

EUFAR – European Facility for Airborne Research: Harmonisation And Standardisation in the Field of Airborne Hyperspectral Remote Sensing

Stefanie Holzwarth, Martin Bachmann, Andreas Müller,
Olivier Henry, Elisabeth Gerard, Phil Brown

Knowledge for Tomorrow



Content

- Introduction to EUFAR
- EUFAR's Networking Activity „Standards and Protocols“
- Common Protocols
- Best Practices
- Software Toolboxes



EUFAR

Pan-European Distributed Infrastructure for Airborne Research

- 4-year Integrating Activity of the 7th Framework Program of the European Commission (2014-2018)
- Pooling of 24 European institutions and companies involved in airborne research
- Operating 18 instrumented aircraft

EUFAR composition:

- Networking Activities
- Transnational Access Activities
- Joint Research Activities

EUFAR objectives:

- Develop transnational access to national infrastructures
- Reduce redundancy, fill the gaps, and optimise the use and development of airborne infrastructure
- Improve the quality of the service by strengthening expertise through knowledge exchange, development of standards and protocols, constitution of data bases, and joint instrumental research activities



Hyperspectral Instruments available through Transnational Access

- AHS and CASI

Operator: INTA (Spain)



- aisaFenix and aisaOwl

Operator: NERC ARSF (UK)



- Airborne Prism Experiment (APEX)

Operator: VITO (Belgium) & UZH (Switzerland)



- HySpex VNIR and HySpex SWIR

Operator: DLR (Germany)



- TASI

Operator: CNR (Italy)



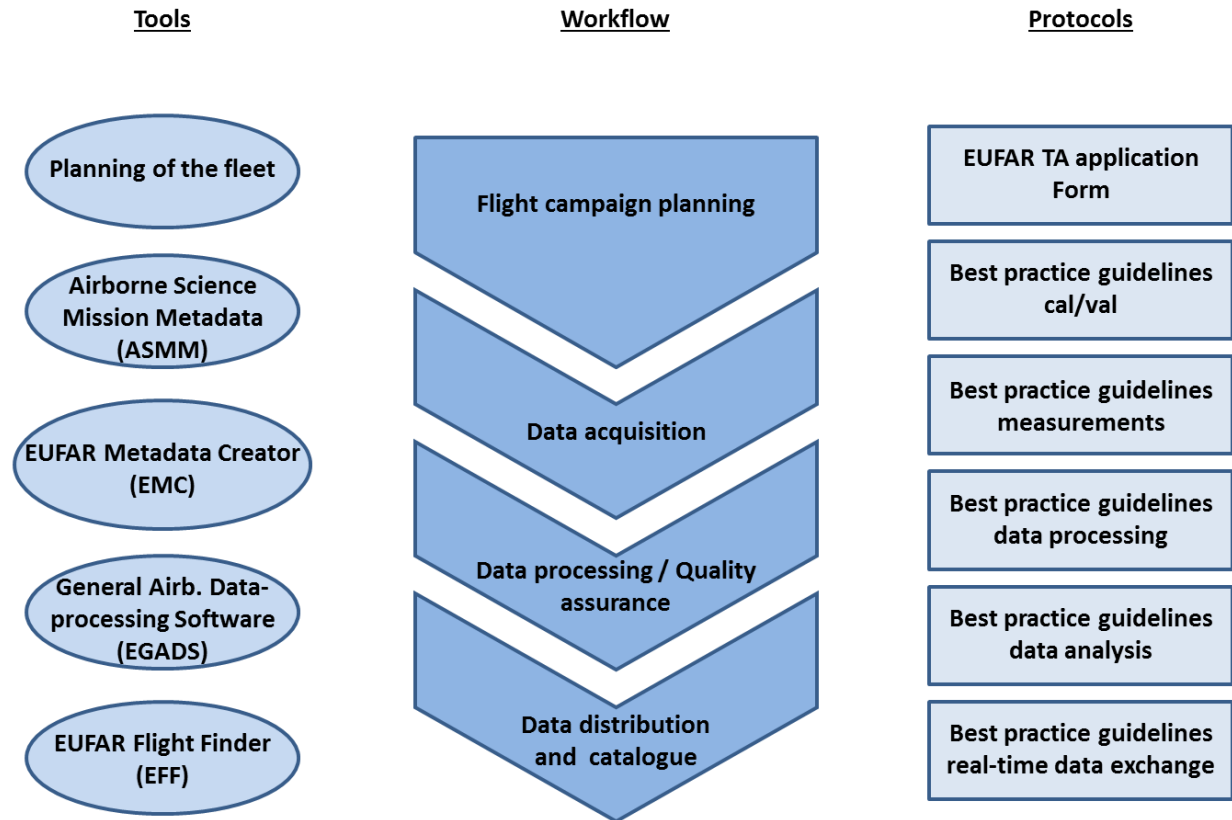
EUFAR's Networking Activity Standards and Protocols

Main goal of EUFAR

- ensure harmonization
- assist new/inexperienced
- facilitate inter-collaboration
- allow comparison
- enable easier exchange

Achieved by the

- development of standards
- recommendatic
- production of software



Development of Common Protocols

- Assessment of compatibility to guidelines of international initiatives
- ▶ ensure conformance with the broader geo-science community
- Review of more than 50 existing standard initiatives

Common interests of different initiatives:

- simplify workflows
- work towards interoperability
- work towards interdisciplinary
- support data discovery
- strengthen the sustainability

ISO/TC 211 Geographic information/Geomatics

Subject	ISO Standards for geographic information
Level	International
URL	http://www.iso211.org/
Started	1994
Short description	ISO/TC 211 Geographic information/Geomatics is responsible for the ISO geographic information series of standards. This work aims to establish a structured set of standards for information concerning objects or phenomena that are directly or indirectly associated with a location relative to the Earth. These standards may specify, for geographic information, methods, tools and services for data management (including definition and description), acquiring, processing, analysing, accessing, presenting and transferring such data in digital/electronic form between different users, systems and locations.
Partners / Organisation	Many bodies are actively engaged in the work of ISO/TC 211. These include national standardization bodies, the OpenGIS Consortium (OGC), international professional bodies, UN agencies, and sectoral bodies. The members are divided in participating members (P-members), observing members (O-members) and liaison members.
Opportunity of Participation	P-members, O-members and liaison members can attend the plenary meetings. In connection with the plenary meetings, a workshop is often arranged. This workshop is normally open for interested parties in the host country.
Significance	Worldwide official standards, mainly used within the field of GIS. The Open Geospatial Consortium (OGC) plays an important role on the implementation level.
Relevance for EUFAR	A subset of the abstract standards is useful for EUFAR to be implemented (see 5.1). Some of them have been already implemented.



Common Protocols within EUFAR

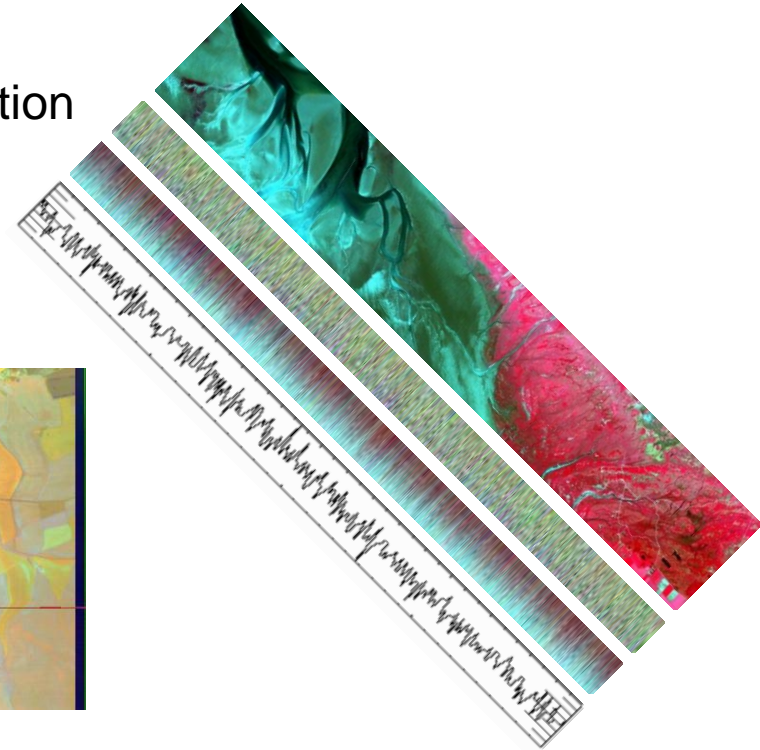
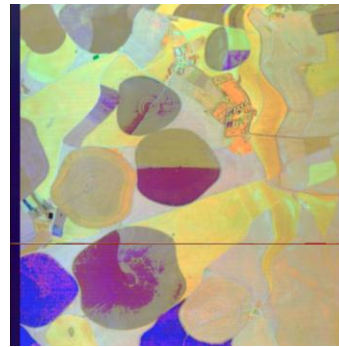
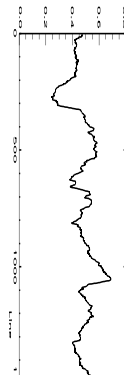
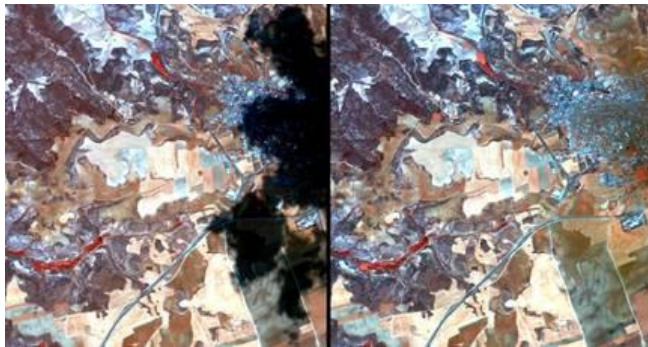
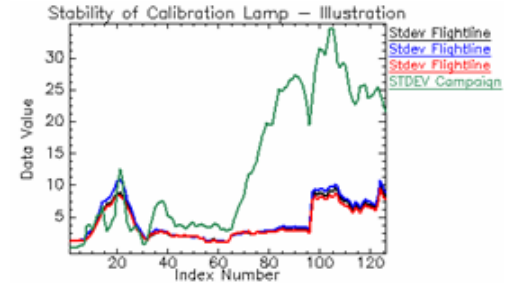
- flight campaign planning
 - EUFAR TA application form (CEOS, INSPIRE, ASPRS, NASA ASP)
- real-time data transfer
 - standard list of variables (IWGADTS)
- quality measures
 - data descriptors and quality layers for hyperspectral image data (HYQUAPRO)
- data distribution and catalogue
 - data format, DOIs, metadata (INSPIRE, NetCDF, OGC, ISO)



Quality Layers and Data Descriptors

Quality indicators for

- (A) - general sensor characterization
- (B) - sensor calibration issues
- (C) - sensor performance during data acquisition
- (D) - external conditions during overflight
- (E) - quality of auxiliary data



Recommendations on Best Practice

- Best practice guidelines cal/val
 - summary of existing protocols and standards (ISO, CEOS)
- Best practice guidelines measurements
 - summary of existing protocols and standards (ISO, ISPRS, NASA ASP, USGS)
- Best practice guidelines data processing
 - summary of existing software, toolboxes, guides (OSGeo, NCAR/UCAR, GSDI)
- Best practice guidelines data analysis
 - summary of existing software, toolboxes, standards (FGDC)

► **EUFAR handbook on Airborne Measurements for Environmental Research: Methods and Instruments**



Toolboxes

1. EUFAR Metadata Creator (EMC): Tool to generate INSPIRE compliant XML metadata files for datasets

→ dedicated to EUFAR with new metadata (aircraft, instruments, ...)

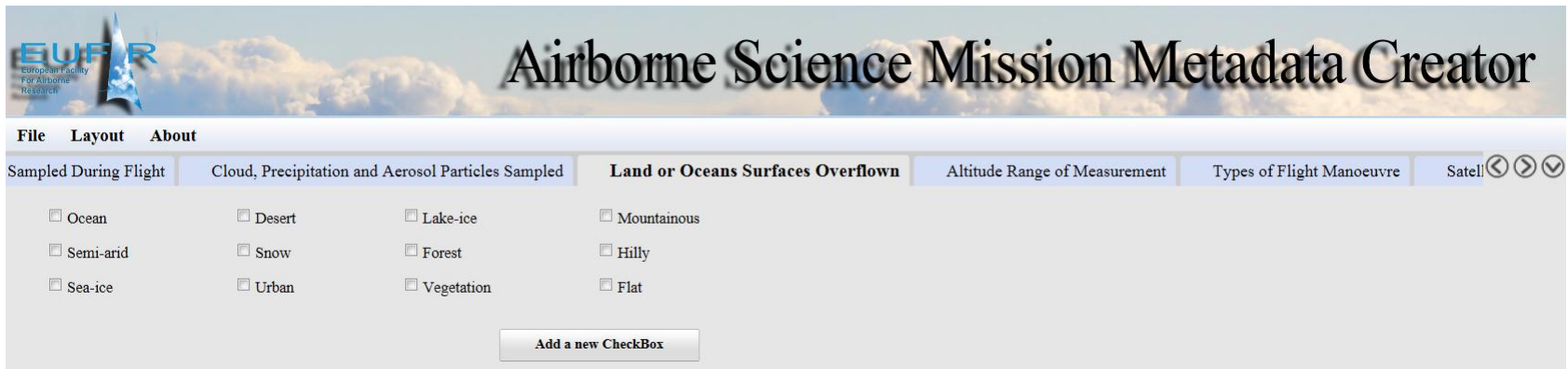
→ creates XML documents



2. Airborne Science Mission Metadata (ASMM): Tool for reporting post-flight scientific metadata

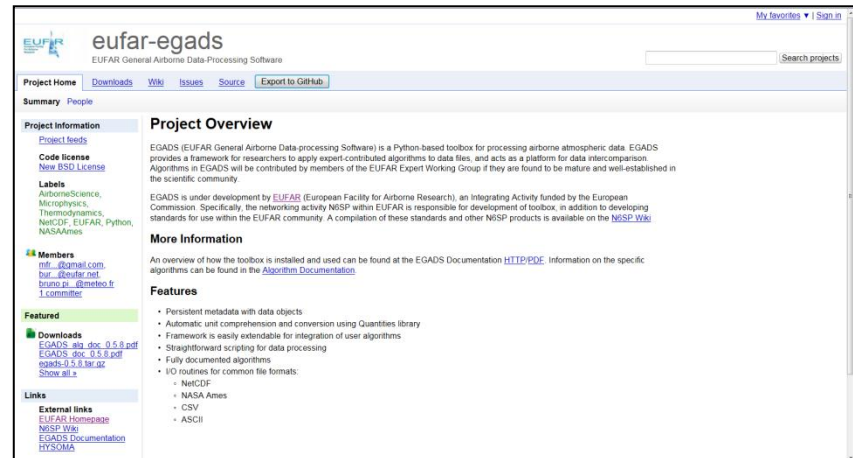
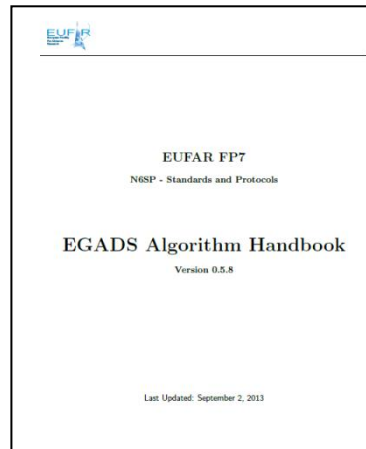
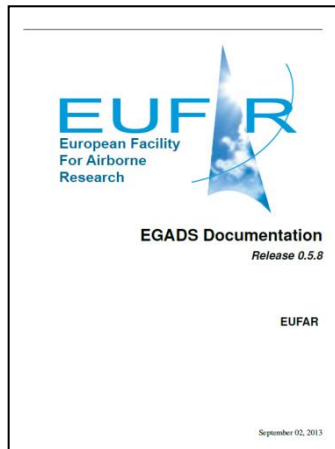
→ harmonizes the information and level of detail of reports

→ creates XML documents and PDF reports



Toolboxes

3. EUFAR General Airborne Data-processing Software (EGADS):
Python-based library of processing and file I/O routines
 - core functions and algorithms are documented in ATBD and Beginner's Tutorial
 - 70 algorithms implemented, ranging from thermodynamics, biophysics etc. to quality control
 - open-source design, always extendable



Toolboxes

3. EUFAR Flight Finder (EFF): Geospatial, temporal, keyword search tool

EUFAR Centre for Environmental Data Archive

EUFAR Flight Finder

Search for flights within the EUFAR archive using the parameters below. Refine your search with geographical, temporal, and text search terms.

[Help! \(Documentation\)](#)
[Tutorial Video](#)

Click an item to expand the panel.

- Geographical Search
- Temporal Filter
- Keyword Search

Keyword Search

Include photography?



Conclusions

- EUFAR: Pan-European interdisciplinary platform with a sustainable structure
- Common protocols, guidelines and toolboxes are instruments to ensure harmonisation
 - Use of existing standards
- Could serve as a base for ISIS standards and protocols with respect to
 - metadata, cataloging
 - data pre-processing
 - information extraction
 - product generation

