Overview of ESA cloud and precipitation products

2nd ESA-JAXA EarthCARE in-orbit validation workshop
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cloud & precipitation algorithm developers

ECMWF
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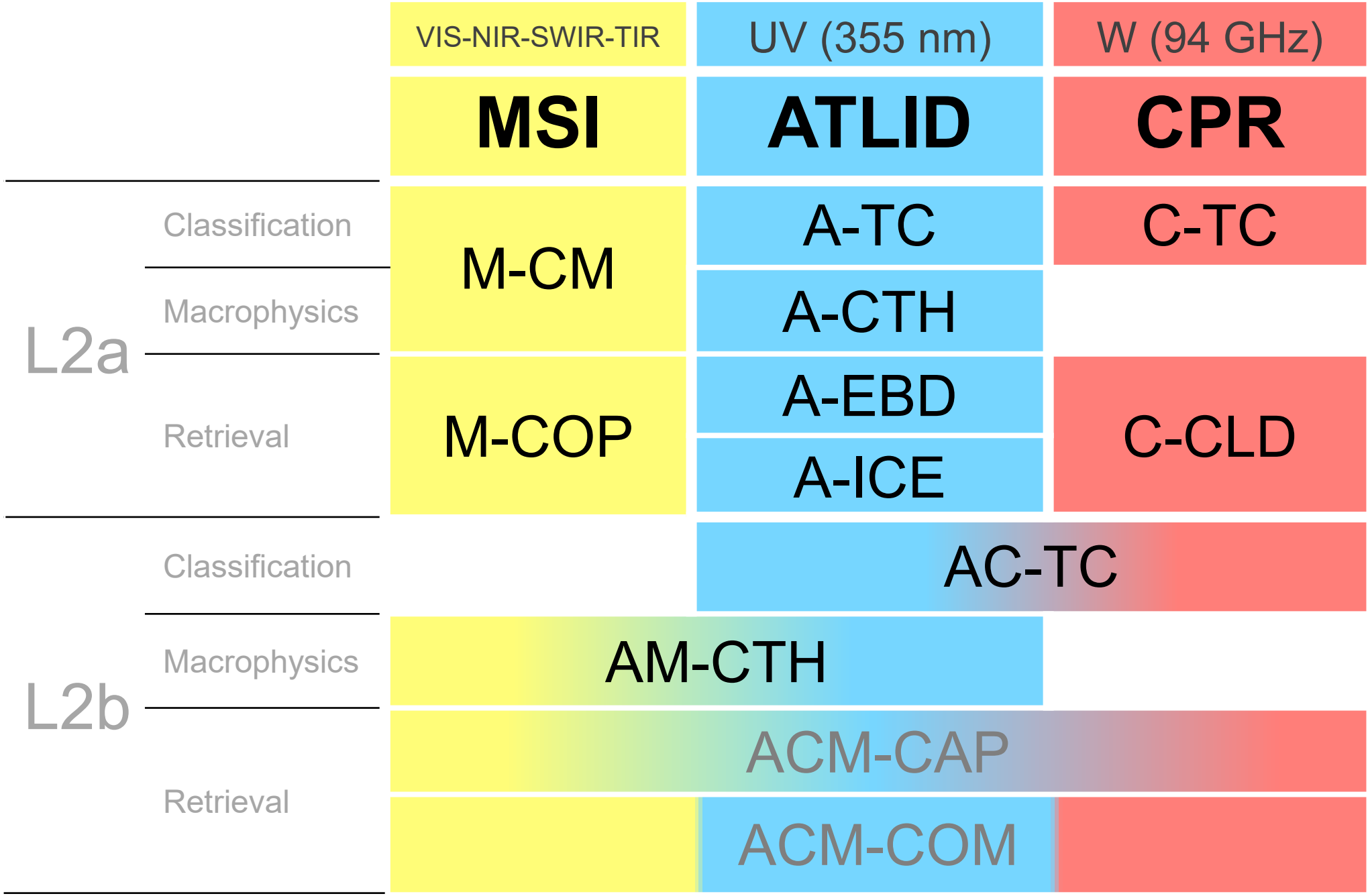
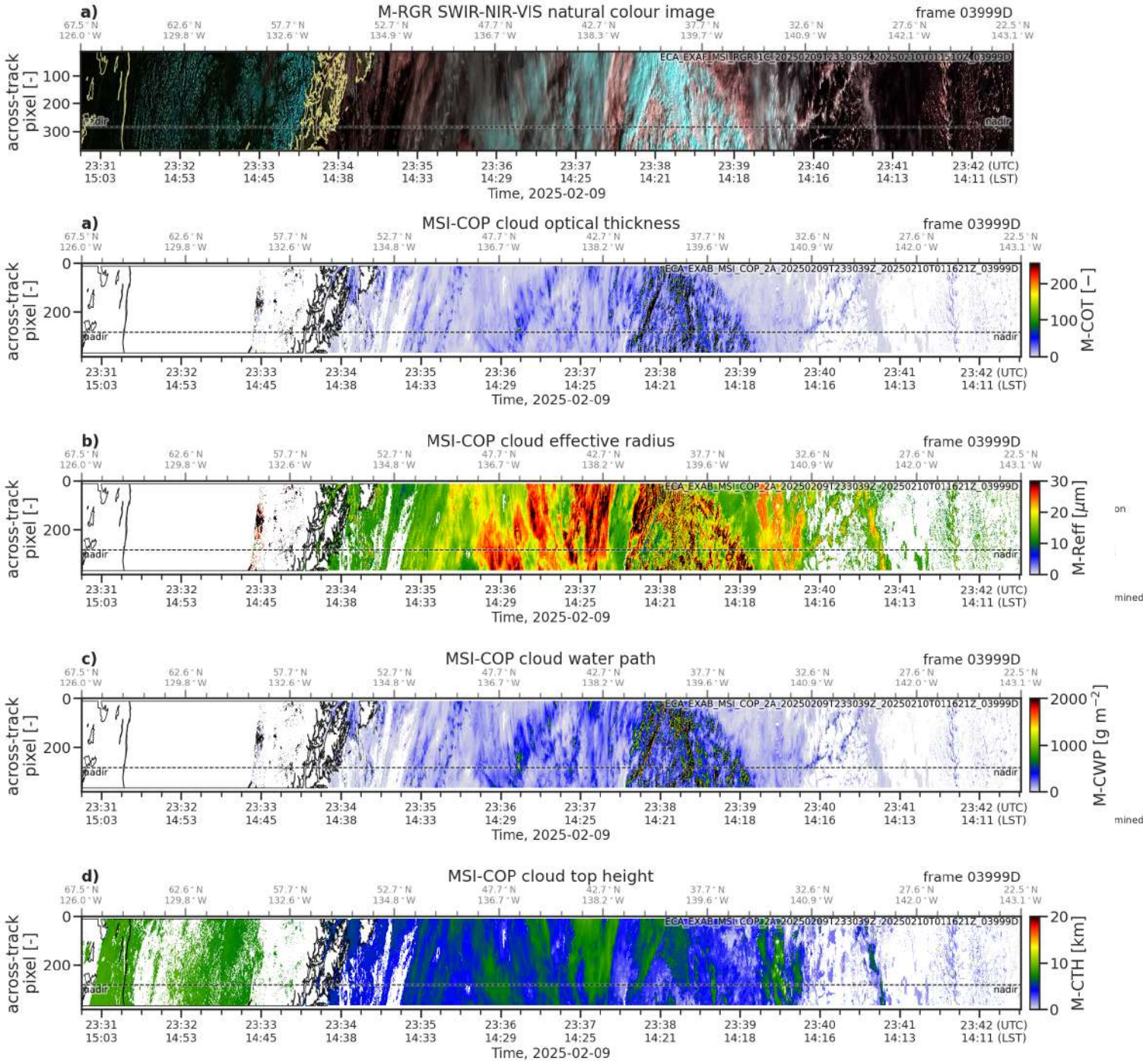
ECMWF


VIS-NIR-SWIR-TIR
UV (355 nm)
W (94 GHz)
MSI
ATLID
CPR
L2a
Classification
Macrophysics
Retrieval
M-CM
M-COP
A-TC
A-CTH
A-EBD
A-ICE
C-TC
C-CLD
L2b
Classification
Macrophysics
Retrieval
AC-TC
AM-CTH
ACM-CAP
ACM-COM

L2a MSI cloud & precipitation products

cf. JAXA product: M-CLP

- *L2a MSI products are provided on the same ~500m grid as L1c (M-RGR)*
- Cloud mask (M-CM)
  - Cloud mask and classification
  - Cloud-top phase
- Cloud optical properties (M-COP)
  - Cloud-top height/temperature/pressure
  - Optical thickness
  - Effective radius
  - Cloud water path

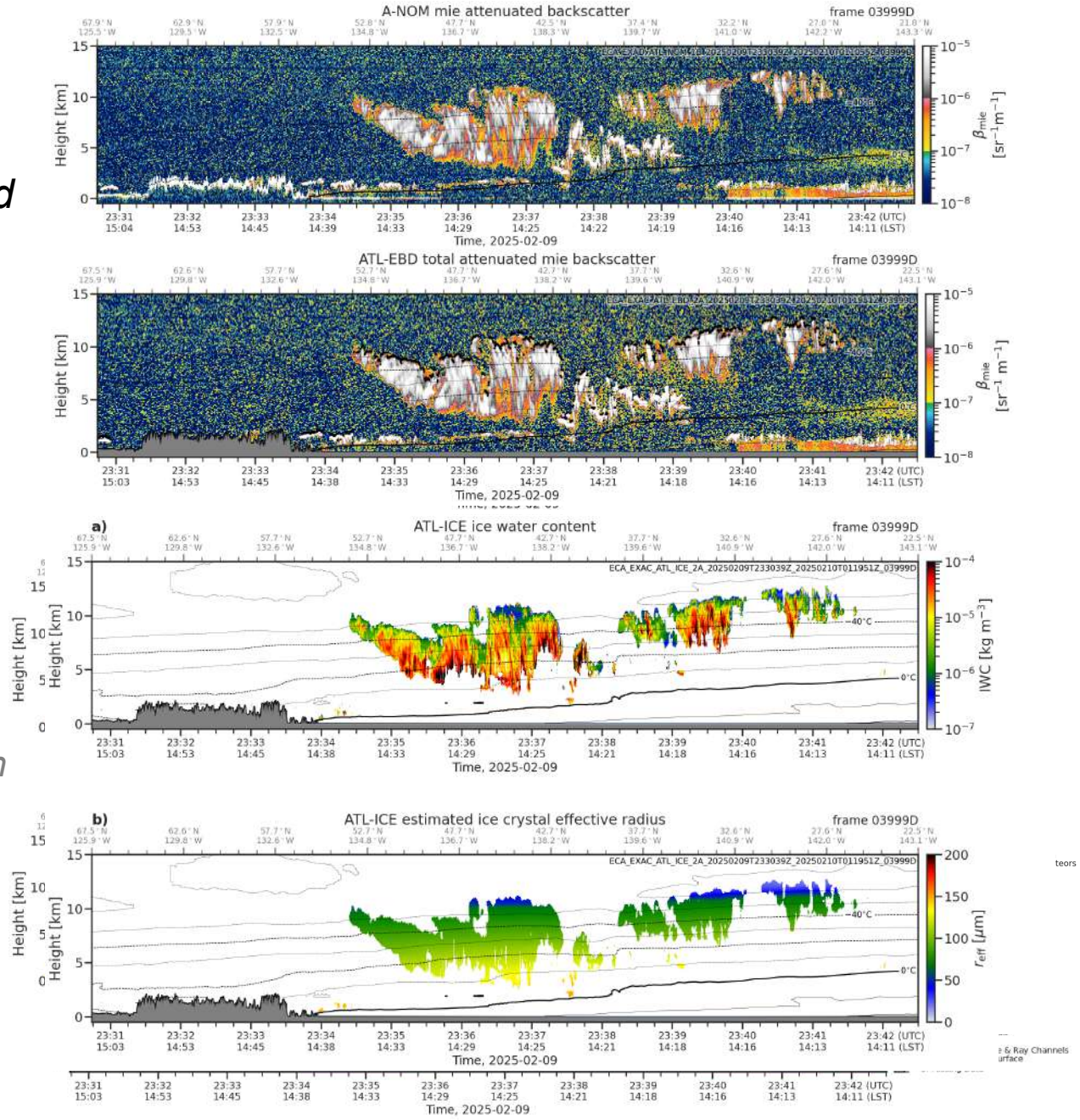


ECMWF

L2a ATLID cloud & precipitation products

cf. JAXA product: A-CLA

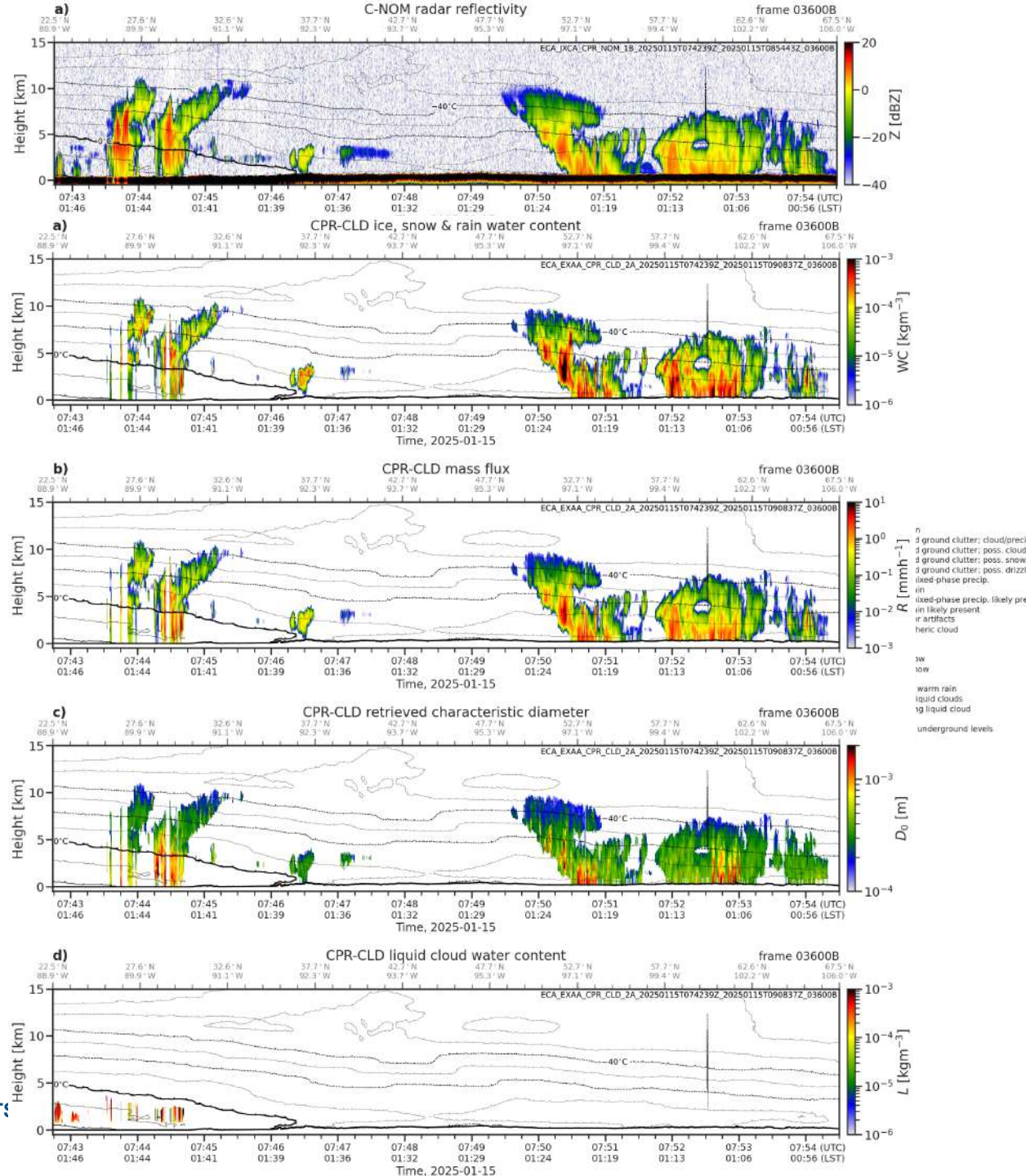
- *ATLID products after A-FM use the Joint Standard Grid (JSG; ~1km along-track, ~100m vertical)*
- Target classification (A-TC)
  - Penetration of ice clouds, quickly extinguished in supercooled liquid layers
  - Also provided at “medium” and “low” resolution with greater degrees of along-track smoothing
- Cloud-top height (A-CTH)
- *Extinction, backscatter and depolarization (A-EBD)*
  - *ATLID’s HSRL capability means that the cloud extinction coefficient can be derived directly*
  - *unattenuated backscatter coefficients*
- Ice clouds (A-ICE)
  - A relatively simple retrieval of ice water content from the A-EBD ice extinction, given a temperature-dependent assumption of ice effective radius



L2a CPR cloud & precipitation products

cf. JAXA product: C-CLP

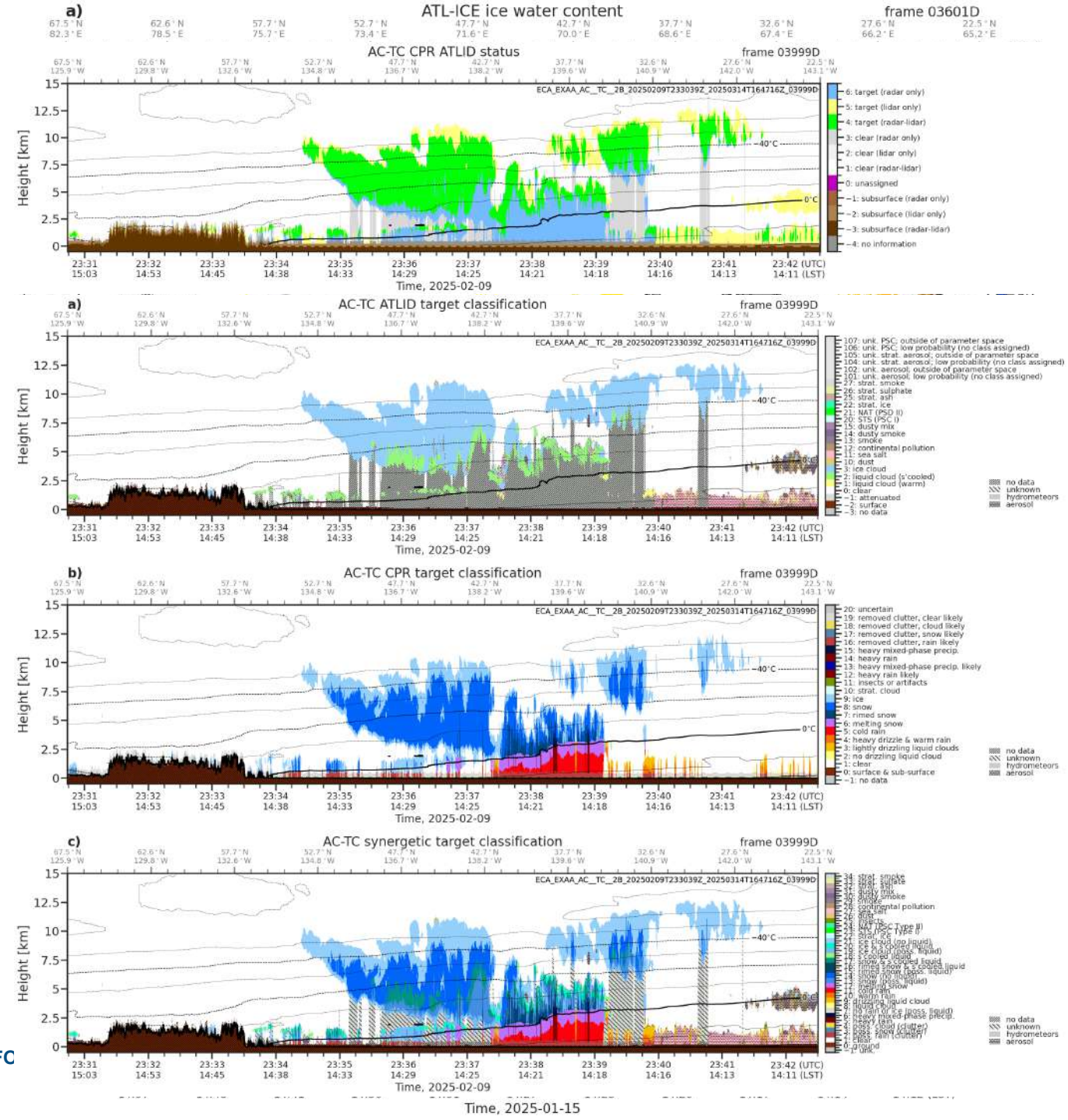
- *CPR L2a products are provided on the CPR grid (~1km along-track, ~100m vertical)*
- Target classification (C-TC)
  - Ice/snow/rimed snow/melting snow
  - Liquid cloud/drizzle/warm rain/cold rain
  - Multiple scattering: heavy precipitation
  - Surface clutter: continuity with classes aloft
- Cloud and precipitation (C-CLD)
  - Variables “water_content”, “mass_flux”, “characteristic_diameter” include all ice cloud, snow & rain: use hydrometeor_classification variable to select by class
  - Liquid clouds are retrieved & reported separately



L2b cloud & precipitation products

cf. JAXA products: AC-CLP, ACM-CLP

- *All L2b products use the JSG*
- Target classification (AC-TC)
  - Synergistic (radar-lidar) classification
  - Also provides A-TC and C-TC on the JSG
- Cloud-top height (AM-CTH)
  - Difference between active and passive cloud-top detection (ATLID minus MSI) across the swath
- Synergistic cloud & precipitation (ACM-CAP)
  - Unified cloud, aerosol & precipitation retrieval
  - ATLID, CPR & MSI solar and thermal channels
- Composite cloud and precipitation (ACM-COM)
  - Merged A-ICE, C-CLD water contents, complemented by M-COP cloud optical depth/water path retrievals



ESA L2 cloud & precipitation products
highlights for the workshop

- Talks by ESA L2 developers:
  - Anja Hünerbein, M-CM & M-COP; **next talk**
  - Zhipeng Qu, A-ICE, C-CLD, M-COP, ACM-COM; **this session**
  - Kamil Mroz, C-CLD; **this session**
  - Robin Hogan, ACM-CAP; **this session**
  - Dave Donovan, A-FM & A-PRO; **16:05 this afternoon**
  - Shannon Mason, A-TC, C-TC & AC-TC; **16:15 this afternoon**
- Selected posters using L2 cloud & precipitation product:
  - Sabina Angeloni, “Validation of EarthCARE CPR Level 2 precipitation products in the central Mediterranean”
  - Lukas Pfitzenmaier, “Low-level cloud observed by the EarthCARE Cloud Profiling Radar, validated against data from Jülich and Ny Ålesund”
  - Esmail Ghaemi, “Validation of EarthCARE cloud and precipitation products by the WegenerNet 3D Weather Research Facility”