



CoSMIR Along-Track Scan for Cloud Tomography

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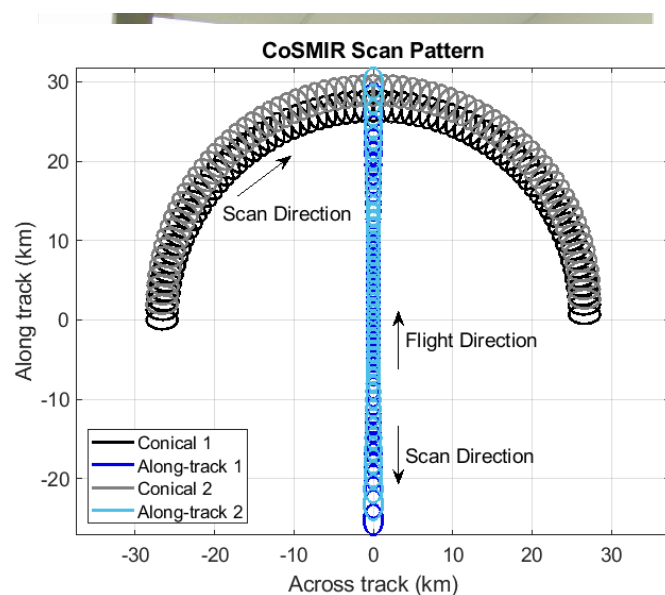
Thanks to Joe Munchak for early science efforts to develop this concept

Extra thanks to Matt Fritts and the Microwave Instruments Branch at Goddard for ensuring reliable operations of CoSMIR while also advancing the new CoSSIR build

CoSMIR and CoSSIR

CoSMIR: Conical Scanning Millimeter-wave Imaging Radiometer

CoSSIR: Configurable Scanning Submillimeter-wave Instrument/Radiometer



CoSMIR			CoSSIR		
Fc (GHz)	BW (GHz)	NEDT (K)	Fc (GHz)	BW (GHz)	NEDT (K)
50.3 h	0.4	0.21			
52.8 h	0.4	0.32			
89.0 v/h	2.0	0.14/0.13			
165.5 v/h	2.0	0.18/0.16	170.5 v/h	1.0	0.20
183.31±7 h	3.0	0.16	177.31 v/h	1.0	0.20
183.31±3 h	2.0	0.18	180.31 v/h	1.0	0.20
183.31±1 h	1.0	0.20	182.31 v/h	1.0	0.20
			325.15±11.5 v/h	2.5	<0.5
			325.15±3.4 v/h	2.5	<0.5
			325.15±0.9 v/h	1.0	<1.0
			684.0 v/h	6.0	~1.0

Fc: Center frequency

v: Vertical polarization

BW: Bandwidth

h: Horizontal polarization

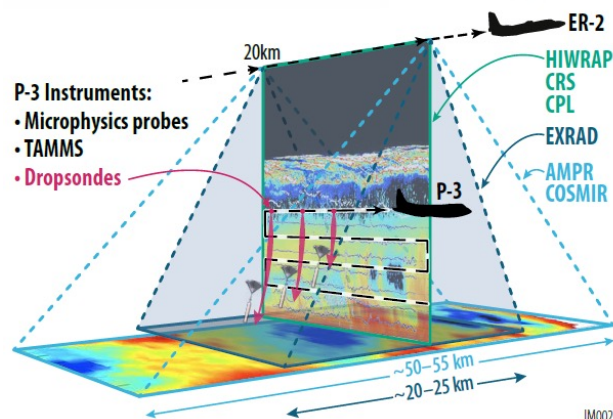
NEDT: Noise Equivalent Delta Temperature

IMPACTS Earth Venture Suborbital 3

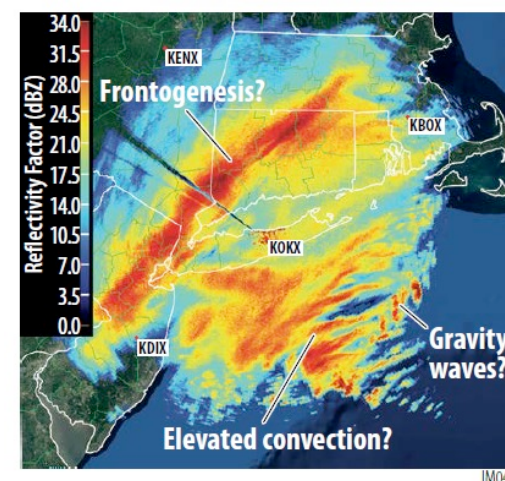


Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms

Deployment: Jan-Feb 2020, 2022, 2023



IMPACTS uses a combination of airborne and ground instrumentation to obtain a high concentration of observations over the East Coast during winter storms, giving a greater understanding of how winter storms form and enable advancement in snowfall retrieval methods from space.



IMPACTS will improve snowfall remote sensing interpretation and modeling to significantly advance predictive capabilities

Data available from the Global Hydrology Resource Center (GHRC):
<https://ghrc.nsstc.nasa.gov/home/field-campaigns/impacts>

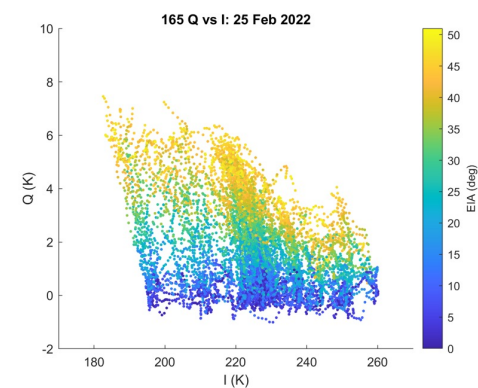
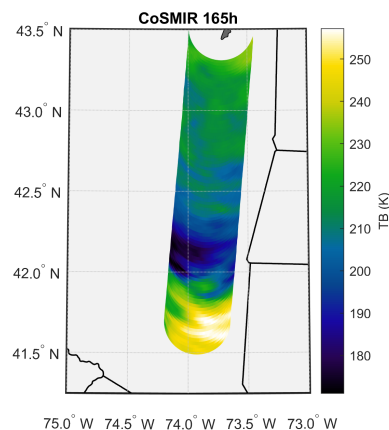
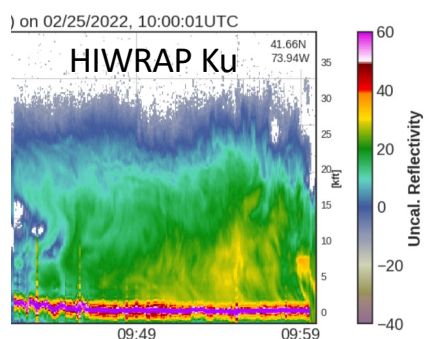
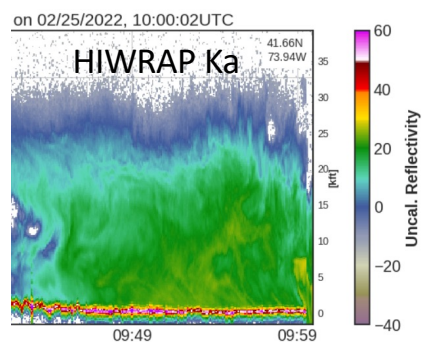
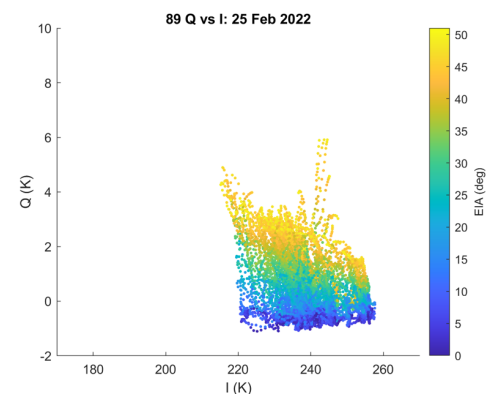
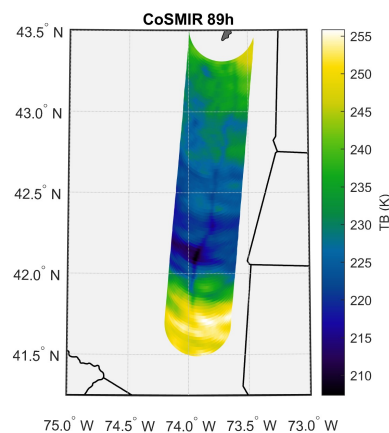
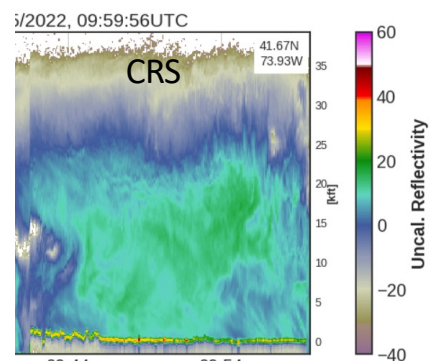
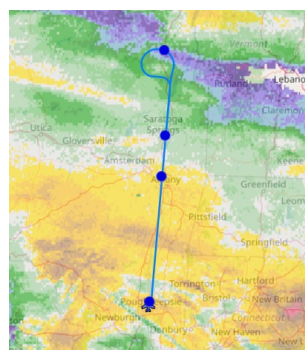
IMPACTS Observation Suite



25 Feb 2022

Flight leg: 09:42–10:00 UTC, southward heading

Radar quicklooks available at <https://har.gsfc.nasa.gov>



Ice Profiling

Compared retrievals using two methodologies

- QRNN
- BMCI

Ice retrievals well constrained

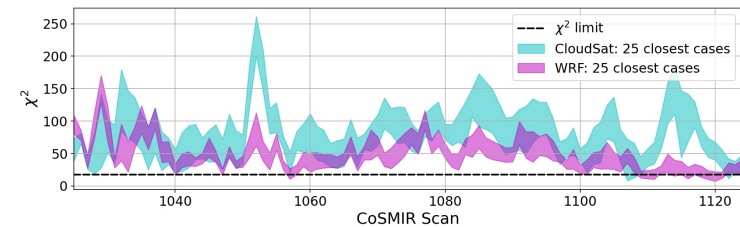
- Liquid more challenging

Overall good agreement between two approaches

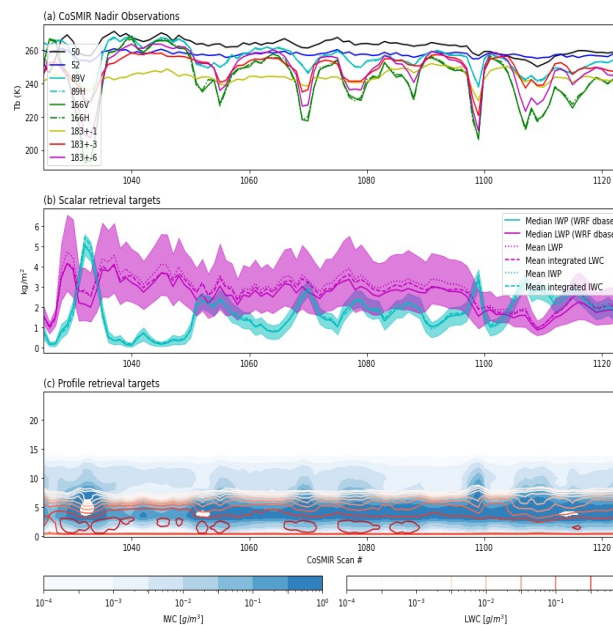
- χ^2 estimates concerningly high

Model run for a priori database performed by Steve Guimond

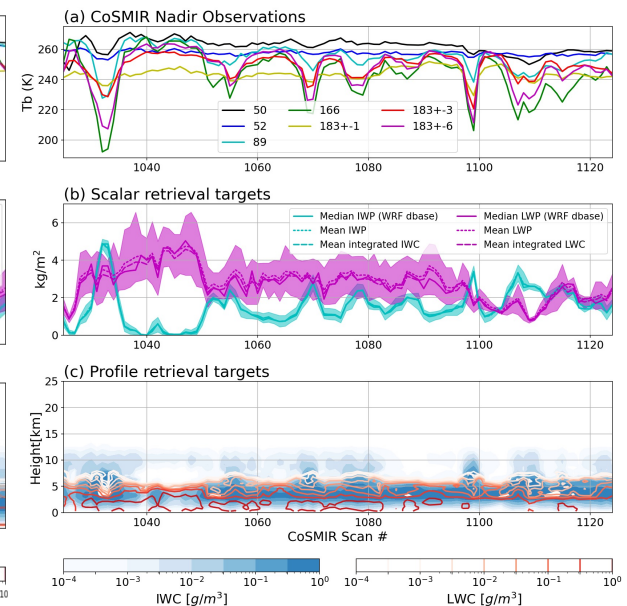
01 February 2020
Coastal Storm



Quantile Regression Neural Network



Bayesian Monte Carlo Integration



Simulated Retrieval Experiment



25 January 2020

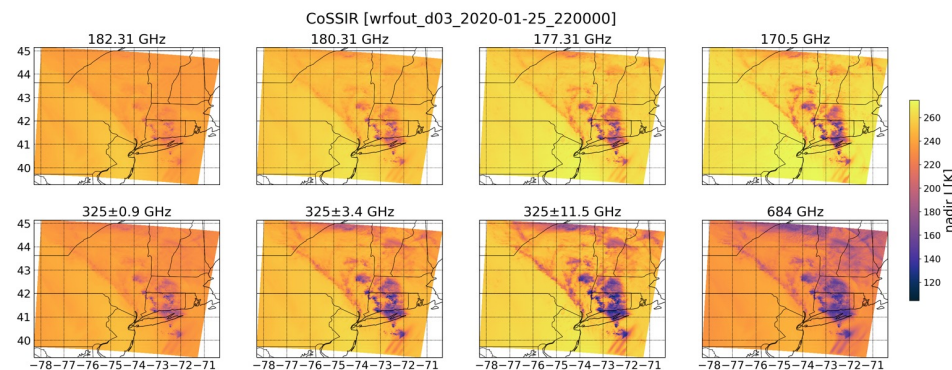
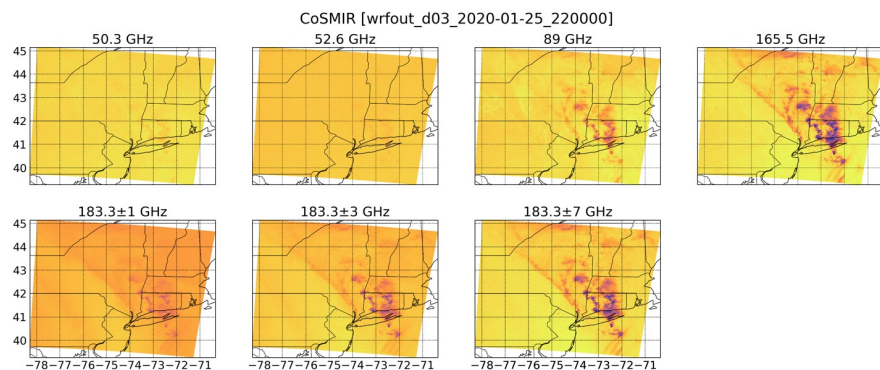
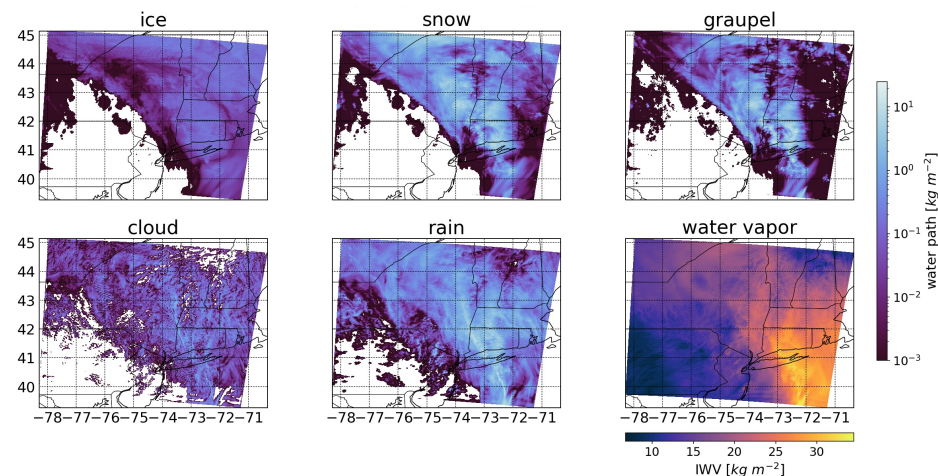
NU-WRF Simulation

Morrison Two-Moment Microphysics

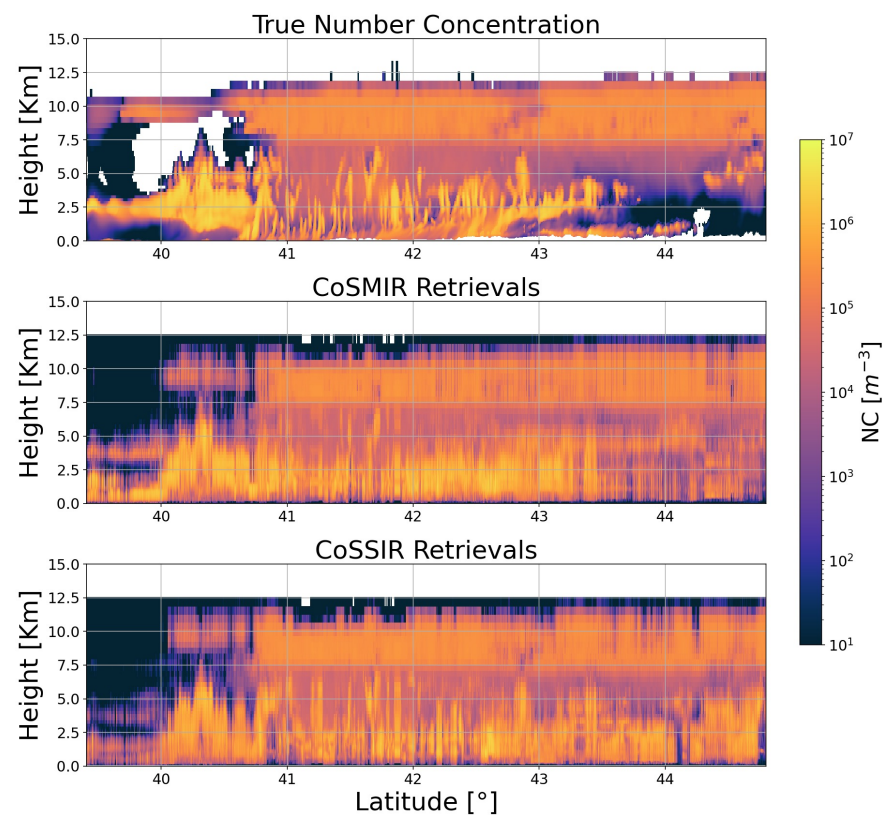
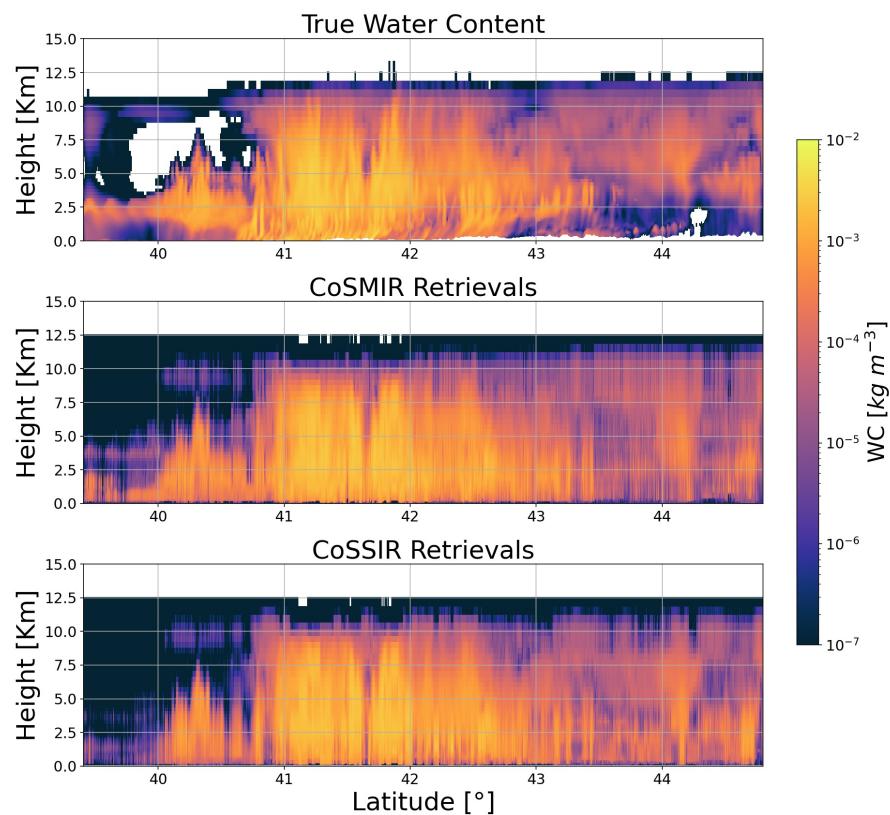
Three Ice Habit

Two Liquid Habits

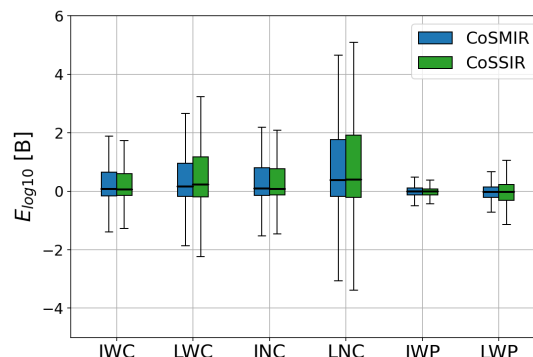
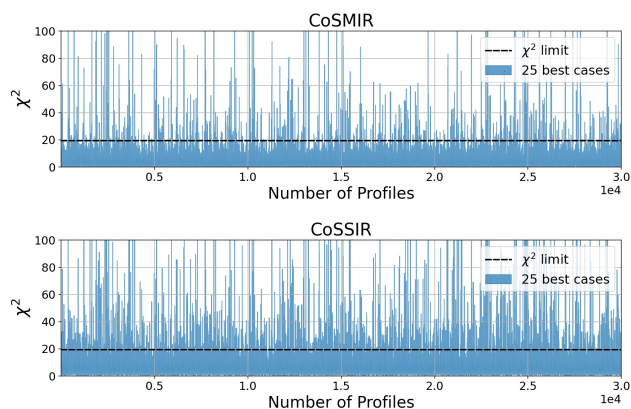
Simulation Performed by Adrian Loftus, GSFC



Curtain Retrievals



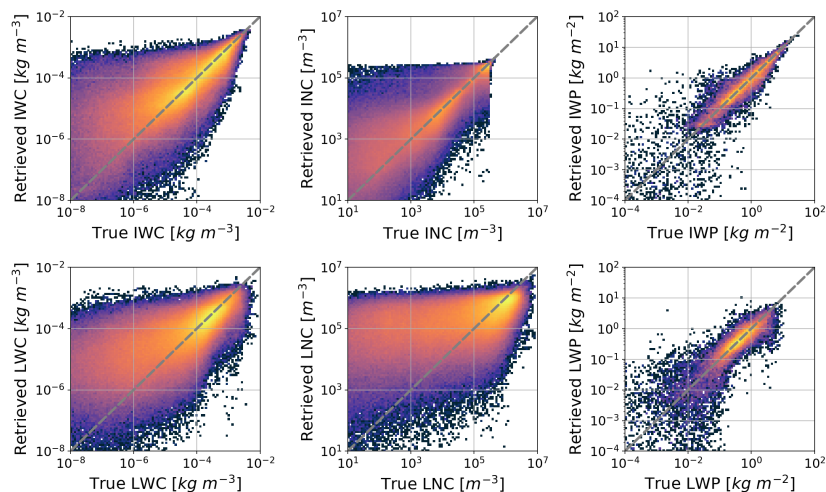
Retrievals Using Full Domain



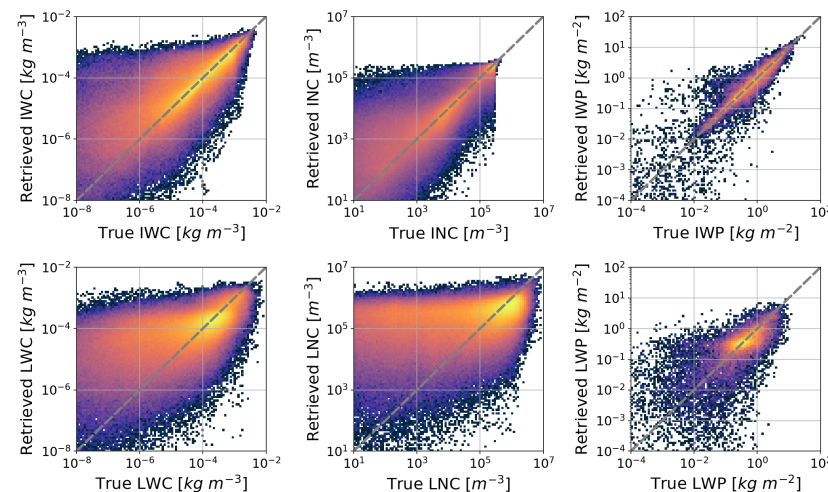
300,000 random samples in prior database
30,000 random samples for testing

$$E_{\log_{10}} = \log_{10} \left(\frac{x_{\text{retrieved}}}{x_{\text{true}}} \right)$$

CoSMIR Retrievals

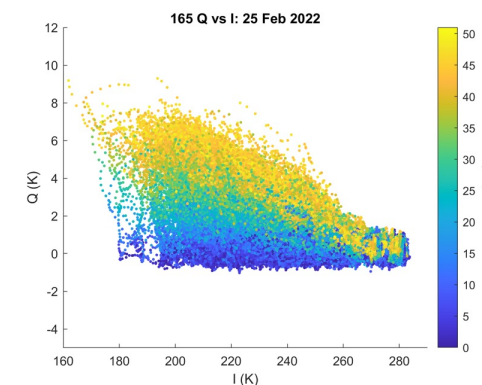
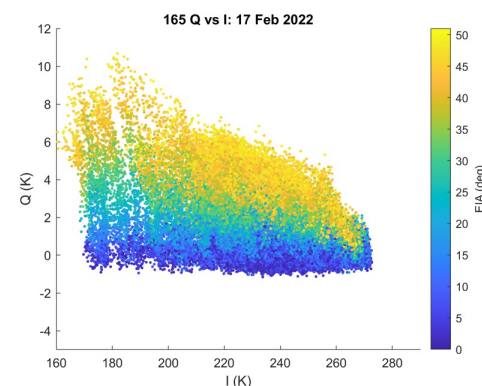


CoSSIR Retrievals



Summary and Conclusions

- Developing tomography retrievals for novel millimeter- and submillimeter-wave polarimeters
 - Fast nadir retrievals will serve as a priori to multi-angle, polarized inversion
 - Polarized radiances key to constraining T_b uncertainties from oriented particles
- QRNN and BMCI provide consistent retrievals
 - Concerning chi squared estimates from BMCI
- Investigation with BMCI shows promising results
 - Good IWP performance for both CoSMIR and CoSSIR
 - CoSMIR provides better estimates of liquid
 - Surprising detail in IWC profiles
 - χ^2 improved, but still concerning

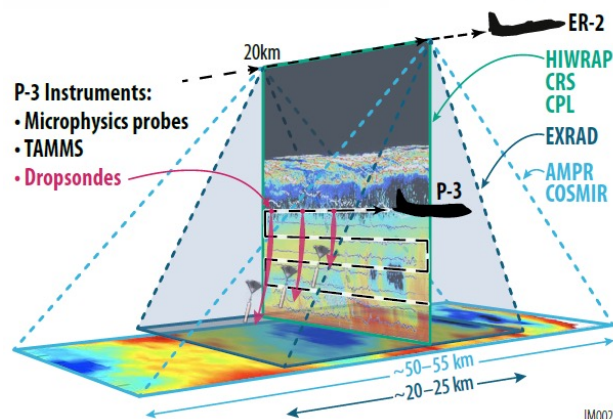


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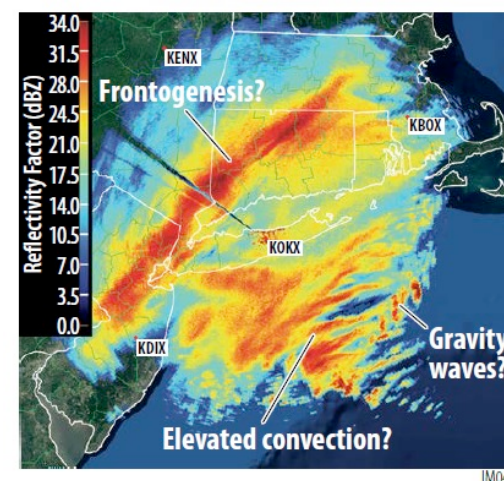


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