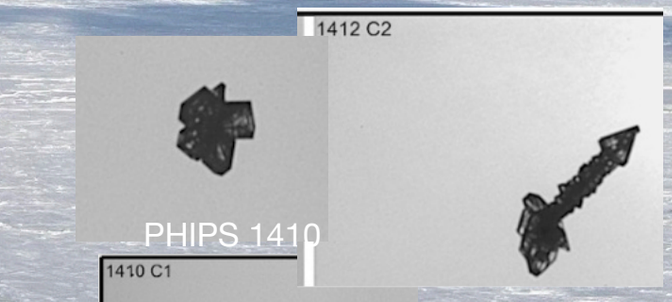
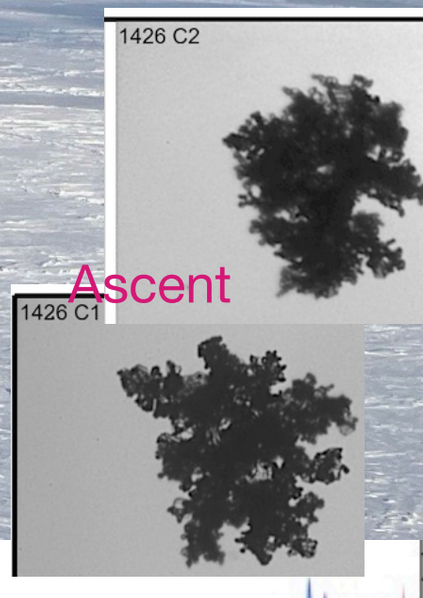
14:09UTC

@ 160 m

First detected particles (by Nevzorov, PHIPS) already appear to be ice, growth by vapor diffusion

2DS Ice conc ~ 20/L



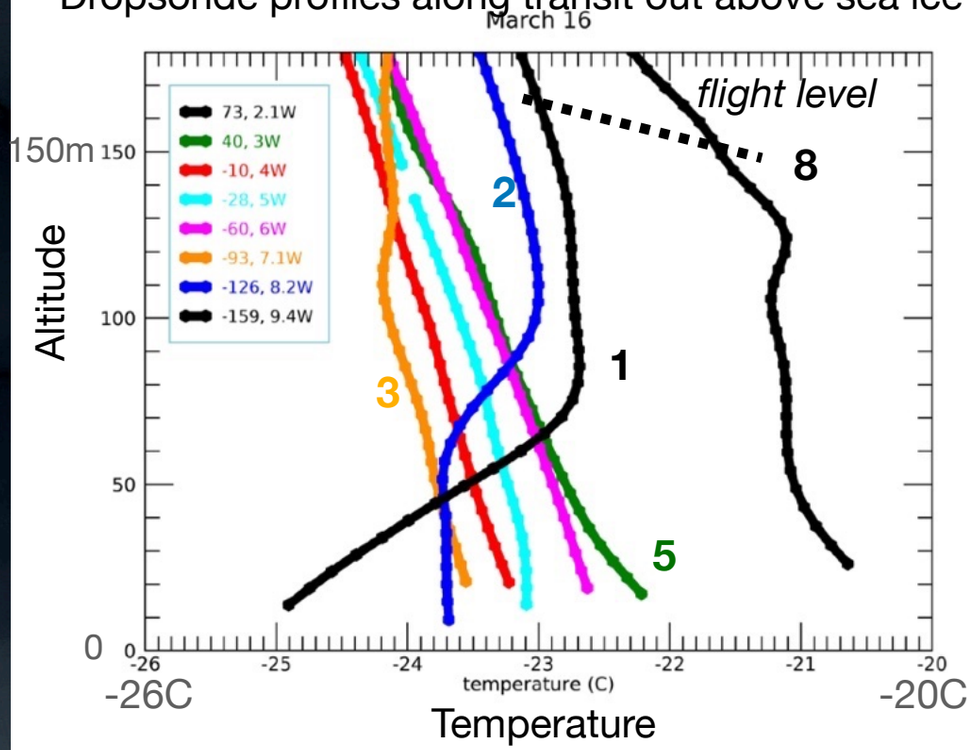


provided by E. Järvinen, KIT

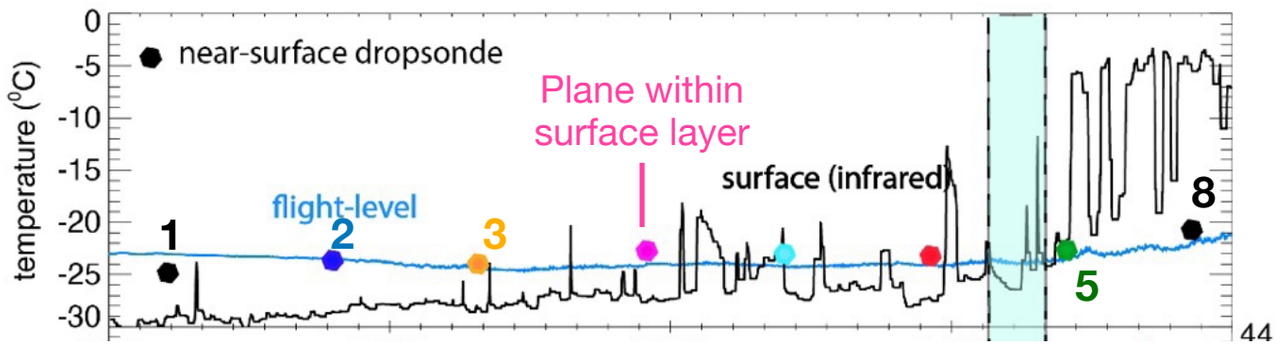
WCR

13:50 13:55 14:00 14:05 14:10 14:15 14:20 14:25

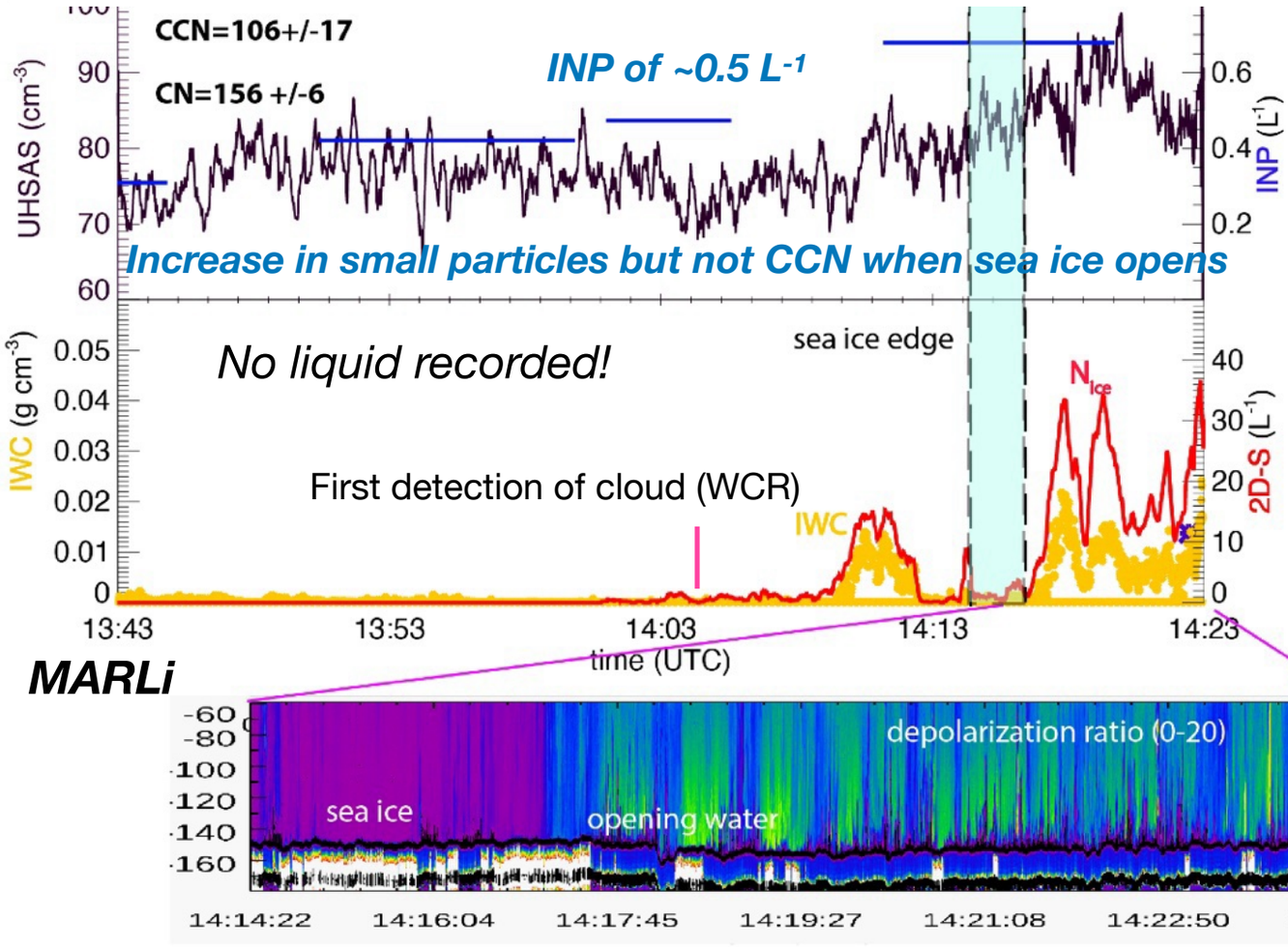
Dropsonde profiles along transit out above sea ice



Ice particles appear to originate from near-instantaneous condensation+freezing at -25C over leads



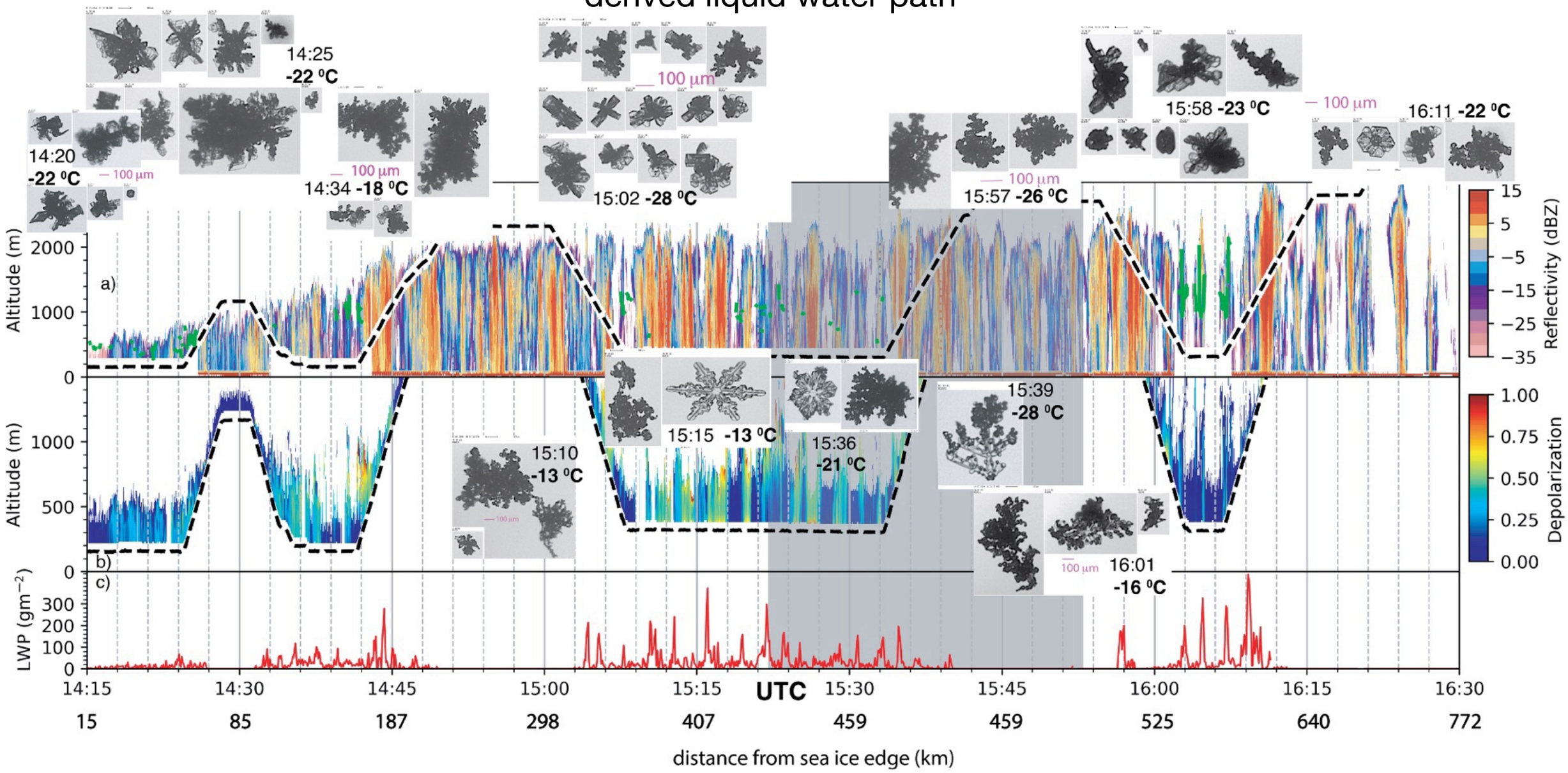
Furthest west

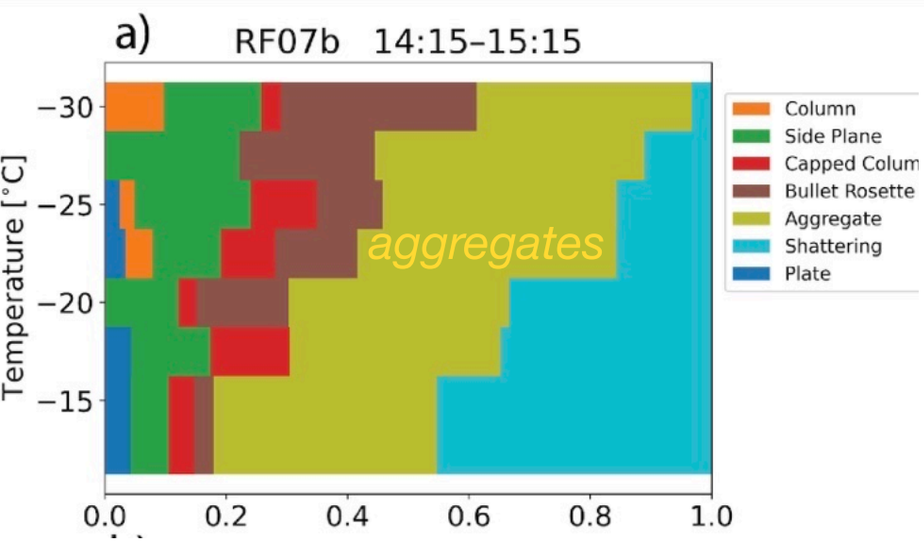


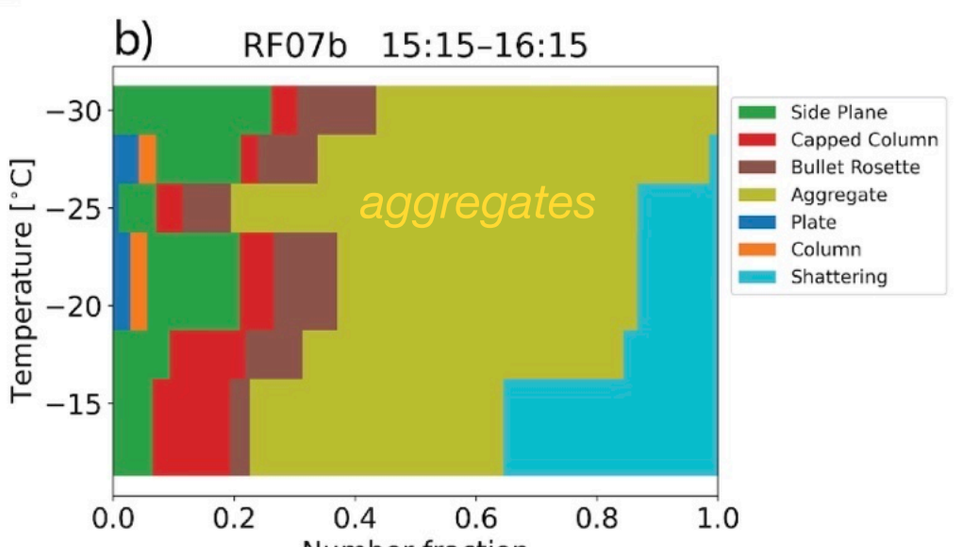
13:40 UTC

~ 250 km

a) up+down pointing 95 GHz radar+PHIPS microphysical imagery; b) lidar depolarization; c) microwave-derived liquid water path







Emma Jarvinen habit-characterization analysis indicates more aggregates with fetch (riming not considered)

This CAO morphed into a polar low near Norway….strongly convectively driven, cloud tops went from 2.5 km to 4km. weak low-level baroclinicity+ upper-level potential vorticity anomaly
(On-going analysis by Pablo Velt/Bart Geerts)

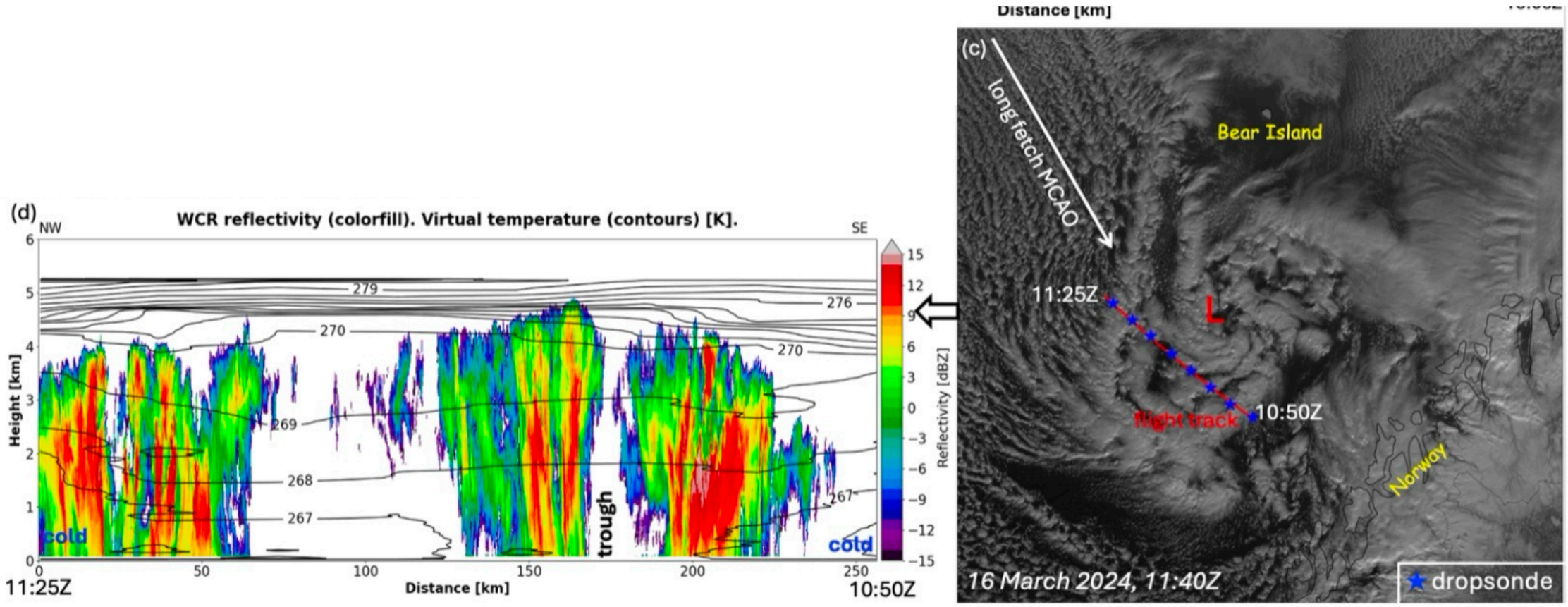


FIG. 9. Two polar lows, a shallow system sampled on 2 April (RF09; panels a-b) and a deeper, more convective polar low on 16 March (RF07; panels c-d). a) Advanced Very High Resolution Radiometer (AVHRR) visible image on 2 April 12:40 UTC (RF09), with C-130 flight track shown from 14:15 UTC to 15:05 UTC (dotted line). b) RF09 2 April 14:15 UTC-15:05 UTC WCR reflectivity with aircraft track shown colored by the

Polar cyclogenesis 2 April, RF09

Newman, E., B. Geerts, J. D. Doyle, C. Grasmick, P. Zuidema, S. Ephraim, and Z. Wang, 2025: Airborne observations of the vertical structure of a shallow polar low in the Norwegian Sea. *Mon. Wea. Rev.*, **154**, https://doi.org/10.1175/MWR-D-25-0109.1.

Polar low resulted from 2 merging CAOs along a convergent shear zone (Jim Doyle has done an adjoint analysis that highlights sensitivity to the Svalbard topography)

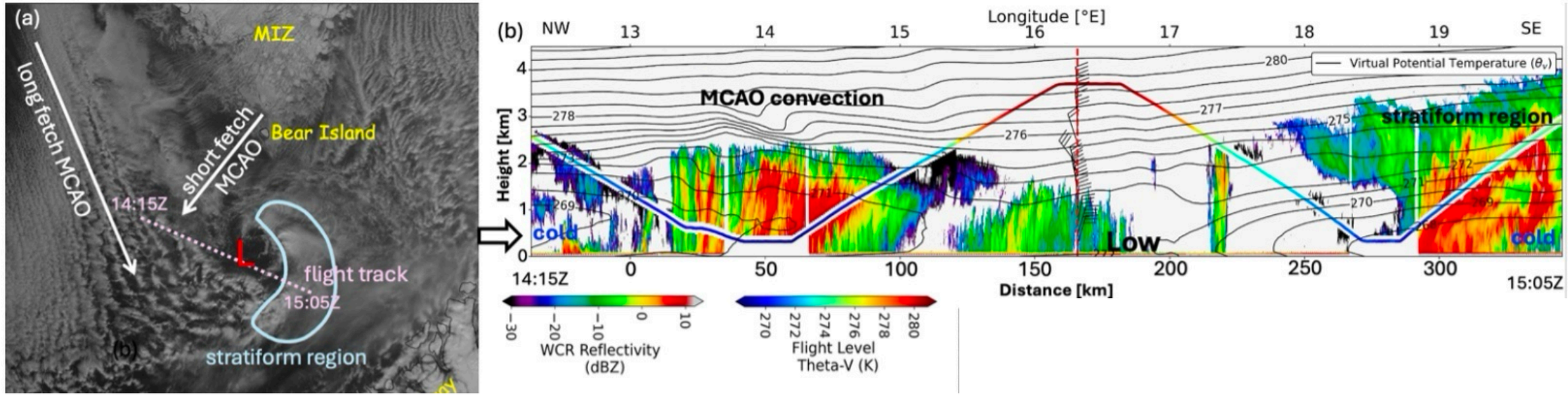
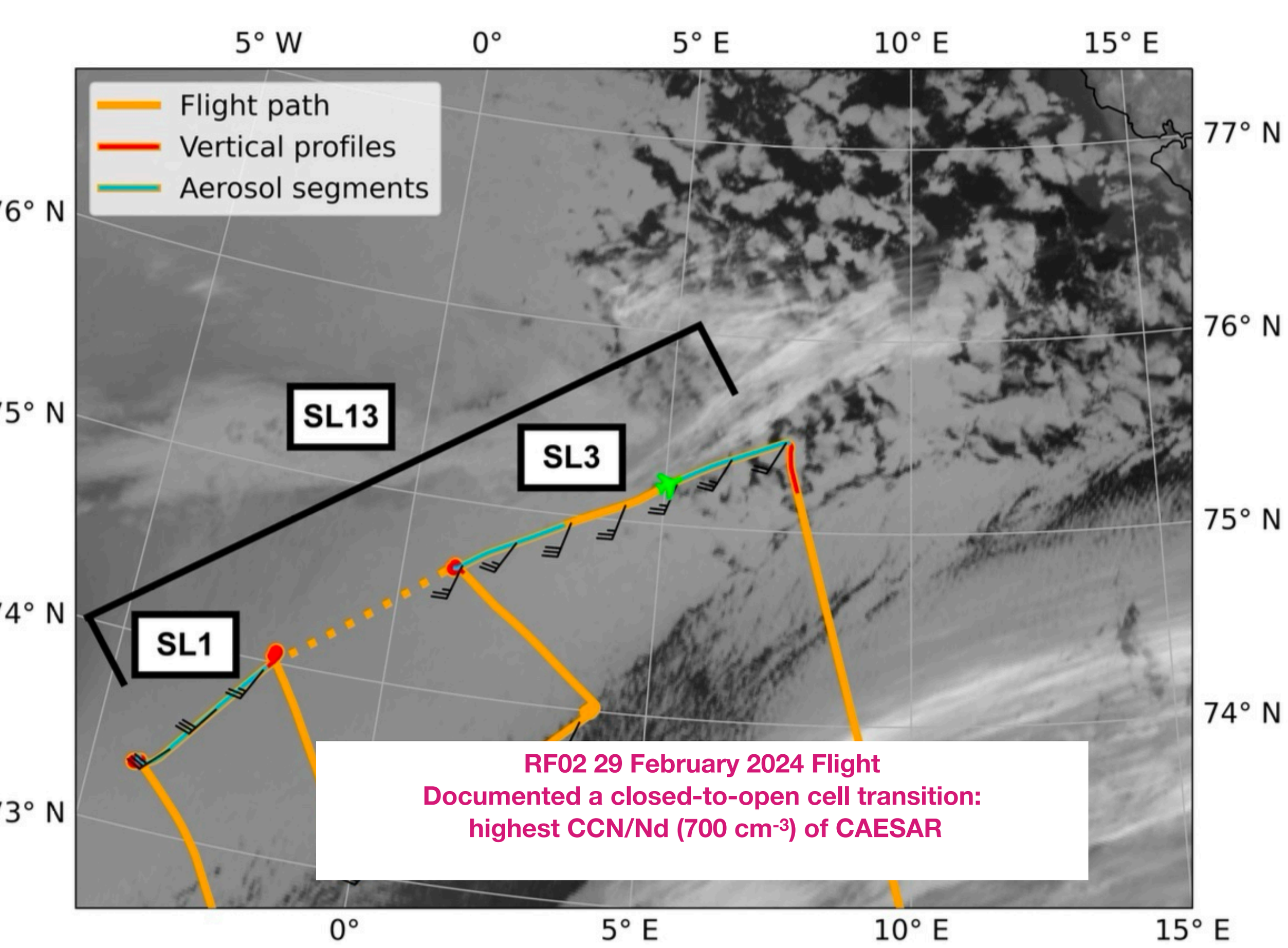
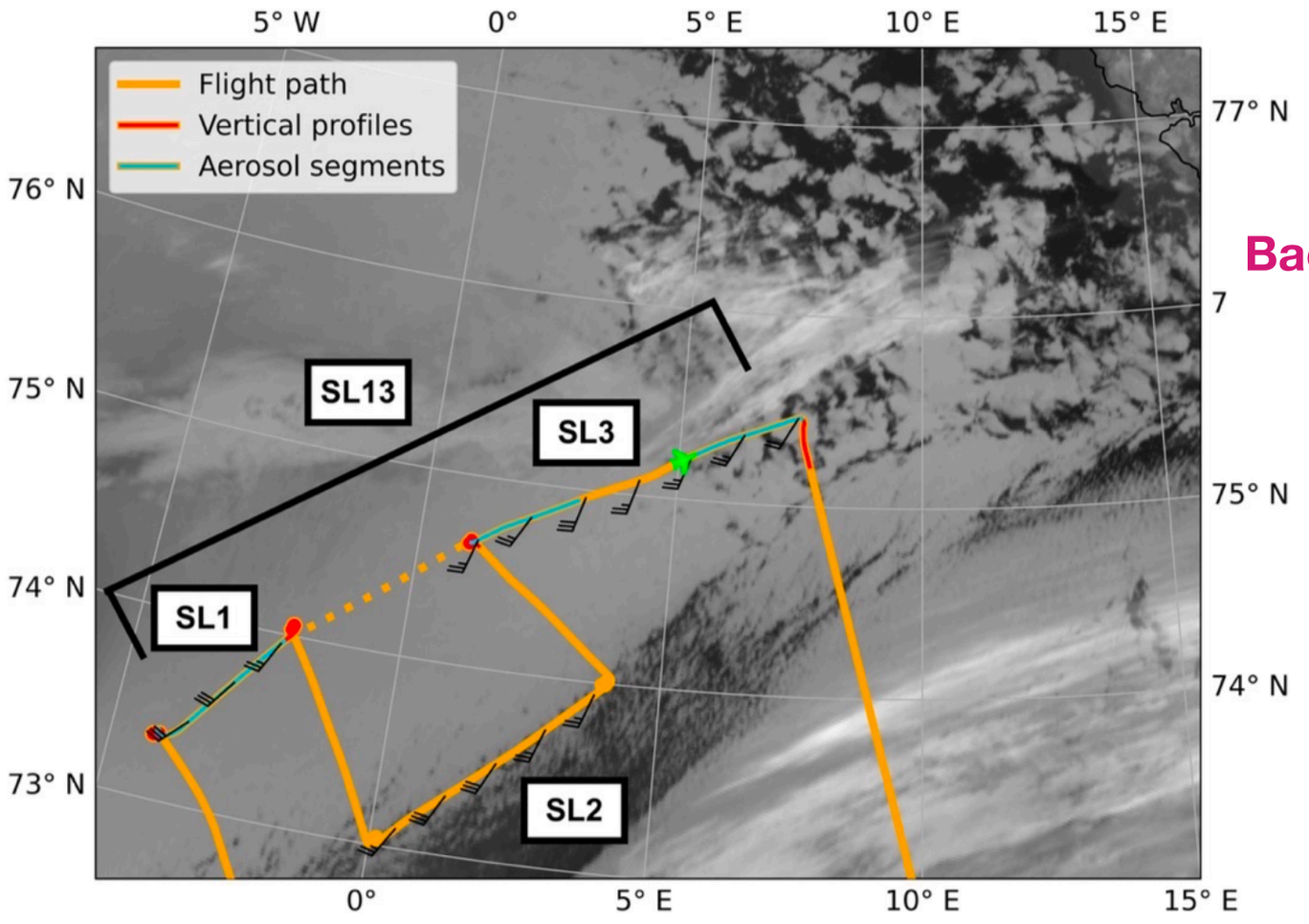


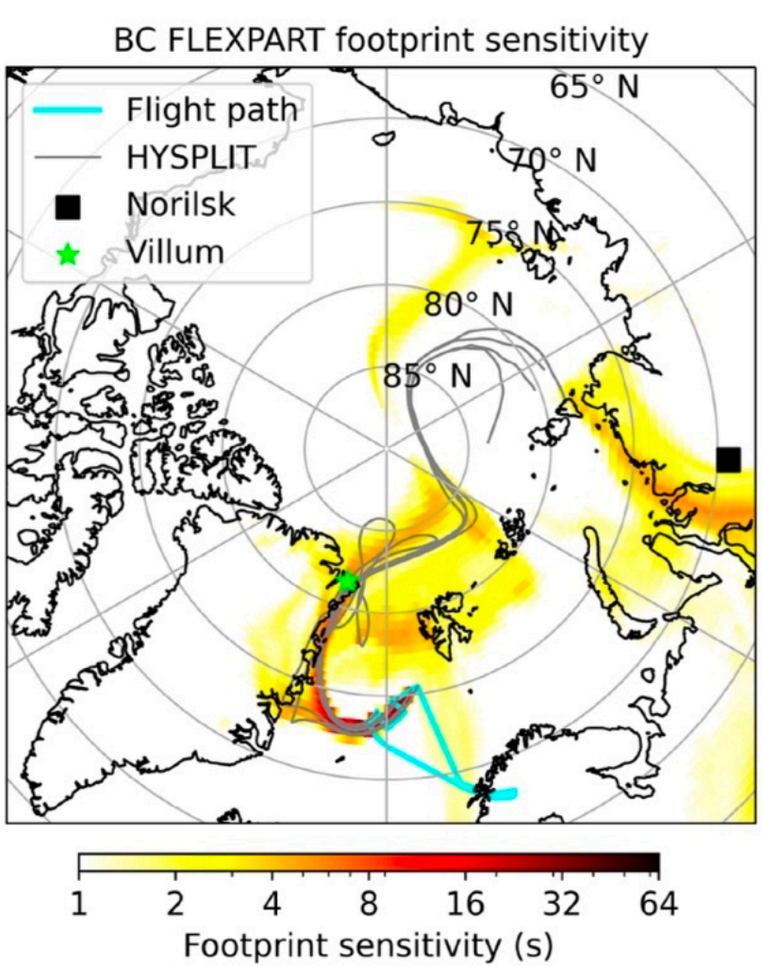
FIG. 9. Two polar lows, a shallow system sampled on 2 April (RF09; panels a-b) and a deeper, more convective polar low on 16 March (RF07 panels c-d). a) Advanced Very High Resolution Radiometer (AVHRR) visible image on 2 April 12:40 UTC (RF09), with C-130 flight track shown

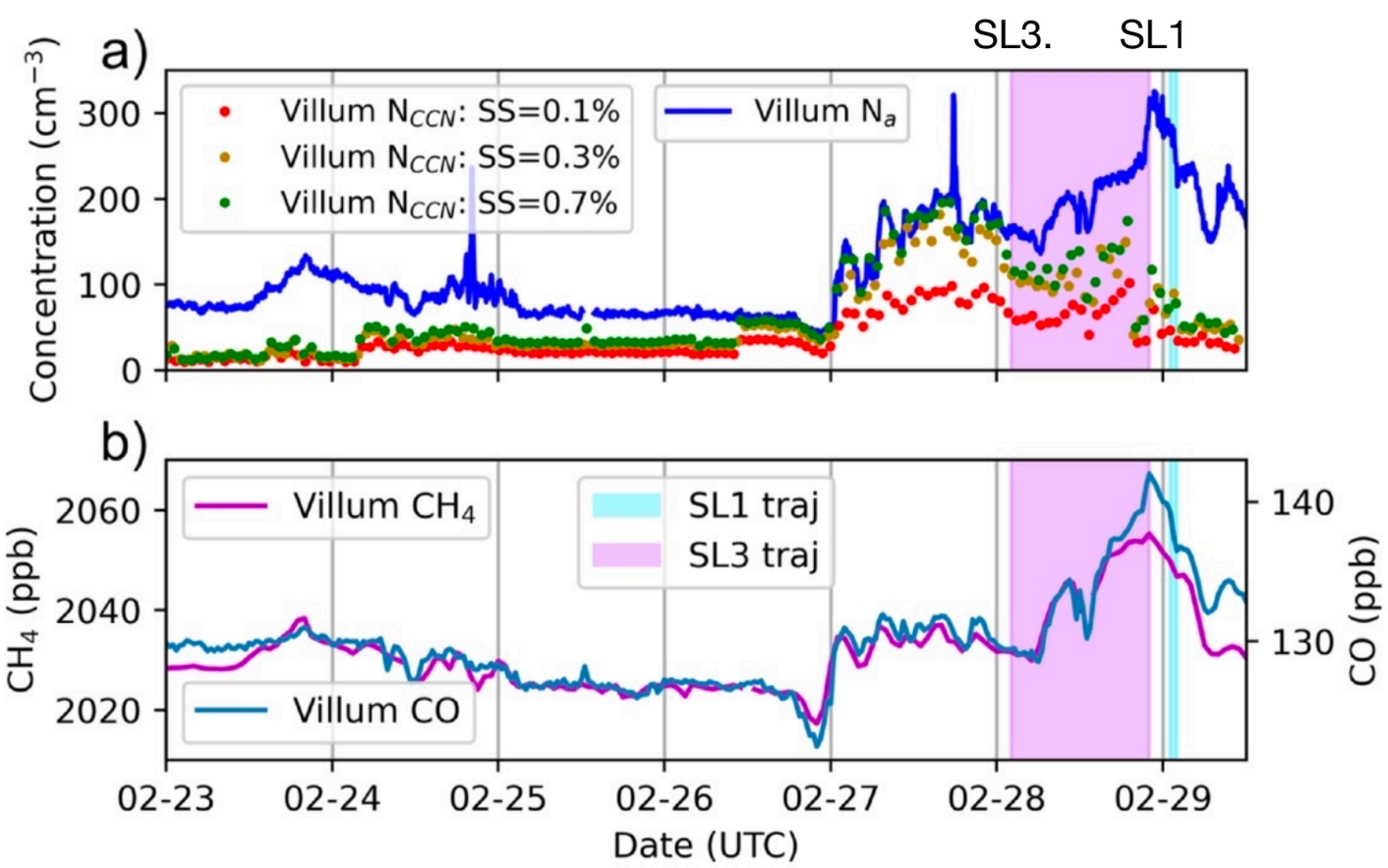


Ephraim et al. poster (manuscript submitted to ACPD)



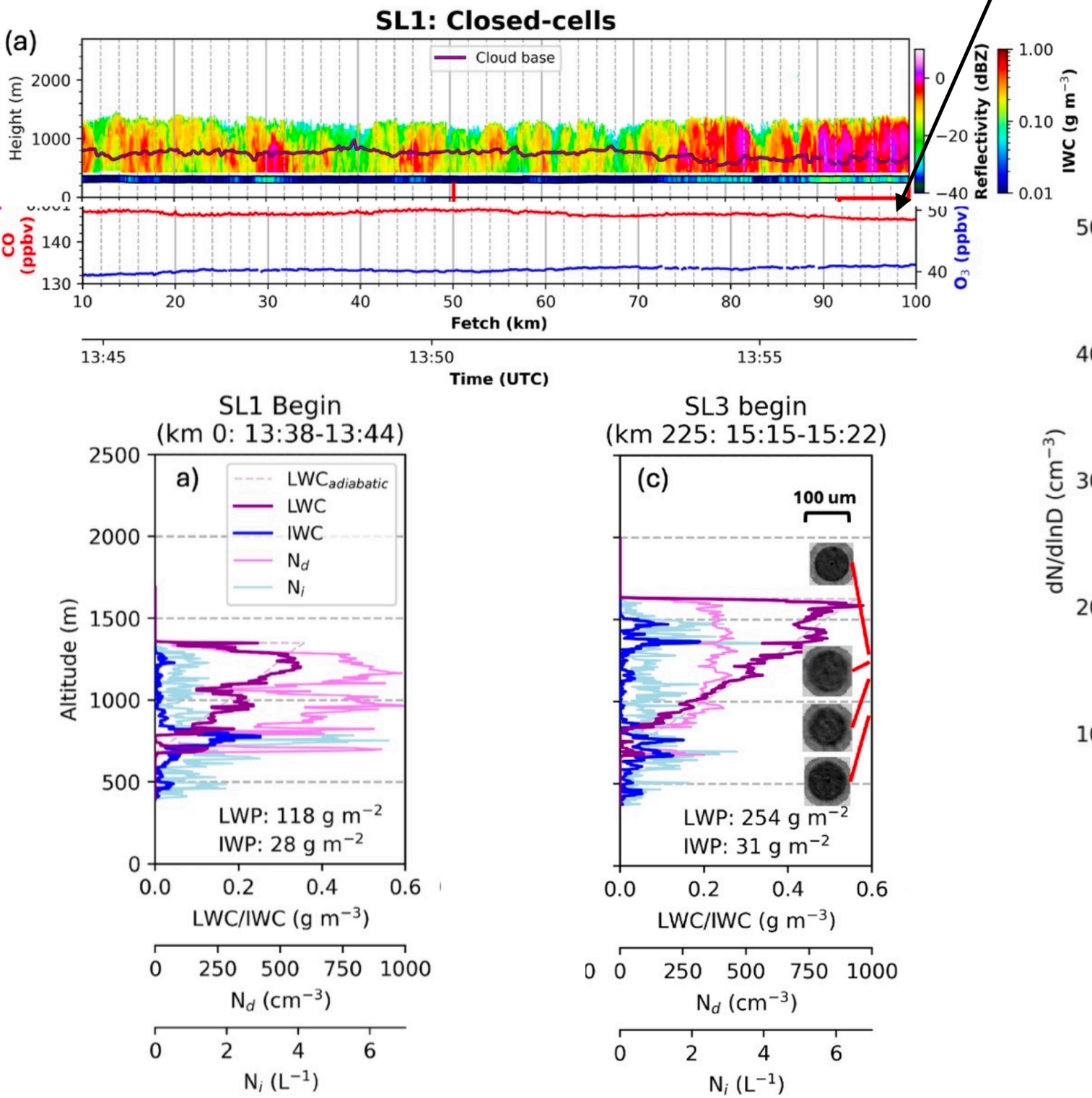
Back-trajectories flow past Villum Research Station northeast Greenland; corroborate pollution advected in from Norilsk, Siberia

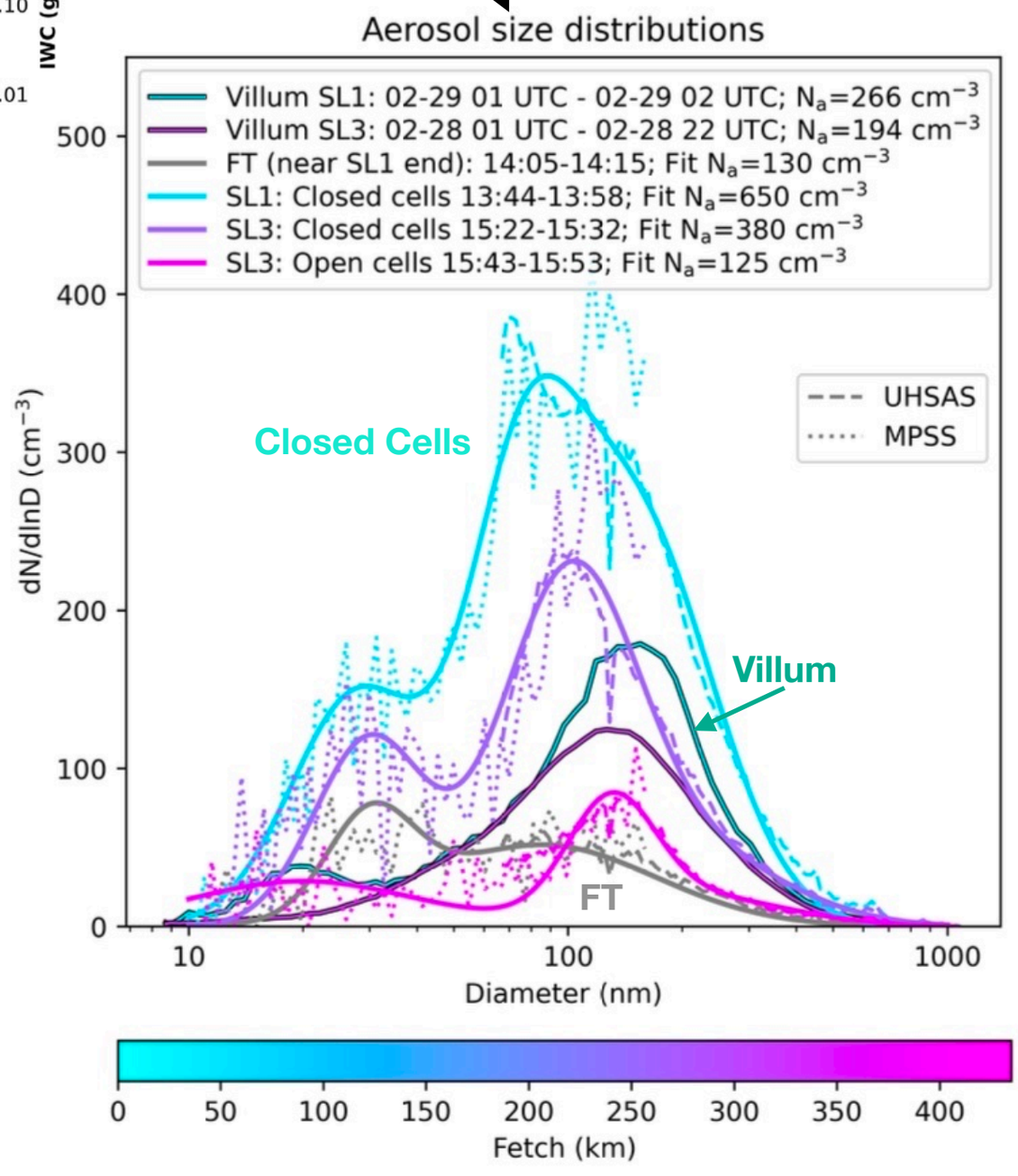


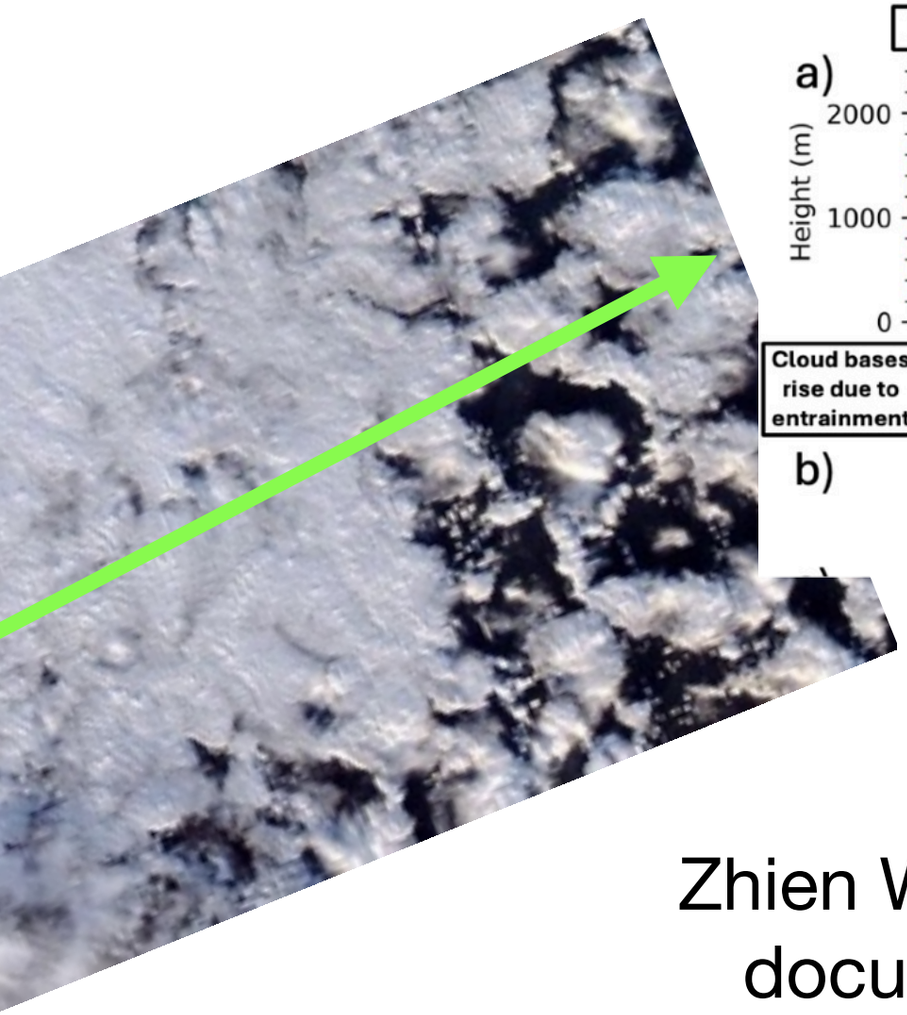


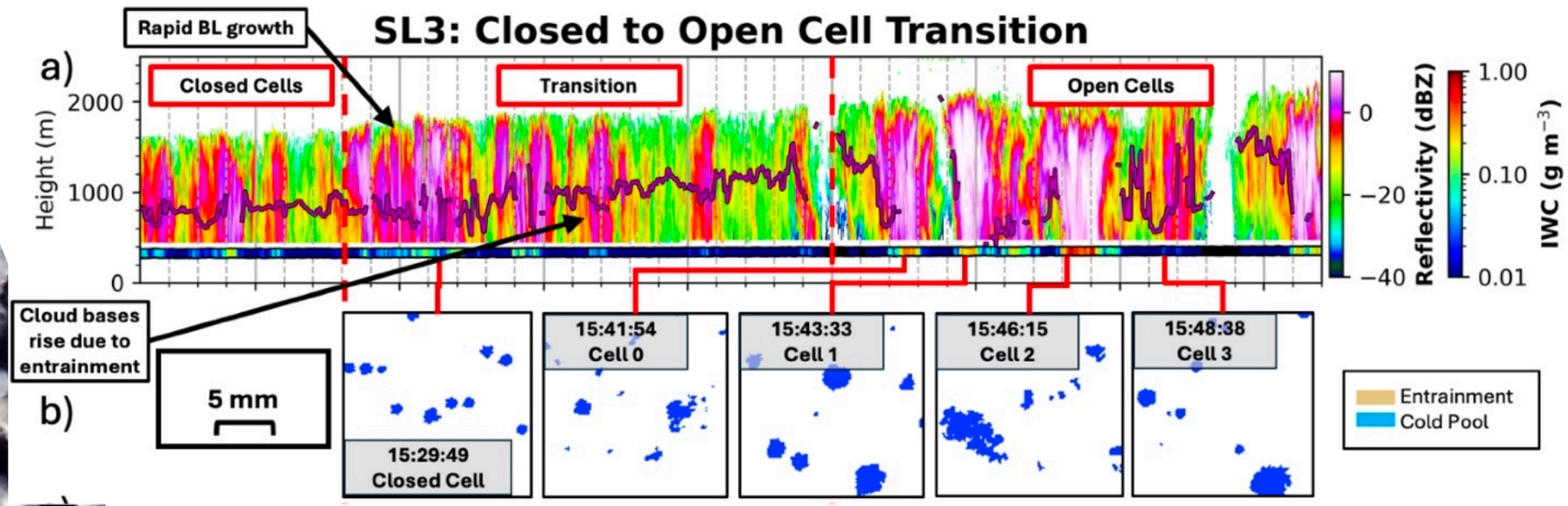
Ephraim et al. poster (manuscript submitted to ACPD)

Closed-cell aerosol size distribution is bimodal (accumulation+Aitken aerosol). Villum is mostly accumulation-mode aerosol, free-troposphere aerosol is dominated by Aitken aerosol.
An entrainment estimate based on CO & O3 suggests free-tropospheric entrainment primarily dilutes the boundary-layer accumulation-mode aerosol (precipitation is < 0.5 mm/hr) increasing the droplet effective diameter

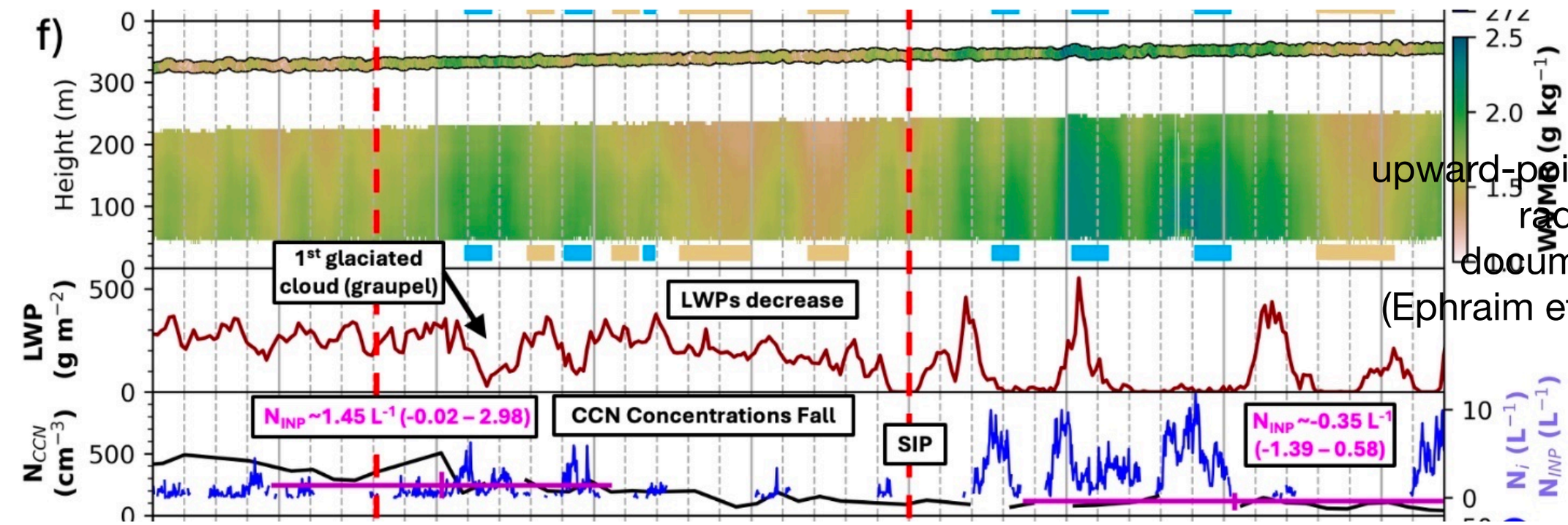








Zhien Wang's downward-pointing Raman lidar documents cold pools/entrainment events



upward-pointing microwave radiometer documents LWPs (Ephraim et al 2025, JAOT)

Liquid-producing (f) updrafts (b) associated with reduced wind speeds (a) indicating surface wind convergence.

Cold pools located to the east (right) of the updrafts (advected with mean winds)

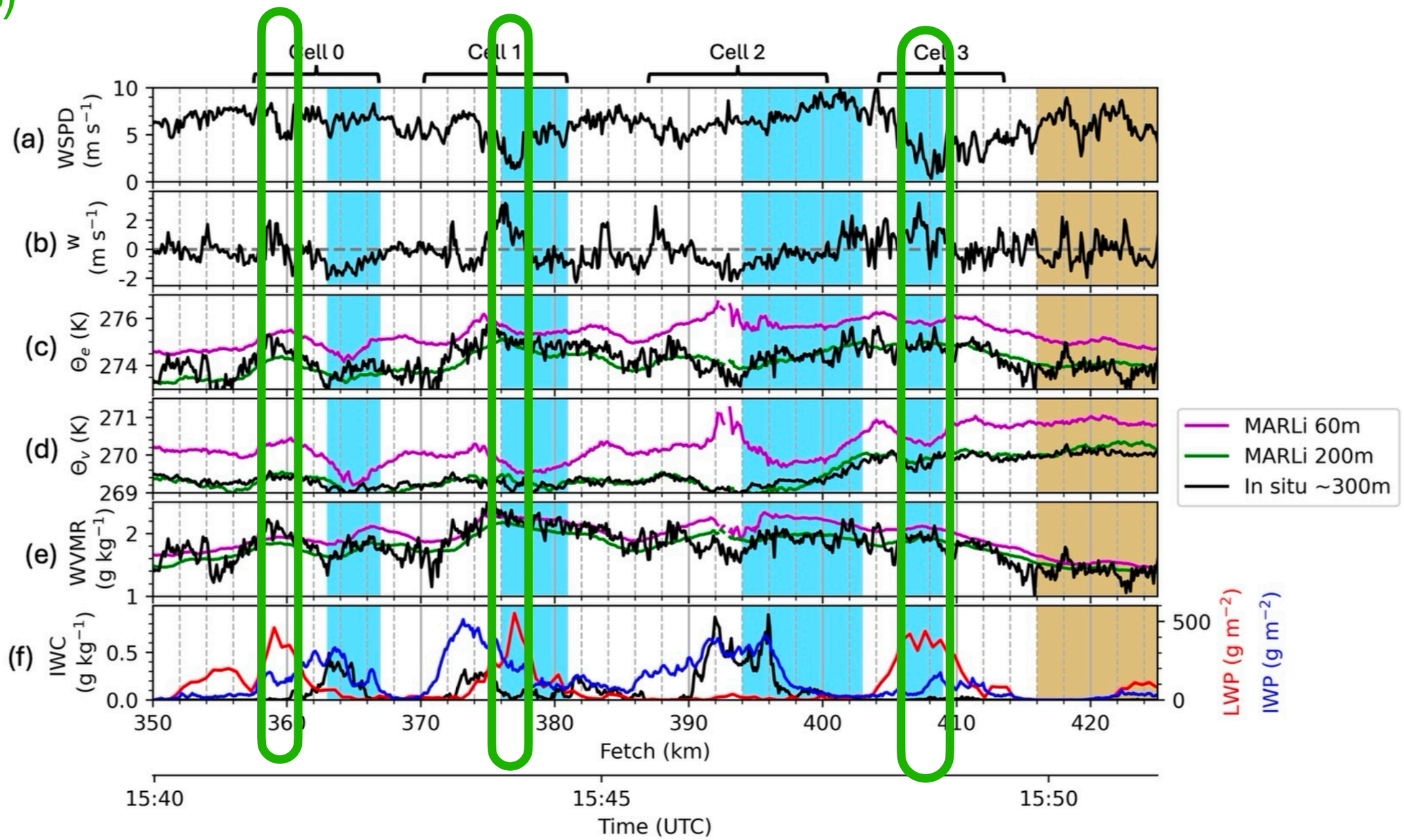


Figure 16. In situ flight level (300 m) (a) horizontal wind speed (WSPD) and (b) vertical wind velocity (w), (c) Θ_e, (d) Θ_v, and (e) WVMR. c)-e) also include MARLi-derived values at 60 m and 200 m altitude. (f) Retrieved LWP/IWP and in-situ IWC. From km 391 (15:46:06 UTC) to km 394 (15:46:33 UTC), the lowest level MARLi derived parameters (θ_e, θ_v, and WVMR; are impacted by heavy ice precipitation attenuating the MARLi signal.

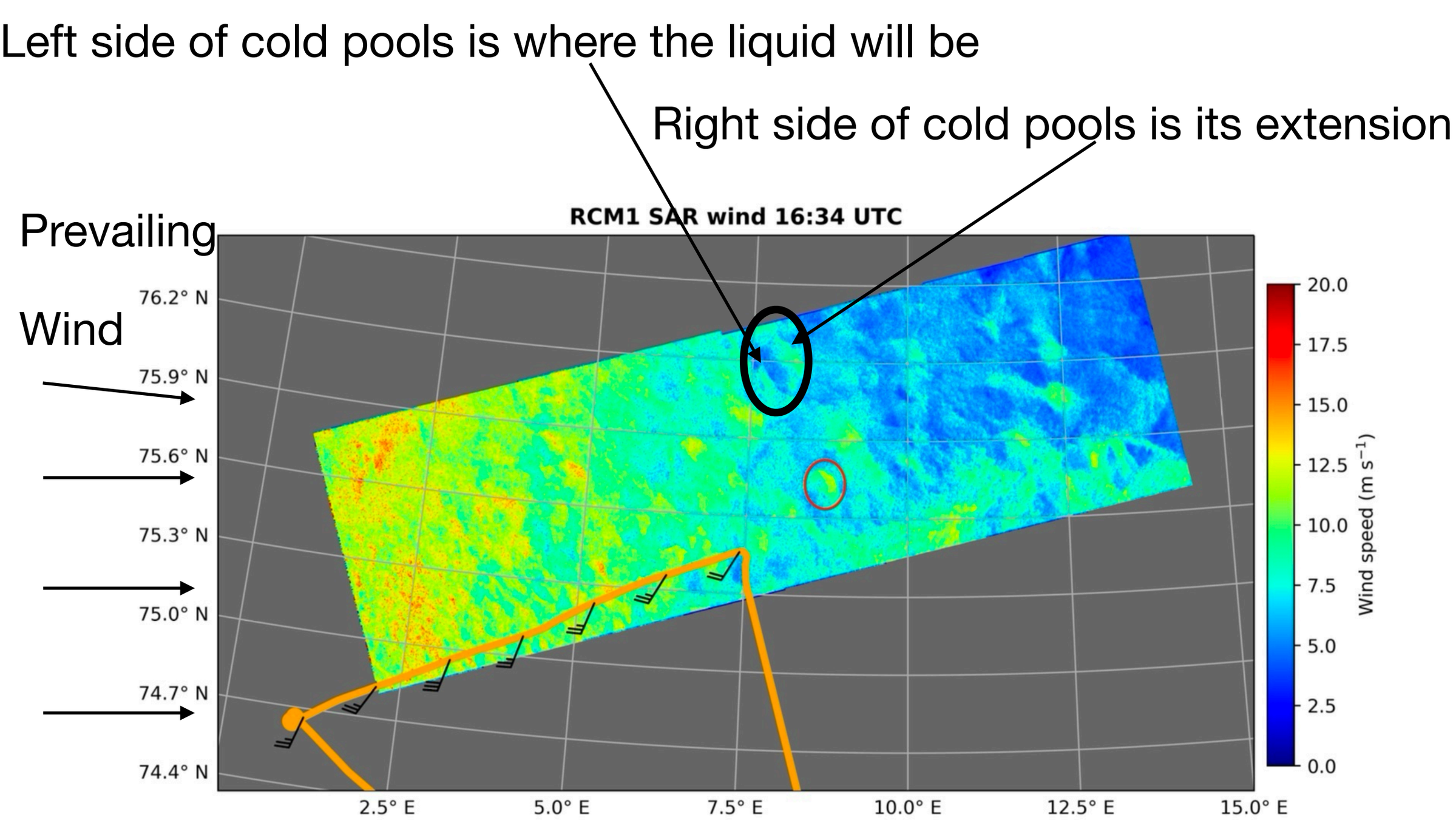
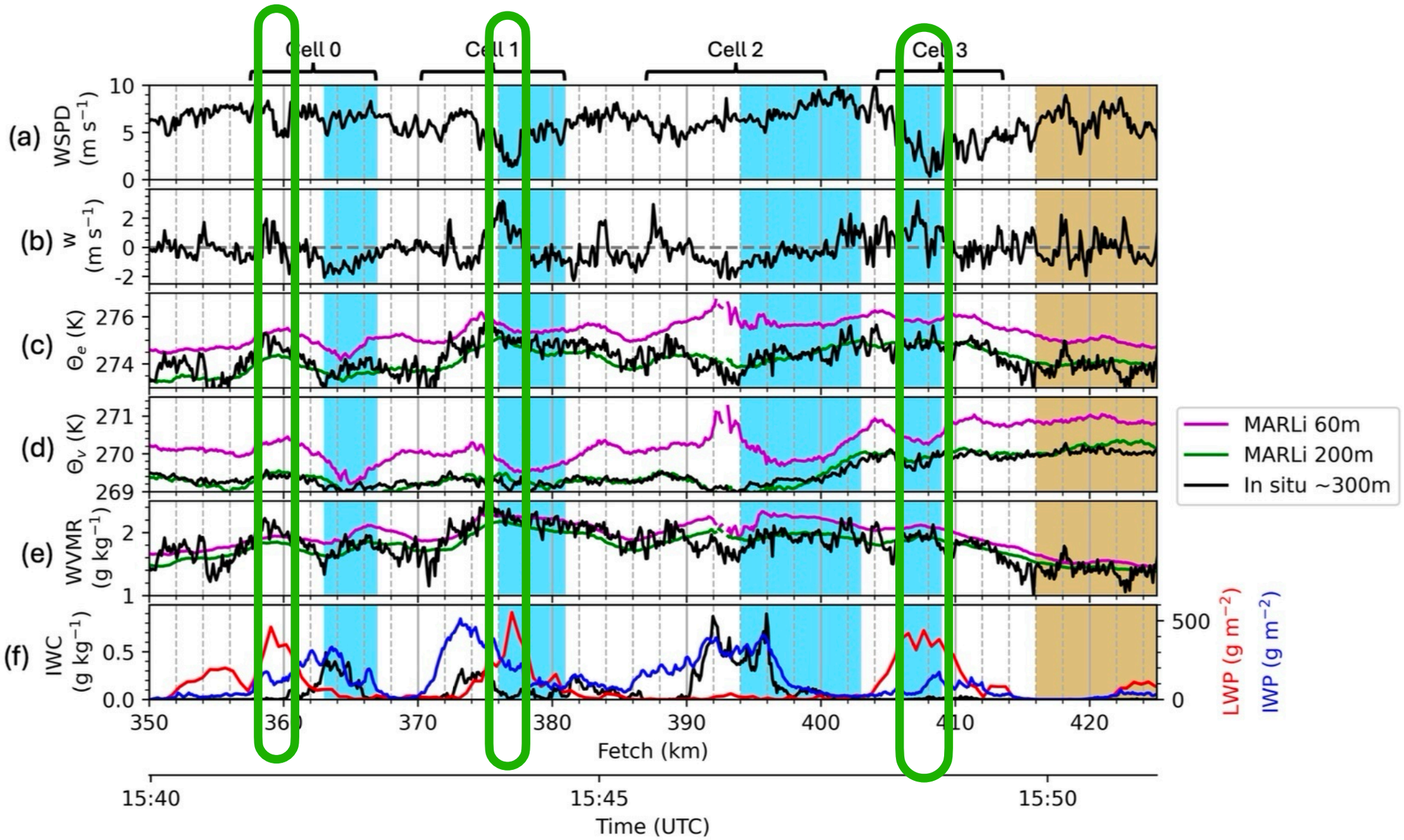


Figure 15. SAR imagery from RadarSat Constellation Mission 1 (RCM1) showing the 10 m wind field in the vicinity of SL3 ~30 minutes after the completion of SL3. Flight track is overlaid on the wind field along with flight-level (300 m) wind barbs (knots). An example of a cold pool signature is circled. at 75°N, 1° longitude is approximately 29 km.

Cold pools in RF02 too weak to thermodynamically decouple the sub-cloud atmosphere. Buoyancy fluxes ~ 200-250 W m^{-2}! Cold pools seem to most just organize where the warm, moist plumes draft up



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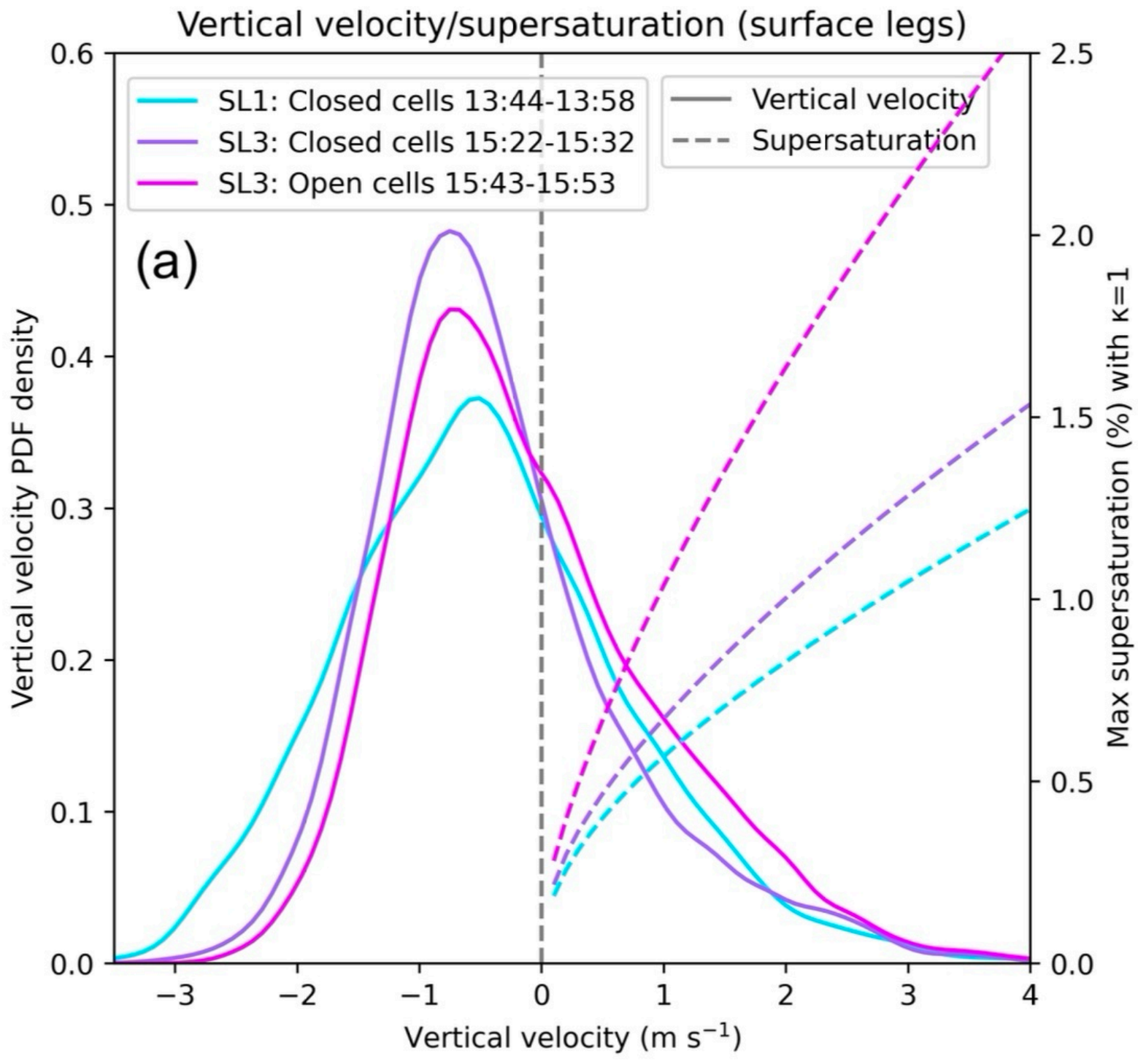
Vertical velocity distribution is positively-skewed, along with overcast ‘stratocumulus’-like cloud deck



CAESAR-related talks/posters at AMS Madison

Monday August 3:

3pm-4:30 posters
Sam Ephraim et al.: A Closed to Open-Celled Mixed-Phase Cloud Transition Observed Over the Nordic Seas Under High Aerosol Loading.

Xia et al.: Marine Boundary Layer Cloud Evolution along an Arctic Cold Air Outbreak: Results from CAESAR Airborne Observations and Simulations

Wednesday August 5:

Marine Cold Air Outbreaks Joint Session 9 8:30-10:00
9:15am Cai et al.: Aerosol Scavenging in Arctic Marine Stratocumulus Clouds during Cold Air Outbreaks
9:30 am An Yang et al.: Cloud and Precipitation Evolution and the Role of Sublimation in Arctic Marine Cold-Air Outbreaks from CAESAR

3pm-4:30 posters
Pablo Velt et al.: Understanding the Transition from Shallow to Deep Open-Cellular Convection In a Marine Cold Air Outbreak: A Case Study from CAESAR

Zhien Wang et al.: Quantify Ice Generation of Cold Air Outbreak Clouds with Combined Airborne Lidar and Radar Observations

Bailey et al: Tracing the Isotopic Signature of Extreme CAO Evaporation In Precipitation

Thursday August 6:

3pm-4:30 posters
Martrich et al.: Assessing the Spatial Scales Resolved by High-Rate Nevzorov Hot-Wire Probe Measurements During CAESAR

Community Engagement Is Important to NSF campaigns

edec.ucar.edu/public/field-projects/caesar

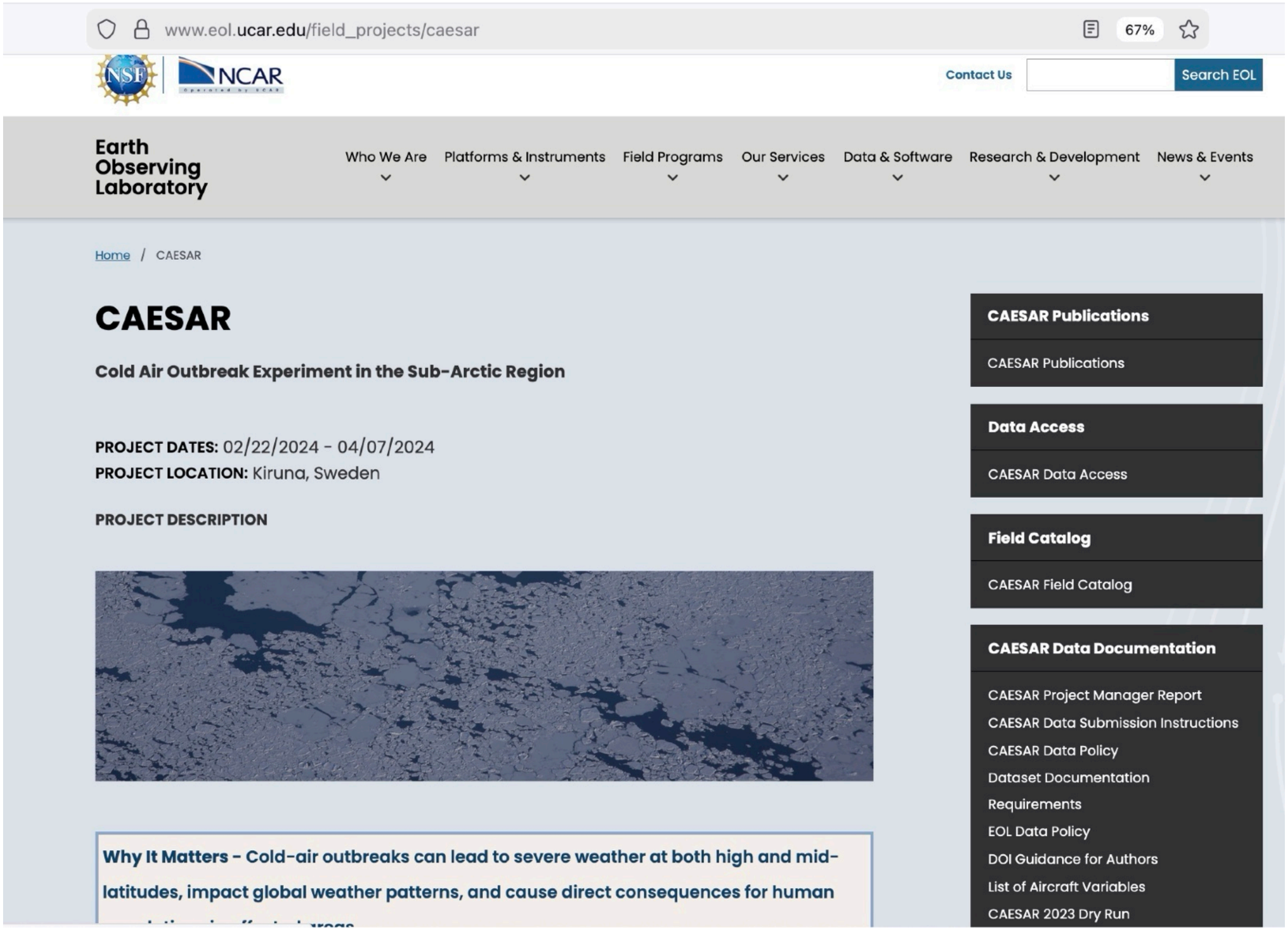
The Science of CAESAR

Official Selection
Polar Film Fest
2024

Data publicly available, some value-added products still under development

TABLE A2. Value-Added Products (VAP)

Product	Description	doi
aerosol	CN+SMPS+UHSAS+SP2+PCASP	10.26023/DQFV-MKGR-J608
microphysical	merged 2D-S+HVPS3, 2D-S liquid/ice discrimination	tbd
remote sensing	merged WCR+WCL+KPR+MARLi,WCL-cloud top,base heights	10.26023/9SGP-MXGP-MA06
camera movies+animated plots	z,p,lon,temp,w,LWC,N_{2DS}, N_{CDP},O_3; MP4, RF 4,5,6,9,10 only	10.26023/NKZ0-AXTJ-TF08



Discussion to request C-130 for CAO-focused "MORPHEUS" project out of Maine, spring 2028….ability for NSF to consider this is not promising