



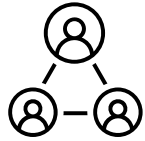
ESA-JAXA Pre-Launch EarthCARE Science and Validation Workshop

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

JAXA EarthCARE Validation Plan

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JAXA Validation Related Activities



JAXA Validation Team

- ✓ Defining validation method and approaches: JAXA validation implementation plan (JAXA VIP)
- ✓ Regular Val. team meetings
- ✓ Maintenance and continuous observation
- ✓ Validation rehearsal with EC Research A-Train product
- ✓ Matchup frequency analysis



Collaboration/Coordination



- ✓ ESA-JAXA Validation Implementation Plan
- ✓ Confluence page for validation-related satellite operation information
- ✓ Validation workshops
- ✓ Mutual use of validation related tools

International collaborations

- ✓ Airborne campaign with DLR
- ✓ Ground-based correlative data exchange with NOAA
- ✓ Contributing to ACPV aiming a CEOS document



Web pages/tools development

- ✓ EarthCARE product monitor (Quick Look)
- ✓ EarthCARE Orbit Prediction
- ✓ EarthCARE Orbit Search
- ✓ JAXA EarthCARE Validation portal
- ✓ Validation Data Archive System (VDAS)
- ✓ Validation Matchup Web



Campaigns

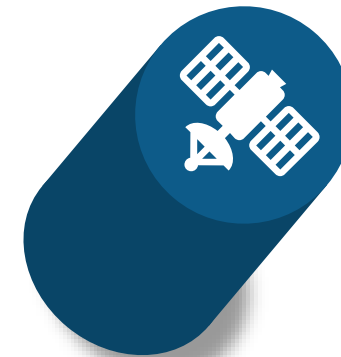
Ground campaign provides multi-sensor detailed evaluations, and airborne campaign abundant number of matchup data in early phase

Networks

Long-term ground observation networks provide detailed validations

Spaceborne

Satellite sensors provide global evaluations and large amount of matchup data

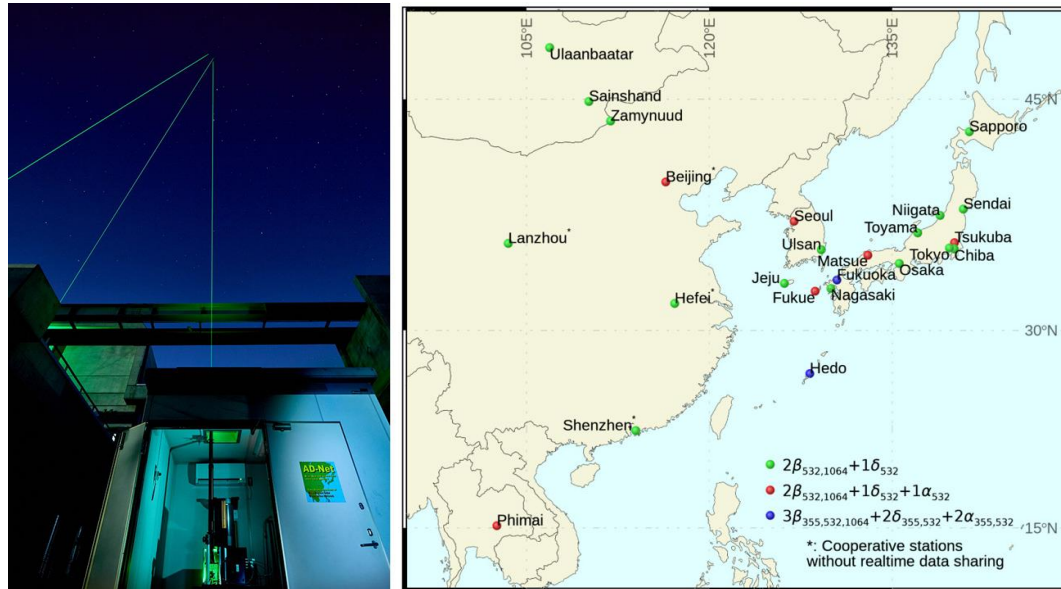


JAXA Validation Approach



AD-Net

Asian dust and aerosol lidar observation network
Main correlative observation for ATLID product



T. Nishizawa-san's and J. Yoshitaka-san's talk on Day 5

Other Networks: AD-Net, SAVERNET, WINDAS, SKYNET, AERONET, NIED Ka-band radars, All-sky cameras, BSRN, GEBA

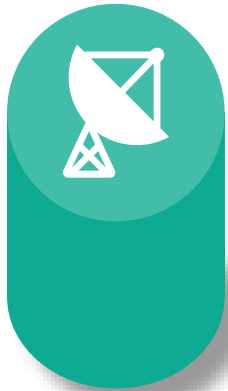
Ka radars: T. Ohigashi-san's talk on Day 5

All-sky cameras : T. Nakajima-san's talk on Day 3

BSRN: A. Yamauchi-san's talk on Day 4

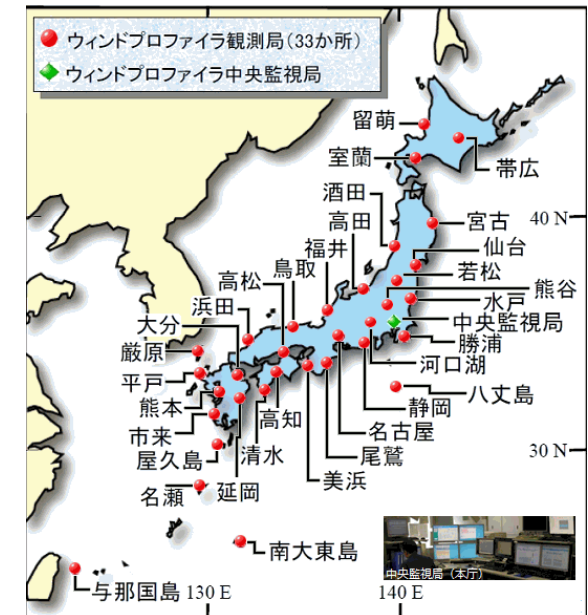
SAVERNET: J. Yoshitaka-san's talk on Day 5

Networks



WINDAS

JMA wind profiler network



Y. Ohno-san's talks on Day 5

H. Okamoto-san's talk on Day 2

Campaigns



Koganei Validation Super Site

High sensitivity doppler cloud radar and scanning doppler cloud radar, wind profiler, doppler lidars, HSRL, MFMSPL, microwave radiometer, all-sky camera, etc.

H. Okamoto-san's talk on Day5

H. Horie-san's talk on Day 4

HALO airborne campaign

Collaboration with DLR. EarthCARE-like airborne campaign EC-TOOC is planned with HALO aircraft (High Altitude and Long Range Research Aircraft)

Silke Gross-san's talk on Day 4



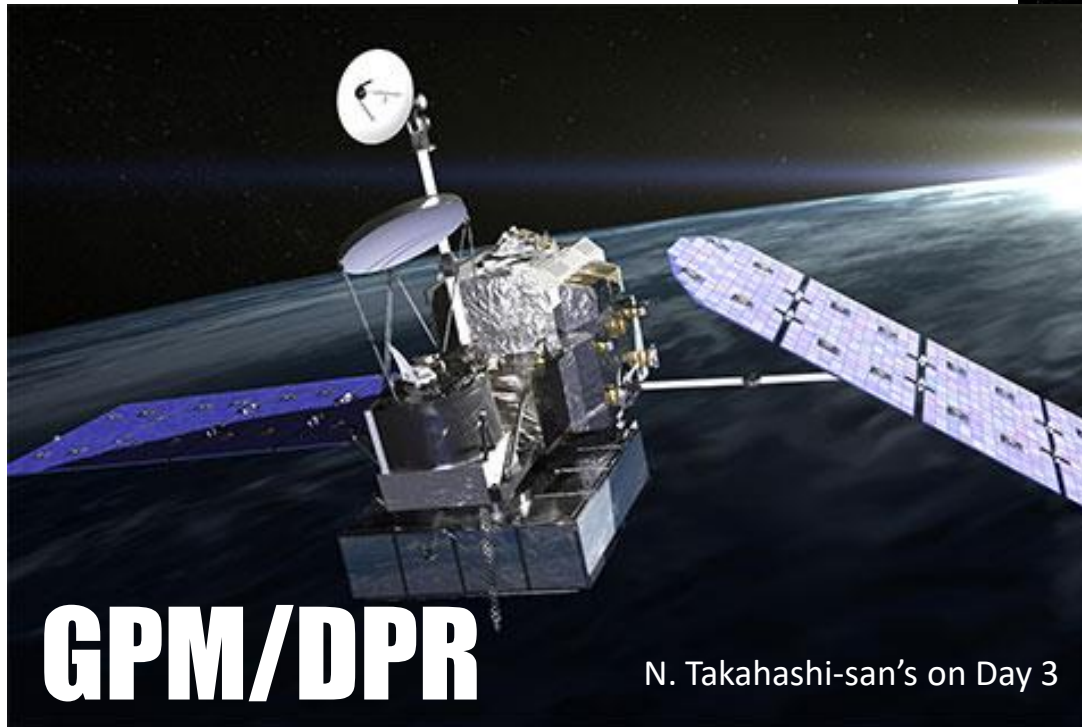
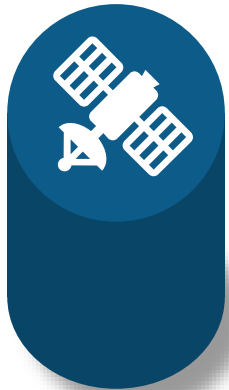
JAXA Validation Approach



Correlative data exchange, matchup dataset creation, LL intake, validation tools heritage, etc.

DPR is Dual-frequency Precipitation Radar, Ka- and Ku-bands.

Spaceborne

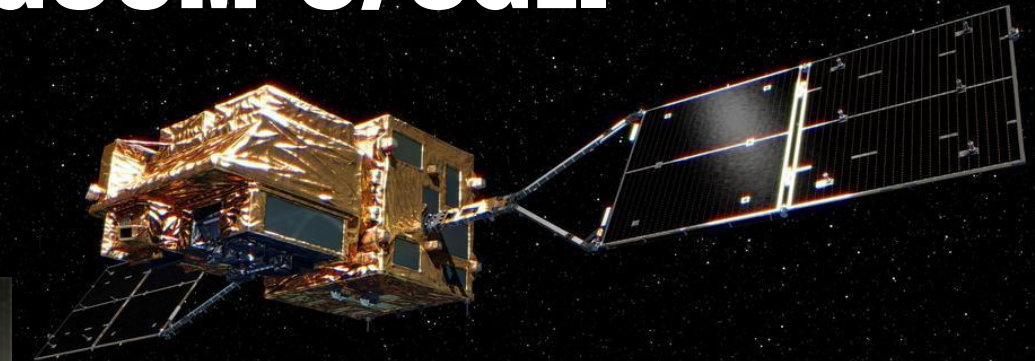


GPM/DPR

N. Takahashi-san's on Day 3

GCOM-C/SGLI

T. Y. Nakajima-san's talk on Day 3



SGLI is multispectral imager with 19 channels, 250m resolution, especially for MSI product.

Others: A-Train, Aeolus, Himawari

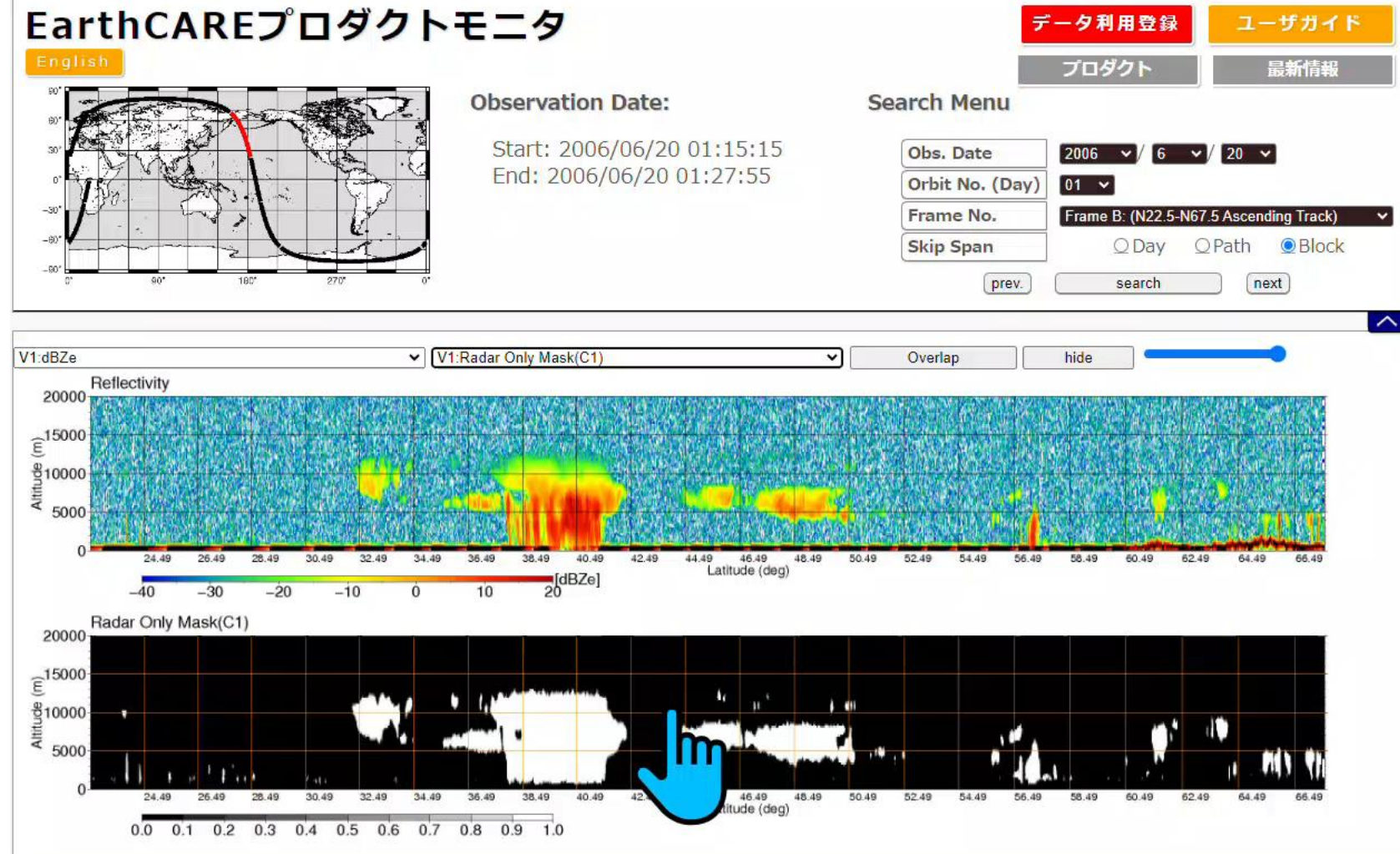
Web Pages/Tools Development



- We are developing several web pages/tools. The right is prototype of EarthCARE Product Monitor (Quick Look). **English page is also under development and will be opened in public.**

- ✓ EarthCARE product monitor (Quick Look)
- ✓ EarthCARE Orbit Prediction
- ✓ EarthCARE Orbit Search
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Prototype of EarthCARE Procut Monitor



Summary and Final Remark



- To fully validate the EarthCARE products which produced in the complicated production model, JAXA validation team detailed validation method for JAXA EarthCARE products which can be summarized as the three pillars.
- Early validation results will be opened when product public release which is scheduled for standard product as
 - L2 one-sensor and two-sensor product: L+9 months
 - L2 3-sensor and 4-sensor product: L+18 months
- When product version-up, the latest results of validation is also opened in public.
- **EarthCARE product validation is highly challenging, so we believe collaboration between validation teams is indispensable, hope the WS helps fostering collaboration internationally, especially between European and Japanese teams.**

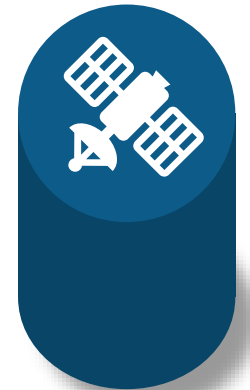
Networks



Campaigns



Spaceborne

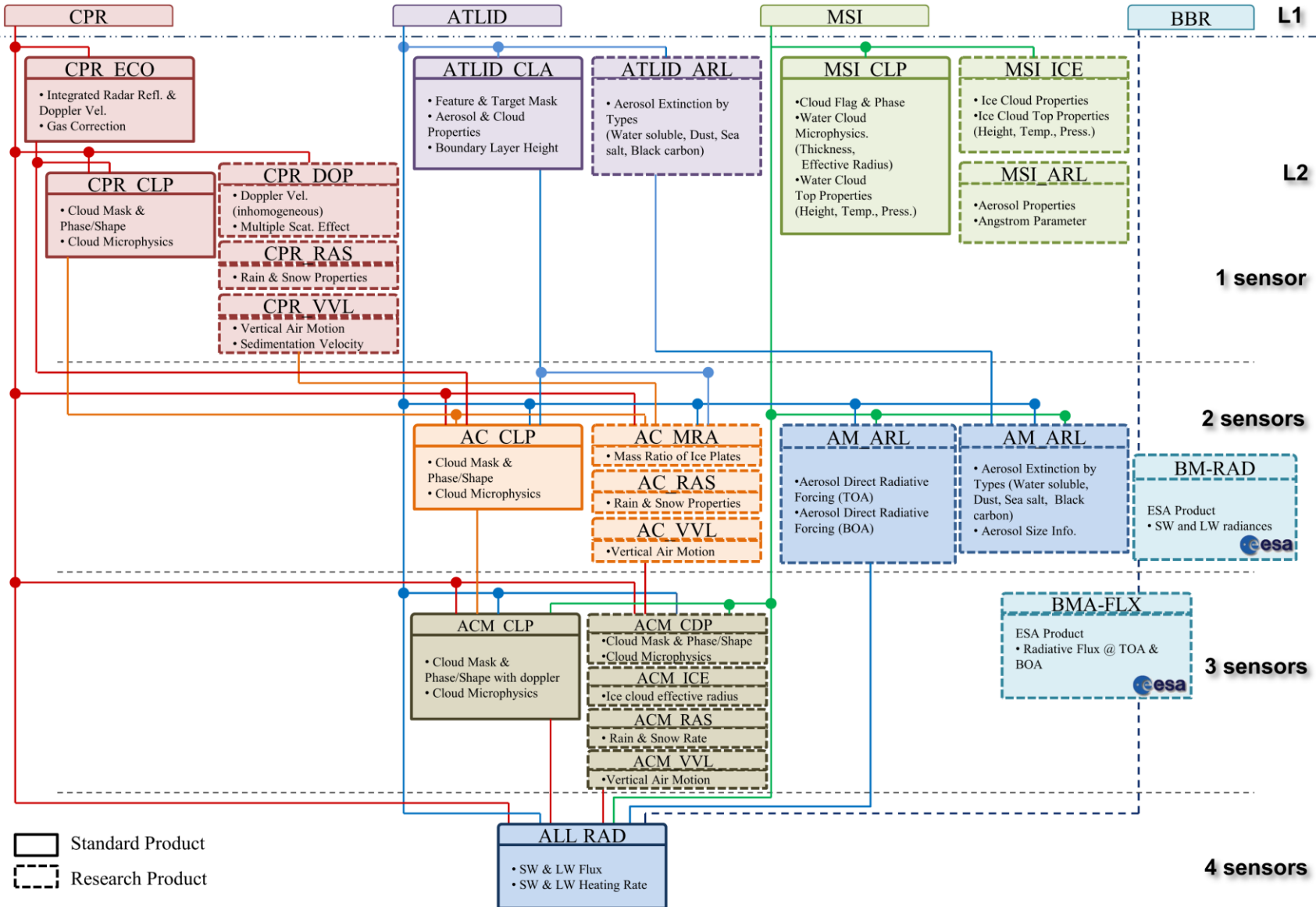




Backups

JAXA Production Model and Product Release

EarthCARE JAXA L2 Production Model



Public Release Target for standard product



L2 one-sensor product
L2 two-sensor synergy product

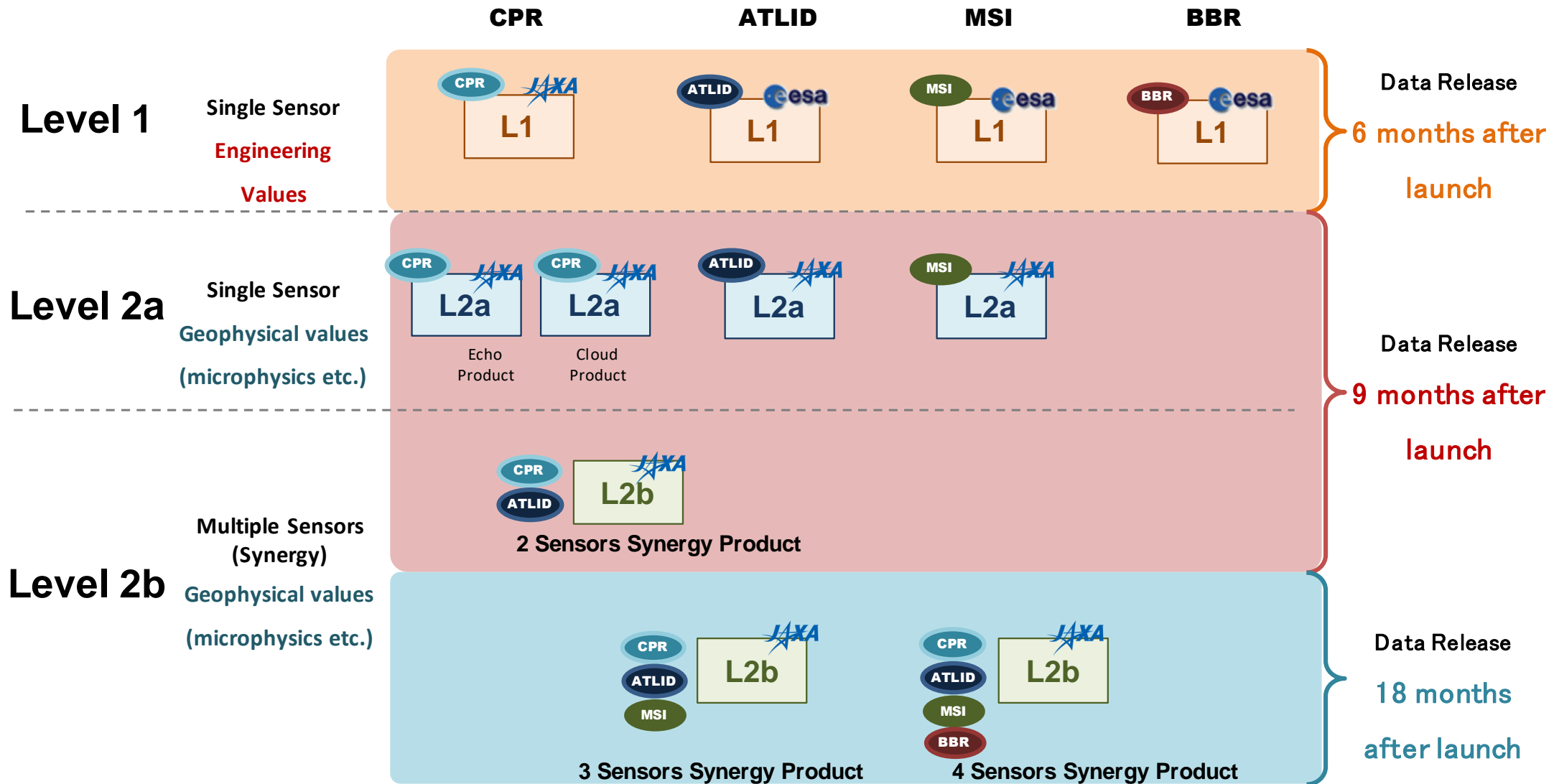
➡ L+9 months

L2 3-sensor and 4-sensor synergy product

➡ L+18 months

Early validation results will be opened at the product release.

Product Release and Early Validation Result



Early validation results will be opened at the product release.

JAXA EarthCARE Validation Implementation Plan Document



List of JAXA standard products

Product Name	Parameter	Required accuracy		
		Release	Standard	Target
CPR One-sensor Echo Product	Integrated Radar Reflectivity Factor	—	—	—
	Integrated Doppler Velocity	—	$\leq 1.3\text{m/s}$	$< 0.2\text{m/s}$
	Gas Correction Factor	—	—	—
CPR One-sensor Cloud Product	Cloud Mask	$\pm 30\%$	$\pm 10\%$	$\pm 5\%$
	Cloud Particle Type	$\pm 100\%$	$\pm 50\%$	$\pm 20\%$
	Liquid Water Content	—	$\pm 100\%$	$\pm 50\%$
	Ice Water Content	—	—	—
	Effective Radius of Liquid Water Cloud	—	—	—
	Effective Radius of Ice Water Cloud	—	—	—
	Optical Thickness	—	$\pm 100\%$	$\pm 50\%$
CPR-ATLID Synergy Cloud Product / CPR-ATLID-MSI Synergy Cloud Product	Cloud Mask	—	Root mean square of errors of one sensor products	—
	Cloud Particle Type	—		—
	Liquid Water Content	—		$\pm 20\%$
	Ice Water Content	—		$\pm 30\%$
	Effective Radius of Liquid Water Cloud	—		$\pm 2\mu\text{m}$
	Effective Radius of Ice Water Cloud	—		—
	Optical Thickness	—		—
	Liquid Water Path	—		—
Ice Water Path	—	—		

Product Name	Parameter	Required accuracy		
		Release	Standard	Target
MSI One-sensor Cloud Product	Cloud Flag	$\pm 15\%$ _(Ocean) $\pm 20\%$ _(Land)	$\pm 15\%$	$\pm 10\%$
	Cloud Phase	$\pm 15\%$ _(Ocean) $\pm 20\%$ _(Land)	$\pm 15\%$	$\pm 10\%$
	Optical Thickness of Liquid Water Cloud	$\pm 10\%$	$\pm 100\%$ <small>(as LWC)</small>	$\pm 50\%$ <small>(as LWC)</small>
	Effective Radius of Liquid Cloud (1.6/2.2 μm)	$\pm 30\%$	$\pm 100\%$ <small>(as LWC)</small>	$\pm 50\%$ <small>(as LWC)</small>
	Cloud Top Temperature	$\pm 1\text{K}$	$\pm 3\text{K}$	$\pm 1.5\text{K}$
	Cloud Top Pressure	—	—	—
	Cloud Top Height	—	—	—
ATLID One-sensor Cloud and Aerosol Product	Feature Mask	$\pm 100\%$	$\pm 40\%$	$\pm 10\%$
	Target Mask	$\pm 100\%$	$\pm 40\%$	$\pm 10\%$
	Extinction Coeff.	$\pm 50\%$ _(Cloud) $\pm 60\%$ <small>(Aerosol)</small>	$\pm 30\%$ _(Cloud) $\pm 40\%$ <small>(Aerosol)</small>	$\pm 15\%$ _(Cloud) $\pm 20\%$ <small>(Aerosol)</small>
		Backscat. Coeff.	$\pm 90\%$	$\pm 70\%$
	Lidar Ratio	$\pm 140\%$ _(Cloud) $\pm 150\%$ <small>(Aerosol)</small>	$\pm 100\%$ _(Cloud) $\pm 110\%$ <small>(Aerosol)</small>	$\pm 65\%$ _(Cloud) $\pm 70\%$ <small>(Aerosol)</small>
		Depolarization Ratio	$\pm 150\%$	$\pm 130\%$
	Planetary Boundary Layer Height	$\pm 500\text{m}$	$\pm 300\text{m}$	$\pm 100\text{m}$
Four Sensors Synergy Radiation	Radiative Flux (SW/LW)	—	$\pm 25\text{ W/m}^2$	$\pm 10\text{ W/m}^2$
	Radiative Heating Rate (SW/LW)	—	—	—

JAXA EarthCARE Validation Implementation Plan Document

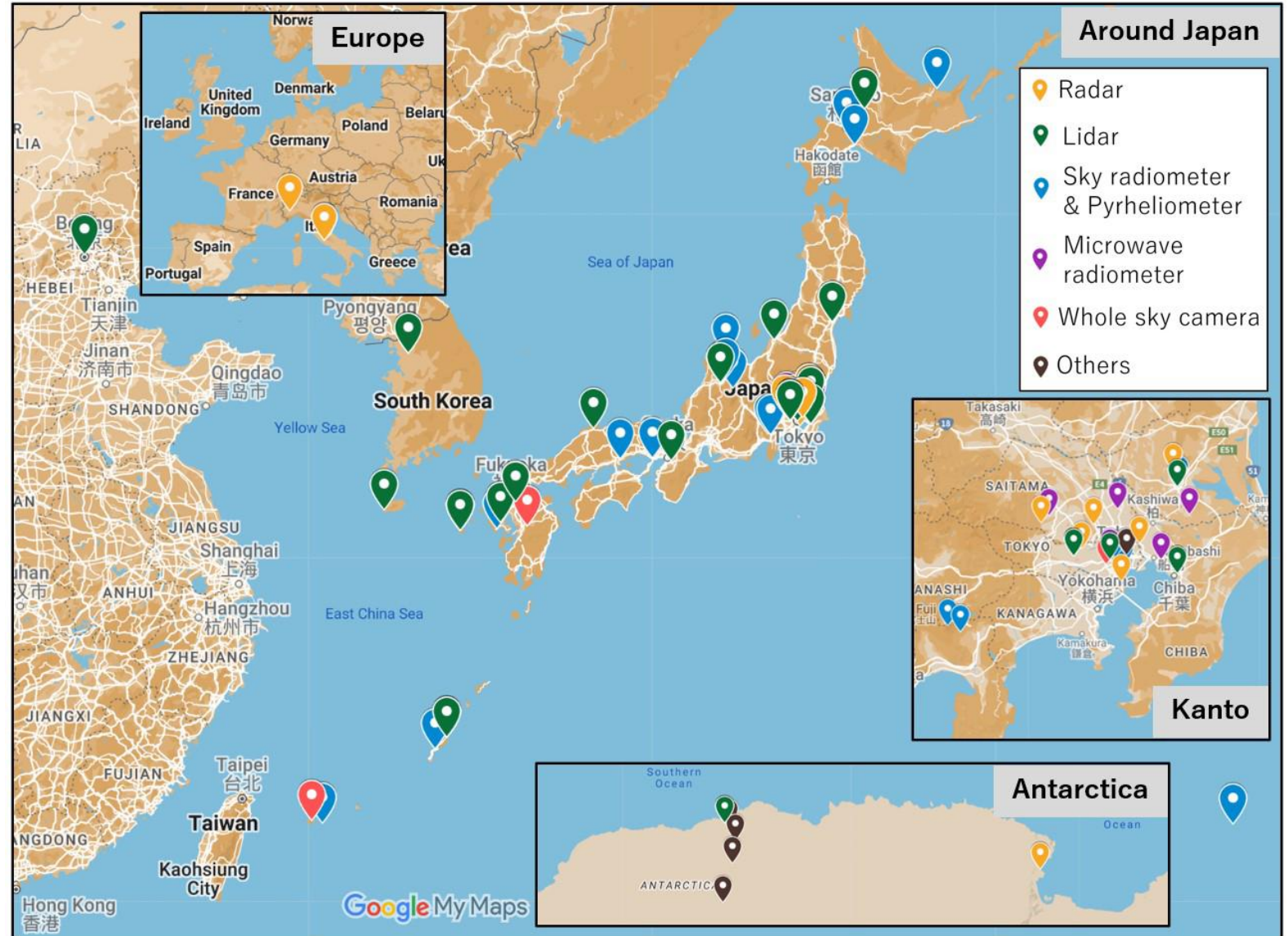


- Correlative data for each JAXA EarthCARE standard product is summarized in the table below.

Product name	Main parameters	Correlative data
CPR One-sensor Echo Product	Integrated radar reflectivity factor, integrated doppler velocity	NICT Koganei composite observation, WINDAS, NIED Ka-band radars, CloudSat (climatology), DLR HALO
CPR One-sensor/ CPR-ATLID Synergy/ CPR-ATLID-MSI Synergy Cloud Product	Cloud mask, cloud particle type, liquid water content, ice water content, effective radius of liquid/ice water cloud, and optical thickness, liquid water path, ice water path	NICT Koganei composite observation, NIED Ka-band radars, A-Train (climatology), DLR HALO, Microwave radiometer
ATLID One-sensor Cloud and Aerosol Product	Feature mask, target mask, extinction coefficient, backscatter coefficient, lidar ratio, depolarization ratio, and planetary boundary layer height	AD-Net, SAVERNET, SKYNET, AERONET, CALIPSO (climatology), Aeolus
MSI One-sensor Cloud Product	Cloud flag, cloud phase, optical thickness, effective radius, cloud top temperature, cloud top pressure, and cloud top height	All-sky camera, GCOM-C, Himawari, BSRN, Sky radiometer, Microwave radiometer
Four Sensors Synergy Radiation Budget Product	SW/LW radiative flux and SW/LW radiative heating rate	BSRN, GEBA, CERES, BBR, A-Train (climatology)

JAXA EarthCARE Validation Implementation Plan Document

- Geolocations of ground-base instruments for validation



Google MyMap link

https://www.google.com/maps/d/edit?mid=1KfijbqxtNQwMTacq0Ec0E5X1hEMylg_T&usp=share_link

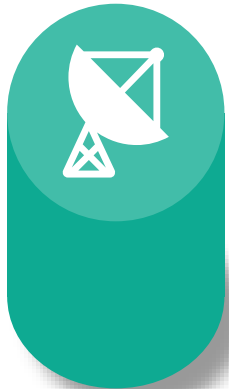


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