EarthCARE Campaigns & Cal/Val

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ESA – ESTEC – Presented at ATMOS 2024 in Bologna

01/07/2024

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Introduction

Topics:

- Roles of ESA and JAXA regarding validation
- Overview of Validation Approaches and Validation Teams
- Airborne Campaigns 2024 and overview of Campaign activities
- Master Validation Schedule, Orbit, Useful Tools & Resources

- Assuring the data quality of EarthCARE's 47 Data products, including 25 Level 2 science products, early after launch, is an essential effort.
- For ESA products this will be realized based on contributions from the independent EarthCARE validation team (ECVT) under coordination by ESA, as well as monitoring-, calibration- and campaign activities performed under ESA (co-)management.
- An early focus to stabilize the data quality will be on airborne activities underflying the satellite with remote sensing and in-situ payloads.

Global map of ground-based stations validating ESA-EarthCARE products

WegenerNet FBR overview map

!Please Update your location on your confluence page!

URL of Validation Activities:
https://ecvt.esa.int/confluence/display/ECAOPI/Validation+Activities

Interactive Map:
https://www.google.com/maps/d/edit?mid=1u1BfClB7Sh4g5HkHqhlMO18LcDJp1MrY&usp=sharing

ESA-JAXA Pre-Launch EarthCARE Science and Validation Workshop
13-17 November 2023 |ESA-ESRIN |Frascati (Rome), Italy

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ESA and JAXA products and roles

- Each agency coordinates the validation of its own products
- ESA and JAXA are coordinating though the **Joint Scientific Validation Implementation Plan,** joint workshops, exchanges on planning, analysis results
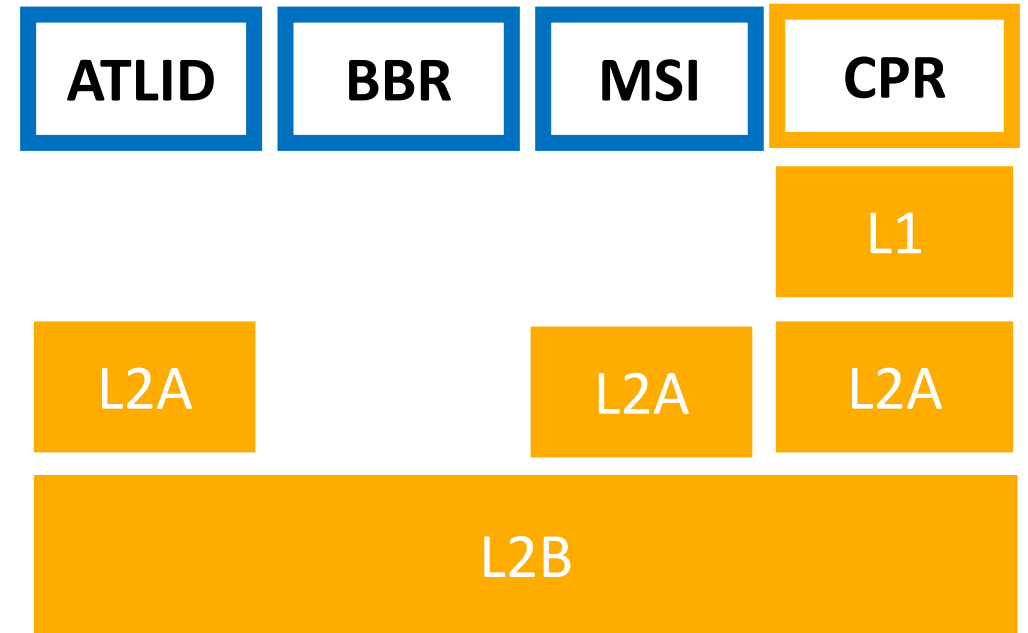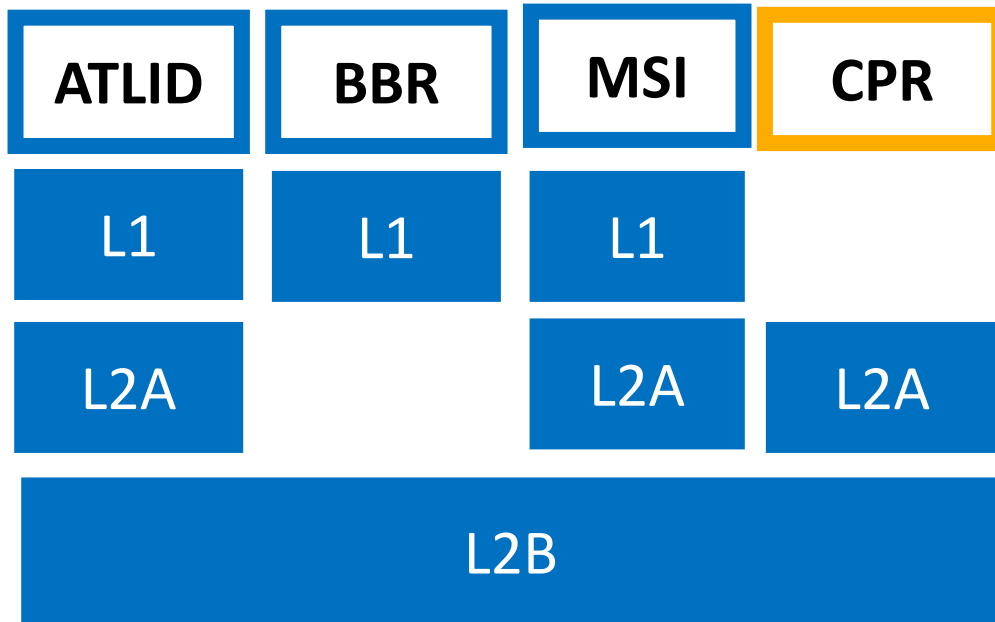
ESA Validation-Related Activities

ECVT
Validation team

- Knowledge transfer (algoritms, instruments)
- Prepare observation planning & correlative data handling
- Organise validation analysis
- Foster interaction with funding sources
- Facilitate interaction with algorithm teams, instrument experts, and peers through interactive validation portal

- **Organisation of pre-launch campaigns**
- **Securing collocated airborne datasets**
- Validation Data Centre for correlative data

National Agencies

Validation bi-laterals with several agencies to address funding

ESA-JAXA joint Scientific Validation Implementation Plan

ESA-NASA Joint Programme Planning Group (campaigns, best practices) and AOS team

Pilot to support cal/val of Atmospheric satellite missions

Various

Consultation with domains/communities to solicit further contributions

Collaboration Coordination

Pre-launch and correlative measurements

Methods and approaches

- **Fiducial Reference Measurement** developments for lidars (eVe, EMORAL) and radars (FRM4RADAR)
- Development of **suborbital to orbital signal converters** for radar, lidar, imager
- **Lessons learned / best practice convergence (**collaboration of EarthCARE, CALIPSO, Cloudsat, Aeolus, and AOS scientists)

ESA Validation Approaches

Parallel surface-based/network data acquisition, continuously, over the mission lifetime: slower collection of collocations, but broader coverage of geophysical and meteorological conditions
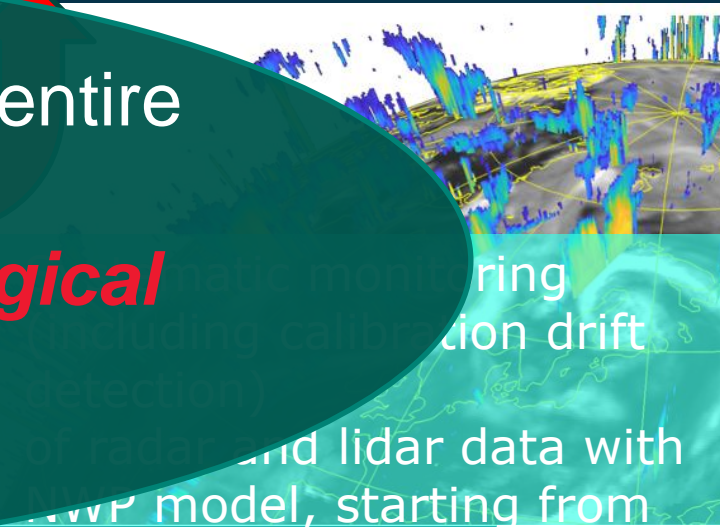
From as early on as possible, underflights for L1 and L2 validation: rapid collection of **numerous**, **precise** collocations

DLR HALO

Safire F20

FAAM-BAE
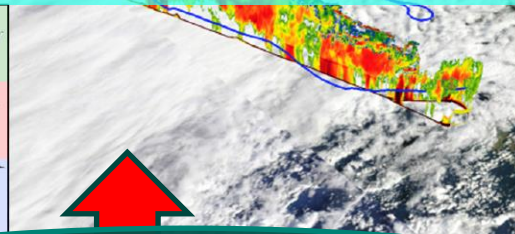
Intercomparison with satellites: semi-global coverage (depending on orbits)

EARTHCARE BBR nadir swath & AQUA MODIS - 25 days
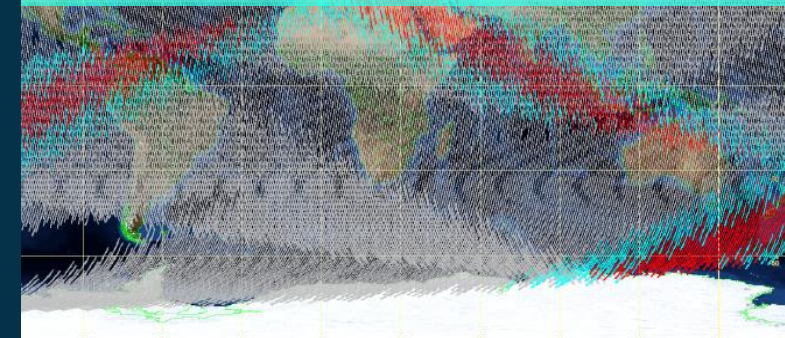
Further campaigns during the entire mission life time: various *geophysical and meteorological* conditions

...ring (including calibration drift detection) of radar and lidar data with NWP model, starting from launch

recent & upcoming cal/val timeline

ESA-JAXA Pre-launch EarthCARE Science and Validation Workshop

EarthCARE Scientific Validation Implementation Plan 2.0

ESA validation rehearsal review (21 Mar 2024)

CPR check out

BBR check out

ATLID check out

MSI check out

Target release L1 data to ECVT

Airborne, shipborne, ground-based Cal/Val campaigns

Preliminary validation results workshop part 1 (online)

Nov 2023	Dec 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Jun 2024	Jul 2024	Aug 2024	Sep 2024	Oct 2024	Nov 2024

L A U N C H

Rehearsal guideline for ESA PIs and CoIs

ESA validation rehearsal (2 weeks)

Commissioning phase (E1)

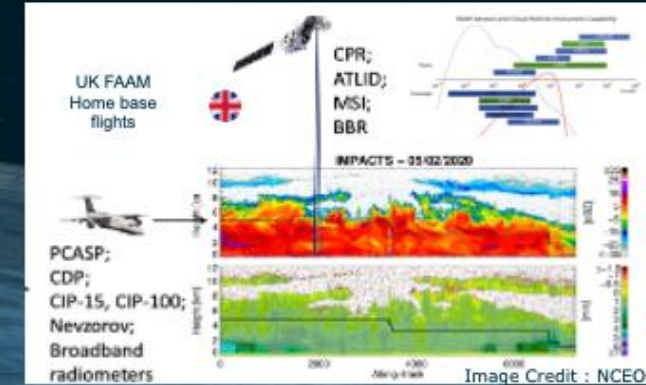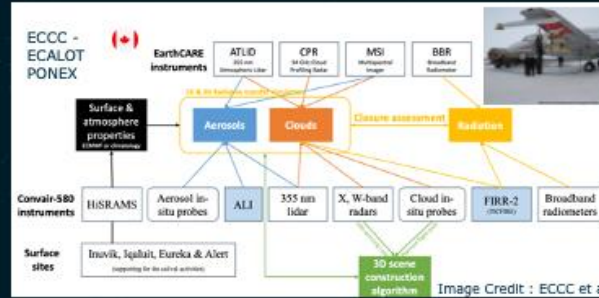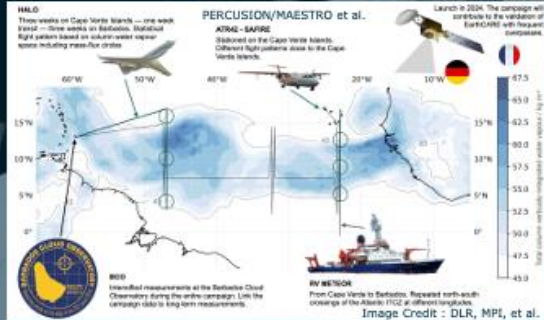**Exploitation phase (E2)**

Preliminary validation results workshops:
Part 2: Launch+9 months (Europe)
Part 3: Launch+18 months (Japan)

ESA Validation Team: Principal Investigators

PI	Institution	PI	Institution	PI	Institution
N. Clerbaux	BIRA, BE	E. Welton	NASA-GSFC USA	Z.Qu	Environment Canada
U. Wandinger	Tropos, DE	D. Josset	NRL, USA	C. Hostetler	NASA-LARC, USA
C. Genthon	CNRS, FR	X. Hu	NSMC, CN	P. Völger	IRF, SE
H Baars	TROPOS, DE	R.O. David	Univ Oslo, NO	G.Kirchengast	UniGraz, AUT
N. Loeb	NASA-LARC, USA	V. Chandrasekar	FMI, FI	V.Philips	Lund Univ, SE
E. Landulfo	IPEN, BR	T. Nishizawa	NIES, JP	L.Sogacheva	FMI, FI
D. Moiseev	Un. Helsinki, FI	V. Amiridis	NOA, GR	Th.Stein	U.Reading, UK
J-B. Renard	LPC2E-CNRS, FR	H. Chepfer	UPMC, FR	K. Stebel	NILU, NO
J. Delanoe	LATMOS, FR	D. Donovan	KNMI, NL	R. Mamouri	ERATOSTHENES CoE, CY
G L. Liberti	CNR-ISAC	S. Tanelli	NASA-JPL, USA	J. Mather	PNNL, USA
D. Muller	U. Hertfortshire UK	A. Rodriguez Gomez,	U.Granada, ES	F. Navas	Univ Grenada, ES
A. Apituley	KNMI, NL	Y. Markonis	U. Life Sciences, CZ	D.Cecil	NASA MSFC, USA
Ph. Gouloub	CNRS/Lille, FR	N. Scott	LMD/IPSL, FR	S. Kazadzis	PMOD-WRDC, CH
A. Devasthale	SMHI, SE	D. Winker	NASA-LARC, USA	A. Protat	BOM, AUS

Airborne Campaign Opportunities '24+

May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb

EarthCARE Launch

Radar (CPR+ Validation)
- PERCUSION/MAESTRO
- Home base
- Home base
- (ARCSIX)
- Home base
- WhymSIE

Lidar (ATLID+ Validation)
- PACE PAX
- Home base
- Home base
- PERCUSION/MAESTRO
- (ARCSIX)
- Home base
- ER 2/CPL, WhymSIE

In situ (cloud/aerosol micro-physics)
- PACE PAX
- FAAM Homebase (TBC)
- Home base
- MAESTRO
- CELLO
- LOAC Home base
- (ARCSIX)
- Home base
- PONEX

Imager and/or polarimeter
- PACE PAX
- WhymSIE
- PERCUSION
- Home base

Legend:
- (Sub)Tropic
- Mid-latitude
- Arctic
- Possible readiness for Cal/Val

Right panel:
- : Safire, LOAC balloons
- : HALO
- : FAAM
- : INCAS (RO)
- : NRC CONVAIR
- : ER-2, CIRPAS Twin-Otter

Outlook from later 2025 (selection of Ideas and Plans):
- GoSouth(ground) /HALO ASCCI & South(air) /ACAROA(ship)
- IMPACT(ground/air)
- CARES(FAAM, TBC)
- CELLO(Palau'25, Arctic'26)
- CoSENSE (Mediterranean, ground/air)

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MULTIPLY Lidar:

eVe lidar

EMORAL lidar

BOW-TIE instrumentation — Atmosphere

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EarthCARE orbit and overpass information

- **Reference Orbit:** Specified to an **ANX of 0.6** degrees and will be achieved after a **drift phase** of less than 2 - 3 months (depending some pending platform test).

- **Overpass Tables** of reference orbit: 'relative' tables available, - will require adaptation once the start of the first regular orbit cycle of 25 days is known.

- **Orbit Maintenance** - reference orbit: From the end of the drift phase onwards, the orbit will be maintained within a deadband of ±25 km around the reference orbit.

- **Precise Collocations**: For more accurate collocations (e.g., underflights), use of predicted orbit file (maximum 3 days old). These are being generated operationally every day, and are already available to Validation Teams

- **Orbit/Overpass predictions during Drift Phase**:
  - Predicted orbit files can be used longer, for about a week during the drift phase.
  - Mission Analysis Tools are currently being adapted to provide longer-term predictions.
  - The results will be provided to Validation Teams as soon as possible.
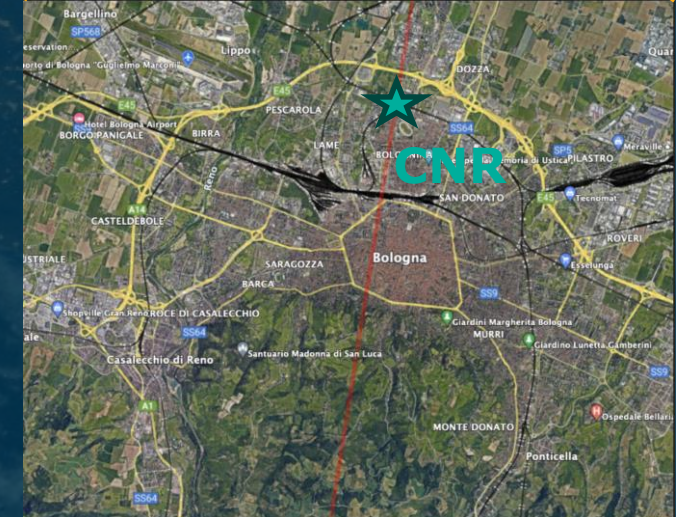
Selection of Tools and Resources

- ESA EarthCARE data: https://earth.esa.int/

- ESA correlative data for EarthCARE validation: https://evdc.esa.int

- ESA EarthCARE validation portal: https://ecvt.esa.int

- Overpass plot tools:

  - ESOV/SAMI : https://eop-cfi.esa.int/index.php/applications

  - EVDC OPOT (browser based) : https://evdc.esa.int/orbit/

  - Command line : Zone/TrajecotryOverPass (instrument collocation tool)

Thank You!