



ESA-JAXA Pre-Launch EarthCARE Science and Validation Workshop

13 – 17 November 2023 | ESA-ESRIN, Frascati (Rome), Italy

Validation sessions
introduction

Rob Koopman , Toshiyuki Tanaka



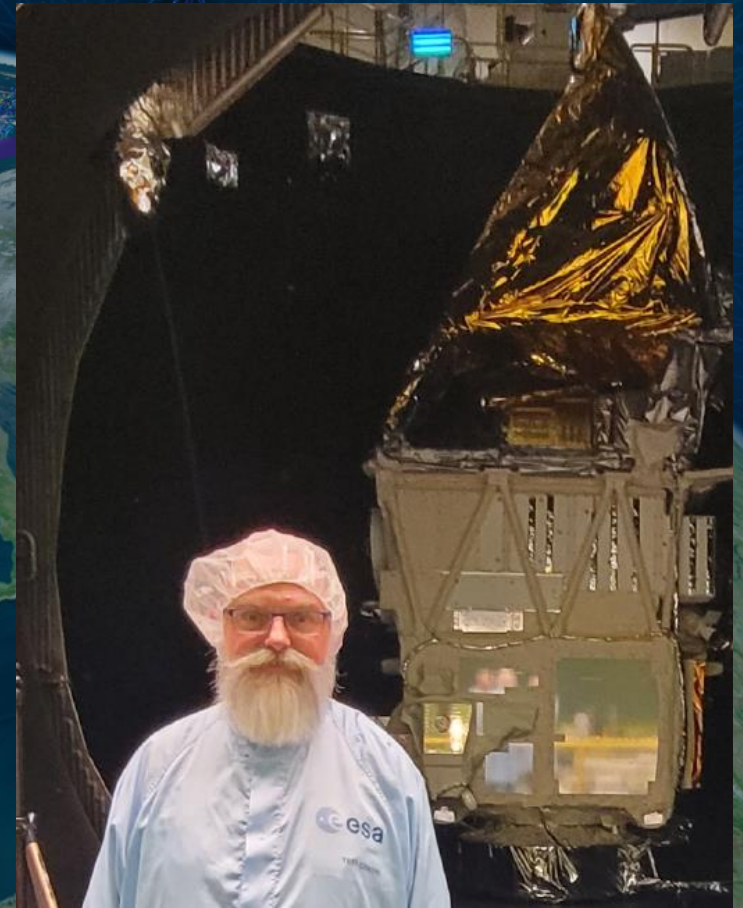


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Validation Sessions organisation



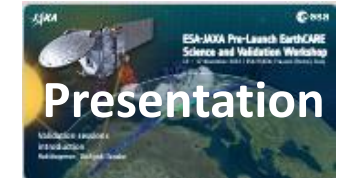
time	Presentations/posters/demos
Wed PM	Lessons Learned
“	Common practice + PI talks
“	Posters and demos
Thu AM	Campaigns (2 sessions)
Thu PM	PI talks (incl prospective)
“	Tools and prospective PI talks
	Posters and demos
Fri AM	Networks and PI talks (2 sessions)
Fri PM	Panel, Closing



Talk types

1. Talks submitted on workshop themes and campaigns 12mins
2. PI projects – accompanied by Posters
 - PIs that have already presented their project at 1st and 2nd workshop: 5 min + Poster
 - New PIs: 10 min talk +Poster
 - Prospective PIs: 10 min

Workshop important to collect updates for validation plan 2.0 and overpass tables



Calibration and Validation

Time	Topic
14:45	15 Introduction by JAXA-ESA
15:00	12 Looking Back on Lessons Learned from CALPSO Validation
15:12	12 Lessons learnt from Aeolus CalVal
15:24	12 Lessons learned from the GCOM C2(Drifsui)SGLI cloud observations (invited)
15:36	12
15:48	12
15:58	32 Coffee Break
Session: Best Practice and PI Talks, Chairs: D. Winker, N. Takahashi (Secretaries: ...)	
16:30	3 Session Intro
16:33	5 Physical validation of EarthCARE Products
16:48	6 Validation of EarthCARE Aerosol with Chinese view of Hainan Airborne ...

Session



Poster



Validation Master schedule



Milestone	Target Date
Pre-launch ESA-JAXA science and validation workshop	13-17 November 2023 @ESRIN
Validation Plan (2.0) – Update of SVIP	January 2024
ESA AO PIs: Validation Rehearsal	February 2024
Validation Rehearsal Review / Validation Readiness	March 2024
Launch	May 2024
Preliminary Validation Results Workshop Part 1, Part 2, Part 3	L+6M (online), L+9M(Europe), L+18M (Japan)
Long-term Validation Phase	until End-of-Mission

Commissioning timeline and data release

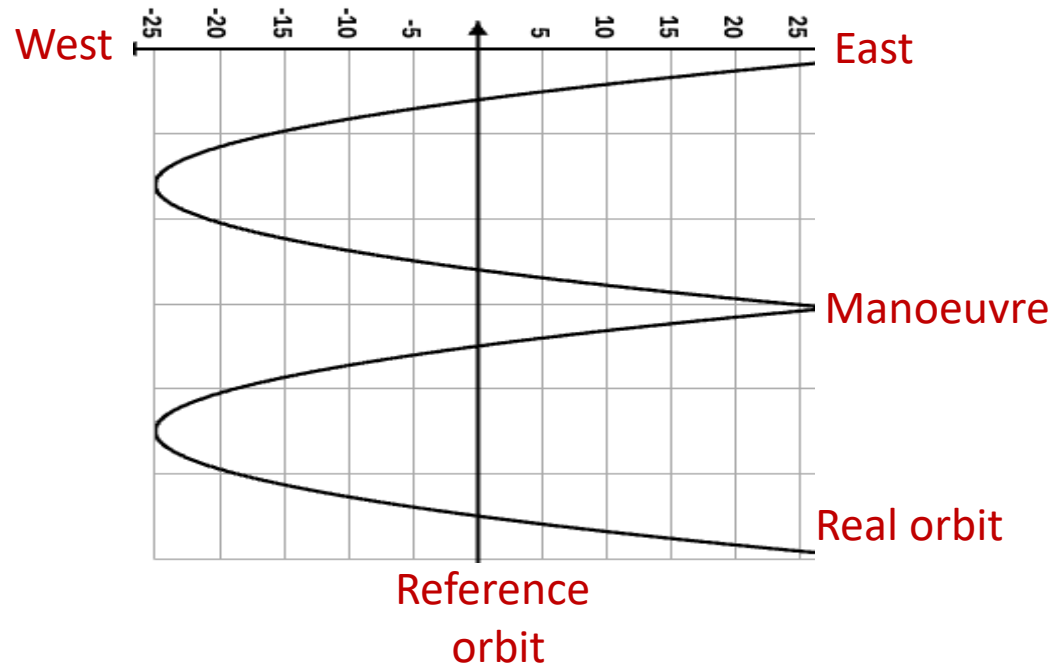


- Commissioning sequence: Launch, Early Ops, Instrument Switch-on, Decontamination, Instrument Characterisation, transition to nominal mode operations (includes further Char&Cal, and much shorter interruptions of calibration modes)
- Each instrument has its own timeline which is still being refined.
- **Start of your correlative measurements to validate an EarthCARE instrument can take place as soon as “stable” NOMinal mode Level 0 products are generated for this instrument, well before Level 1 product release. Validation teams will be kept informed on progress towards this milestone.**
- Current planned sequence of stable NOM mode operations: CPR, BBR, then ATLID, and finally MSI

Data level	Target date(*) release to EarthCARE Cal/Val Team	Target date public release
Level 1	3 months after launch	6 months after launch
Level 2a and Level 2b two-sensor products	6 months after launch	9 months after launch
Level 2b three-sensor and four-sensor synergy products	9 months after launch	18 months after launch

* Intention is to release datasets to validation teams even before the target, if possible

“Orbit is maintained within a deadband of 25 km each side of the reference orbit”



What does this mean?

- The **reference** orbit is theoretical orbit (that can be used in long-term correlative activity planning)
- The **real** orbit will vary East and West of this reference, **depending on solar activity** (causing a drift towards the Eastern edge of the deadband) and Orbit Control Manoeuvres (to bring it close to the Western edge of the deadband)
- The **predicted** orbit (available 3 days in advance) takes into account these deviations and should be used for short-term overpass planning

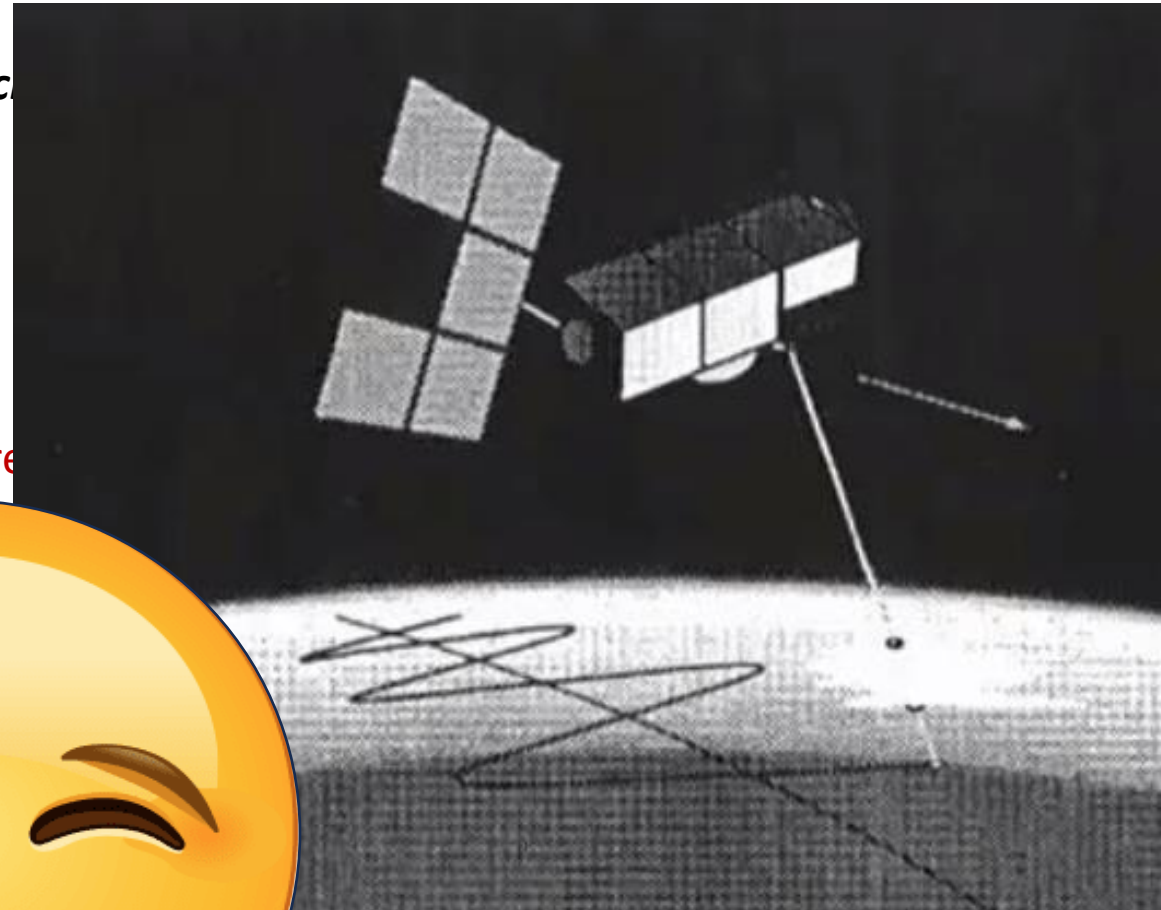
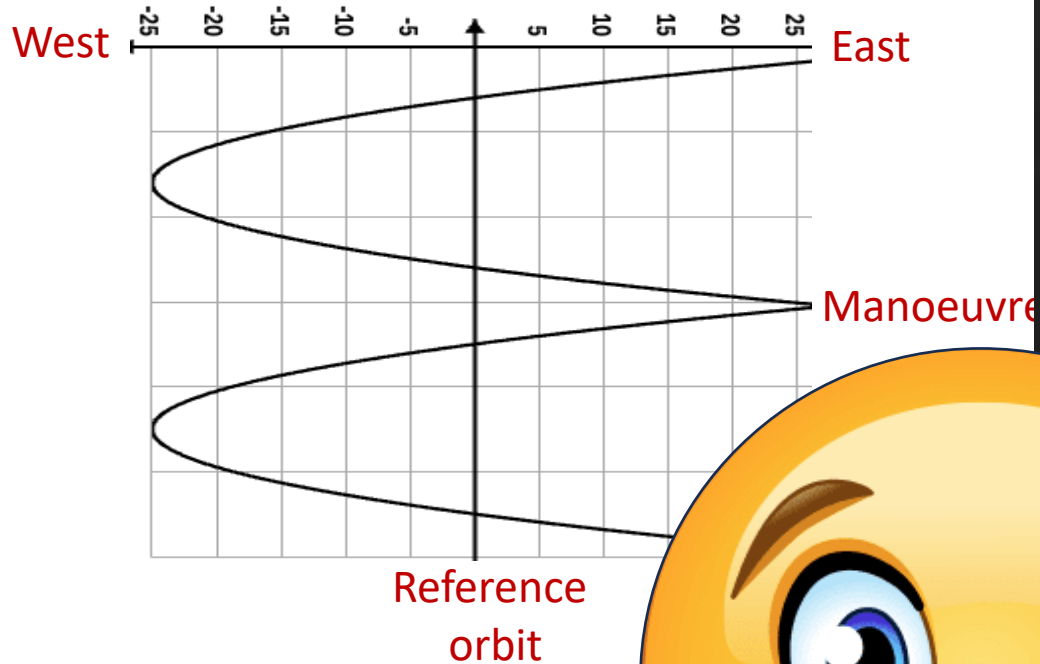
The reference orbit has been specified as a system requirement, but leaves one parameter free: the longitudinal shift of the entire orbit pattern. It is intended to select a value for this free parameter a priori, to support validation sites coverage planning.

The optimisation process for this is ongoing. Validation teams will be informed.

Orbits and overpasses



“Orbit is maintained within a deadband of 25 km each



The reference orbit has been specified for the entire orbit pattern. It is important for coverage planning.

The optimisation process for this is ongoing.

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...will be informed.





Validation teams will be continuously informed of EarthCARE news affecting their planning (e.g., outages) and analysis (e.g. degraded quality events)

This information will cover all four instruments: ESA and JAXA are setting up technical information flow

PIs are requested to submit **progress reports** on data acquisition and (once EarthCARE products become available, intercomparisons)

Presentations at the validation workshops are also expected. The preliminary results workshop is split in three parts corresponding to the staggered public release date.

Publications on **pre-operational** data need prior authorisation, and a clarification statement

To be discussed at this workshop: **special issue?**



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ESA Validation Introduction

*Rob Koopman, Stephanie Rusli, Jonas von Bismarck,
Timon Hummel, Fabien Marnas, Michael Eisinger,
Vasileios Tzallas, Olivier Defauchy*
ESA

ESA Validation-Related Activities



ECVT Validation team

- Knowledge transfer (algorithms, 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-Related Activities



ECVT
Validation
team



Pre-launch and correlative
measurements

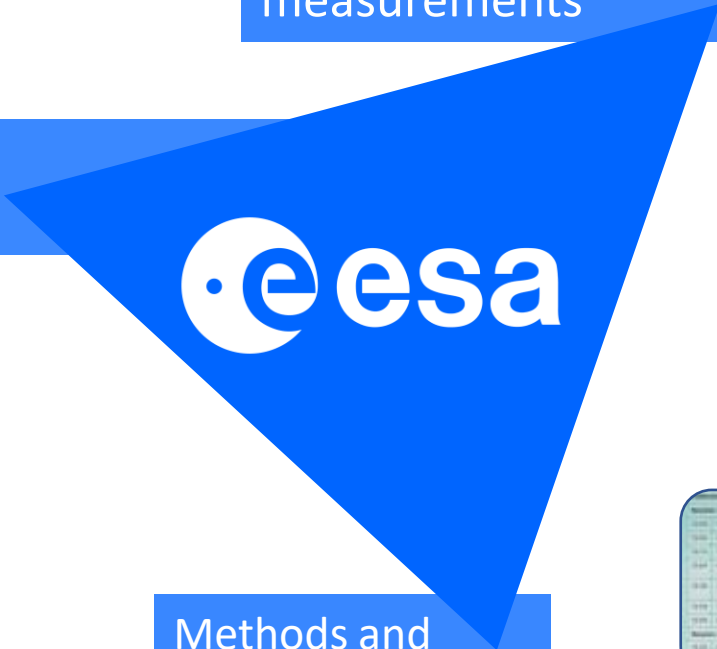
National
Agencies



Various



Collaboration
Coordination



Methods and
approaches



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



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

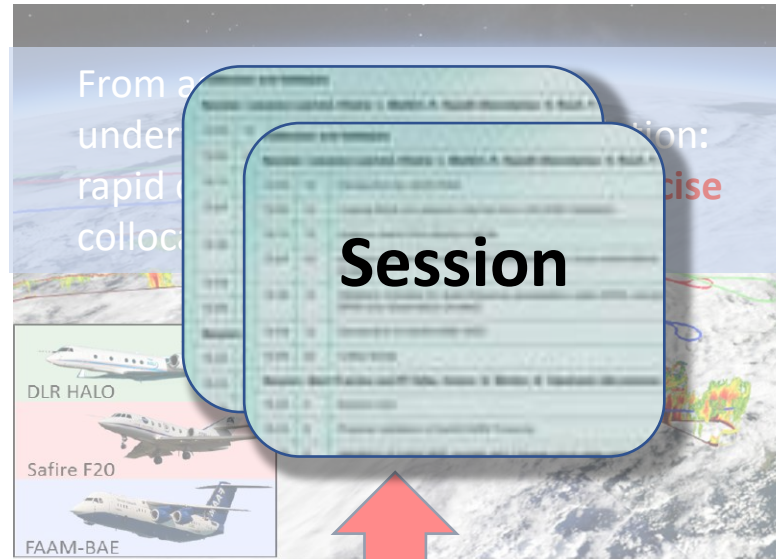
Further campaigns during the entire mission life time: various **geophysical and meteorological** conditions

Assimilation of radar and lidar data with NWP model, starting from launch

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



Airborne Campaigns
Satellite-Satellite

Networks

Assimilation



Presentation

System calibration of radar and lidar data with NWP model, starting from launch

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	D. Perez-Ramirez	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		CMA
A. Devasthale	SMHI, SE	D. Winker	NASA-LARC, USA		PMODWRC

2024

Campaign opportunities pursued

2025

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Jan

Feb

Radar



Home base



PERCUSSION/
MAESTRO



Home base



Home base



Home base

Lidar



Home base



PACE
PAX

Home base



Home base



PERCUSSION/
MAESTRO



Home base

(ARCSIX)



In situ
(micro-
physics)

FAAM



Home base



PACE
PAX



MAESTRO



ALIVIO



LOAC Home base



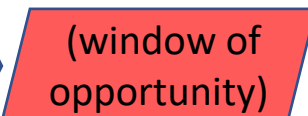
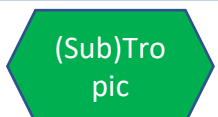
Home base

(ARCSIX)



PONEX

Legend:



Imager
and/or
polarimeter



PACE
PAX



PERCUSSION



Home base

Later in '25 GoSouth(ground)
/HALO South(air) /ACAROA(ship)
IMPACT(ground/air)
CARES(FAAM)
ALVIO(Palau'25 and Arctic'26)
Review ongoing for NASA EV
proposals

Validation Analysis



Level 1
(2A for CPR)

Columns
Layers

Profiles

Radiation

EVID		01	03	04	05	06	07	08	09	10	11	12	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42									
Level 1																																																		
Level 1 (2A for CPR)	MSI																																																	
	BBR																																																	
	ATLID																																																	
	CPR																																																	
Level 2 - Cloud-top, vertically integrated and layer-wise retrieval product																																																		
Target classification	Cloud-top height																																																	
	Cloud-top phase																																																	
	Aerosol layer height/depth																																																	
	Aerosol layer classification																																																	
	Cloud detection, Cld aer discr																																																	
Ice cloud & snow	Optical thickness																																																	
	Effective radius																																																	
	Water path																																																	
	Surface snow rate																																																	
Liquid cloud	Optical thickness																																																	
	Effective radius																																																	
	Water path																																																	
Rain	Surface rain rate																																																	
	Rain water path																																																	
Aerosol	Aerosol optical thickness																																																	
	Ångström exponent																																																	
Level 2 - Vertical profiles at nadir																																																		
Target classification	Cloud/precipitation fraction																																																	
	Cloud/precipitation phase																																																	
	Aerosol fraction																																																	
	Aerosol species																																																	
Ice cloud & snow	Extinction																																																	
	Effective radius																																																	
	Water content																																																	
	Snow rate																																																	
Liquid cloud	Extinction																																																	
	Effective radius																																																	
	Water content																																																	
	Rain	Rain rate																																																
Rain water content																																																		
Median drop size																																																		
Aerosol (per species)	Aerosol extinction																																																	
	Extinction-to- backscatter ratio																																																	
	Particle linear depolarization ratio																																																	
Level 2 - Radiation Products																																																		
Radiation	BBR-SW and LW unfradiances																																																	
	Solar top-of-atmosphere flux																																																	
	SW and LW fluxes at surface																																																	
	Terrestrial top-of-atmosphere flux																																																	



Tools, Facilities/Support



GROUND SITE OVERPASS TABLE HTML REPORT

Creation Date: 2023-06-15 13:04:58

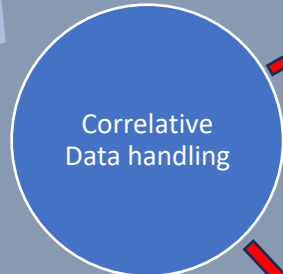
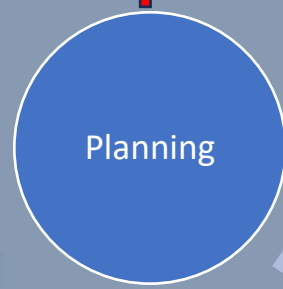
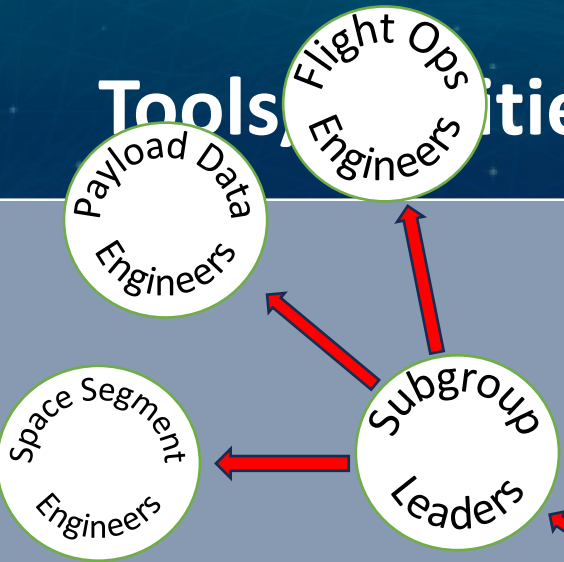
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Orbit File	Example_Instel_180SENTINELA
Ground Site	EXAMPLE_CIRCLE
Ground Site Radius	5.000002 km

Graphical Applications

- ESOV**
Earth Observation Swath and Orbit Visualization
- SAMI**
Satellite Missions 3D Visualization Software

Command Line Tools

- ZoneOverPass**
Satellite / Instrument overpass times over region of interest or ground site
- TrajectoryOverPass**
Instrument overpass times over a given time-tagged trajectory



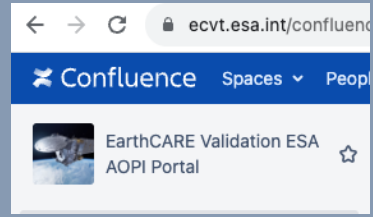
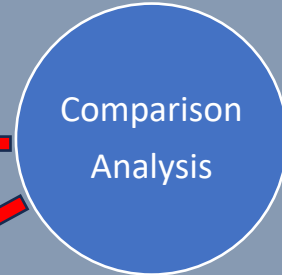
The Generic Earth Observation Metadata Standard (GEOMS)



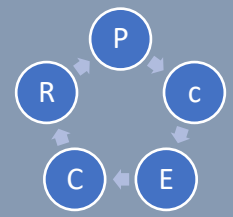
Collocations of Sulphur Dioxide

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Commissioning FTP



Validation



Rehearsal



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ECVT is getting ready for EarthCARE launch in 168 days

Campaign convergence accelerating

(Inter)national funding: recent major progress but coverage still not complete