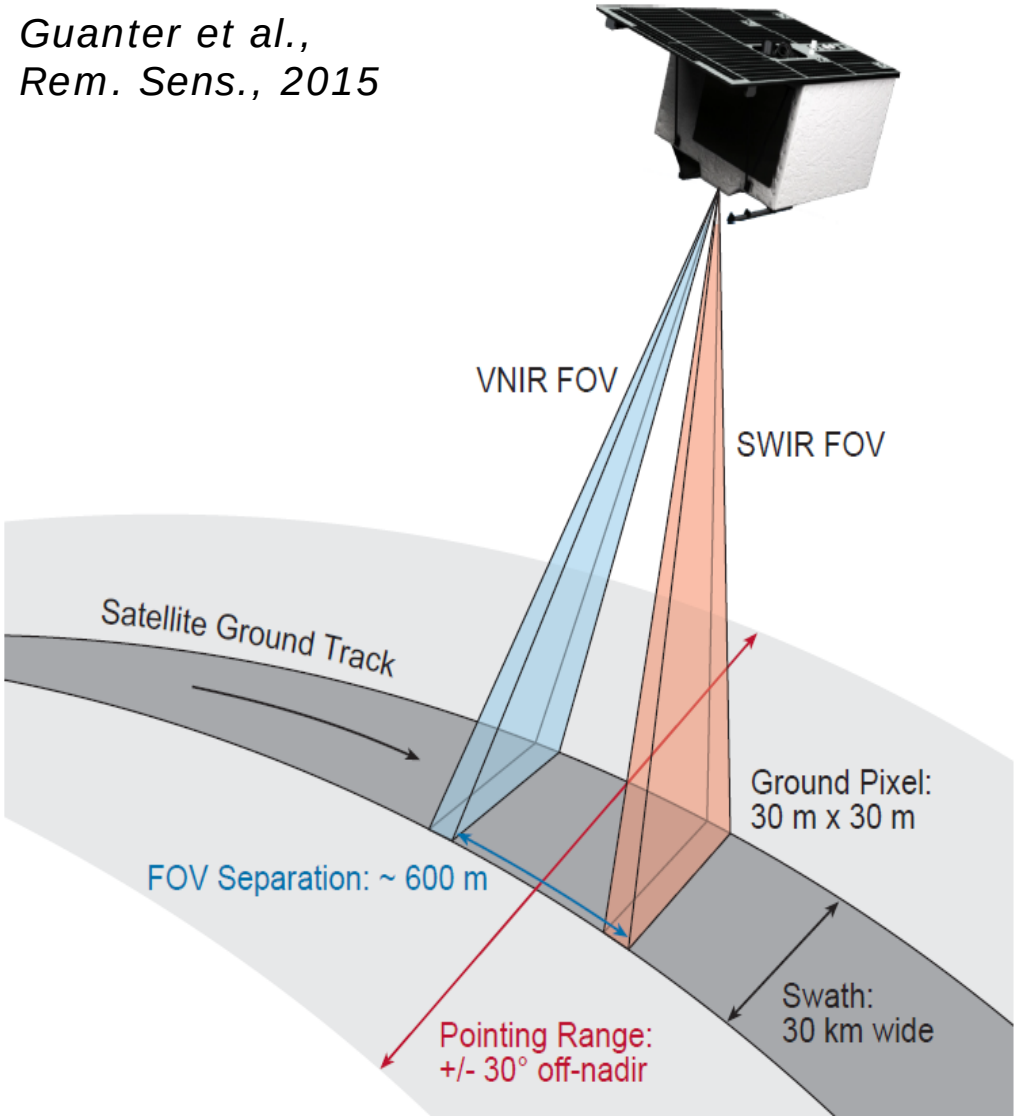
- Instrument: Independent VNIR & SWIR spectrometers
- Curved prism design to maximize spectral and spatial uniformity



Guanter et al., Rem. Sens., 2015

EnMAP – Main Mission Parameters

Guanter et al., Rem. Sens., 2015



- Push-broom imaging spectrometer
- Sun-synchronous orbit, 11h LTDN
- Spectral range
  - VNIR: 420 nm to 1000 nm
  - SWIR: 900 nm to 2450 nm
- Spectral sampling distance
  - VNIR ~6.5 nm
  - SWIR ~10 nm
- Data acquisition
  - 1000 km/orbit
  - 5000 km/day
- Swath width 30 km
- Ground sampling distance 30 m
- Revisit time
  - 27 d nadir
  - 4 d with 30° across-track pointing
- Mission lifetime ≥ 5 years

Data Products & Acquisition Priorities

User products

Product	Definition
Level 0	Time-tagged instrument raw data with auxiliary information (internal)
Level 1B	Radiometrically-corrected, spectrally- and geometrically-characterised radiance
Level 1C	Orthorectified level 1B
Level 2A	Atmospherically-corrected level 1C

Acquisitions:

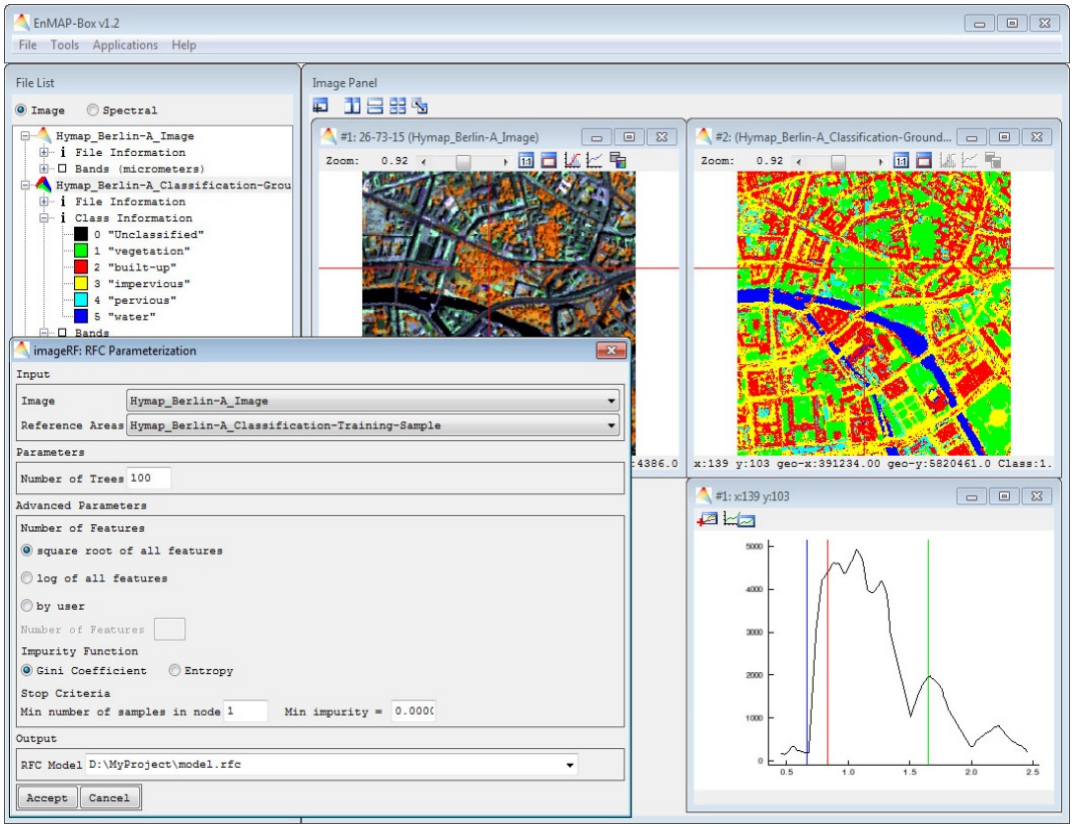
- Restricted to 1000 km/orbit and 5000 km/day
- Daily acquisition plan driven by user priorities and cloud forecast
- Acquisitions based on user requests

EnMAP preparatory activities

Rabe, van der Linden et al. (HU Berlin)

Main research lines:

- Agriculture
- Forest
- Ecosystems
- Soils & Geology
- Coastal and inland waters



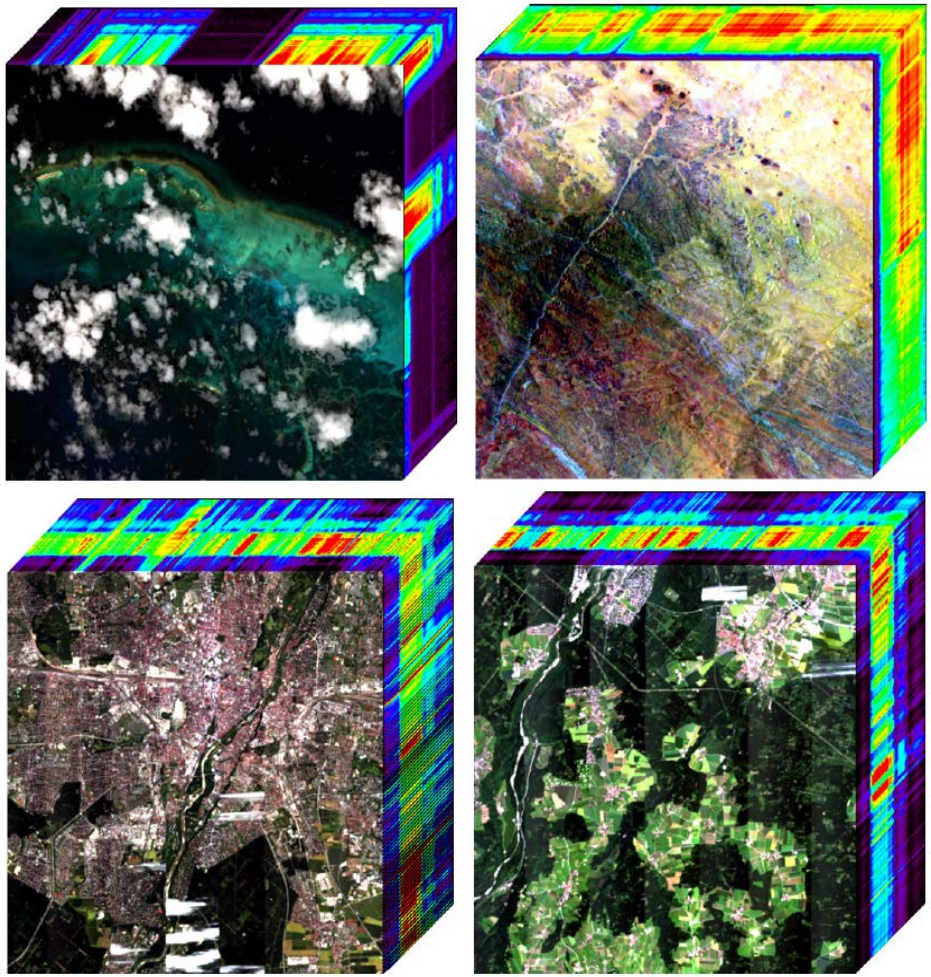
Focus on the development of algorithms for the **EnMAP-Box:**

- Software for the pre-processing and scientific exploitation of EnMAP data
- Free, open source and platform independent

Download from
www.enmap.org/?q=enmapbox

EnMAP end-to-end scene simulations

Simulation of EnMAP-like L1b and L2 products for algorithm development, validation and calibration



Many (>100) simulated EnMAP data sets already available

Contact Karl Segl at GFZ if you need simulations for your study site!

EnMAP-flight campaigns

Airborne hyperspectral images and associated in-situ data

provided free of charge to science community under CC BY-SA Licence

Search **metadata portal** at www.enmap.org → data

Datasets published as **data publications** (with DOI)

Technical Report will be provided with each dataset (documentation of data acquisition, processing, quality etc.)

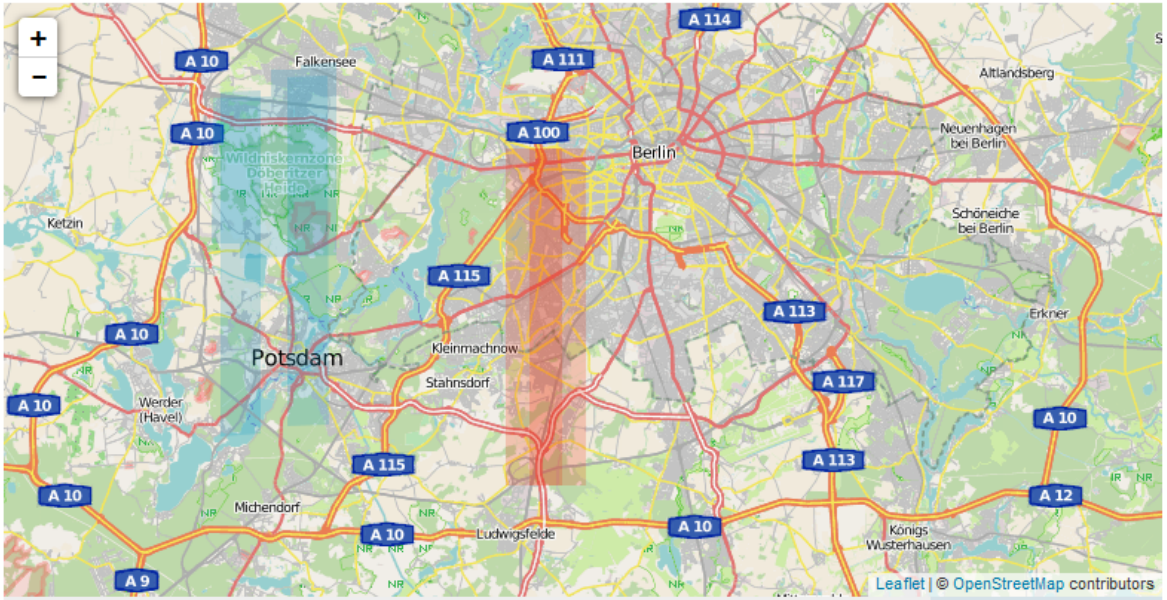
Home | Mission | Science | Applications | EnMAP Box | Data

http://www.enmap.org/?q=flightbeta

EnMAP - Flight campaigns

Several hyperspectral airborne flight surveys have been carried out in the frame of the EnMAP preparatory program to support method and application development in the prelaunch phase. The metadata base below provides details about the campaigns, information about recorded airborne hyperspectral data sets and other data associated to the respective campaigns like field and laboratory measurements. Further, it informs about the availability of simulated EnMAP and Sentinel-2 data. Contact details of the data owners are given for interested researchers regarding data exchange. The data listed in this metadata base is freely available for scientific purposes.

All data on this website are provided free of charge and under a Creative Commons Licence CC BY-SA 3.0 Unported Licence and is subject to the following terms and conditions:



Name	Application	Sensor	Product-Level	Date
search				
Idarwald/Hochwald (DE)	Forest	HySpex VNIR-1600 HySpex SWIR320m-e	L1	Jun 9, 2014
Idarwald/Hochwald (DE)	Forest	HySpex VNIR-1600 HySpex SWIR320m-e	L1	May 5, 2014
Pfälzer Wald/Merzalben (DE)	Forest	HySpex VNIR-1600 HySpex SWIR320m-e	L1	Apr 16, 2014
Idarwald/Hochwald (DE)	Forest	HySpex VNIR-1600	L1	Apr 10, 2014

GFZ Helmholtz Centre Potsdam

HELMHOLTZ ASSOCIATION

Support to young researchers

- **PhD Programme:** 15 PhD projects currently ongoing on different research areas and groups in Germany
- **YoungEnMAP:** International Summer Schools organised every year

EnMAP summer school participants (Lauenburg, March 2015)

Thank you for your attention!

Federal Ministry
of Economics
and Technology

GFZ
Helmholtz Centre
POTSDAM

DLR