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First intercomparison between CPR and NAW cloud radar during ECALOT campaign

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1st EarthCARE In-Orbit Validation Workshop – 14-17 Jan 2025

EarthCARE Commissioning Cal/Val Campaign in Ottawa (ECALOT)

Ottawa based aircraft/surface calibration/validation campaign: ECALOT

- During EarthCARE's commissioning phase

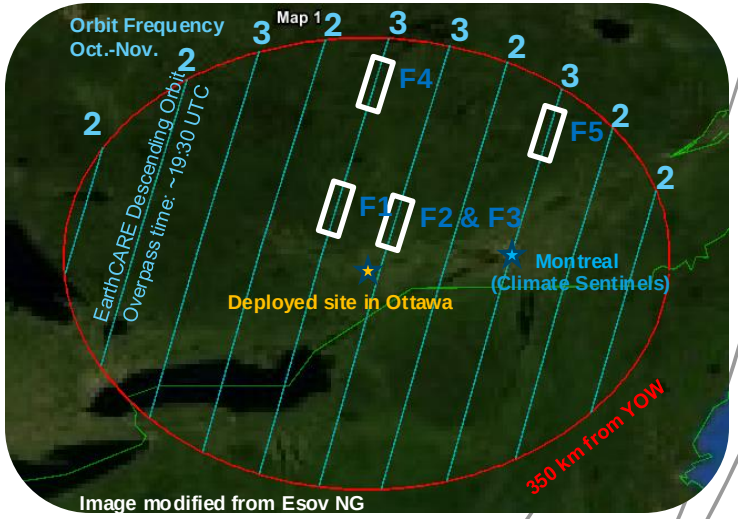
  Mid-latitude continental fall conditions with extension into winter

Surface observations

- Ottawa site (deployed by ECCC and McGill) + 2 Climate Sentinels: around Montreal region (McGill & UQAM)
- Performed surface observations during each flights + orbits with no flight
- T & humidity (profile & surface), precipitation rate/type/profile, radiation (bb & spectral for IR), wind profile, etc.

Airborne observations

- ✓ Flight 1: Oct. 1st – Cu & Sc
- ✓ Flight 2: Oct. 10th – Sc + aerosols
- Flight 3: Nov. 4th – NS + large scale rain
- ✓ Flight 4: Nov. 20th – two-layer Sc + aerosols
- Flight 5: Nov. 22nd – Ci + Ns



NRC Airborne W- and X- band (NAWX) radar systems

Antenna systems

Cabin components

	W	X
Frequency	94.05 GHz	9.41 GHz +/- 30 MHz
Peak Transmit Power	1.7 kW	25 kW (split b/w 2 ports)
Pulse Width	0.5 us	0.5 us
Antenna	Nadir: 12” lens ant. single pol. Aft + side” 12” lens ant. dual-pol	Up + Down: 18” single pol. slotted ant. Side: 26” parabolic ant. dual-pol.

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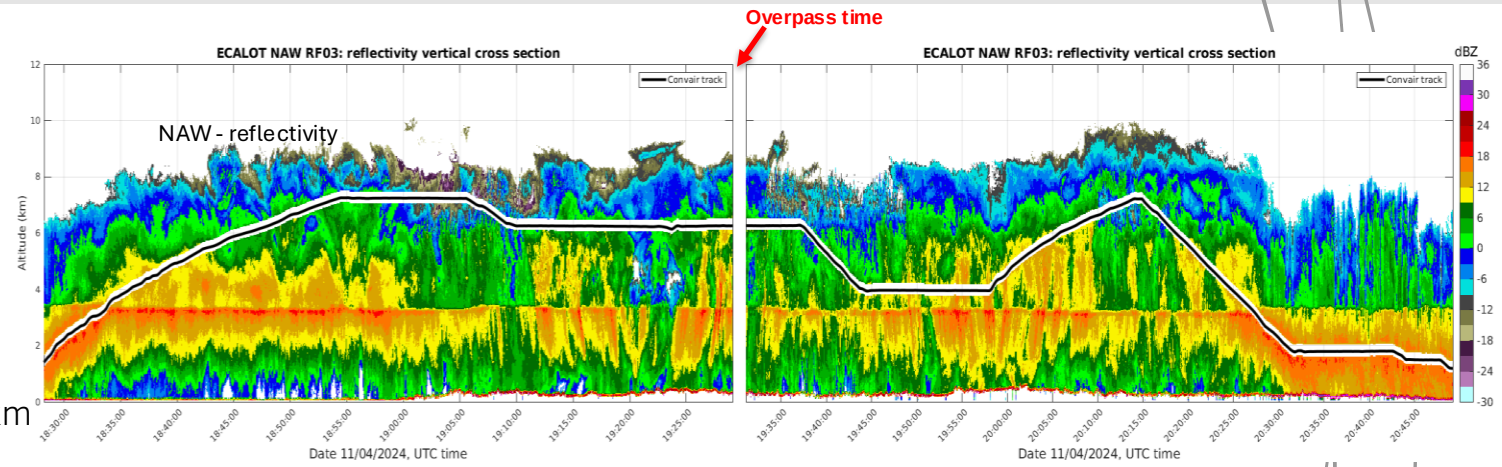
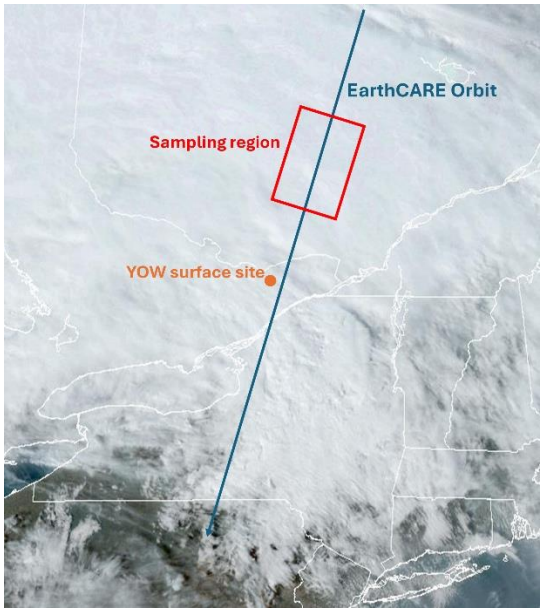
ECALOT Flight 3 – 4 Nov 2024

Weather Conditions

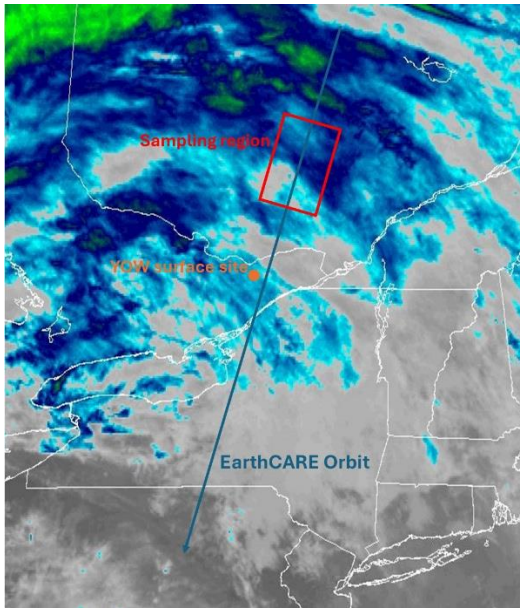
Targets:

- Thick ice clouds
  - 6-7 km
- Mixed-phase clouds
  - 4 km
- Large-scale rain
  - below 3 km

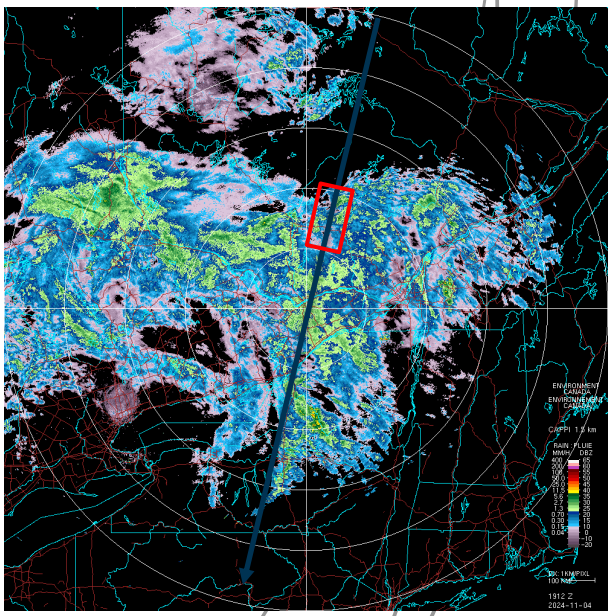




NOAA GOES geo-color image



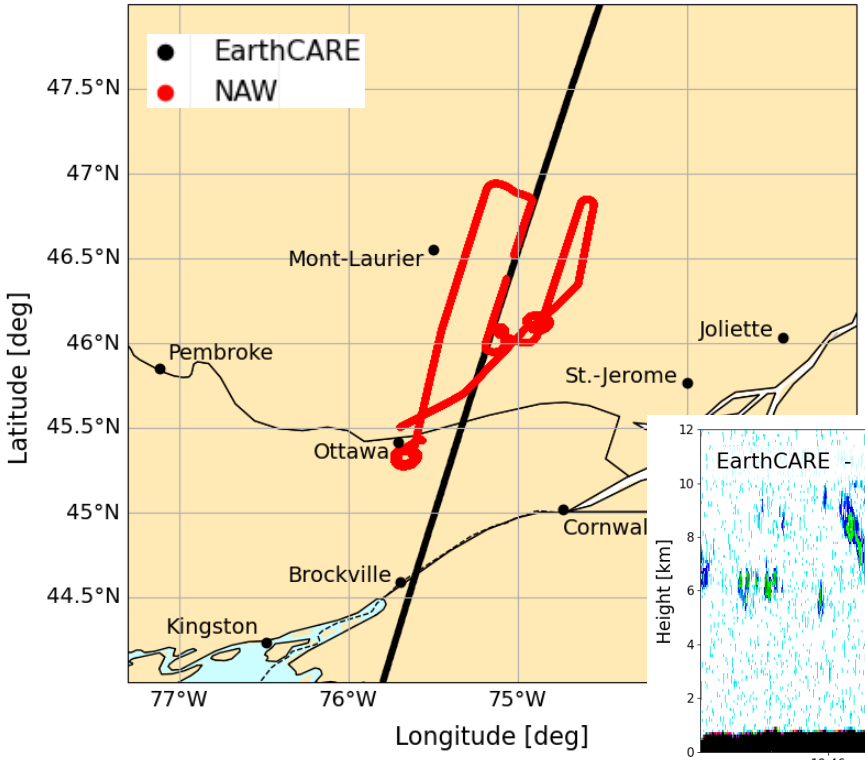
NOAA GOES 10.3-micron image



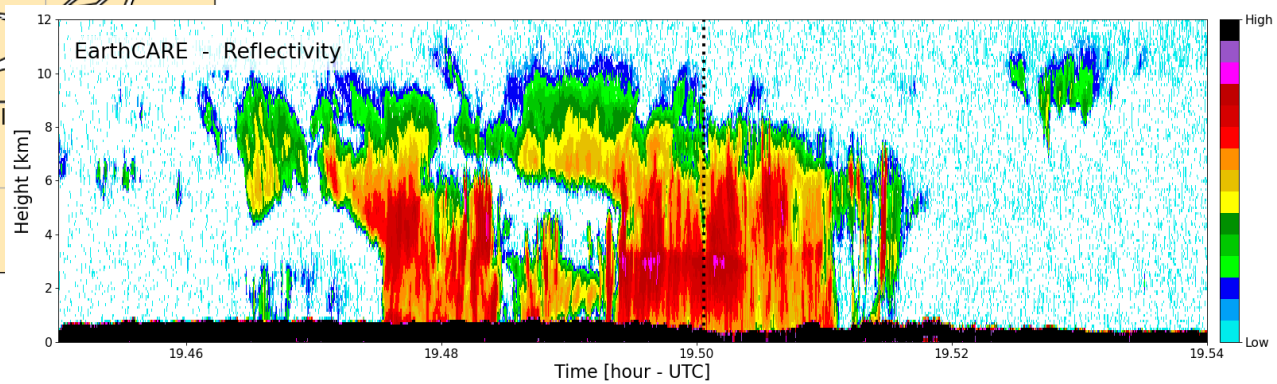
ECCC CAPPI

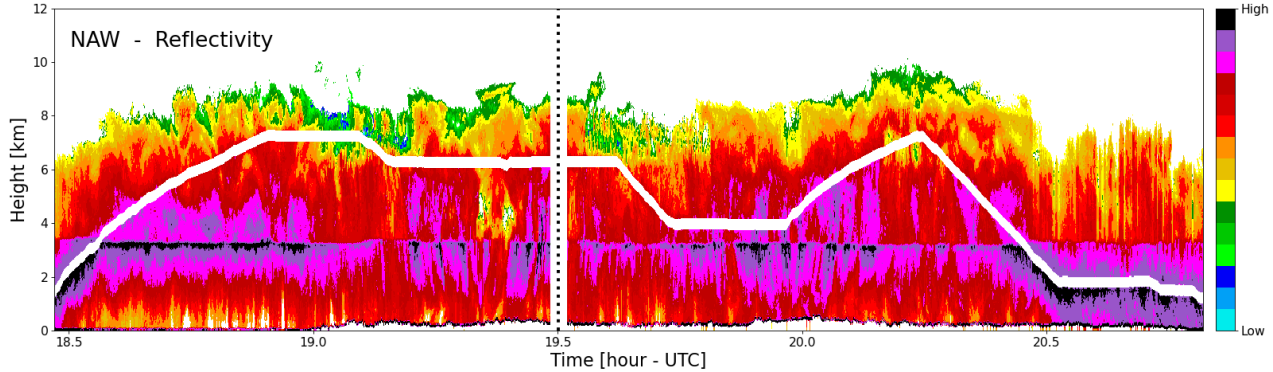
NAW vs CPR L1 reflectivity comparison

Flight 3 – 4 Nov 2024



Baseline: BA – Processor version: 0.15





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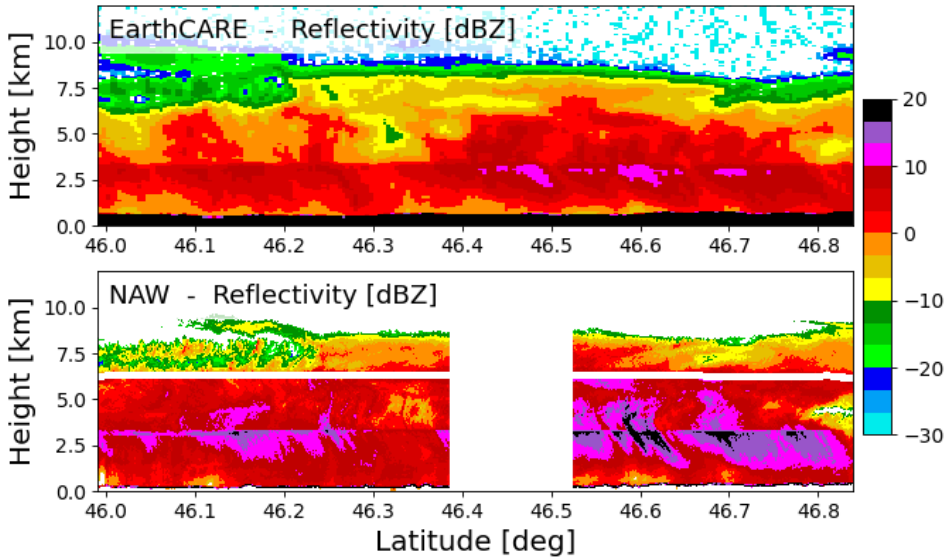

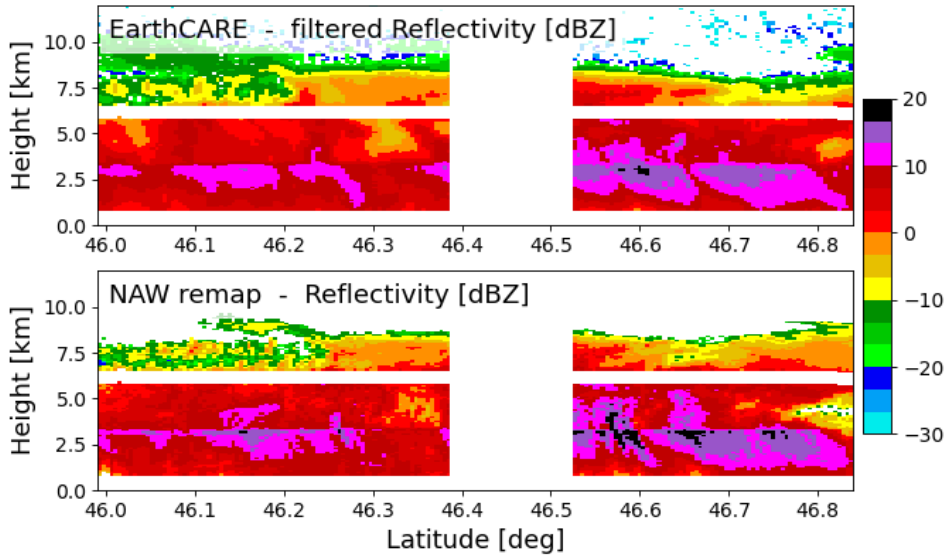

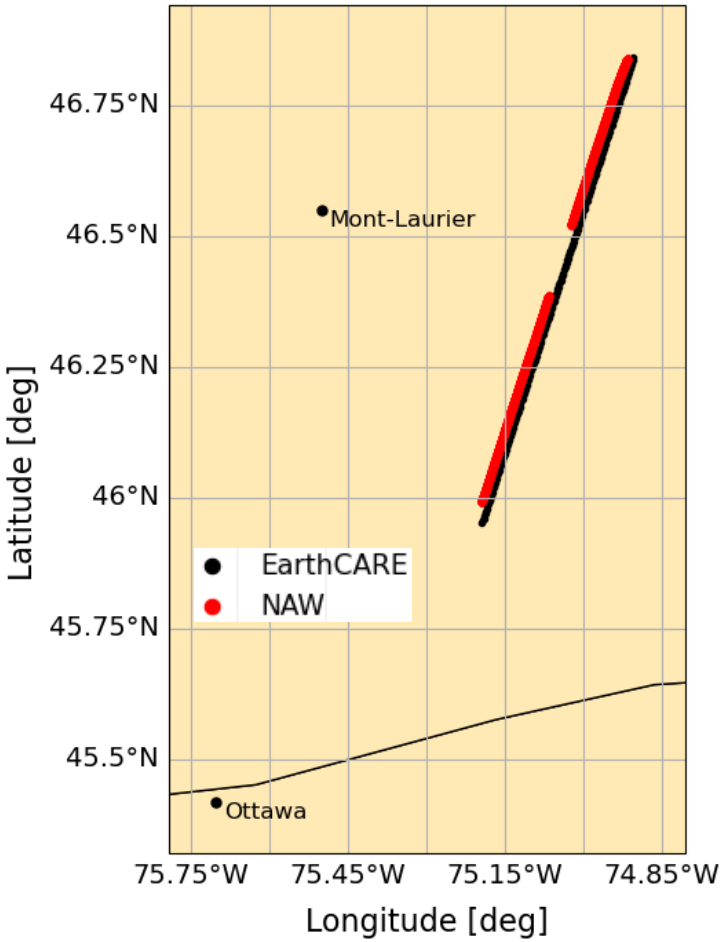

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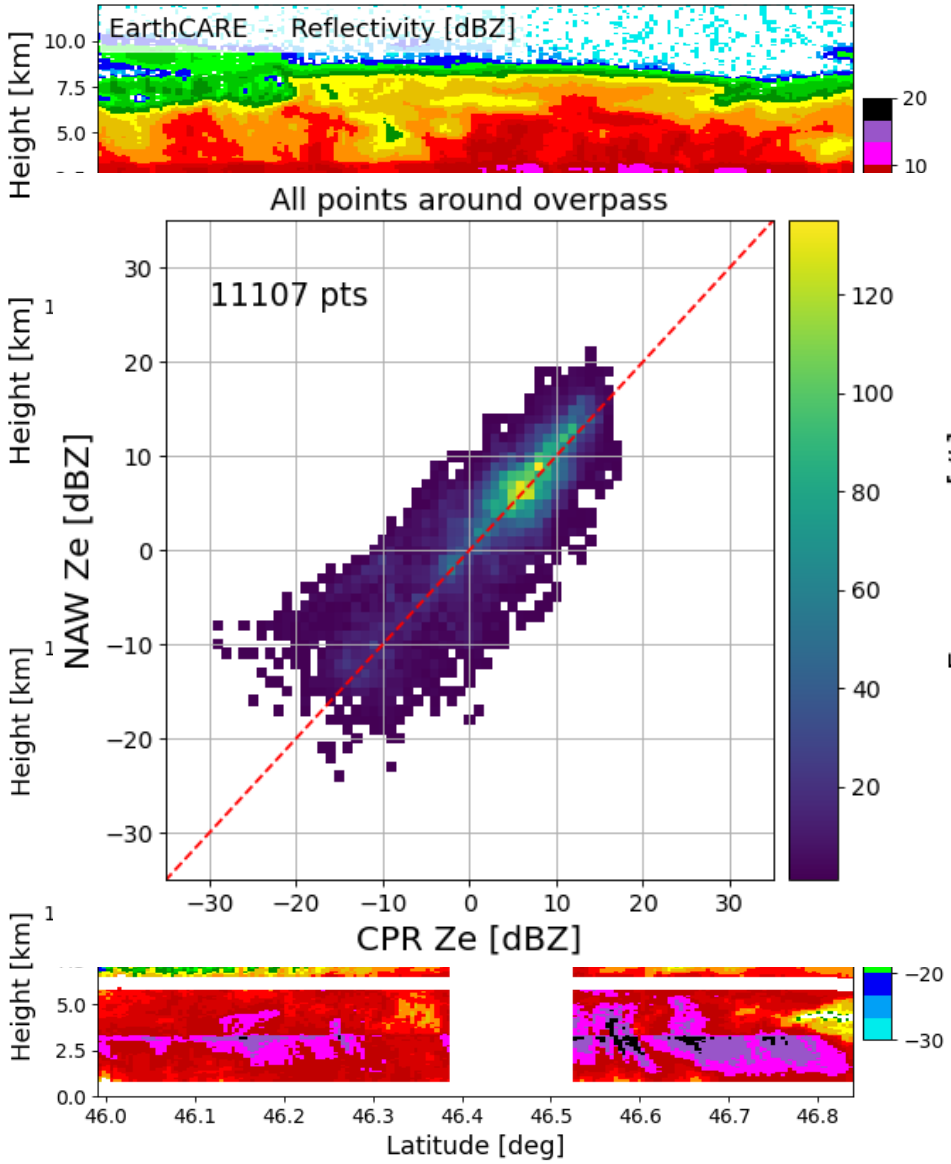
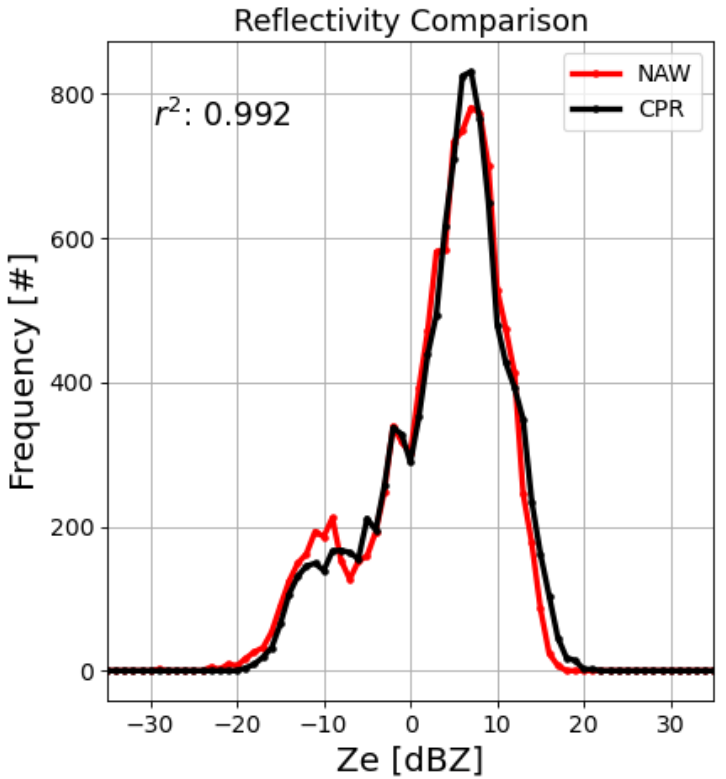


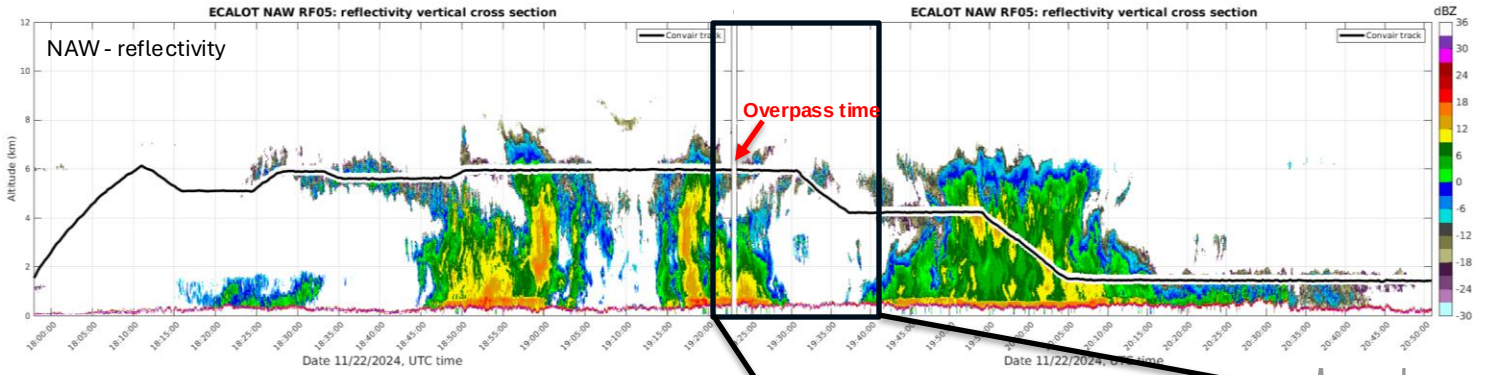


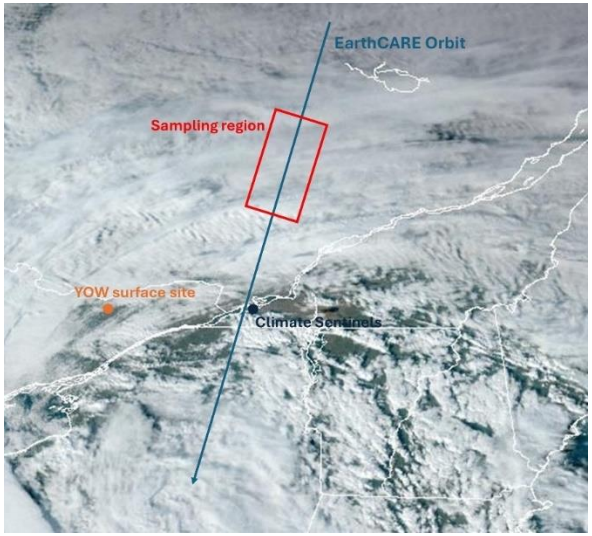
ECALOT Flight 5 – 22 Nov 2024

Weather Conditions

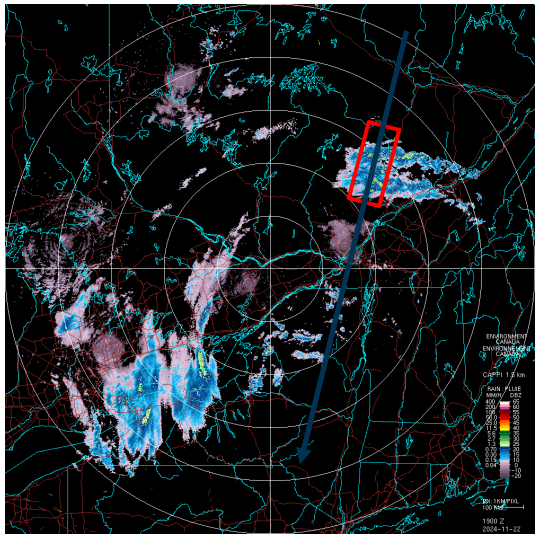
Targets:

- Multi-layer cloud
- Thin ice clouds
  - ≻ 6 km
- Mixed-phase clouds
  - ≻ 4 & 1.8 km
- Supercool liquid layers

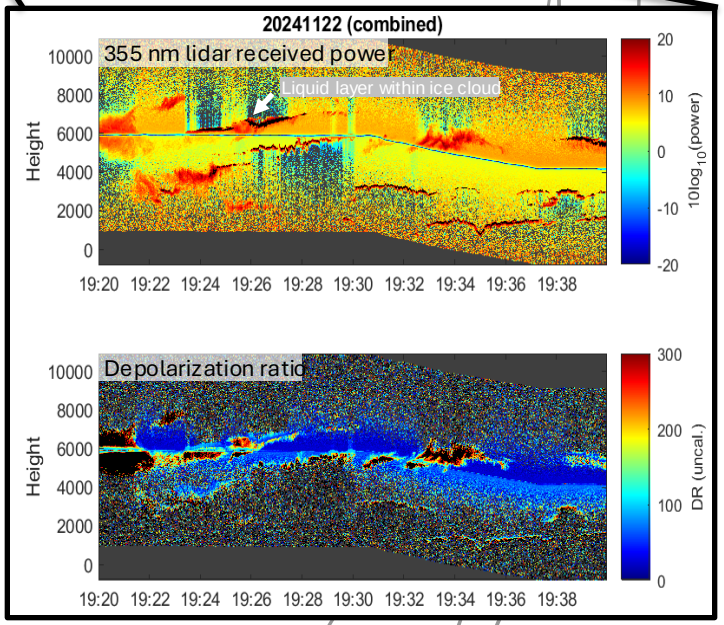




NOAA GOES geo-color image

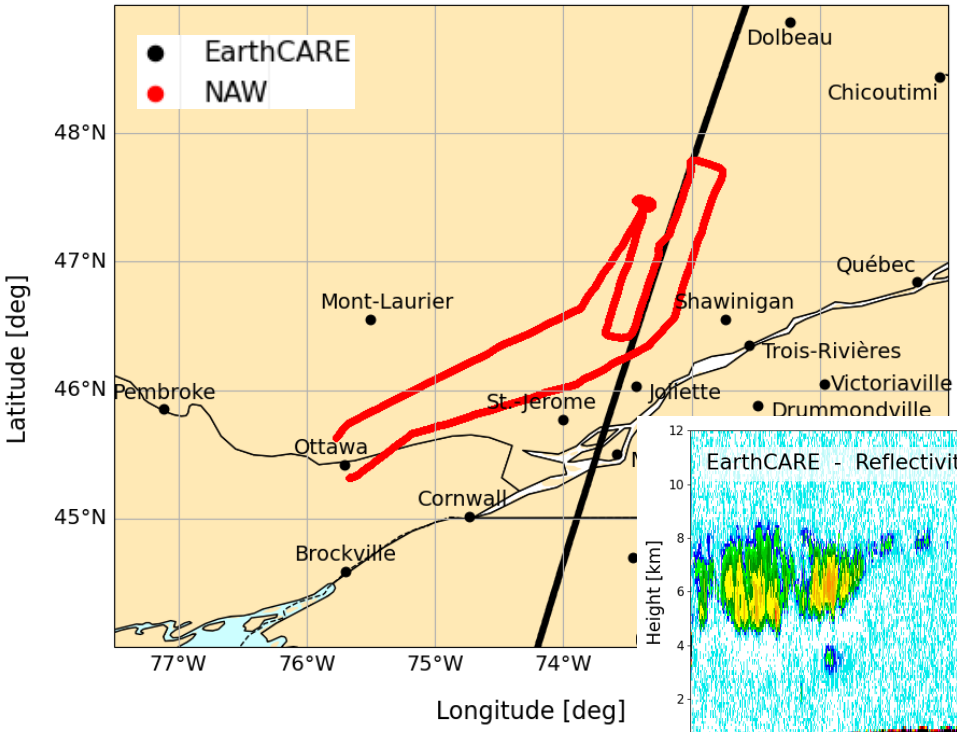


ECCC CAPPI

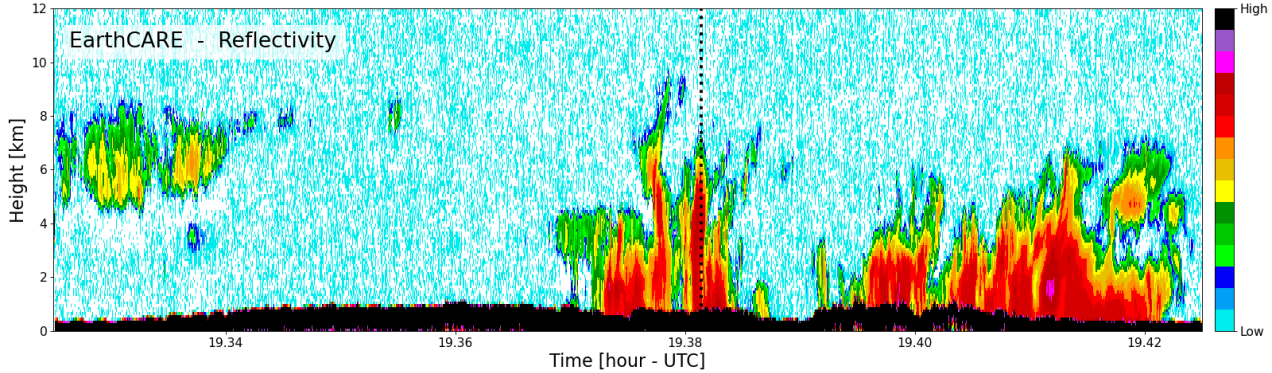


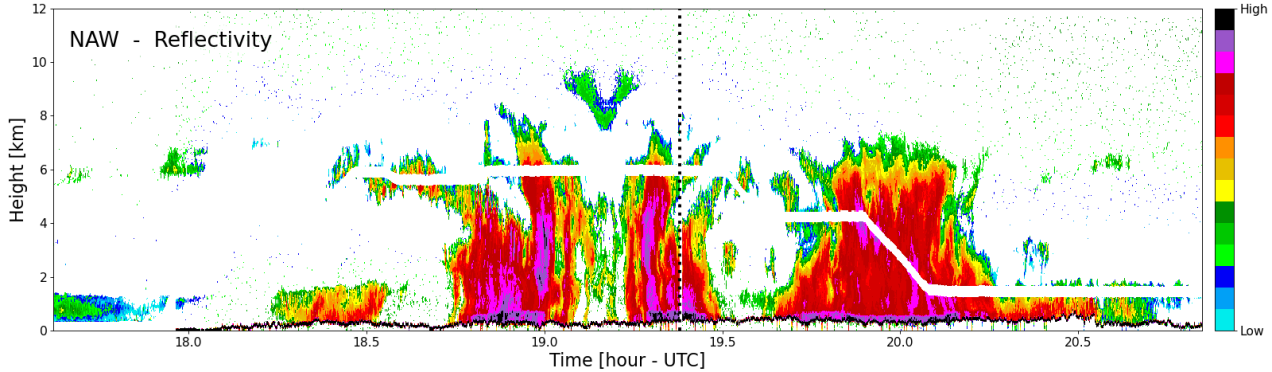
NAW vs CPR L1 reflectivity comparison

Flight 5 – 22 Nov 2024



Baseline: BA – Processor version: 1.0





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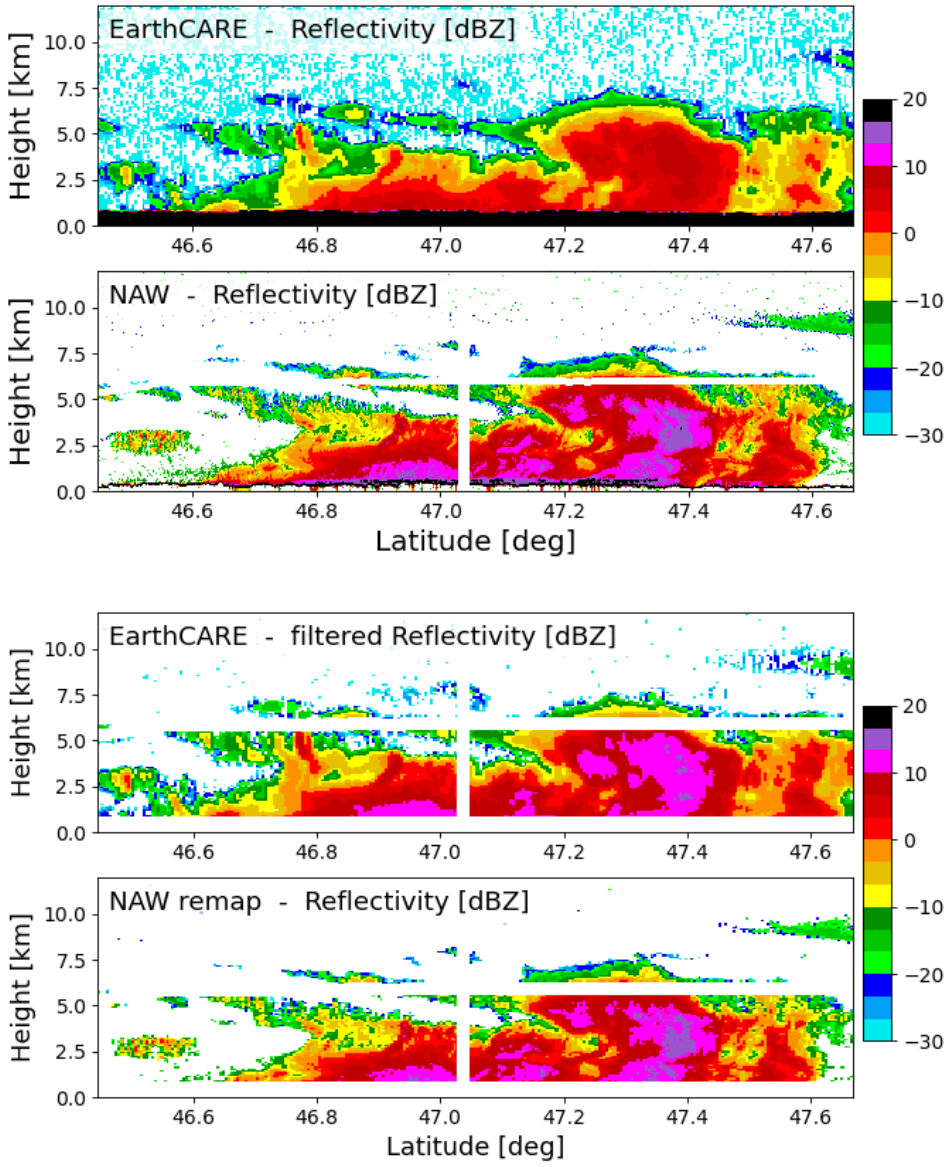

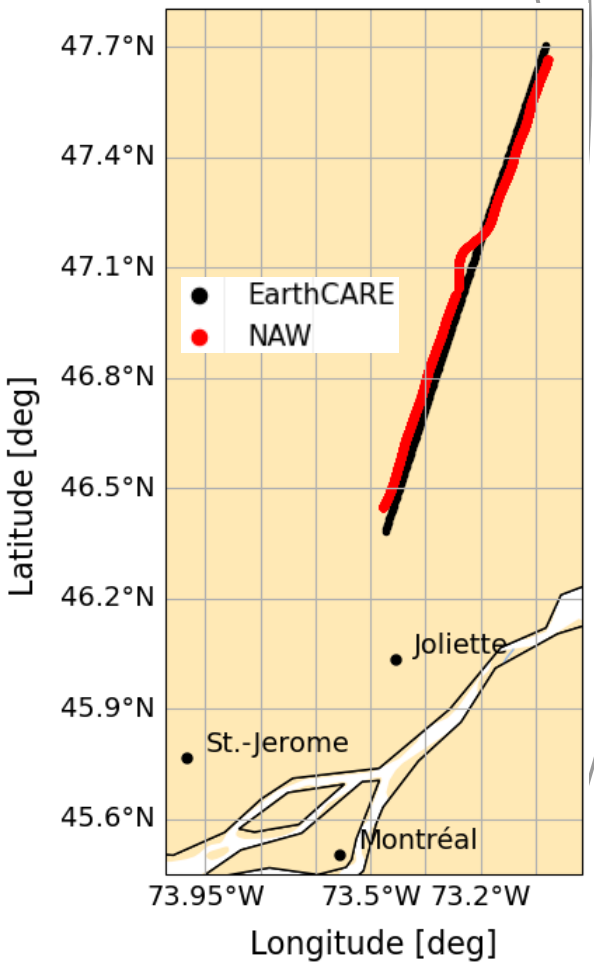

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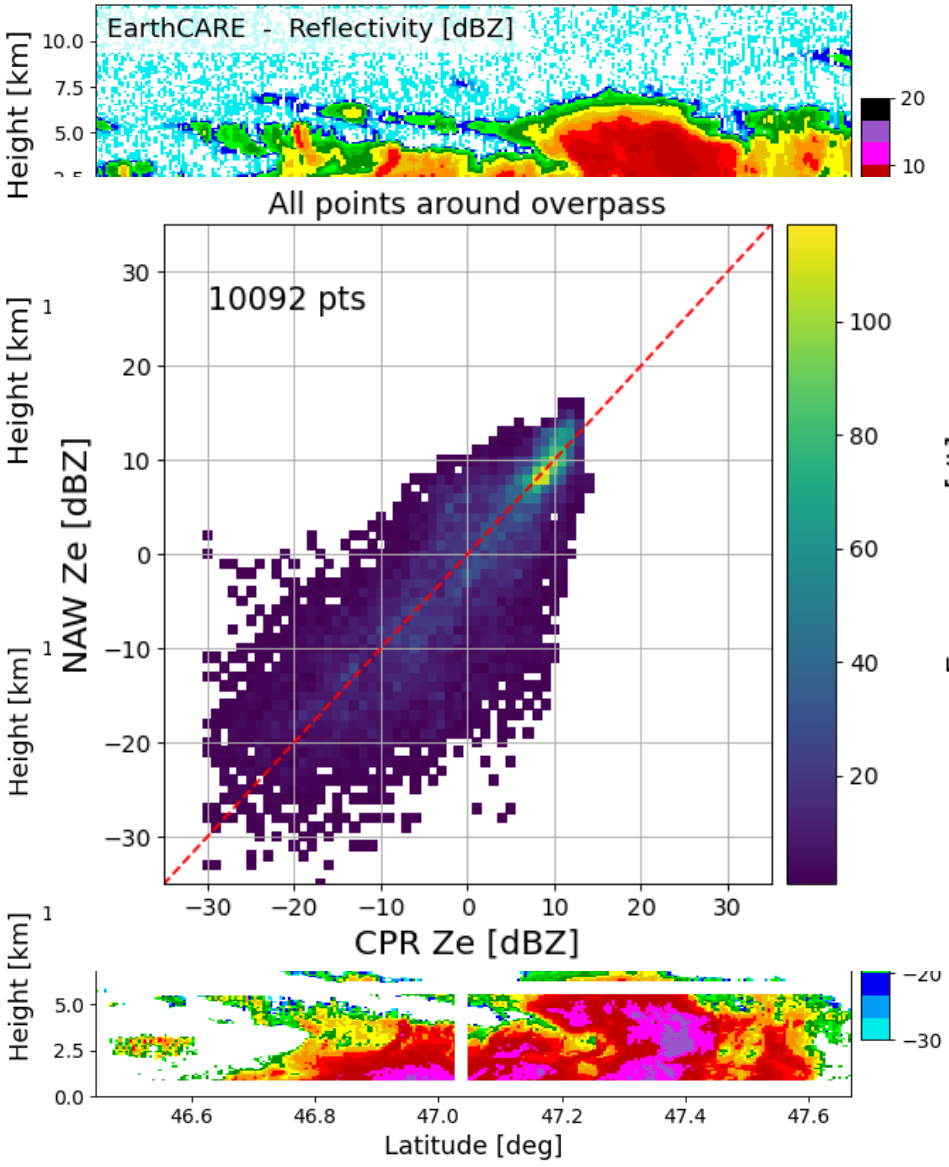

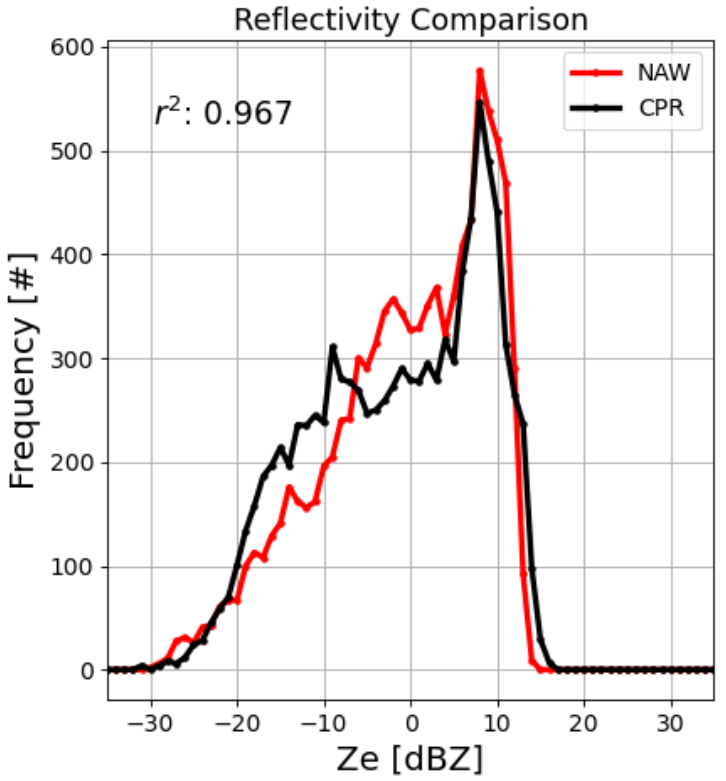

Main Points

- ECALOT took place around the Ottawa region during Fall 2024 (extension into Winter 2025):
  - First aircraft/surface calibration/validation campaign in North America.
  - Provided good quality data for targeted flights to sample relevant mid-latitude continental weather to validate EarthCARE observations.
- Sampled clouds by CPR and NAW show very similar internal structure.
- Flights 3 & 5 provided more than 10,000 points each between the Convair-580 and EarthCARE to compare NAW and CPR reflectivity values, resulting in a good correlation with $r^2 > 0.97$ for each flights.
- Comparison between CPR and NAW reflectivity for Flights 3 & 5 overpasses shows similar CPR offset of -5 dBZ.

NEXT STEP

- Doppler velocity comparison.

Questions?

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