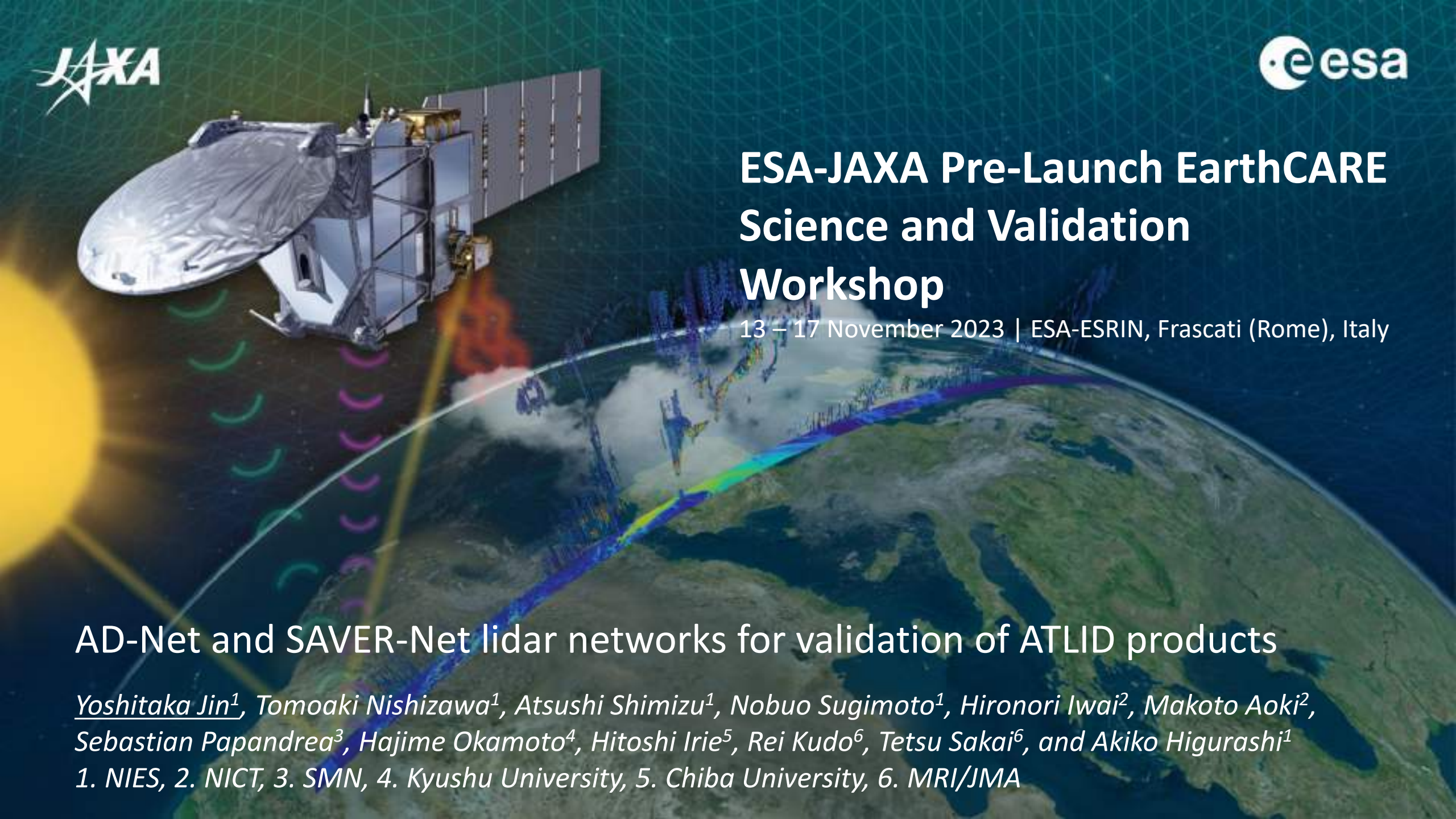

ESA-JAXA Pre-Launch EarthCARE Science and Validation Workshop

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

AD-Net and SAVER-Net lidar networks for validation of ATLID products

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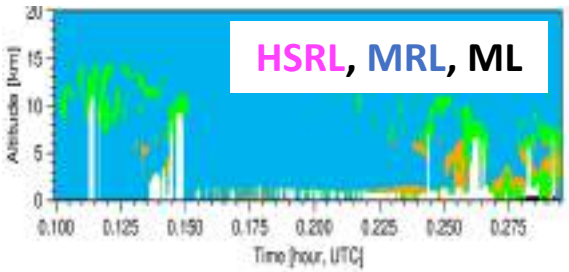
1. NIES, 2. NICT, 3. SMN, 4. Kyushu University, 5. Chiba University, 6. MRI/JMA

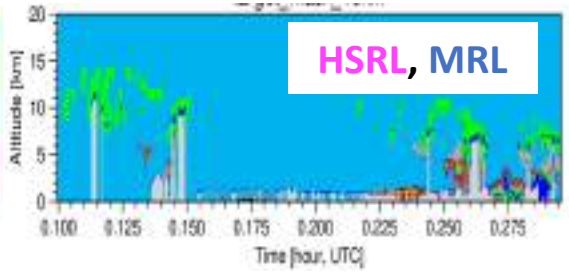
Objective: validation of JAXA ATLID L2a product

- Direct comparison using match-up ground-based lidar / photometer data (basic idea)
- Statistical analysis using CALIPSO and ADM-Aeolus will also be performed in the case of insufficient number of match-up data points
- JAXA ATLID research products are also the target of validation

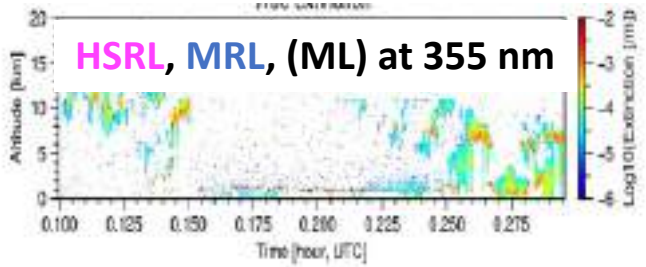
Feature mask



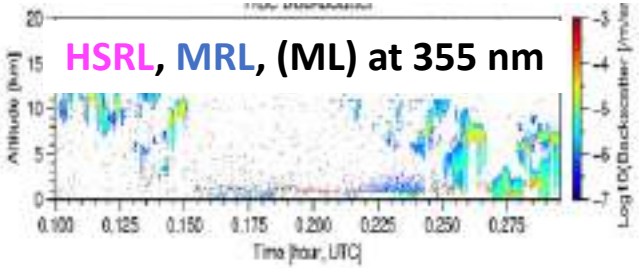
Target mask



Extinction

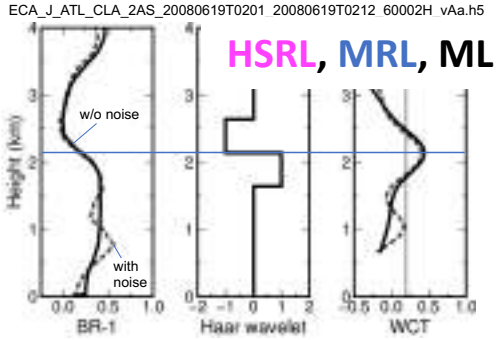


Backscatter

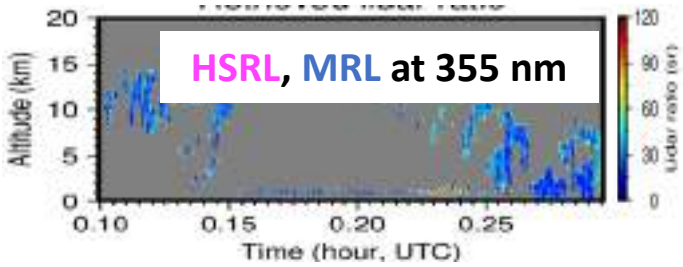


HSRL: high-spectral-resolution lidar
MRL: Mie/Raman lidar
ML: Mie-scattering lidar

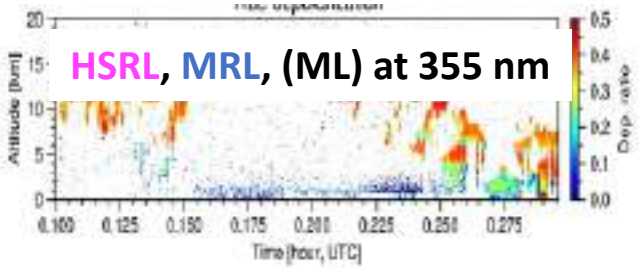
PBL height



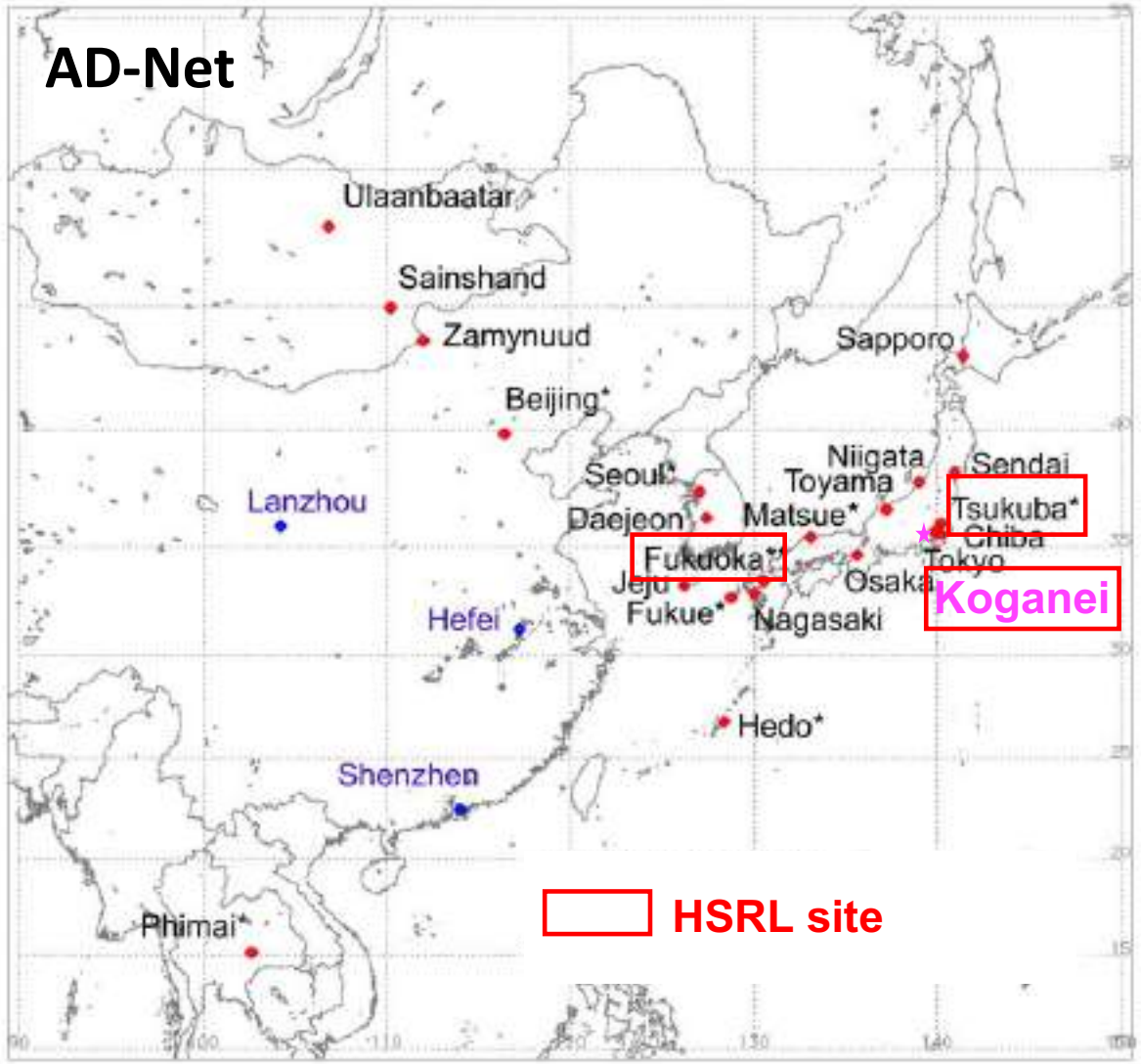
Lidar ratio



Dep. ratio



Validation facilities: AD-Net and Asian lidars



Mie-scattering lidar (ML)

Mie/Raman lidar (MRL)

JAMSTEC's research vessel "Mirai"

Obs. site	Lat Lon	Instrument	Parameter
Koganei (Urban)	35.7N 139.48E	**355 HSRL (2019~) 355MFMSPL 355DWL**	**α**, **β**, **δ**, **S**: 355 (Day & Night) Attenuated backscatter: 355 (Day & Night) Attenuated backscatter: 355 (Day & Night) (Multiple scatter) Vertical wind
Tsukuba (Rural)	36.05N 140.12E	**HSRL (NIES)**	**α**, **β**, **δ**, **S**: 355 (Day & Night) **α**, **β**, **δ**, **S**: 532 (Day & Night) Attenuated backscatter: 355/532/1064 (Day & Night)
		ML (MRI)	**β**, **δ**: 532 (Day & Night) Attenuated backscatter: 532 (Day & Night)
Fukuoka (Rural-Urban)	33.52N 130.48E	**MRL =>MRHSRL (2021~)**	**α**, **β**, **δ**, **S**: 355 (Night) **α**, **β**, **δ**, **S**: 532 (Day & Night) *2021~ Attenuated backscatter: (Day & Night)
Hedo (Maritime)	26.87N 128.25E	**MRL**	**α**, **β**, **δ**, **S**: 355/532 (Night) Attenuated backscatter: 355/532/1064 (Day & Night)
Toyama (Rural)	36.7N 137.1E	**MRL**	**α**, **β**, **δ**, **S**: 355/532 (Night) Attenuated backscatter: 355/532/1064 (Day & Night)
Palau (Maritime)	7.34N 134.5E	**MRL (2019~)**	**α**, **β**, **δ**, **S**: 355/532 (Night) Attenuated backscatter: 355/532/1064 (Day & Night)
RV Mirai (Maritime)	Ocean	**MRL**	**α**, **β**, **δ**, **S**: 355/532 (Night) Attenuated backscatter: 355/532/1064 (Day & Night)
11 stations in East Asia		**ML**	Attenuated backscatter: 532/1064 (Day & Night) Total depolarization ratio: 532 (Day & Night)

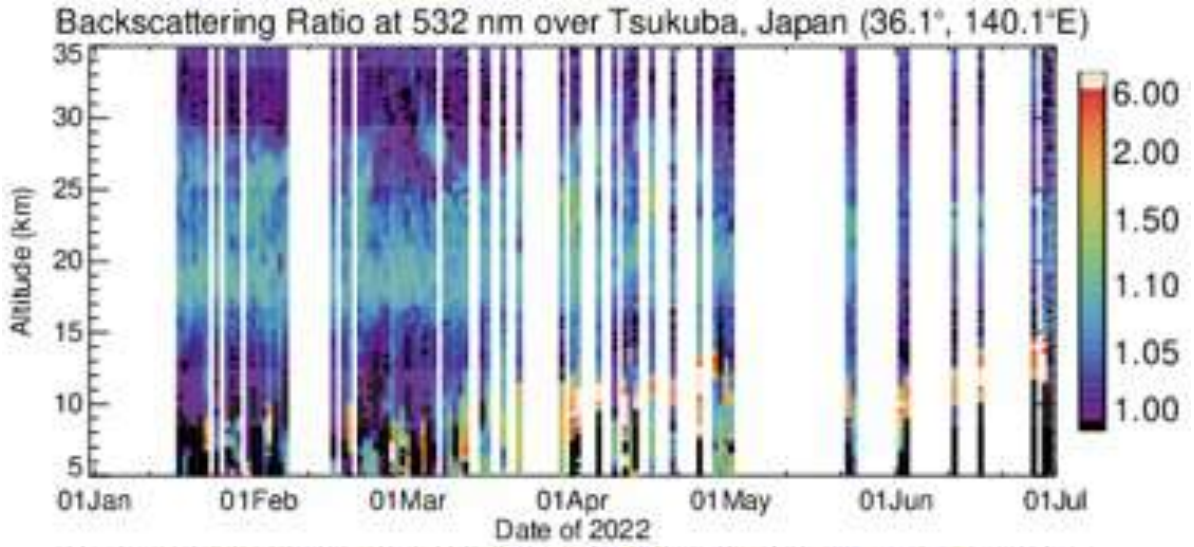
(24/7 measurement, Δt = 15 min., Δz = 30 m)

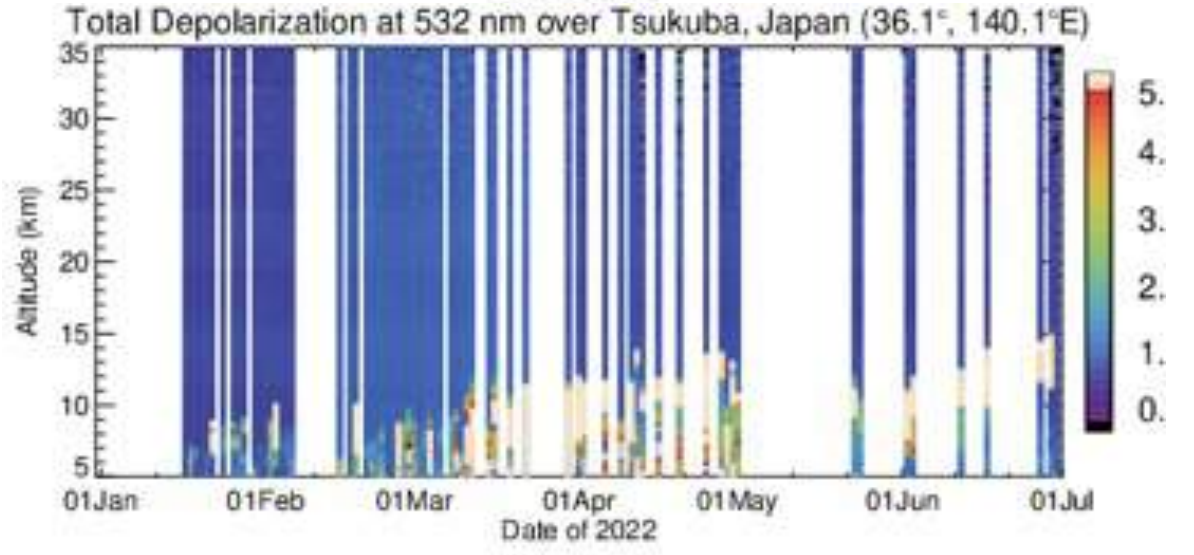
Validation facilities: MRI lidar

Observation products for validation:

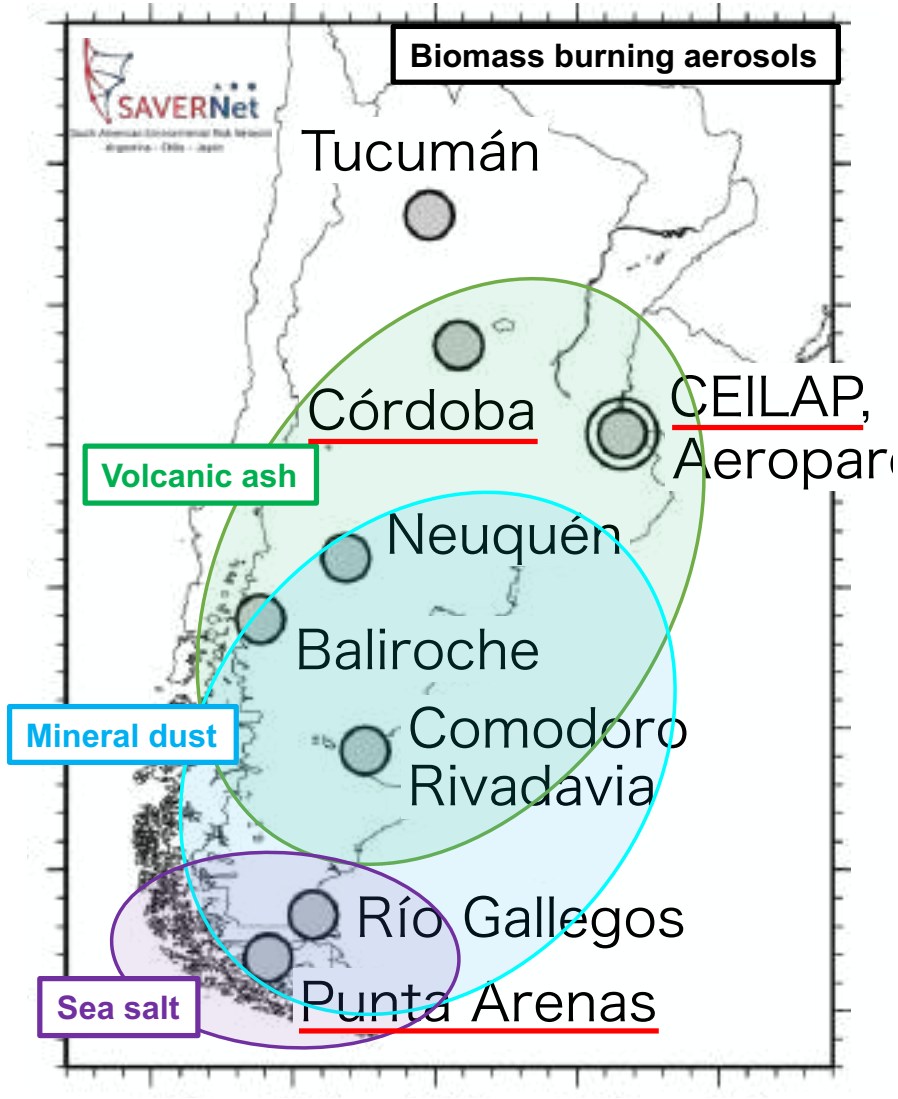
- BSR (**β**), **δ** at 532 nm between 0.1–35 km (night)
- Temporal resolution: ~3 hour / daily mean
- Vertical resolution: 150 m
- Measured uncertainty: <10% for BSR and **δ**

Useful for validation of stratospheric aerosol properties





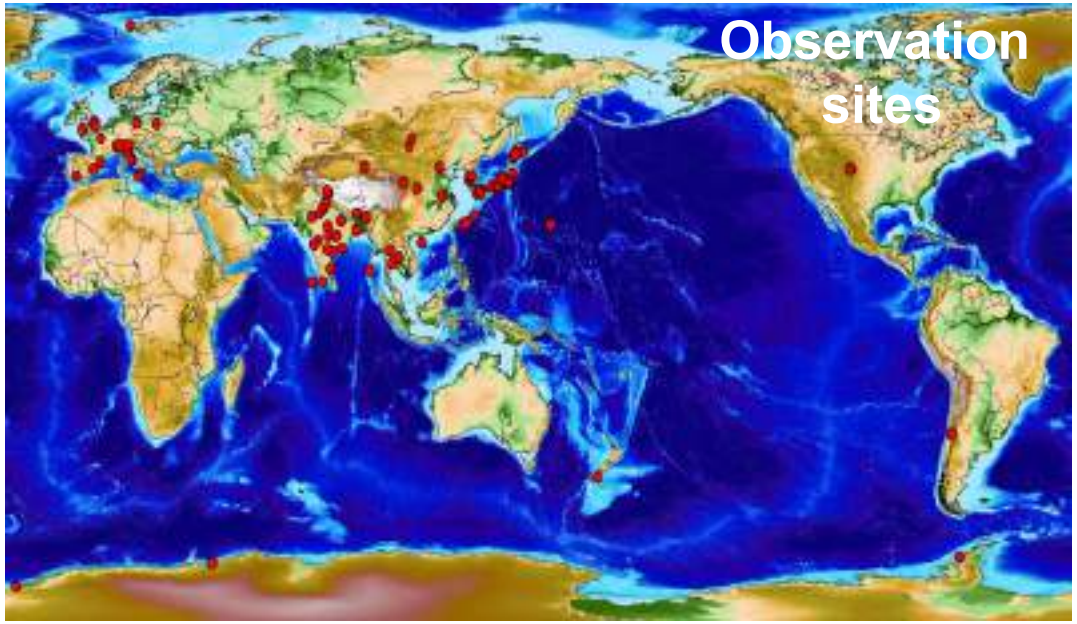
Validation facilities: SAVER-Net (Argentina and Chile)



Obs. site	Lat Lon	Instrument	Parameter
Tucuman	26.8S 65.2W	**ML**	Attenuated backscatter with Depolarization 532/1064 (Day & Night)
Aeroparque	34.6S 58.4W	**ML**	Attenuated backscatter with Depolarization 355/532/1064 (Day & Night)
Cordoba	31.7S 63.9W	**ML**	Attenuated backscatter with Depolarization 355/532/1064 (Day & Night)
Neuquen	39.0S 68.1W	**ML**	Attenuated backscatter with Depolarization 532/1064 (Day & Night)
Baliroche	41.1S 71.2W	**ML**	Attenuated backscatter 532/1064 (Day & Night)
Comodoro Rivadavia	45.8S 67.5W	**ML**	Attenuated backscatter with Depolarization 532/1064 (Day & Night)
Punda Arenas	34.6S 58.5W	**ML**	Attenuated backscatter with Depolarization 355/532/1064 (Day & Night)

SAVER-Net lidar network was developed in the framework of tri-national (Japan-Argentina-Chile) SATREPS project to monitor aerosols in southern south America such as volcanic ash, biomass burning aerosols, and dust

Validation facilities: SKYNET



Skyradiometer (by Prede co, Japan)

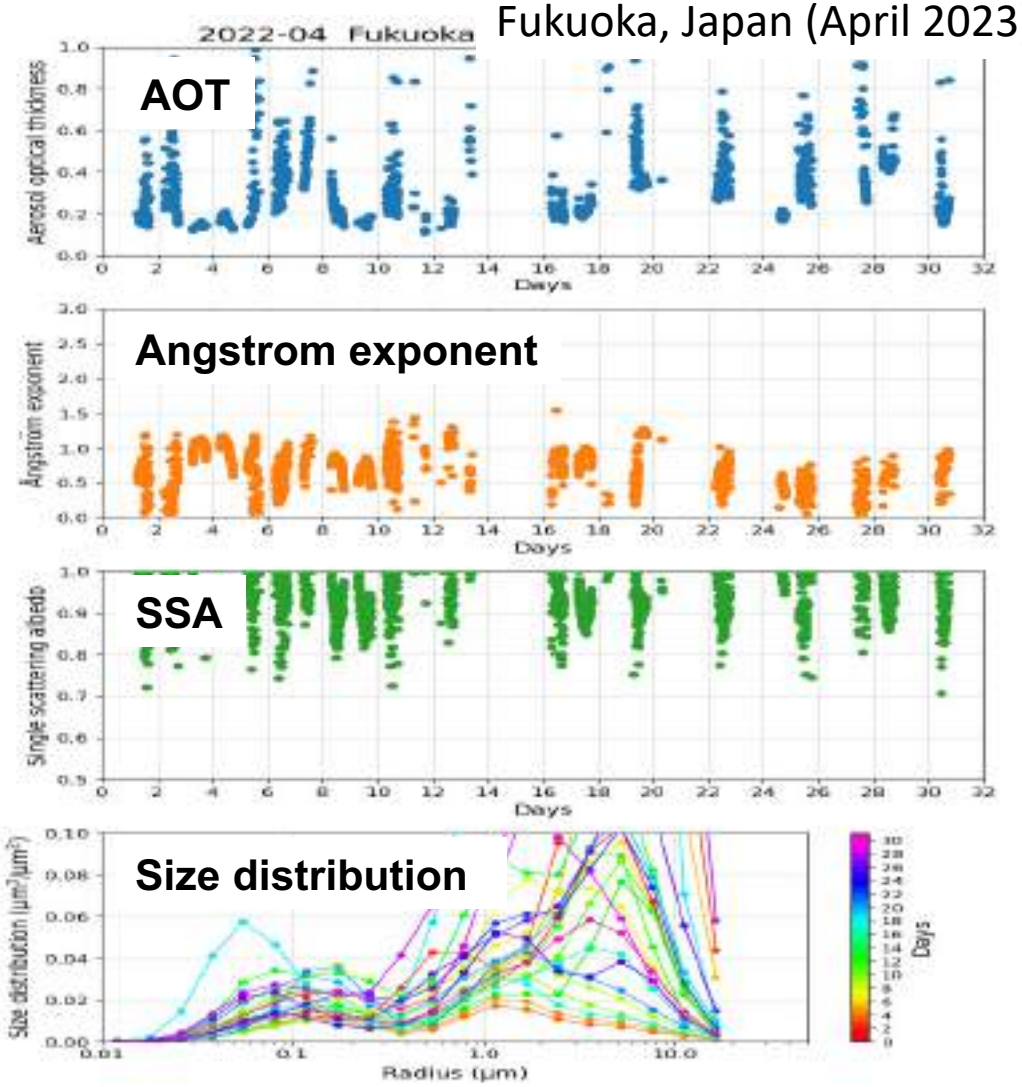
✓Sun-scanning sunphotometer

✓Measured wavelengths:
315, 340, 380, 400, 500, 675, 870, 940, 1020, 1627, 2200nm

✓Data recorded every 10~15min

✓Derived parameters:
AOT, Angstrom exponent, SSA, Size distribution, Refractive index

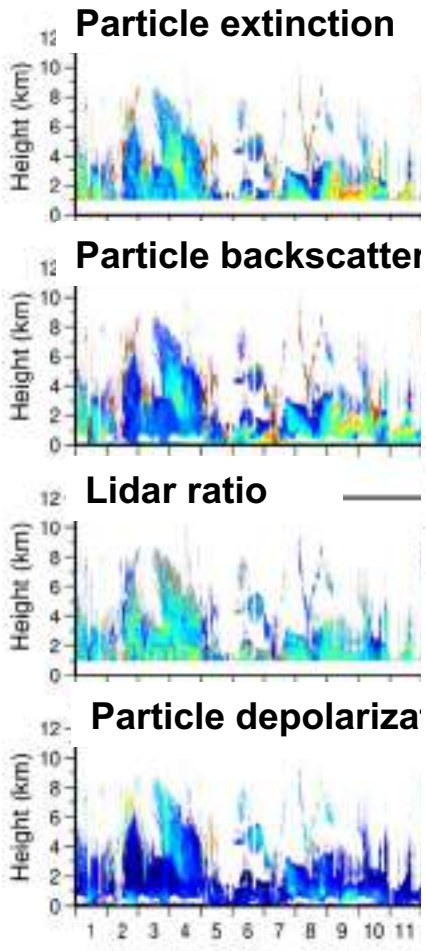
Fukuoka, Japan (April 2023)



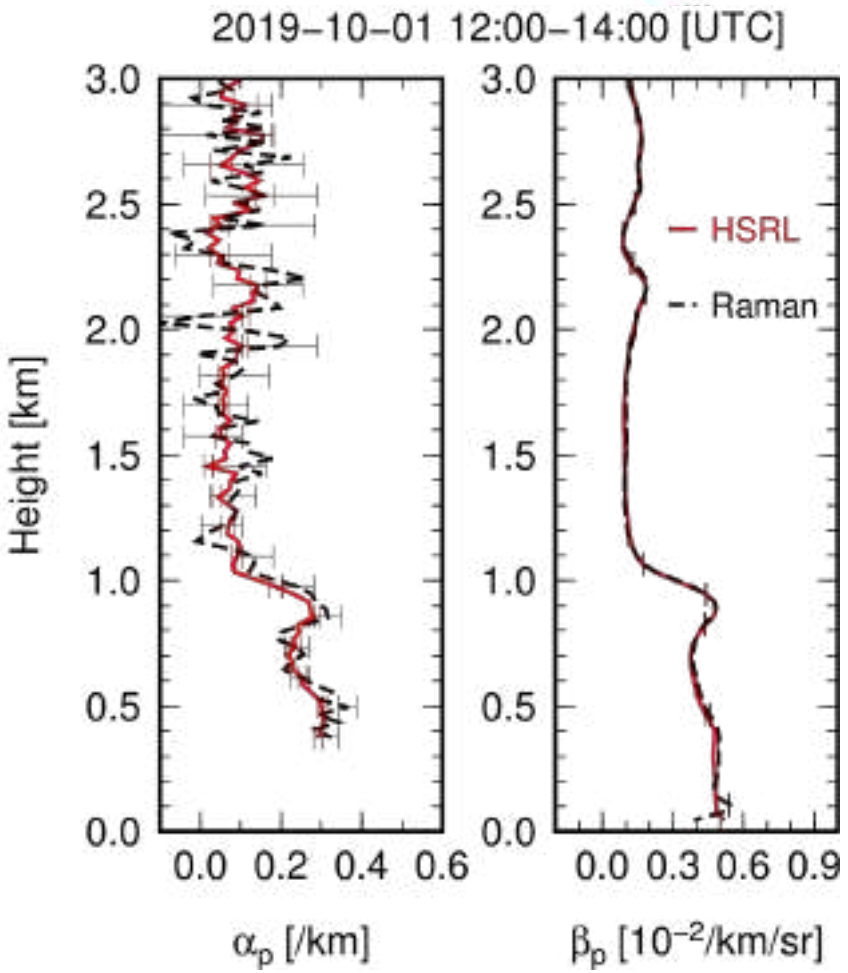
https://www.skynet-isdc.org/

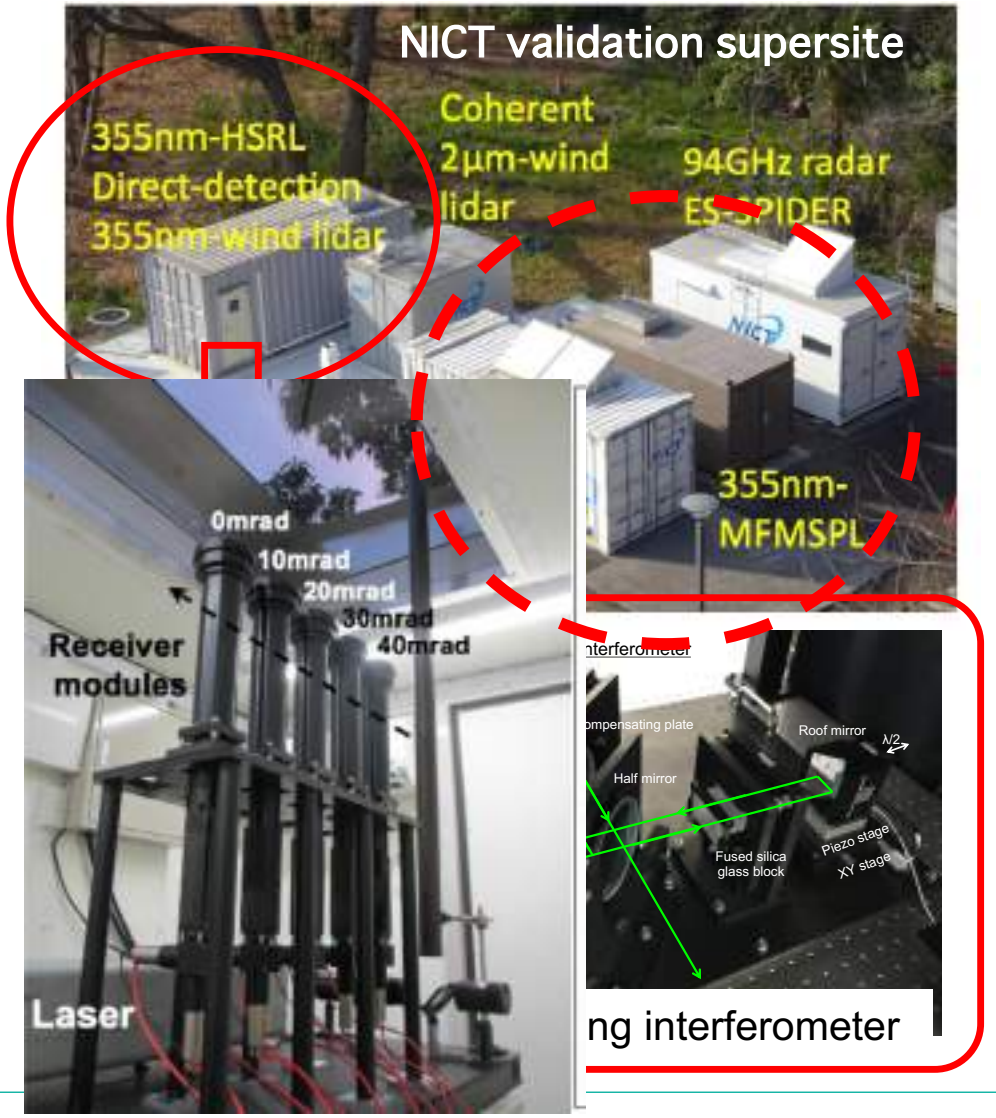
Ground-based HSRL: 355-nm HSRL at Koganei, NICT

Continuous observation of α, β, δ at 355 nm since Sept. 2019



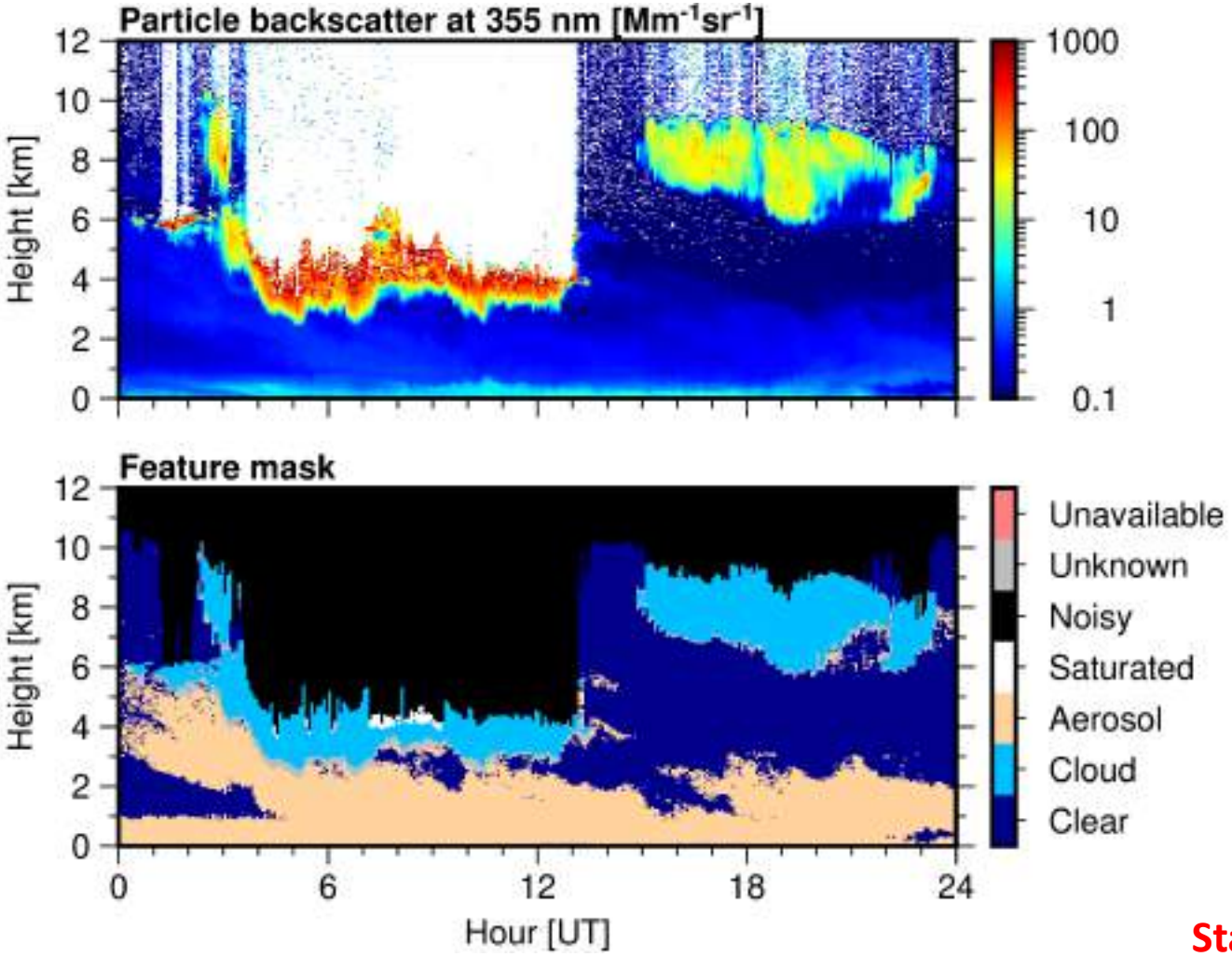
Jin et al., (2020)



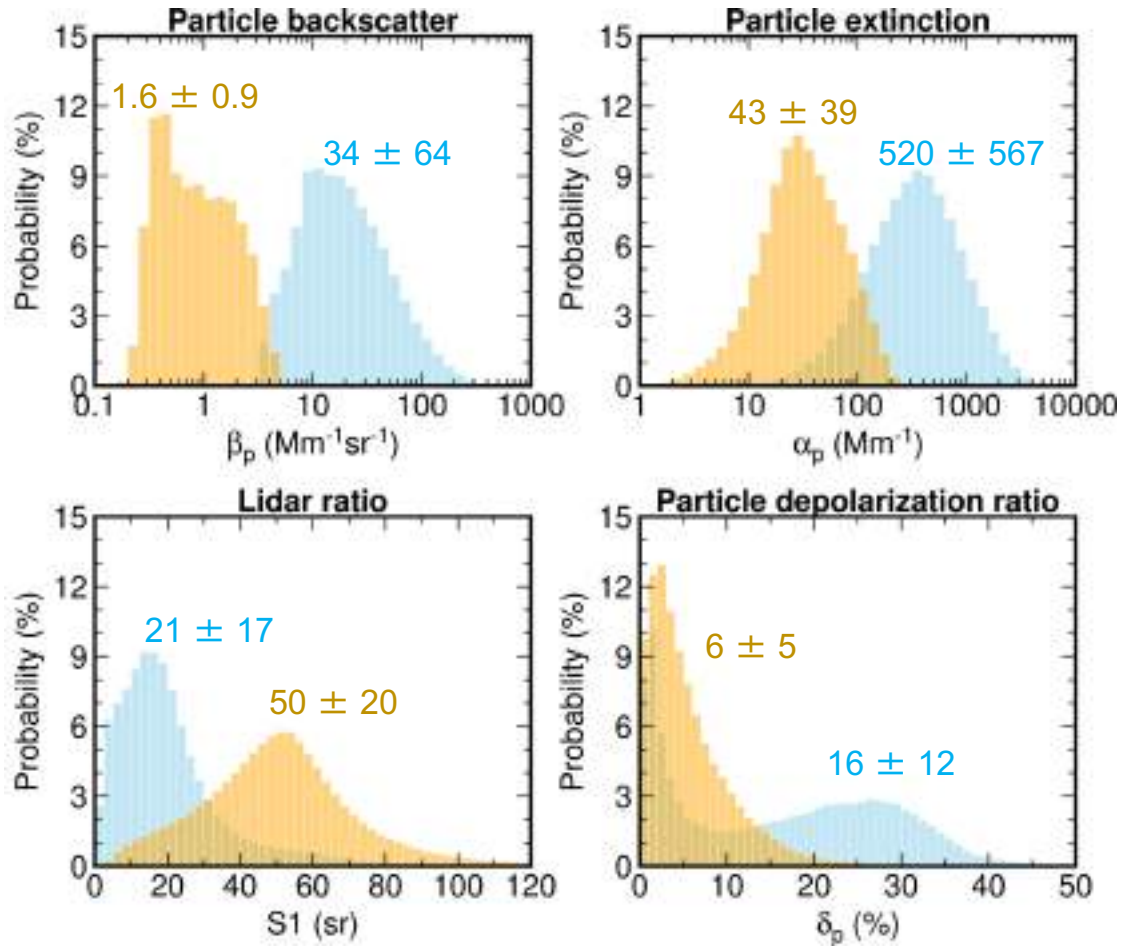


Ground-based HSRL: 355-nm HSRL at Koganei, NICT

2020.12.24



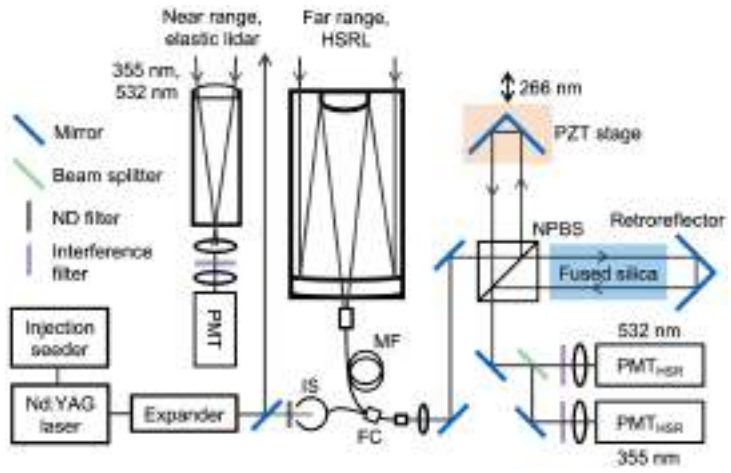
Analysis period: 2021/01 – 2021/12

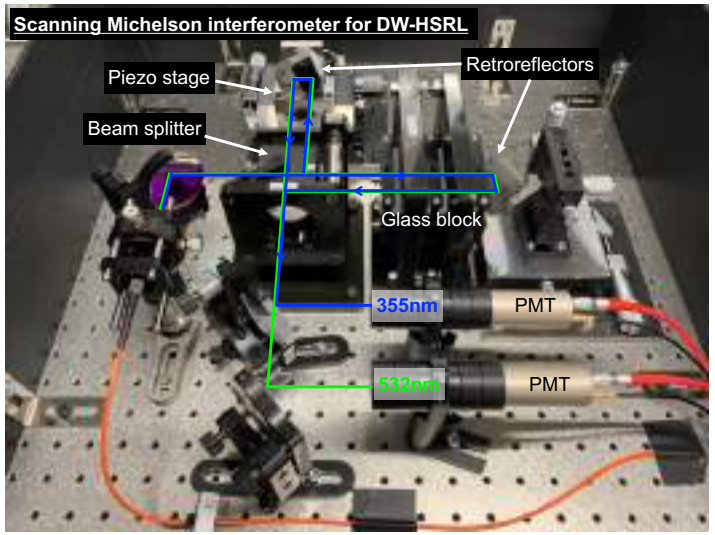


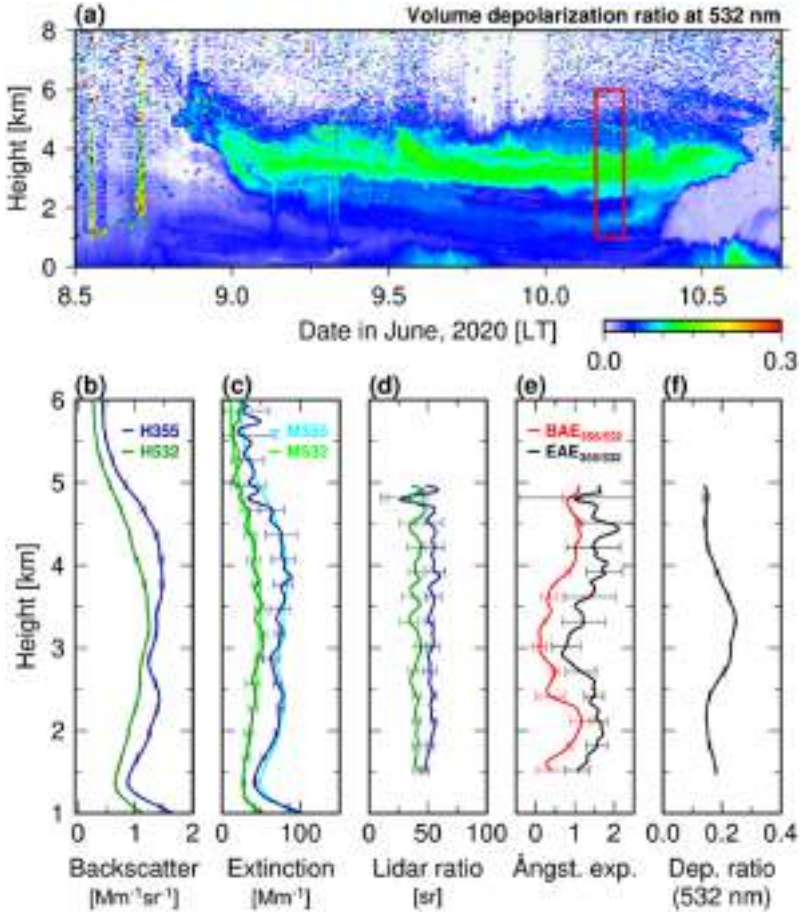
Statistical analysis of aerosol and cloud optical properties

Ground-based HSRL: DW-HSRL (Tsukuba) and 532-nm HSRL (Fukuoka)

【Dual-wavelength HSRL (355/532) at Tsukuba, NIES】

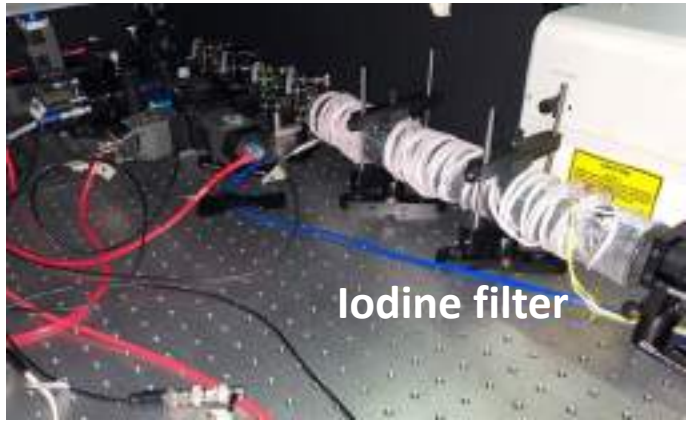


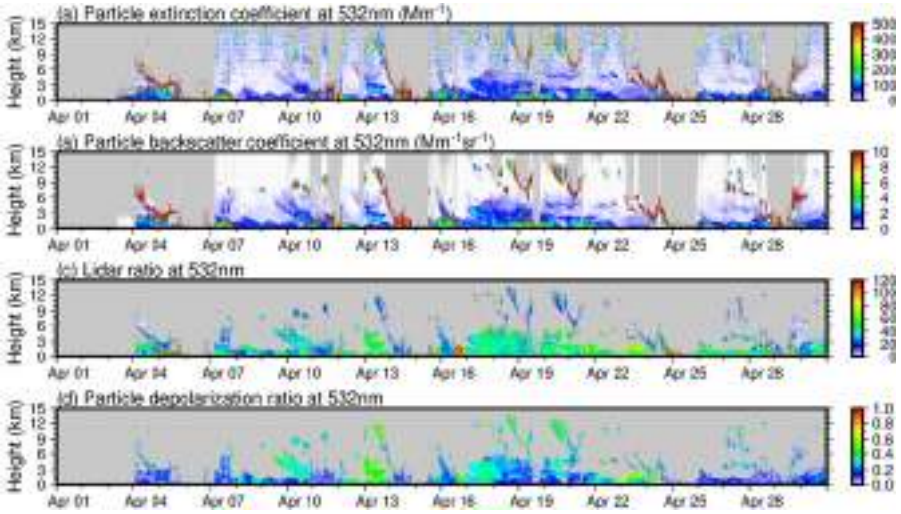




Jin et al., (2022)

【532-nm HSRL at Fukuoka, Kyushu University】





Capability of validation of ATLID α, β, and δ using ground-based HSRL data

Summary

- JAXA ATLID L2a products are validated by direct comparison with match-up ground-based lidar / photometer data
- AD-Net, MRI lidar, Shipborne lidar, SAVER-Net, and SKYNET data are used for the validation
- HSRLs are developed at three sites (Koganei, Tsukuba, and Fukuoka) and will provide measurement of α, β, δ, and S1 during day and night
- Improvement of the validation instrument (HSRL) is ongoing and continuous measurement will be made during the EarthCARE mission

Thank you for your attention!