



An updated MSI cloud type (M-Ctype) product based on reprocessed EarthCARE observations

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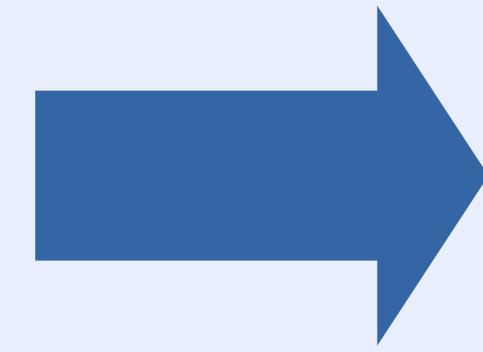
Introduction

Multispectral Imager (MSI)

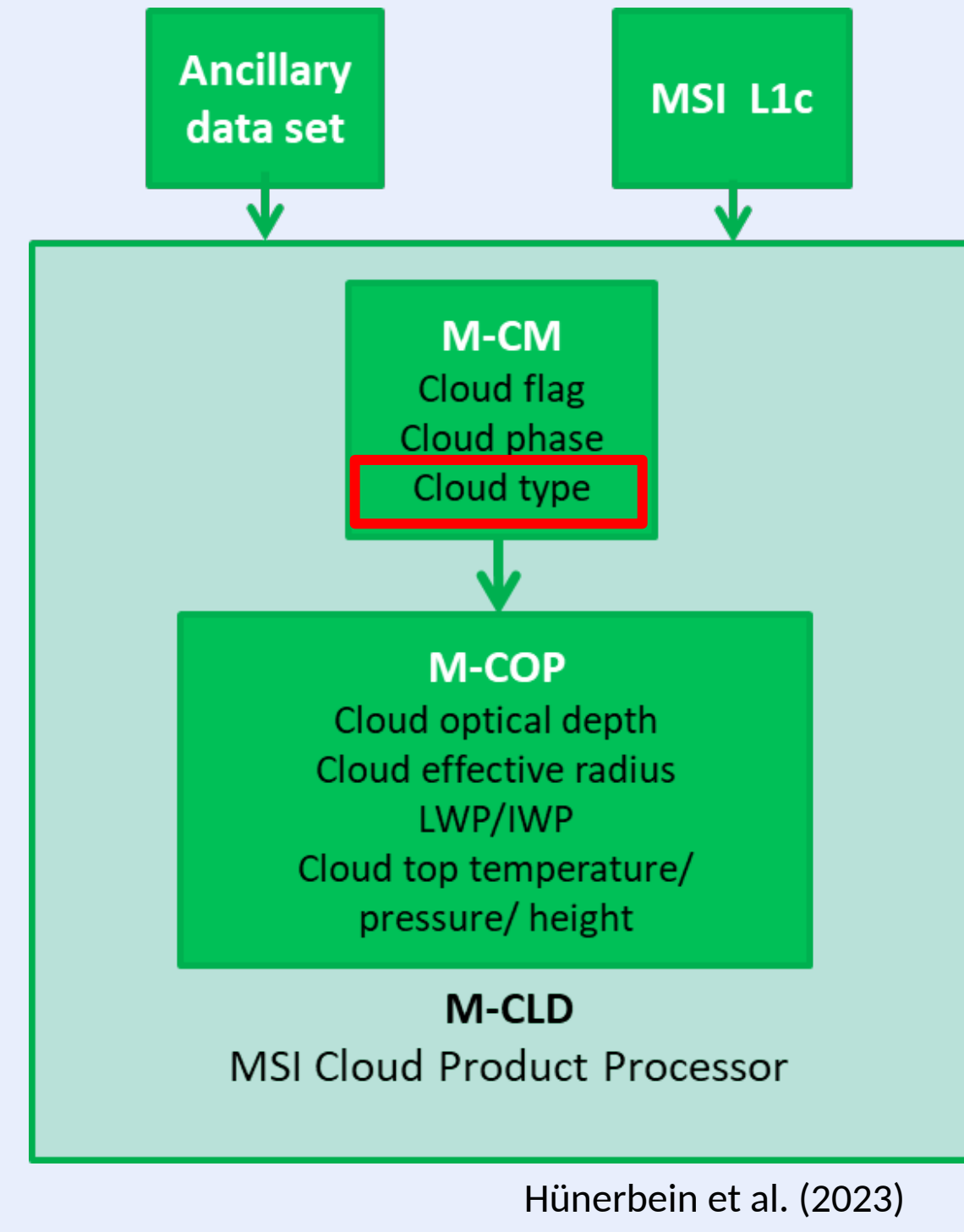
The **Multispectral Imager (MSI)**, one of the passive instruments aboard EarthCARE, observes a 150 km wide swath with a spatial resolution of 500 m. MSI has seven channels:

MSI λ [μm]	MSI $\Delta\lambda$ [μm]	Atmospheric purpose
0.67	0.02	Cloud optical thickness over land
0.865	0.02	Cloud optical thickness over sea
1.65	0.05	Cloud effective radius
2.2	0.1	Cloud effective radius
8.8	0.9	Cloud properties
10.8	0.9	Cloud top temperature
12.0	0.9	Cloud top temperature

- Used to determine:
- Properties of clouds
 - Horizontal structures of clouds
 - Cloud cover
 - Cloud type
 - Cloud optical and microphysical properties



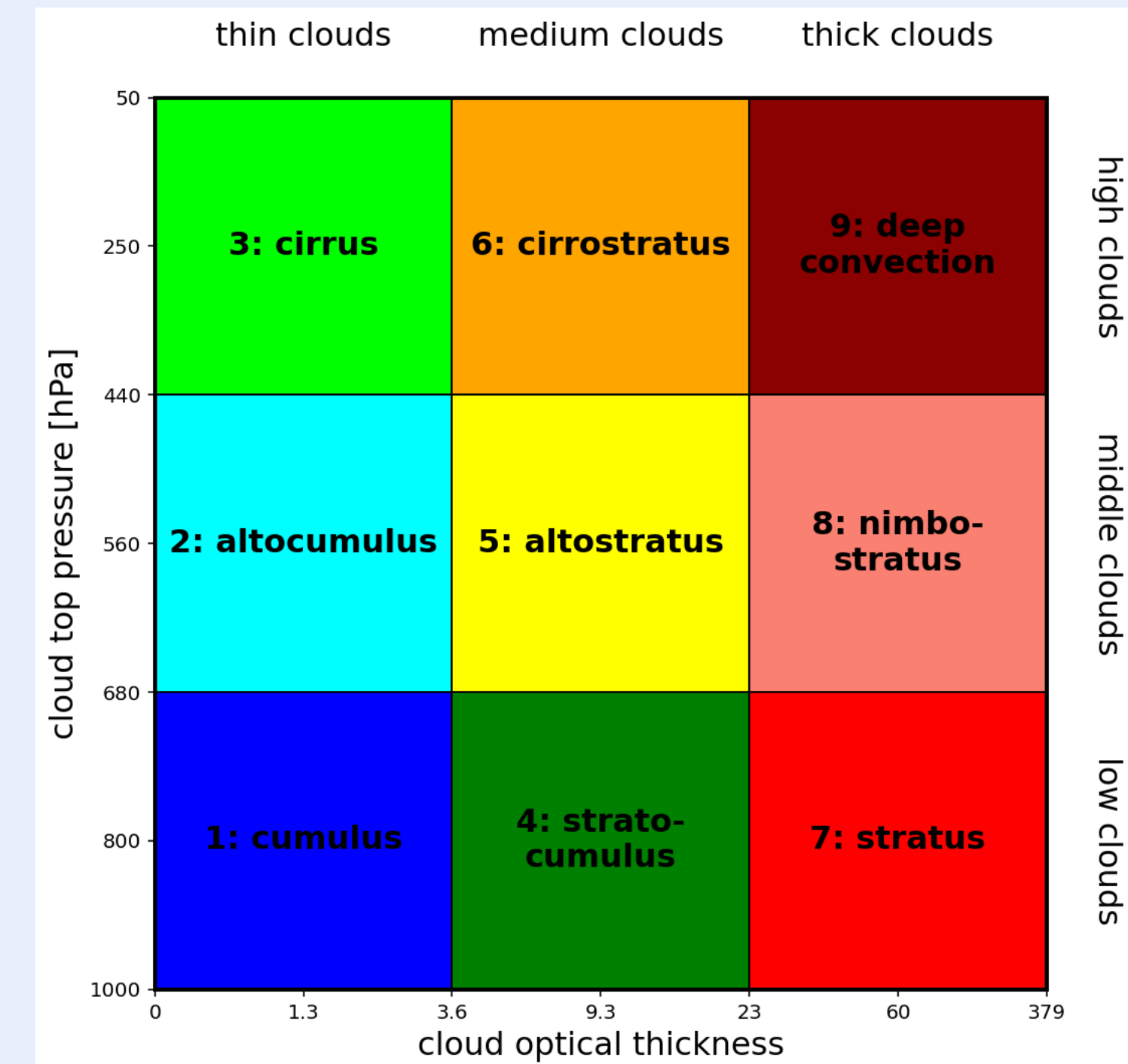
M-CLD processor



Hünenbein et al. (2023)

The **MSI cloud type (M-Ctype)** is determined using the cloud classification by the **International Satellite Cloud Climatology Project (ISCCP)**. Under this framework, clouds are classified into nine different types based on the categories of thin, medium, and thick cloud optical thickness and low, medium, and high cloud top height.

ISCCP cloud classification

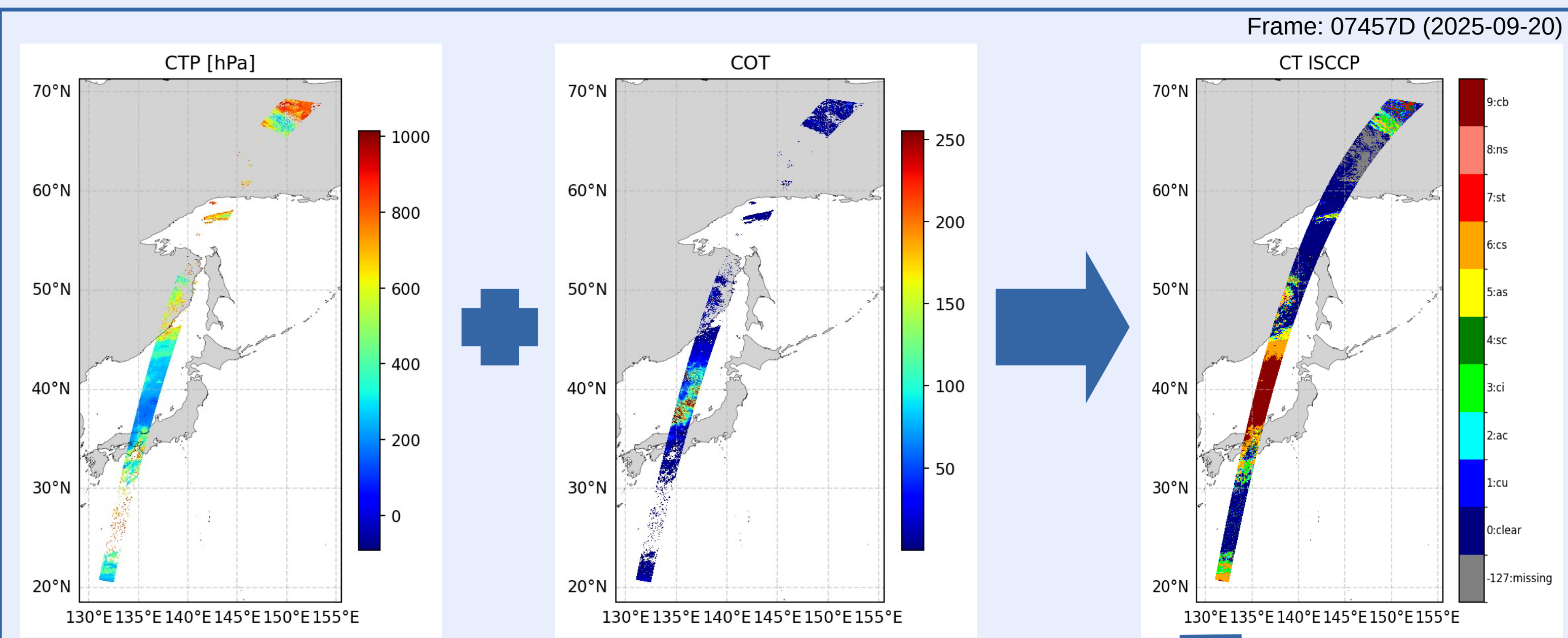


Method

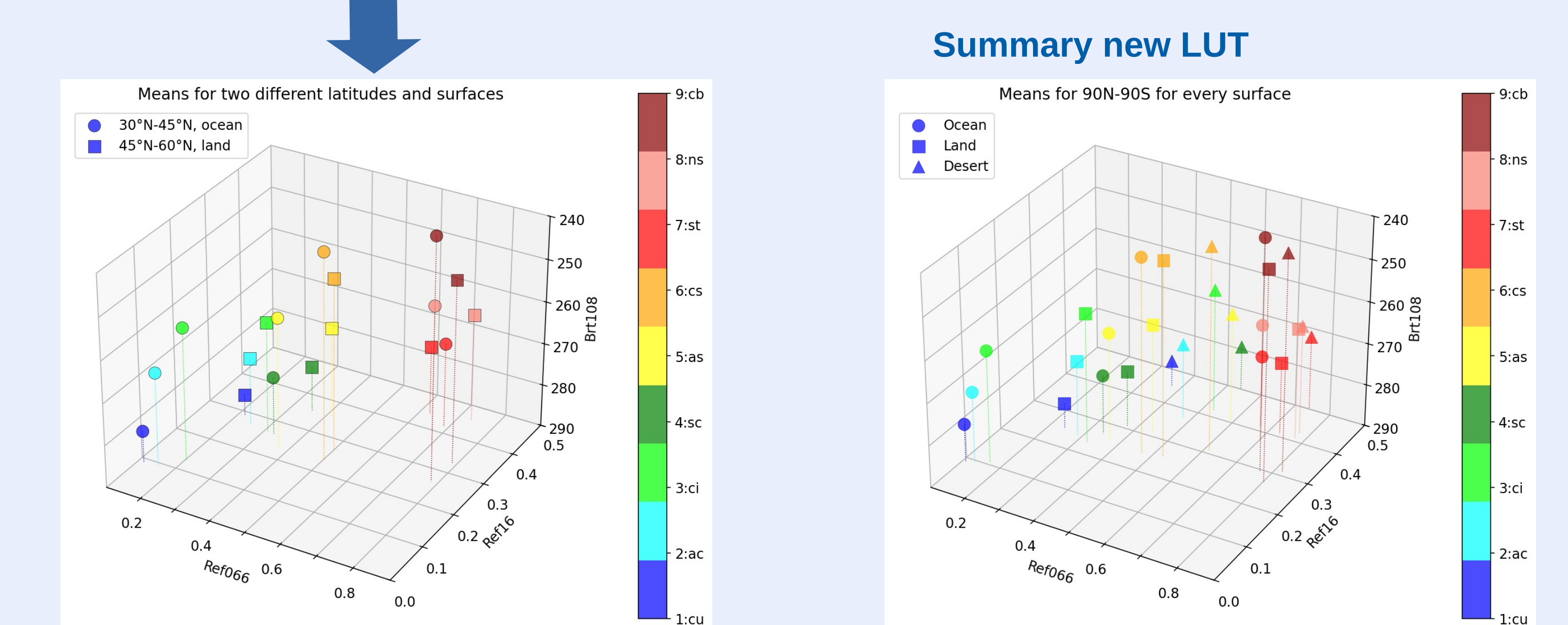
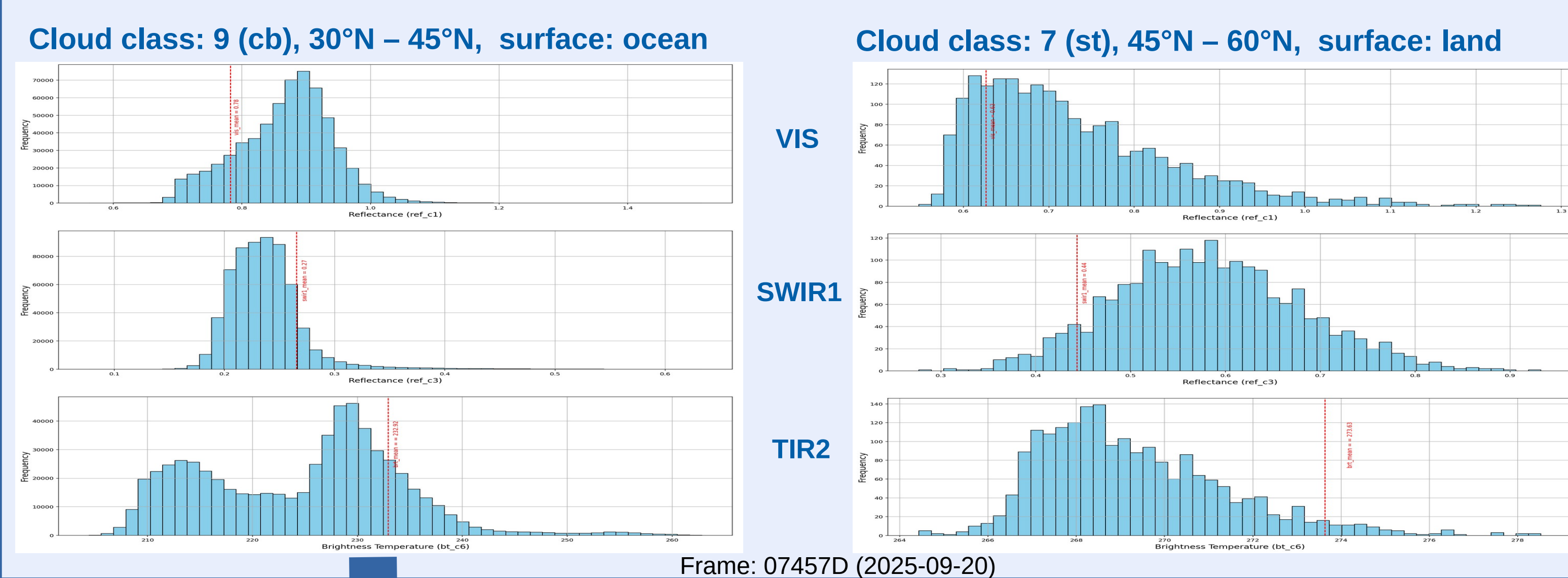
Updated lookup table (LUT) for MSI cloud type

- Algorithm based on Maximum-Likelihood classifier (ISCCP)
- Using three channels: VIS (670 nm), SWIR1 (1.6 μm) and TIR2 (10.8 μm)
- New LUT Based on BA reprocessed version
- All day-frames (C-G) from one selected day per month were used
- Data between November 2024 and October 2025

M-COP input data

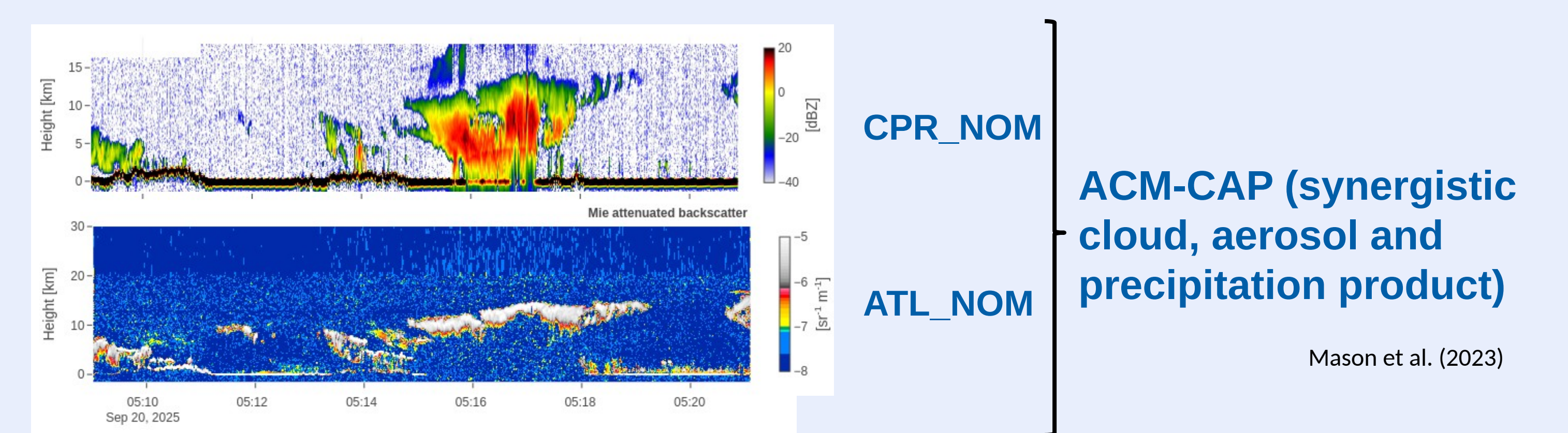
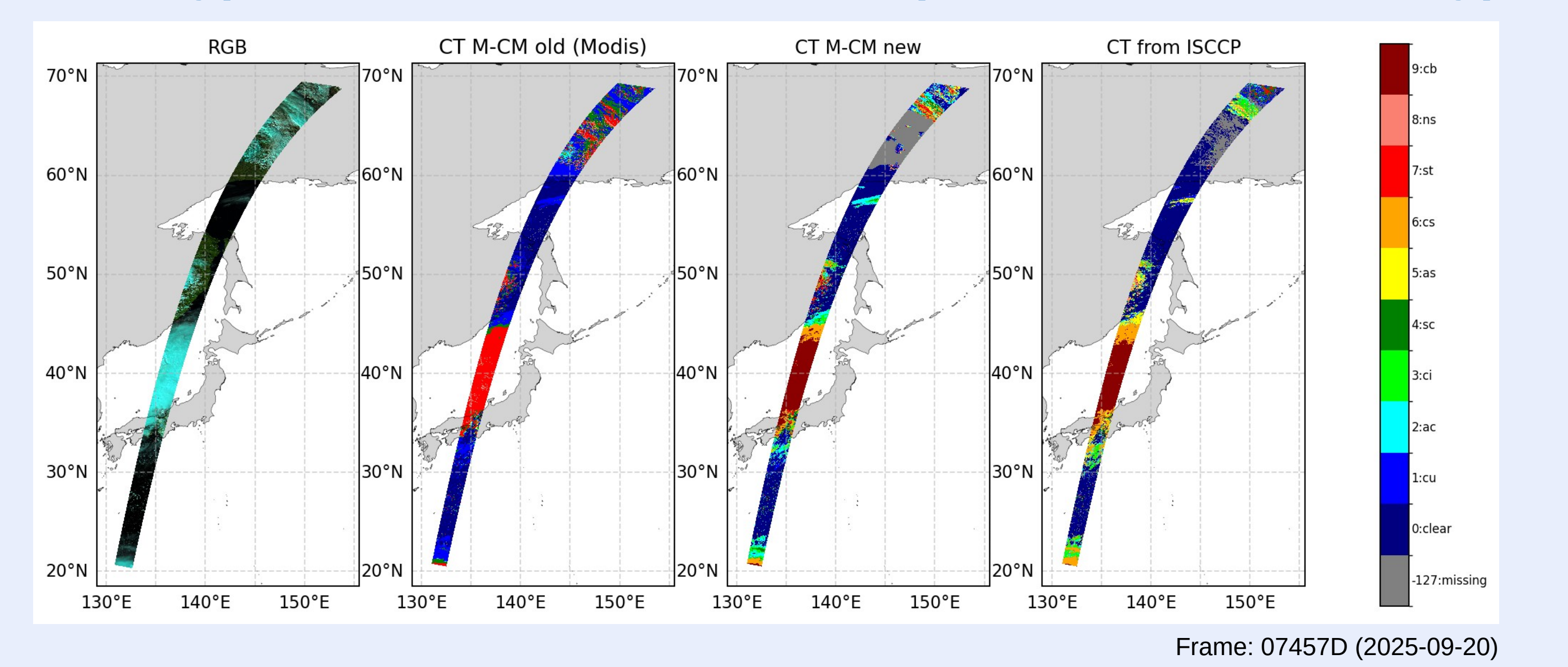


- Training data stratified by surface type (sea, land, desert)
- Divided into 15° latitude bands
- Statistics for three channels were calculated



Example case

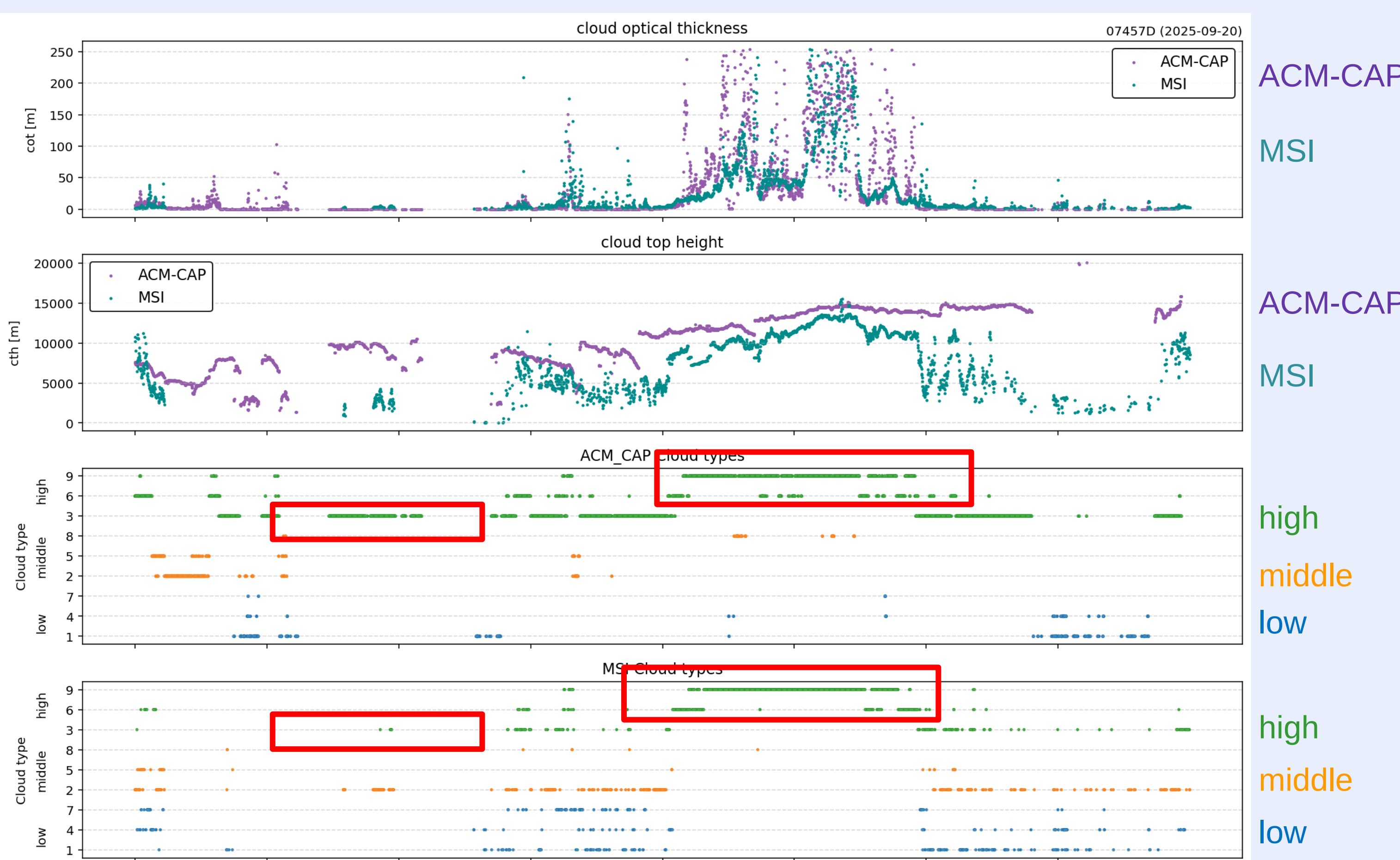
Cloud type old LUT and new LUT compared to ISCCP cloud type



ACM-CAP (synergistic cloud, aerosol and precipitation product)

Mason et al. (2023)

- COT and CTH calculated for track
- => Used ISCCP on Track for active instrument and compared to passive MSI



- Ci (high, thin): not detectable with MSI
- Cb (high, thick) high agreement

Outlook

- Updated M-CM cloud type will be implemented in new version 11.6, the baseline will be BD
- Further analysis over desert
- Add more surfaces to LUT, like ice, and snow

References

Hünenbein, A., et al.: Cloud mask algorithm from the EarthCARE Multi-Spectral Imager: the M-CM products, <https://doi.org/10.5194/amt-16-2821-2023>
Mason, S. L., Hogan, R. J., Bozzo, A., and Pounder, N. L.: A unified synergistic retrieval of clouds, aerosols, and precipitation from EarthCARE: the ACM-CAP product, *Atmos. Meas. Tech.*, 16, 3459–3486, <https://doi.org/10.5194/amt-16-3459-2023>, 2023.

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