Evaluation of JAXA ATLID L2a products using AD-Net lidars

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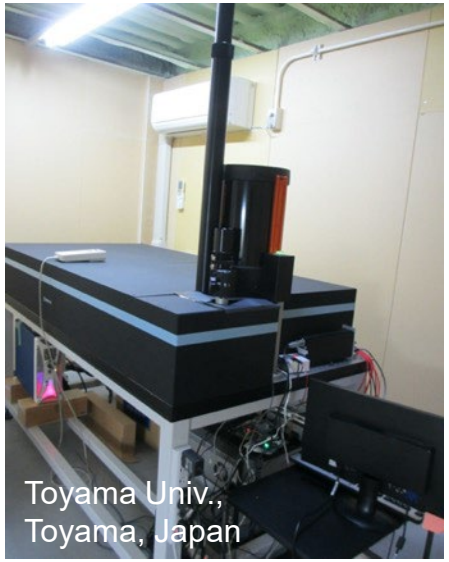
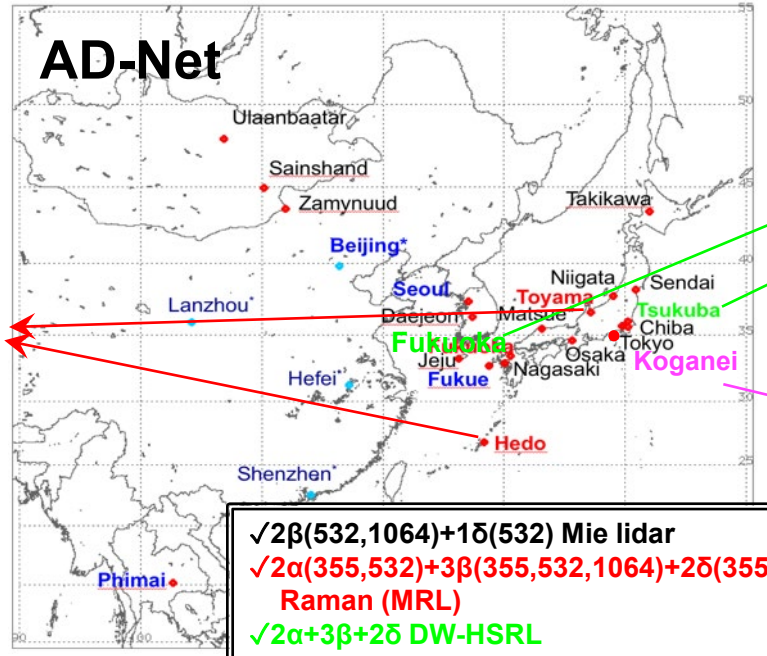
Validation of ATLID products using AD-Net ground-based lidars

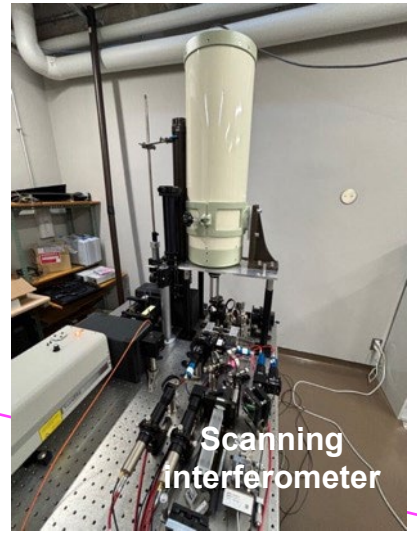
- Asian dust and aerosol lidar observation network (AD-Net) is one of the important lidar networks to validate ATLID products
- AD-Net has been upgraded by installing multi-wavelength HSRL and Raman lidars, which are useful for direct comparison of extinction and backscatter (Koganei, Tsukuba, Fukuoka, Toyama, and Hedo)
- In this study, JAXA ATLID L2a products are evaluated using AD-Net data (Comparison analysis for ESA ATLID L2a products are presented in poster #33 by Tomoaki Nishizawa et al.)



MRL
(Toyama, Hedo)



✓2β(532,1064)+1δ(532) Mie lidar
✓2α(355,532)+3β(355,532,1064)+2δ(355,532) Raman (MRL)
✓2α+3β+2δ DW-HSRL
✓ 1α(355)+1β(355)+1δ(355) HSRL

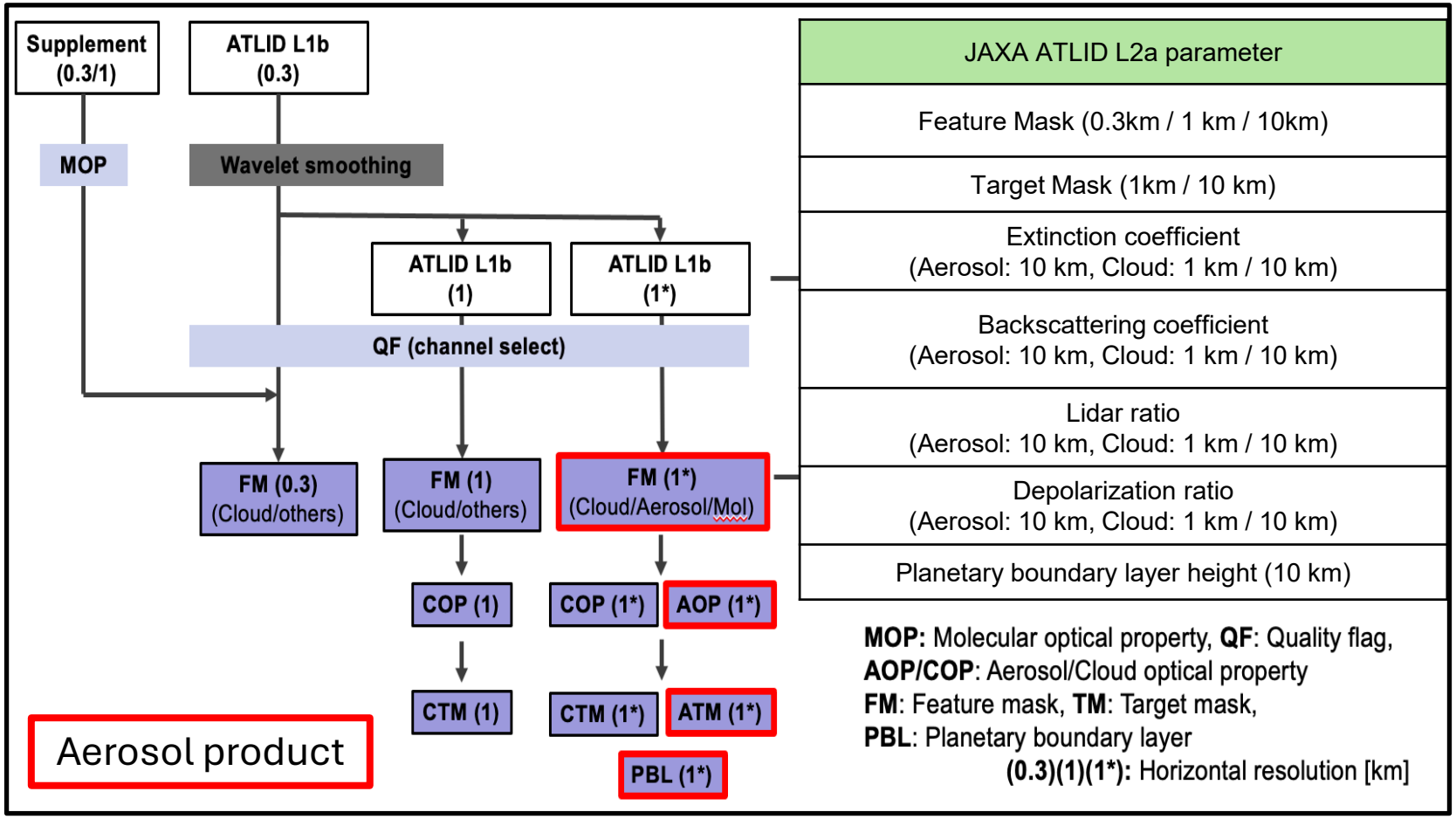


DW-HSRL
(Tsukuba, 2024.08.15~)

355nm HSRL
(Koganei)

JAXA ATLID L2a product list

◆ Evaluation of standard L2a product (10-km horizontal resolution)



Observation of aerosol optical properties by SKYNET

Lidar site used for validation (HSRL & Raman lidars)

Target data and validation method

【Target data and period】

- JAXA ATLID L2a product (ATL_CLA v1.0) algorithm using ATLID L1b baseline AD
- Period: 2024.08.10 – 2025.01.31 with the helps of JAXA and ESA

【Validation method】

- Direct comparison with ground-based HSRL and Raman lidars
- Average ATLID data within a 50 km radius of ground-based lidar site
- This report will mainly focus on aerosol cases, since suitable cloud cases for direct comparison are not available

【Ground-based lidar sites and number of match-up frames】

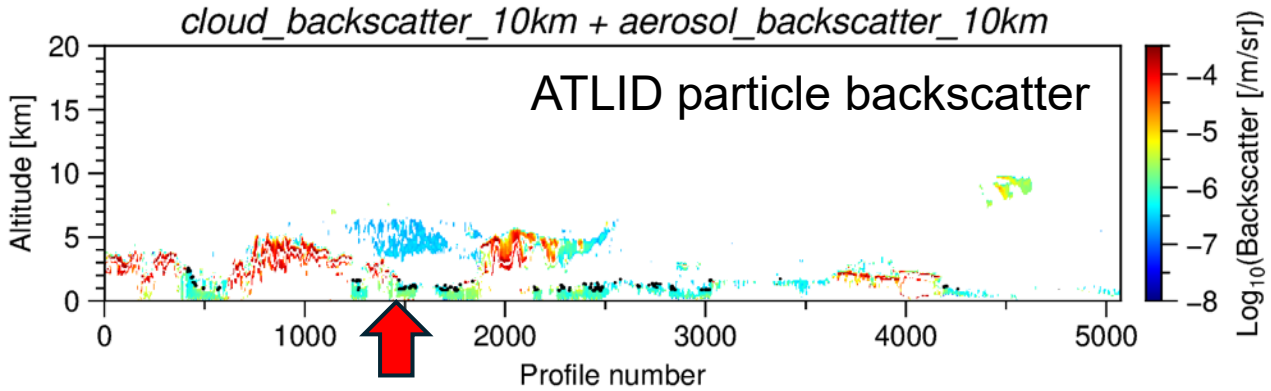
Koganei	Tsukuba	Fukuoka	Toyama	Hedo
12(12)	18(15)	20(16)	18(7)	16(4)

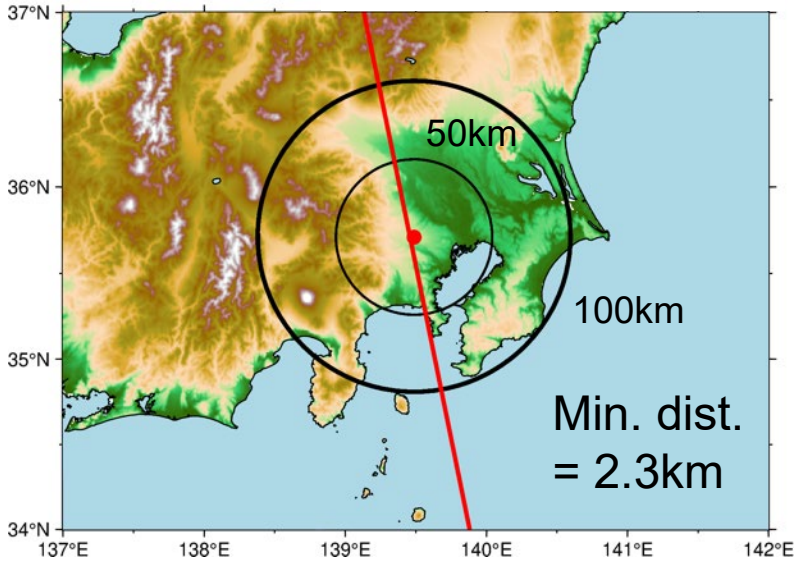
() ground-based lidar data available

Comparison of ATLID L2a profiles with ground-based lidar

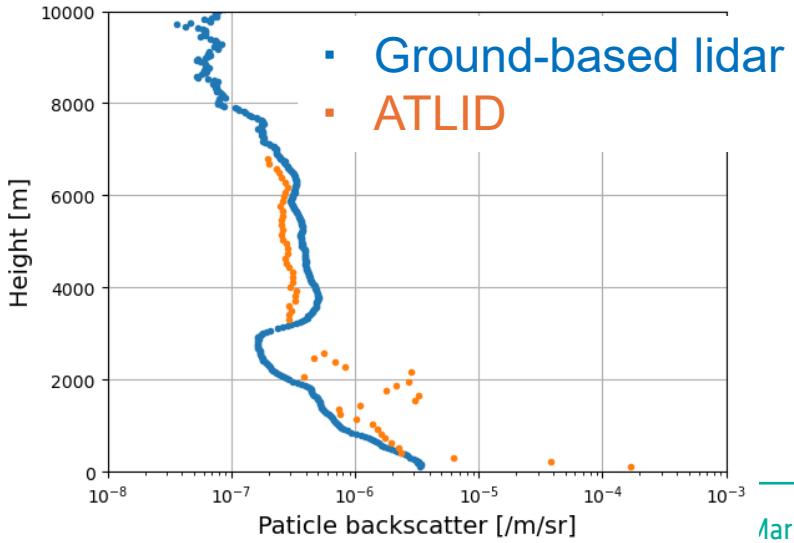
2024.12.20 1621UT

- Very good agreement with ground-based lidar observation
- Effect of clouds around the top of planetary boundary layer

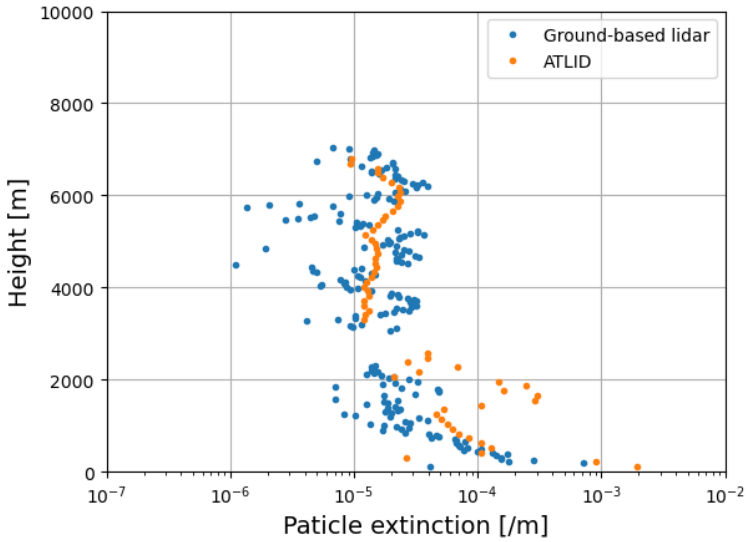




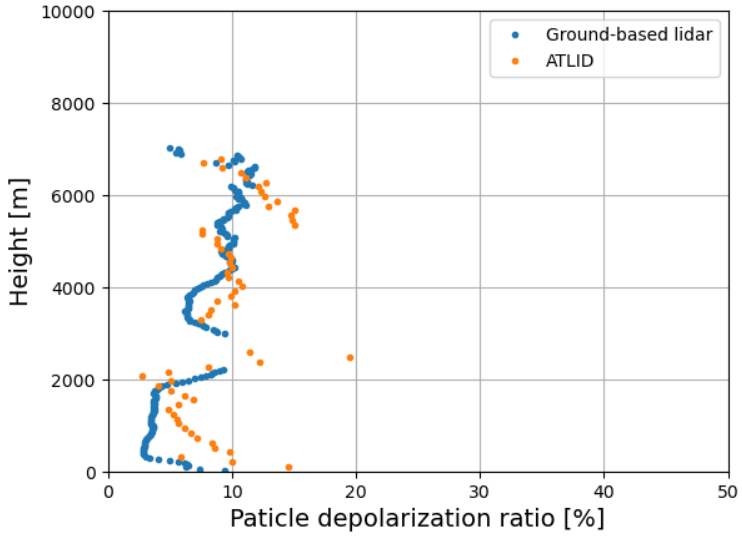
Particle backscatter [/m/sr]



Particle extinction [/m]



Particle dep. ratio [%]



Validation of ATLID L2a optical properties

◆ Achieved release accuracy target for all optical properties

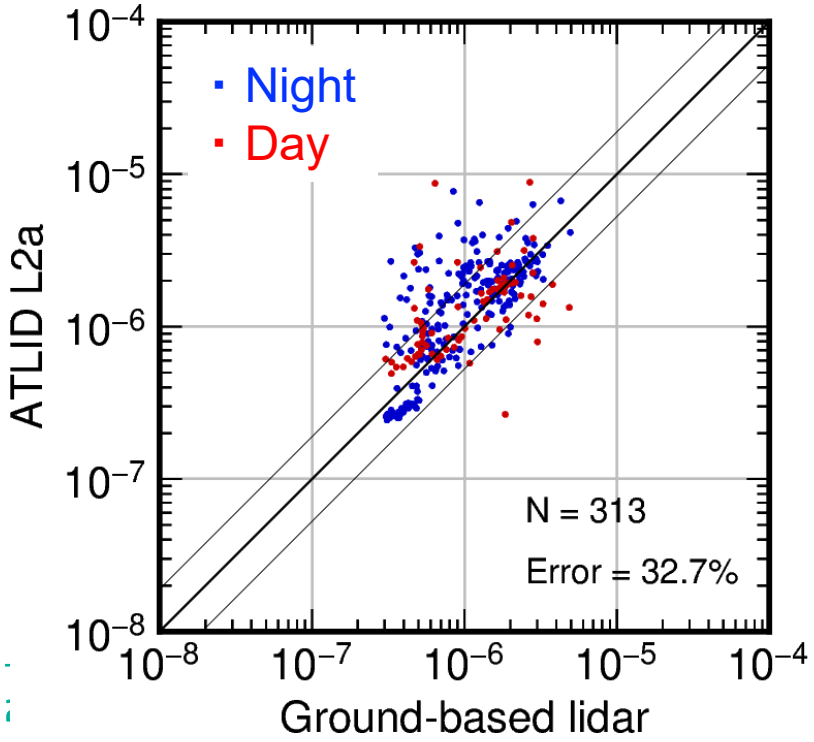
	Backscatter	Extinction	Dep. ratio
Error [%]	32.7%	31.4%	56.9%
Target [%]	±90%	±60%	±150%

Estimated error = $\left(\frac{1}{N}\Sigma_i(E_i - T_i)\right) \Big/ \left(\frac{1}{N}\Sigma_i T_i\right)$

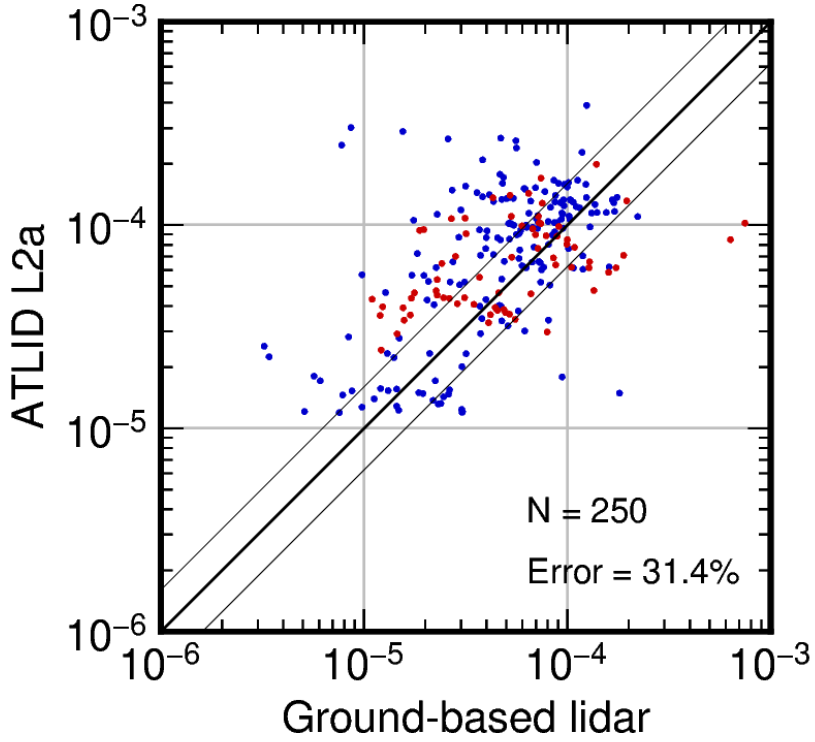
（Quoted from JAXA validation plan document）

E_i : ATLID、T_i : Ground-based lidar

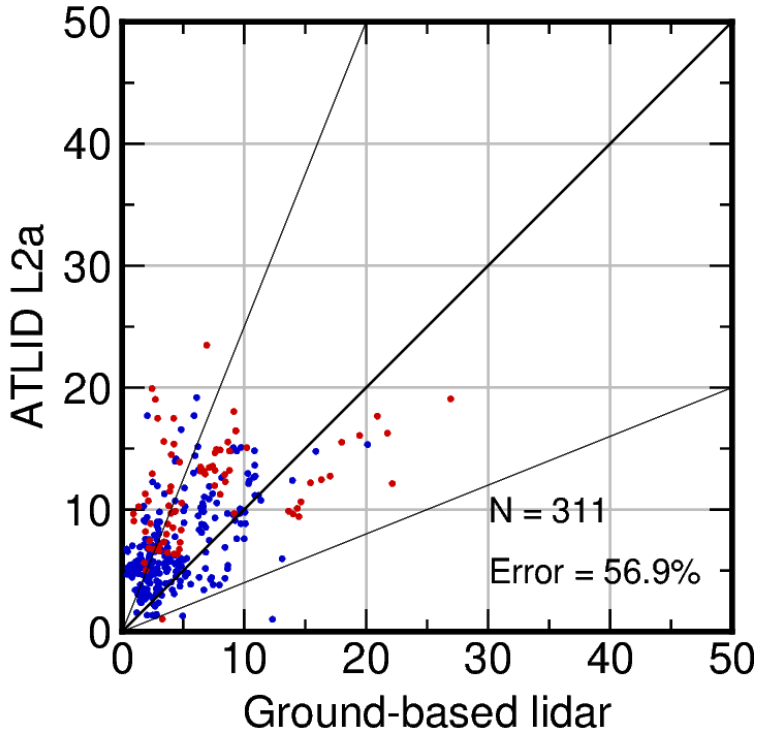
Particle backscatter [/m/sr]



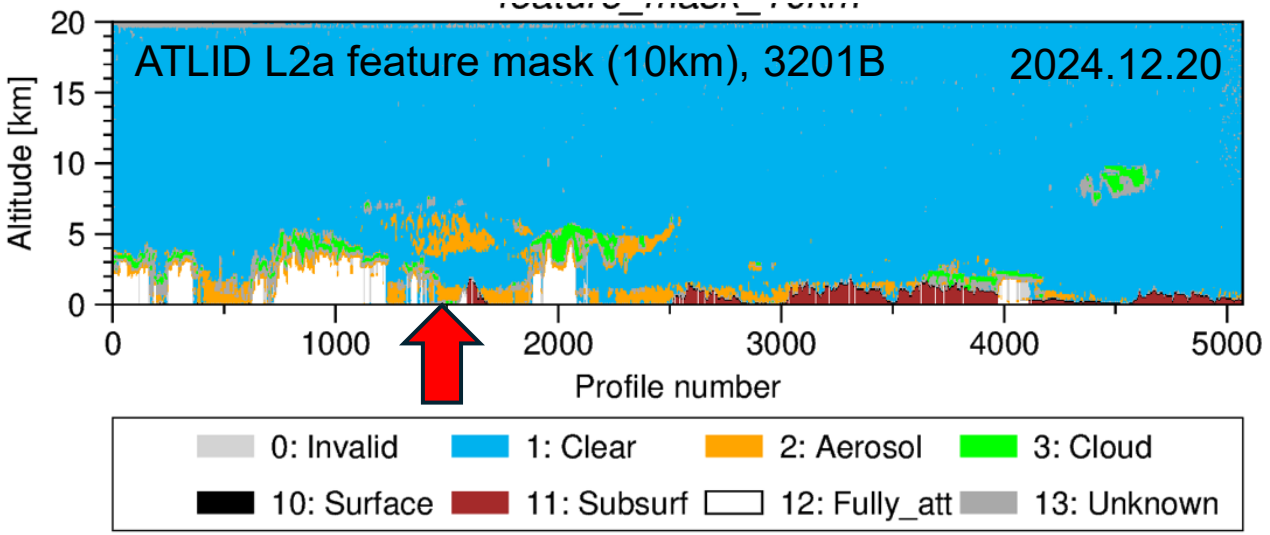
Particle extinction [/m]



Particle dep. ratio [%]



Validation of ATLID L2a feature mask



False detection ratio = $\frac{FP + FN = 282}{TP = 1377}$ = ~20 %

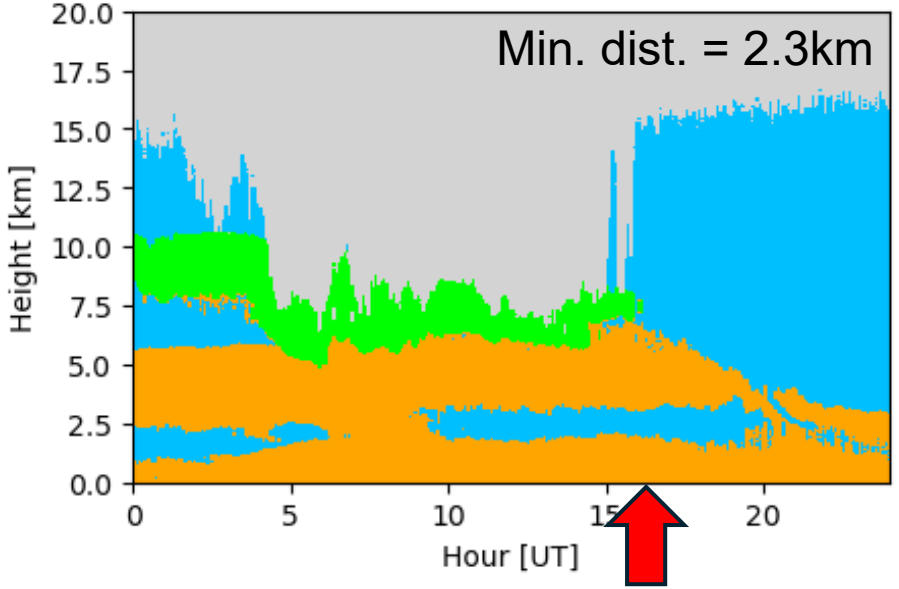
(Only clear and aerosol cases)

(Target: 100%)

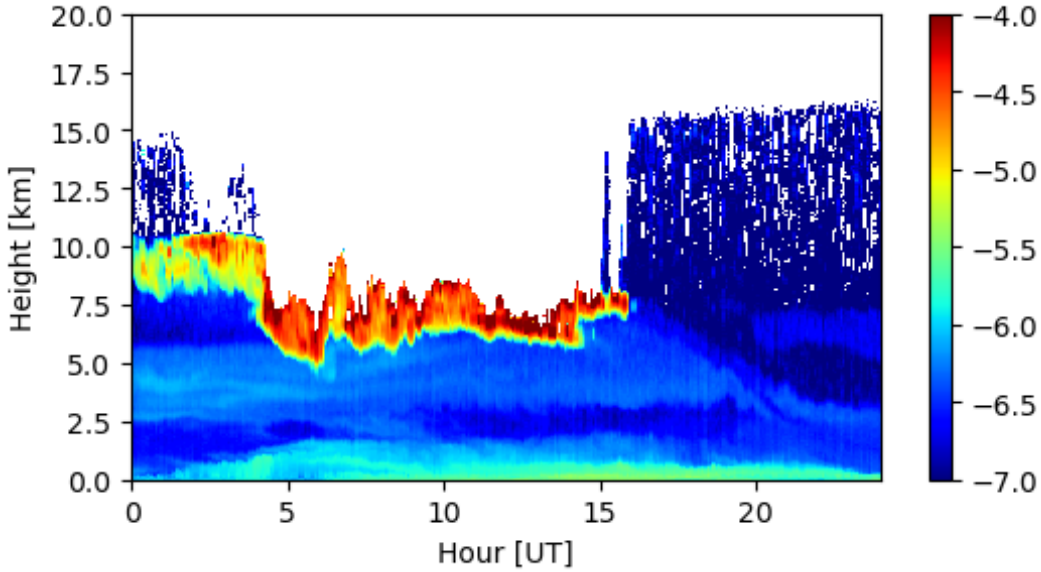
Ground-based lidar

ATLID	Existence	Non-existence
Existence	TP	FP
Non-Existence	FN	TN

Feature mask (Koganei)



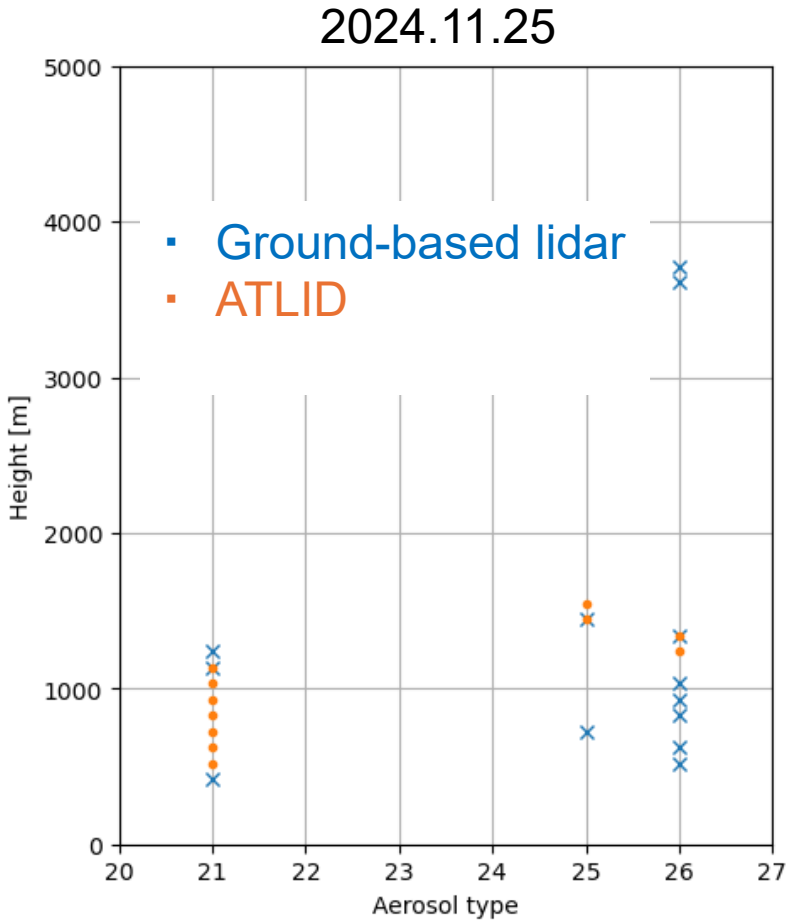
Particle backscatter [/m/sr] (Koganei) (Log10)

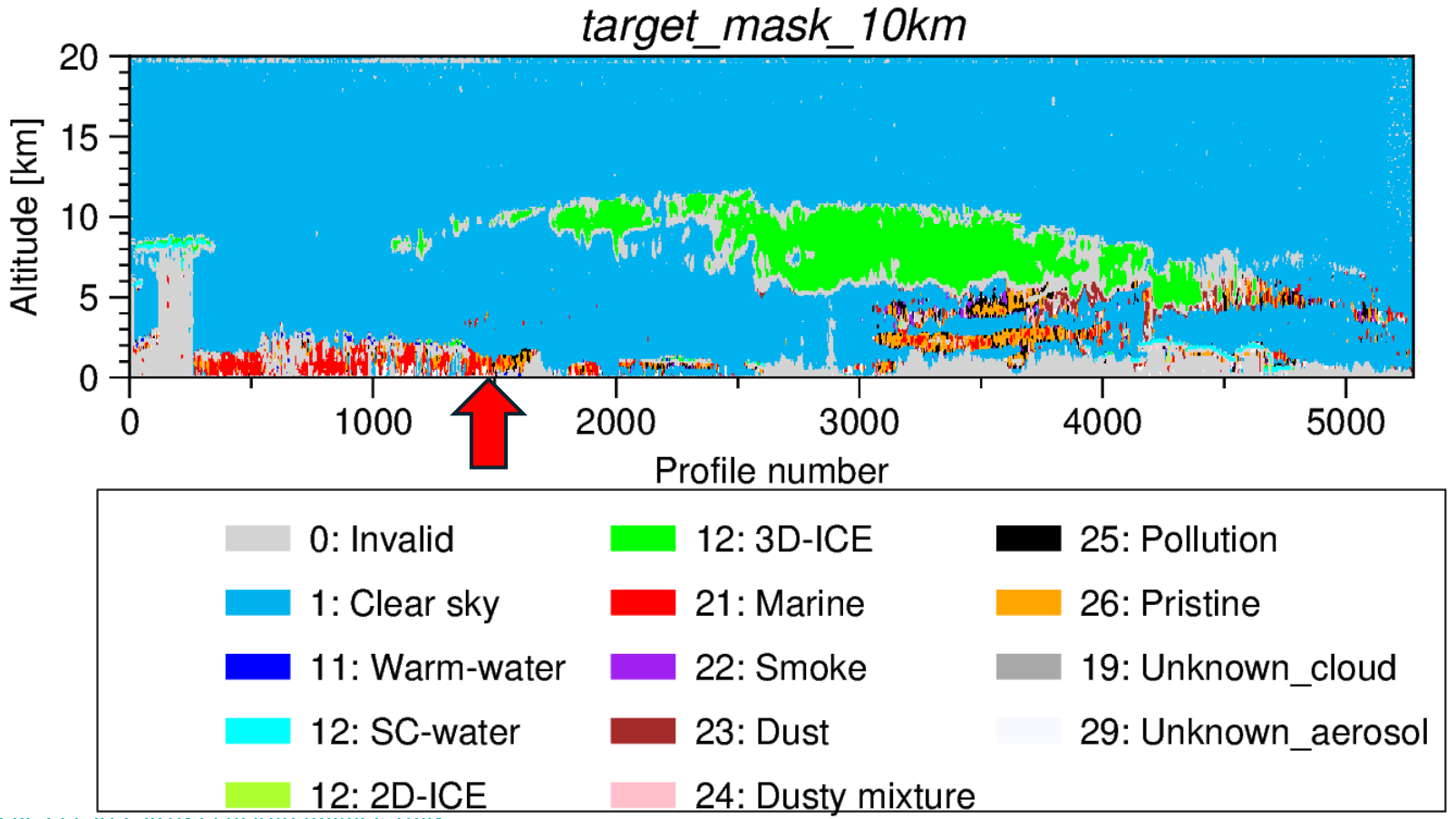


Validation of ATLID L2a target mask (aerosol typing)

- Target mask errors were >100%
- Homogeneous & high load aerosol layers (e.g., Asian dust) should be checked for the validation of target mask

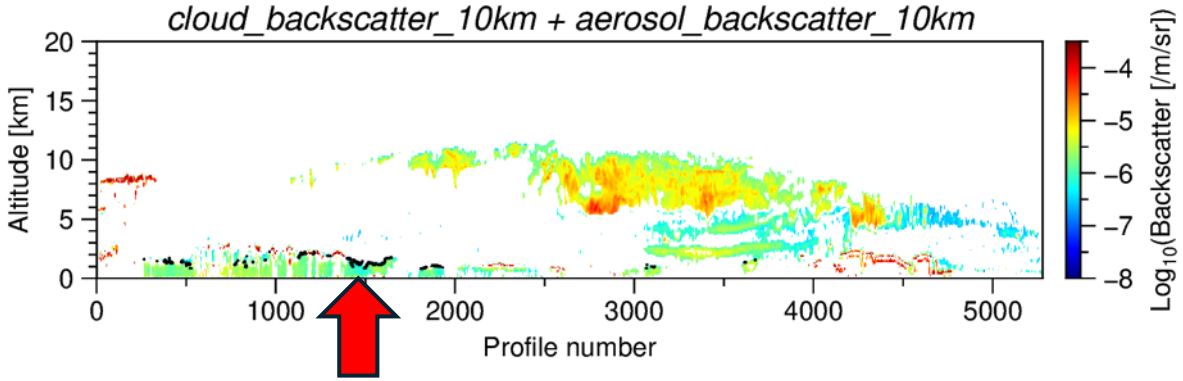
$$\text{False detection ratio} = \frac{\text{FP + FN = 217}}{\text{TP = 71}}$$

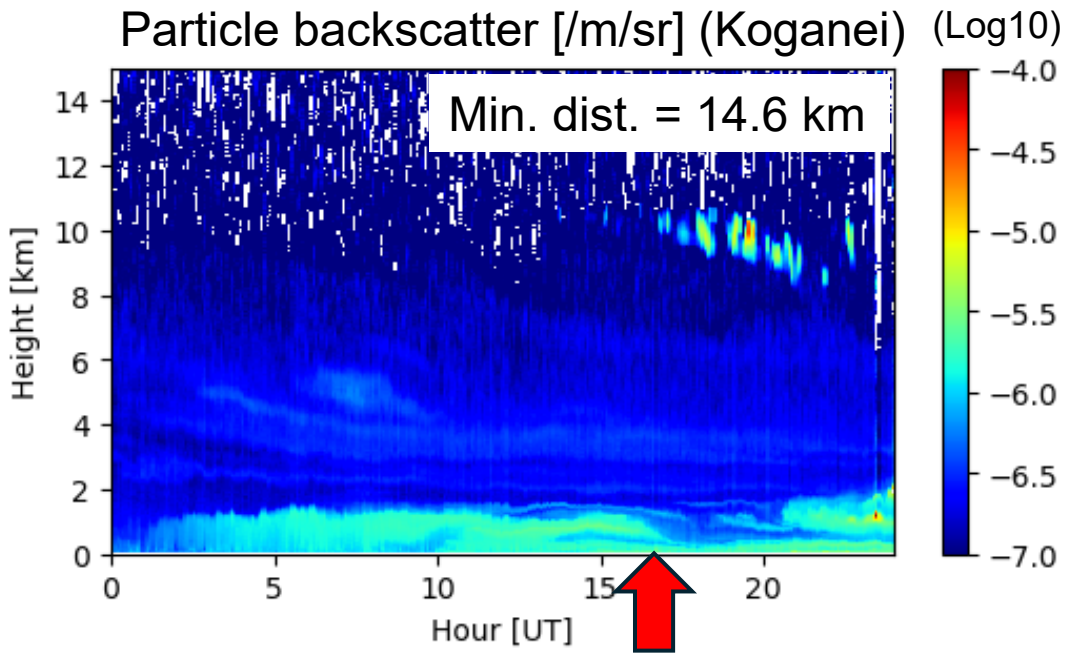


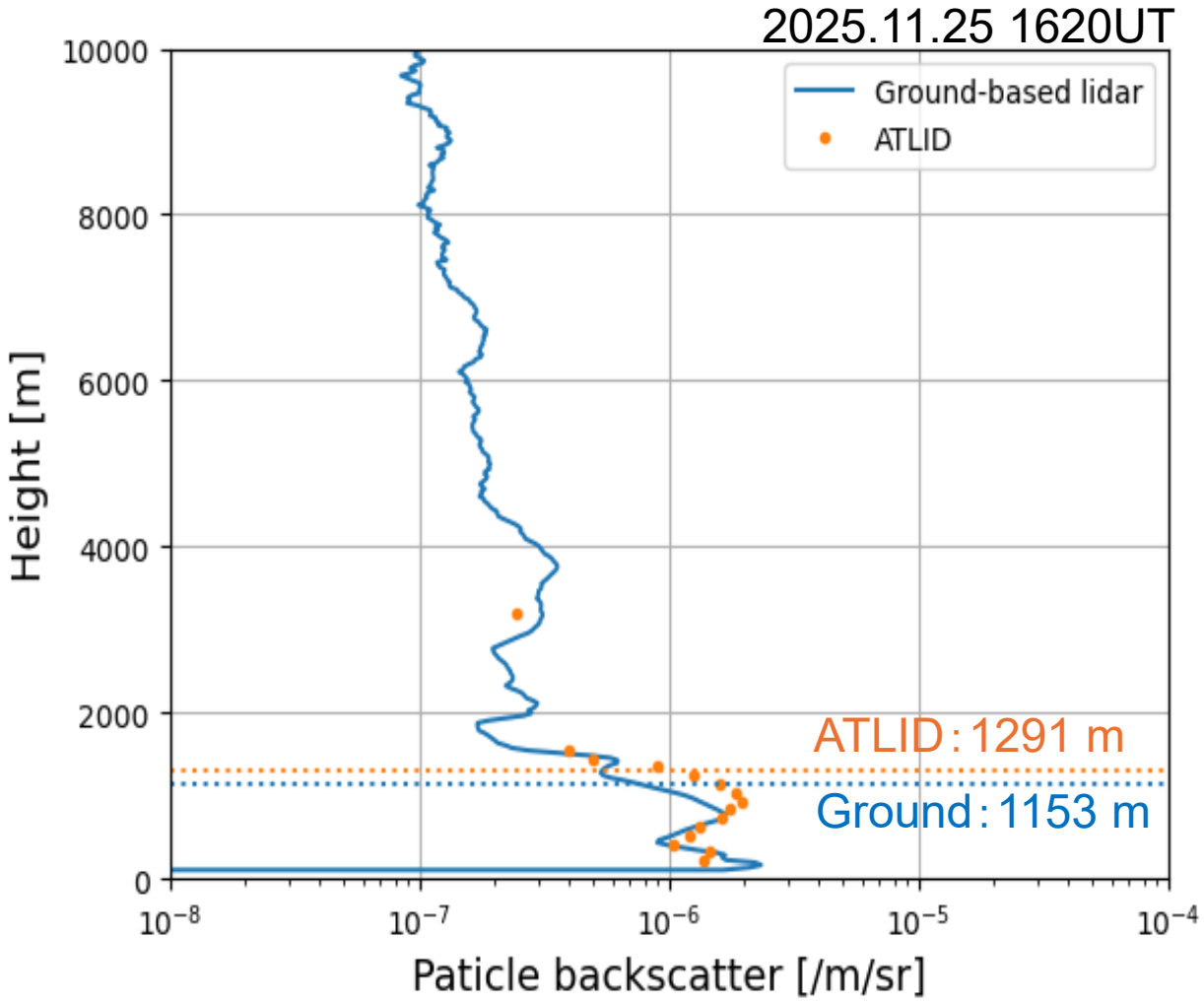


Validation of ATLID L2a PBL height

- Estimated errors are ~270 m（Target:±500m）
- Limited number of cases (N=4) where PBL height can be estimated by both ground-based and ATLID



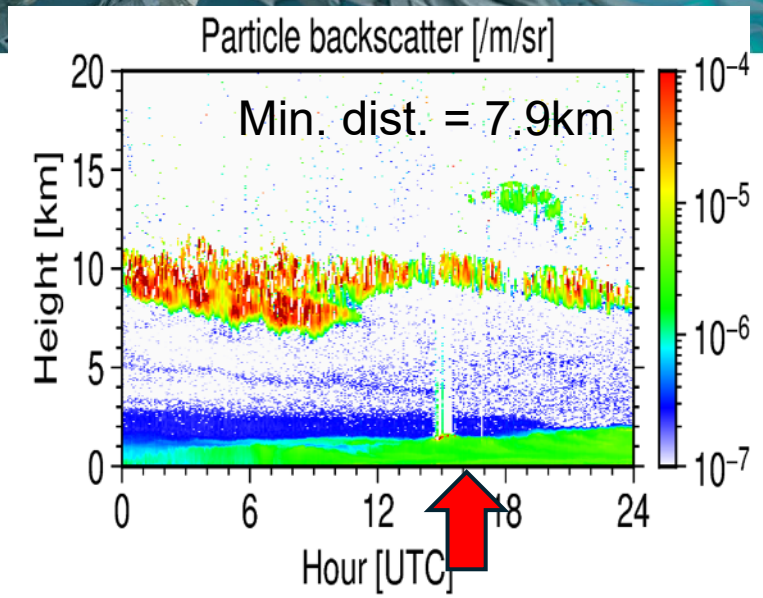


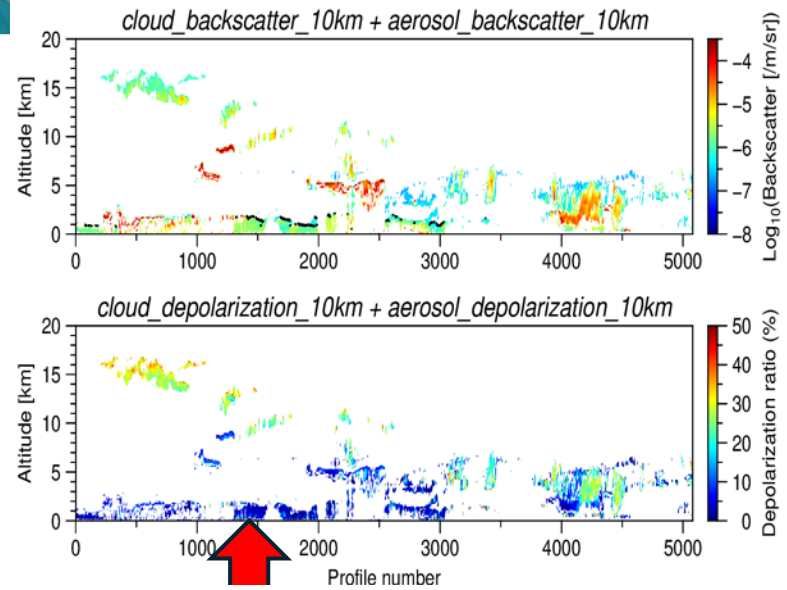


Comparison analysis for cloud case

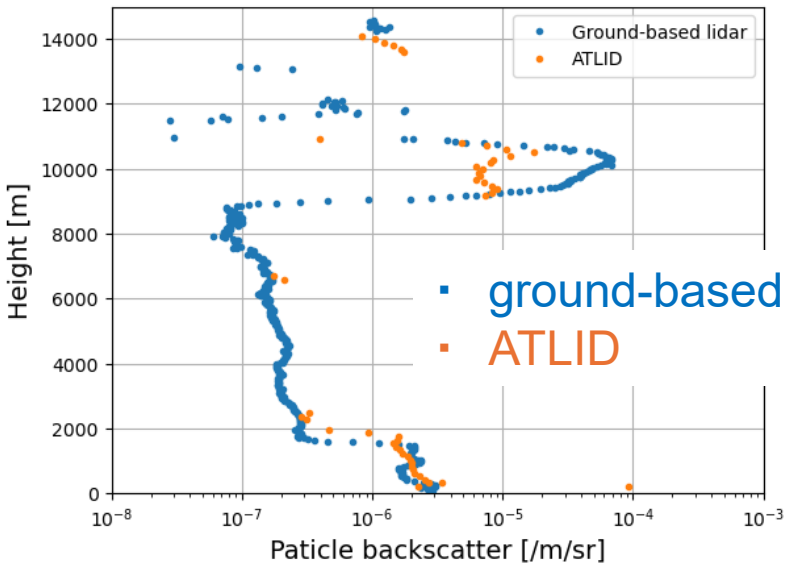
2025.10.31 1620UT

- Limited number of cases very close to ground-based lidar site
- Good agreement in cloud height



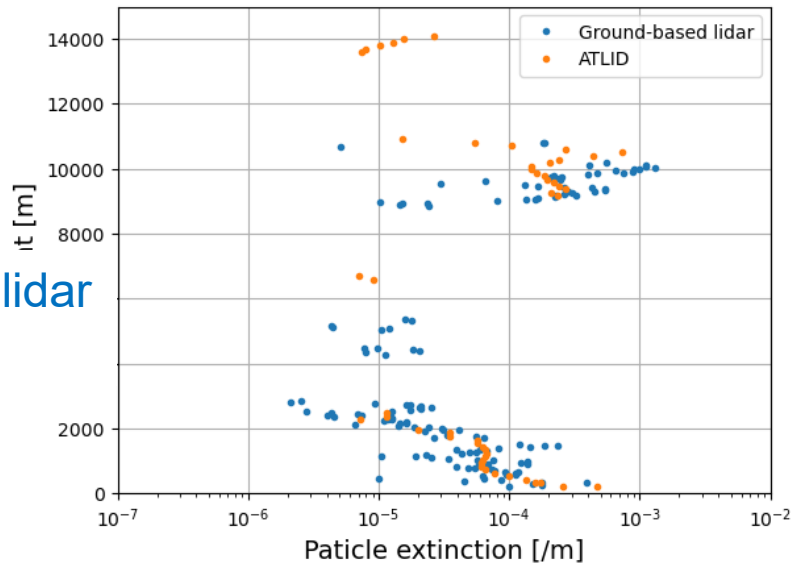


Particle backscatter [/m/sr]

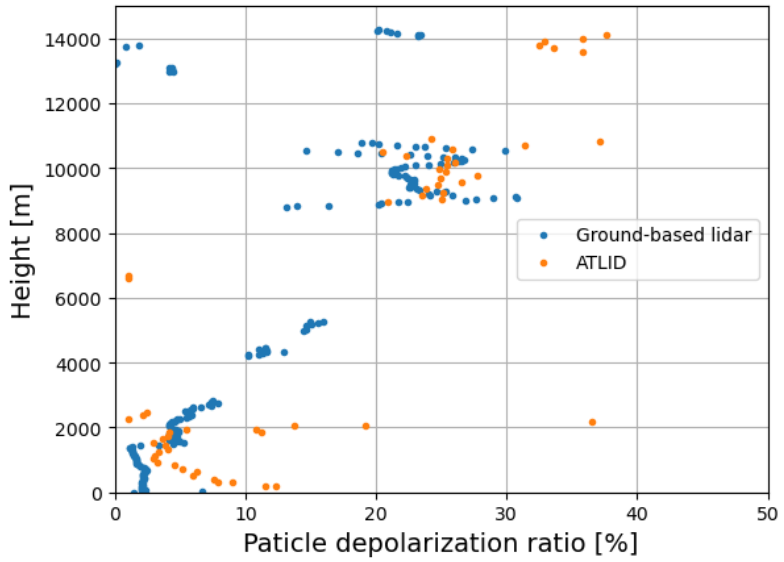


- ground-based lidar
- ATLID

Particle extinction [/m]



Particle dep. ratio [%]



Summary

- Validation of JAXA ATLID L2a products by direct comparison by ground-based HSRL/Raman lidars

	Feature mask	Aerosol backscatter	Aerosol extinction	Aerosol dep. ratio	Target mask	PBL height
Error	~20%	~33%	~31%	~57%	N/A	~270m

- Very good agreement with ground-based lidar observations even though mostly thin aerosol cases
- Expect scenes suitable for the validation of target mask, such as large-scale Asian dust (Asian dust season just started)