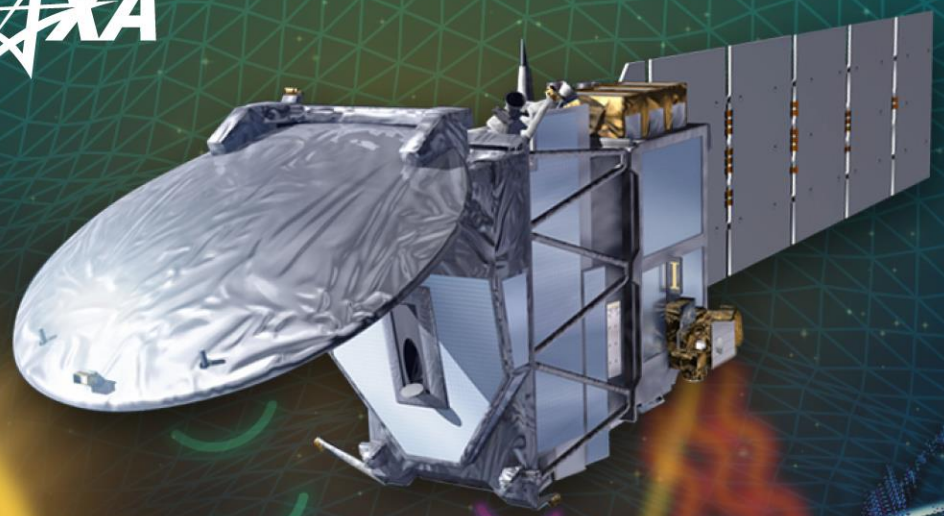


ESA-JAXA Pre-Launch EarthCARE Science and Validation Workshop

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

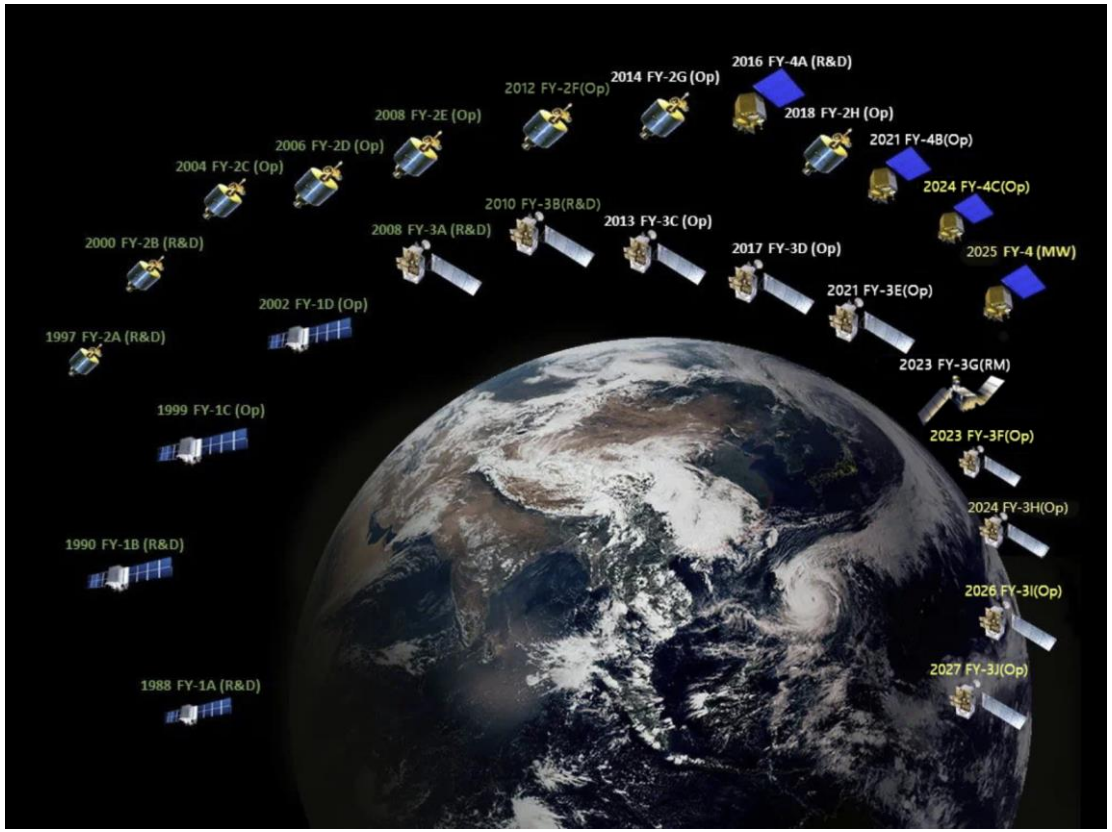
Preparation for the validation of EarthCARE Product in China

*Xiuqing Hu, **Xuan Wang**, Detlef Müller,*
Jian Shang, Lin Chen, Qiong Wu, Zhenping Yin, Fa Tao, Yubao Chen,
Yiming Zhao, Jing Li ,Fei Li , Chang Guo

[1] *National Satellite Meteorological Center, **China Meteorological Administration (CMA)***
[2] ***Wuhan University***
[3] *Meteorological Observation Center, China Meteorological Administration (CMA)*

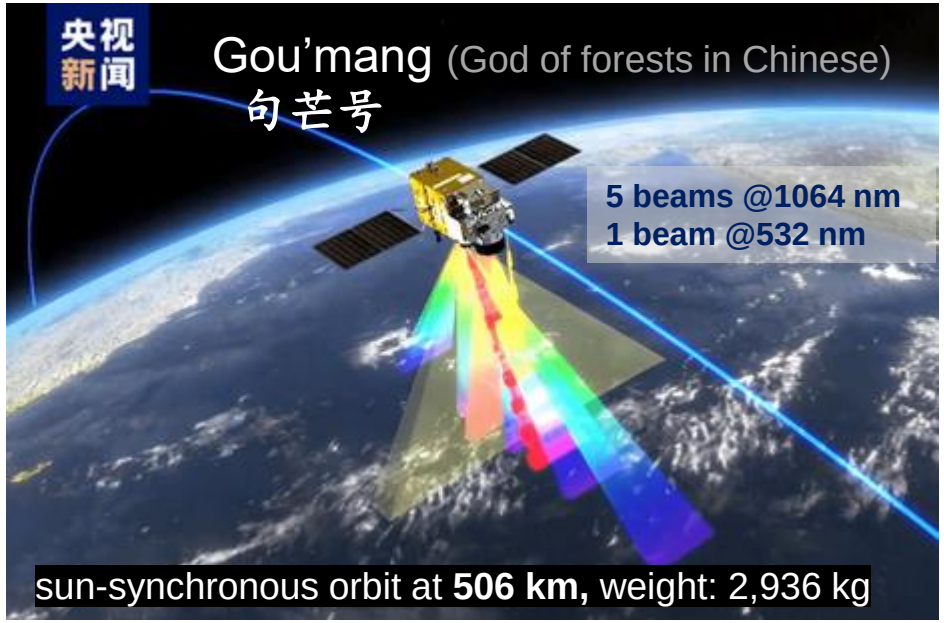
National Satellite Meteorological Center - CMA

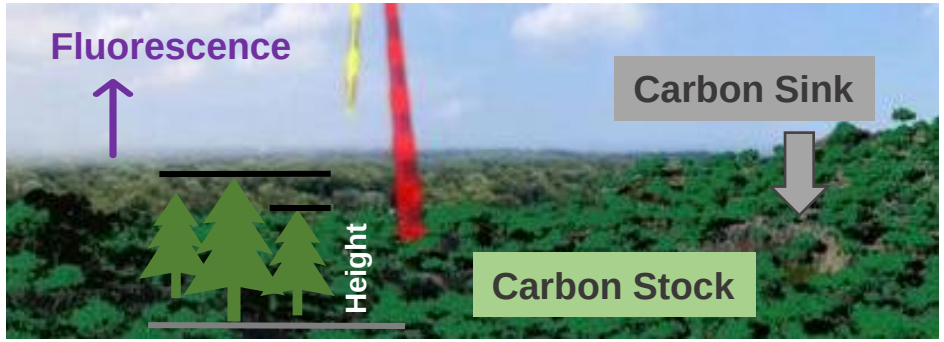
FengYun Series Satellite



CAL/VAL for Chinese Meteorological Satellites

Chinese Terrestrial Ecological Carbon Satellite

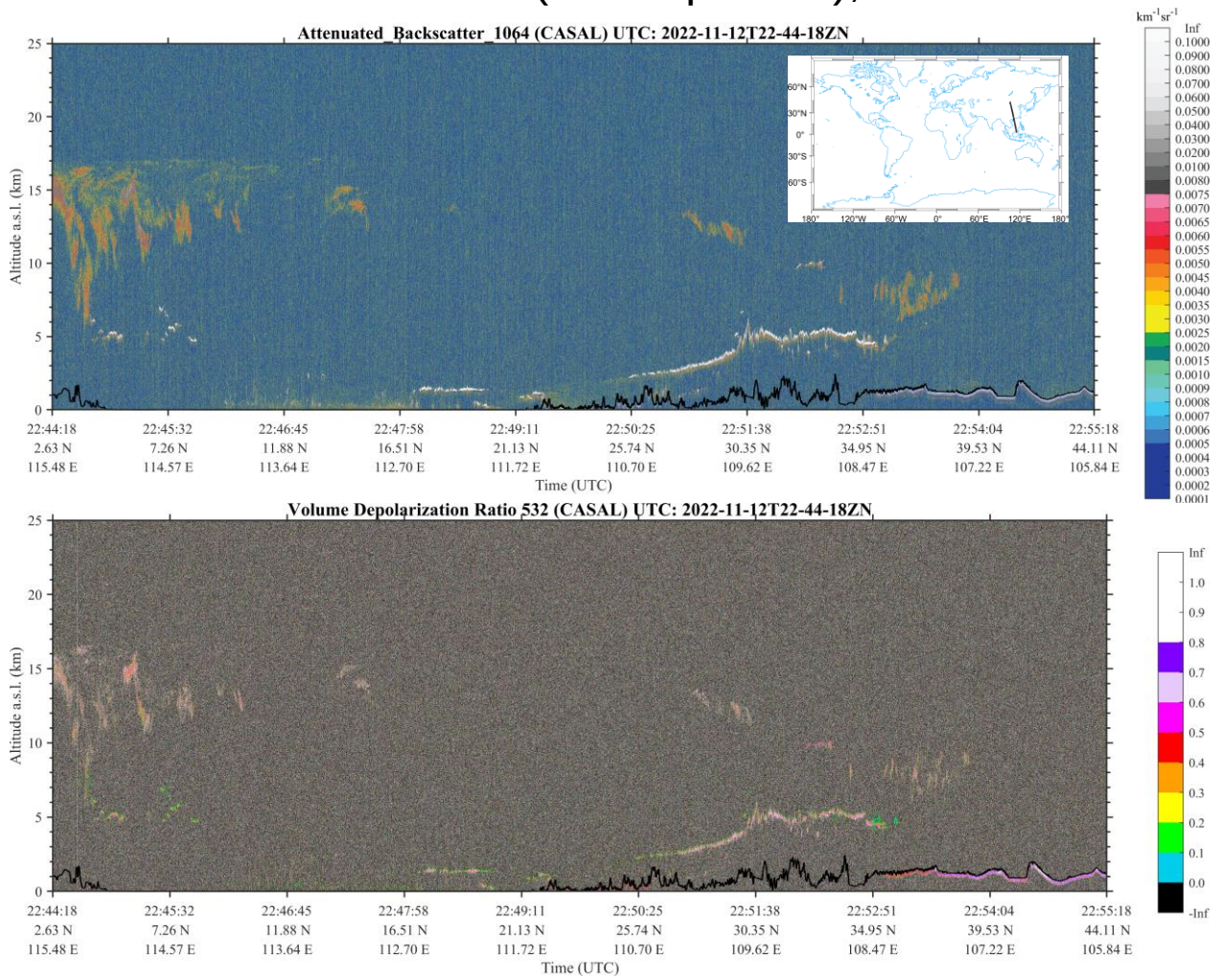




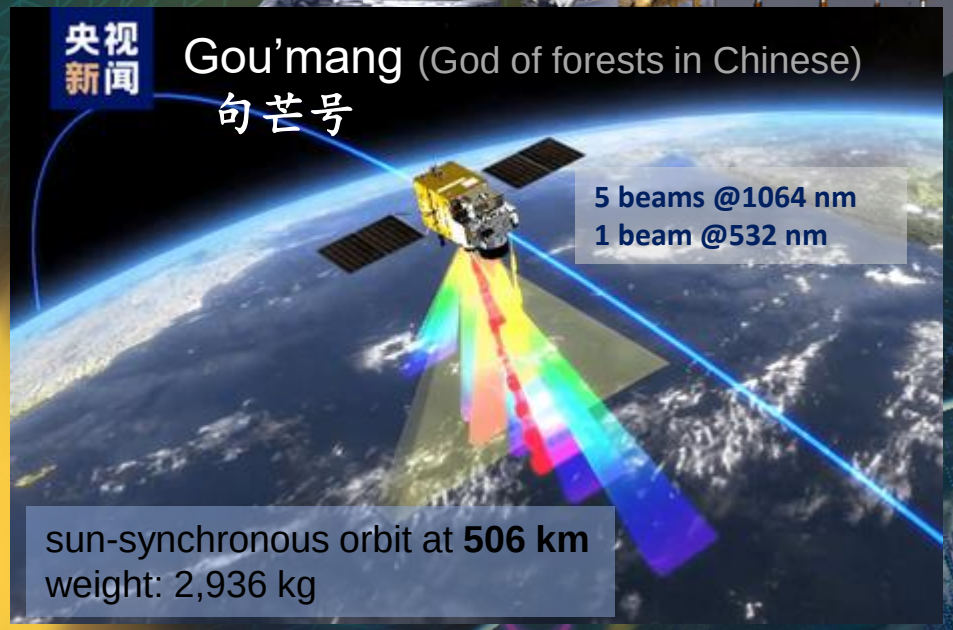
Forest + Aerosol + Cloud Remote Sensing

Launched on **4th Aug, 2022**

Lidar channels: 532 nm (cross+parallel), 1064nm nm



Chinese Terrestrial Ecological Carbon Satellite



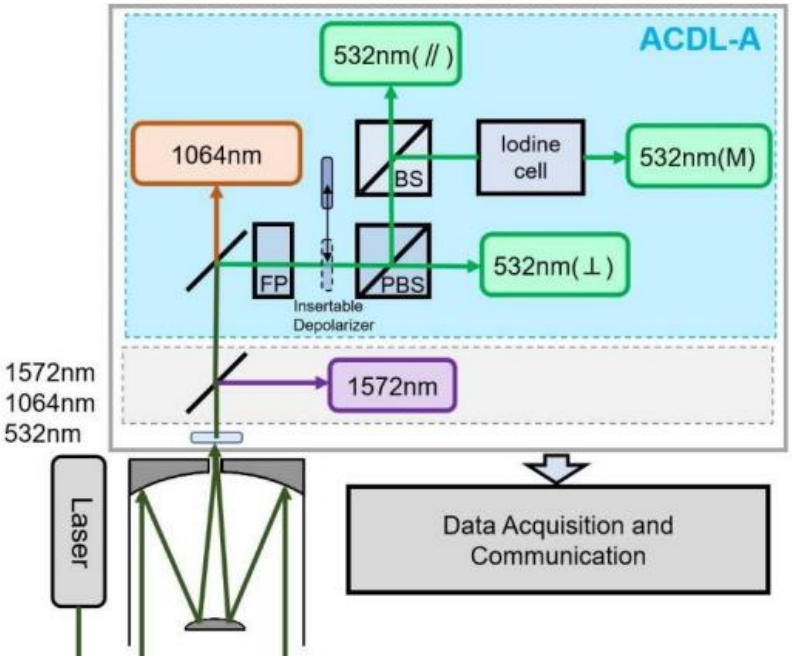
Forest + Aerosol + Cloud Remote Sensing

Launched on **4th Aug, 2022**

Payload	Key Parameters
Multi-beam lidar	➢ **5 beams** for forestry remote sensing ➢ **1 beam** for **atmospheric remote sensing** ➢ channels: 532 nm (cross+parallel), 1064 nm ➢ Foot print: 40~60 μrad (20~30 m) ➢ Laser Divergence: ≤ 200 μrad ➢ Distance of Laser Beam: 3~4 km
Multi-angle Imaging Spectro-Radiometer	Angles: 0°, ±19°, ±41° Swath Width: ≥ 20km
High Spectral Resolution Imager	➢ Spectral Range: 670 nm ~ 780 nm ➢ Spectral Resolution: ≤ 0.3 nm ➢ Pixel Resolution: 1-2 km (on ground)
Multi-angle Polarization Imager	9 angles Polarimetry at 490 nm, 670 nm and 865 nm

Aerosol and Cloud Detection Lidar (ACDL) onboard DQ-1 Satellite

Launched on **16th April, 2022**



Adapted from Fig.1 in Dai et al. 2023

sun-synchronous orbit at **705 km**

Payloads
Aerosol and Carbon Detection Lidar (ACDL)
Particulate Observing Scanning Polarimeter (POSP)
Directional Polarization Camera (DPC)
Environmental trace gas Monitoring Instrument (EMI)
Wide Swath Imaging system (WSI)

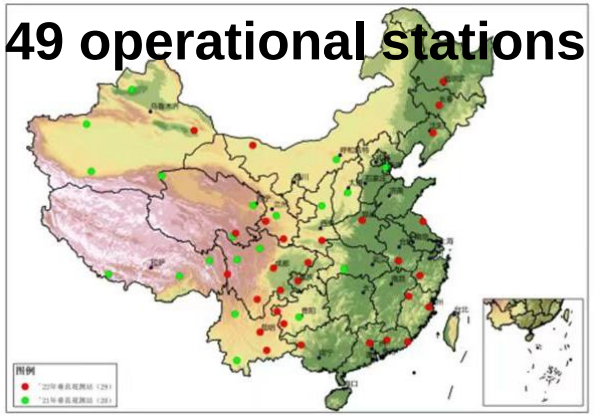
ACDL	Key Parameters
Transmiter	➢ ≥150 mJ@532 nm; ≥110mJ @1064 nm; ≥75 mJ@1572 nm ➢ 20Hz @1572 (On/Off double pulse); 40Hz @532 nm & 1064 nm ➢ Spectral Width: 0.3 MHz @1572 nm within 10,000 s; 1 MHz @1064 nm within 10,000 s
Receiver	Telescope: 1000 mm Channels: 532 nm parallel; 532 nm cross; 532 nm HSRL; 1064 nm Elastic; 1572 nm CO2
Resolution	337.5 m in horizontal; 30 m in vertical

Meteorological Observation Center - CMA

National Ground-based Meteorological Observation Network

Ground-based Profiling Network

49 operational stations



Integrated QA/QC and Processing Platform

"Tianheng Tianyan" (天衡天衍)

Near real-time processing

Lidar: 355, 532, 1064nm, Output: 3 backscatter +2 Raman + 2 depolarizations + Water Vapor

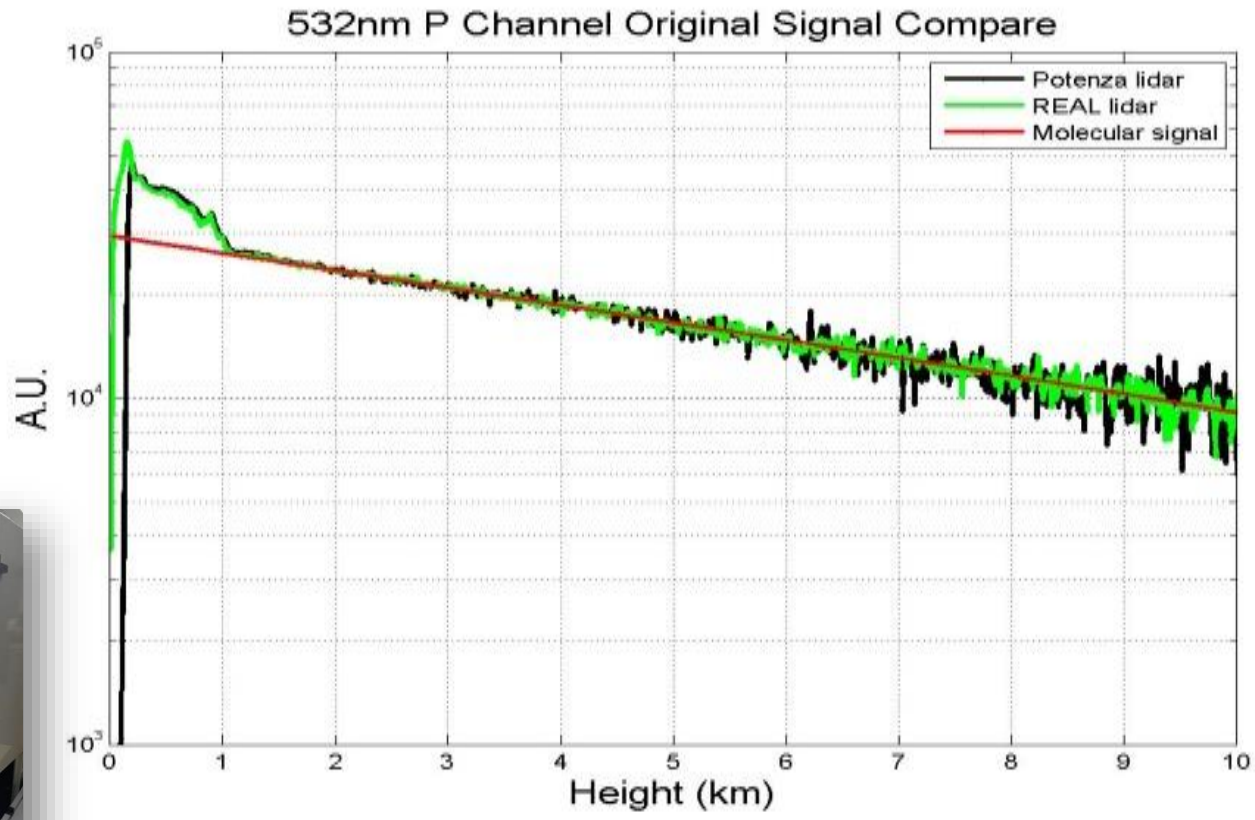
Meteorological Observation Center - CMA

CMA Atmospheric Lidar Calibration Center

REAL-IR REAL-UV

Nanjiao, Beijing

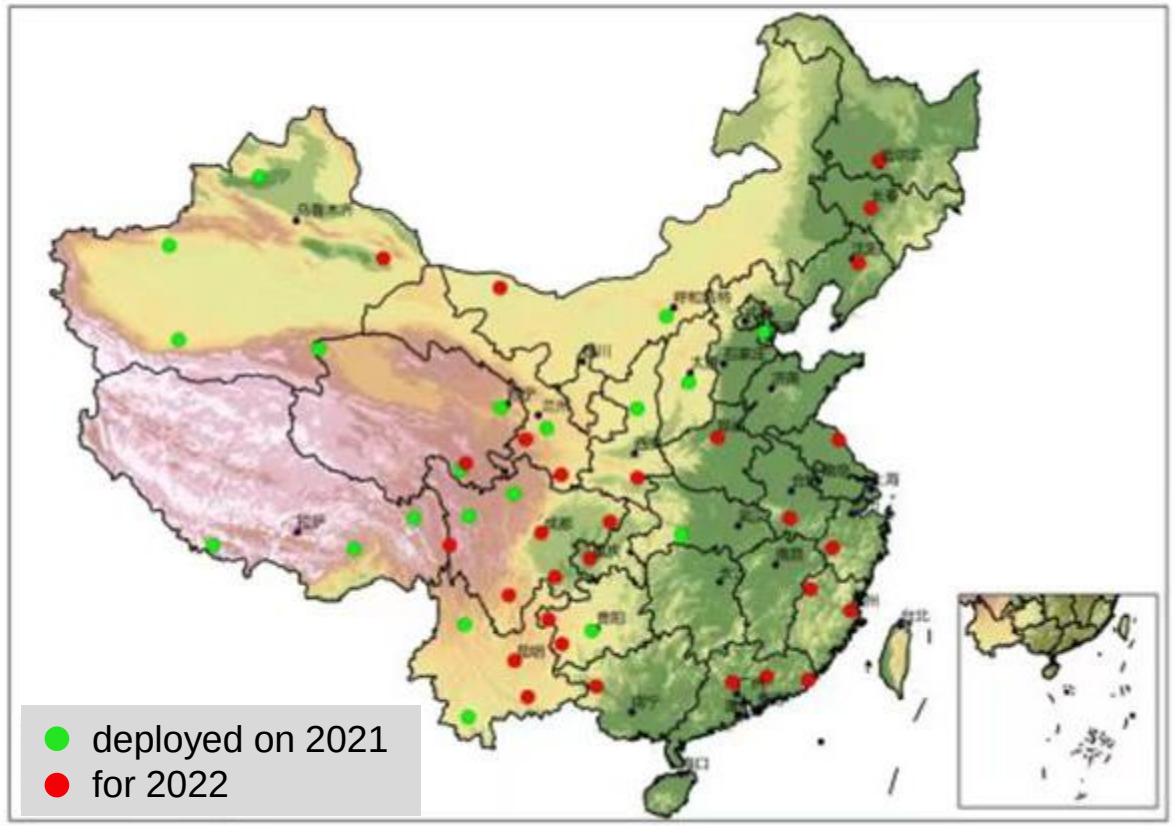
REference **A**erosol **L**idar @532 nm (**REAL-VIS**)



All lidars were calibrated before deployment to ensure traceability

CMA Atmospheric Lidar Network for CAL/VAL

Atmospheric Vertical Profiling Network



With routinely collocated radiosonde launching

Multiwavelength polarization Raman lidar (24/7)

3β+ 2α +2δ+1WV

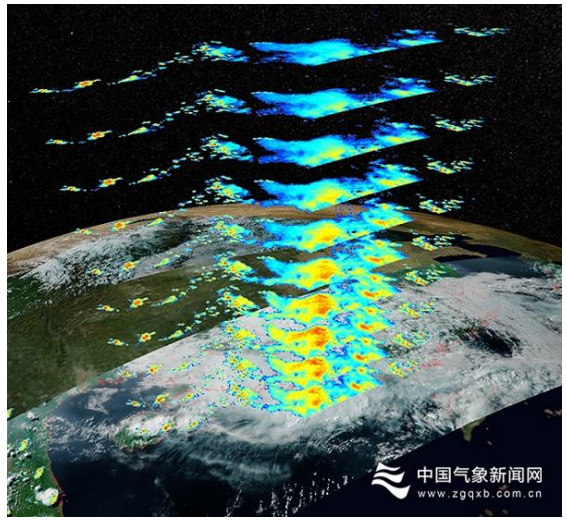
355 nm cross + parallel
532 nm cross + parallel
387 nm, 407 nm and 607 nm Raman channels
1064 nm elastic

Products for EarthCARE CAL/VAL in China

From space view 24/7

- Attenuated backscatter @532 + 1064 nm
- Volume depolarization ratio @532nm
- 3D Precipitation from FengYun-3G
- Cloud Top Height/Cloud Phase/Cloud Type

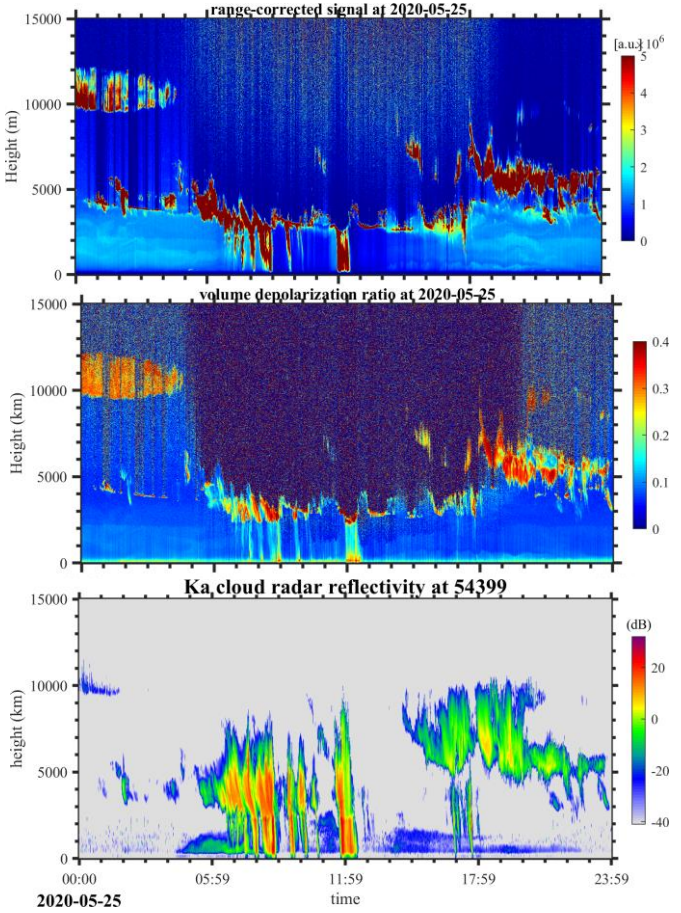
Precipitation from FengYun-3G



From ground view 24/7

- Backscatter @355+532+1064 nm
- Extinction @355+532nm
- Volume depolarization ratio @355+532 nm
- Cloud Base/Top Height (lidar+radar)
- Cloud Phase
- Mean Doppler Velocity/Doppler Spectral Width
- Liquid Water Path
- Precipitation

Precipitation from Ground-based Obs.



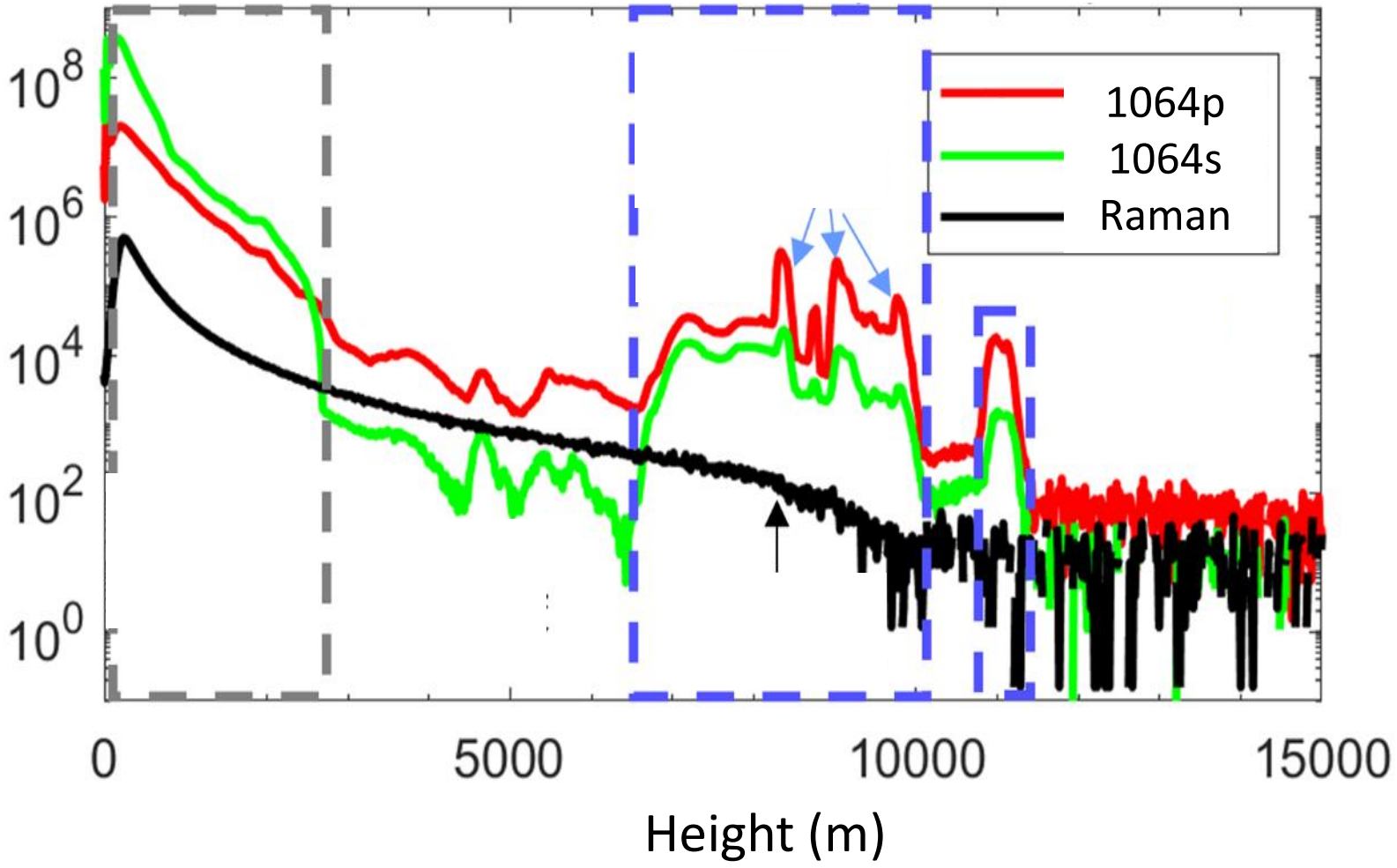
Laser remote sensing group in **Wuhan University**

Team

- Prof. Xuan WANG, Prof. Detlef Müller
- 4 post-doc
- 4 engineer
- 8 PhD students, …

Facility

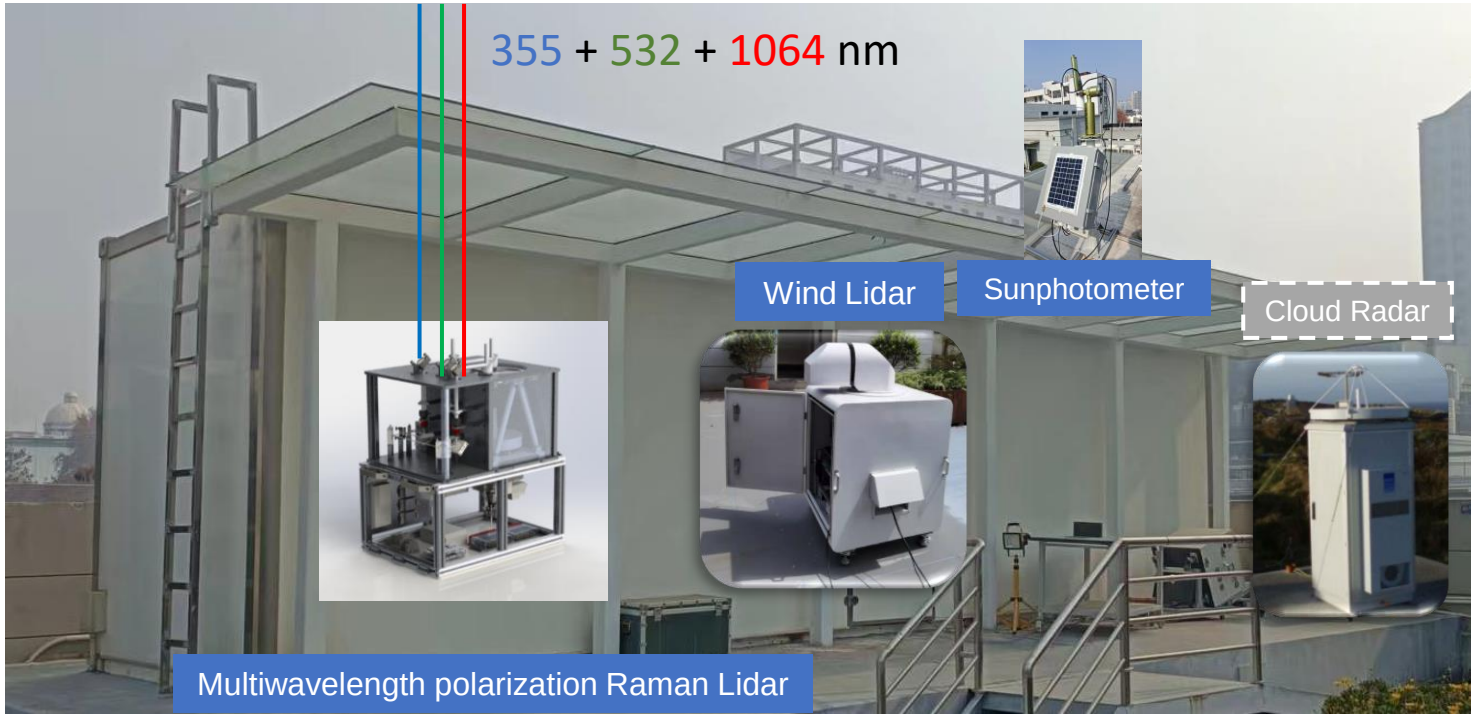
- **12 channel aerosol, temperature lidar**
- Doppler wind lidar
- Sun photometer
- Ka cloud radar
- Ceilometer
- ……



Lidar: 355, 532, 1064nm, 3 backscatter +3 Extinction + 3 depolarizations + Temperature + WV

Atmospheric Remote Sensing Observatory in Wuhan University

Mobile Atmospheric Observatory



Multiwavelength polarization Raman Lidar

355 High J + 355 Low J	**Temperature Profiling**
407	**Humidity Profiling**
386 + 607 + 1055	**3 extinction**
355 P + 355 S	**3 backscatter**
532 P + 532 S (NFOV)	**3 particle depol.**
1064 P + 1064 S	

Wind Lidar

1550 nm — **Wind Velocity & Wind Direction**

Sunphotometer

Cloud Radar 35 GHz Polarimetric Cloud Radar

will be ready next year