

Examples of Science the ArcticShark can deliver to ARM users

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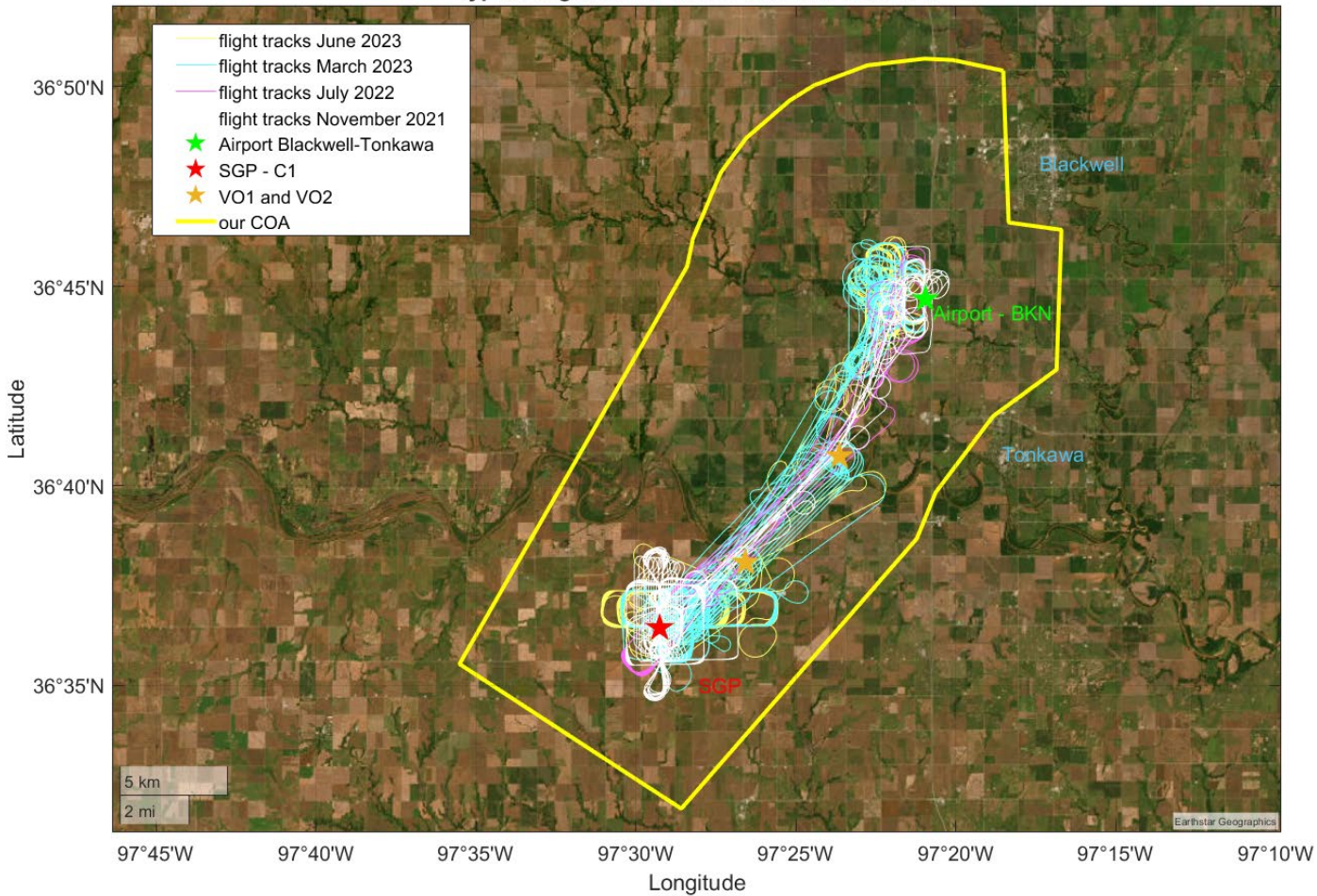
1. Pacific Northwest National Laboratory
2. University of California, Davis
3. University of Oklahoma

ARM/ASR PI meeting, Aug. 2023

TigerShark and ArcticShark Flights over SGP 2021 - 2023



Typical flight tracks at SGP from 2021 to 2023



UAS Measurements



Baseline Measurements

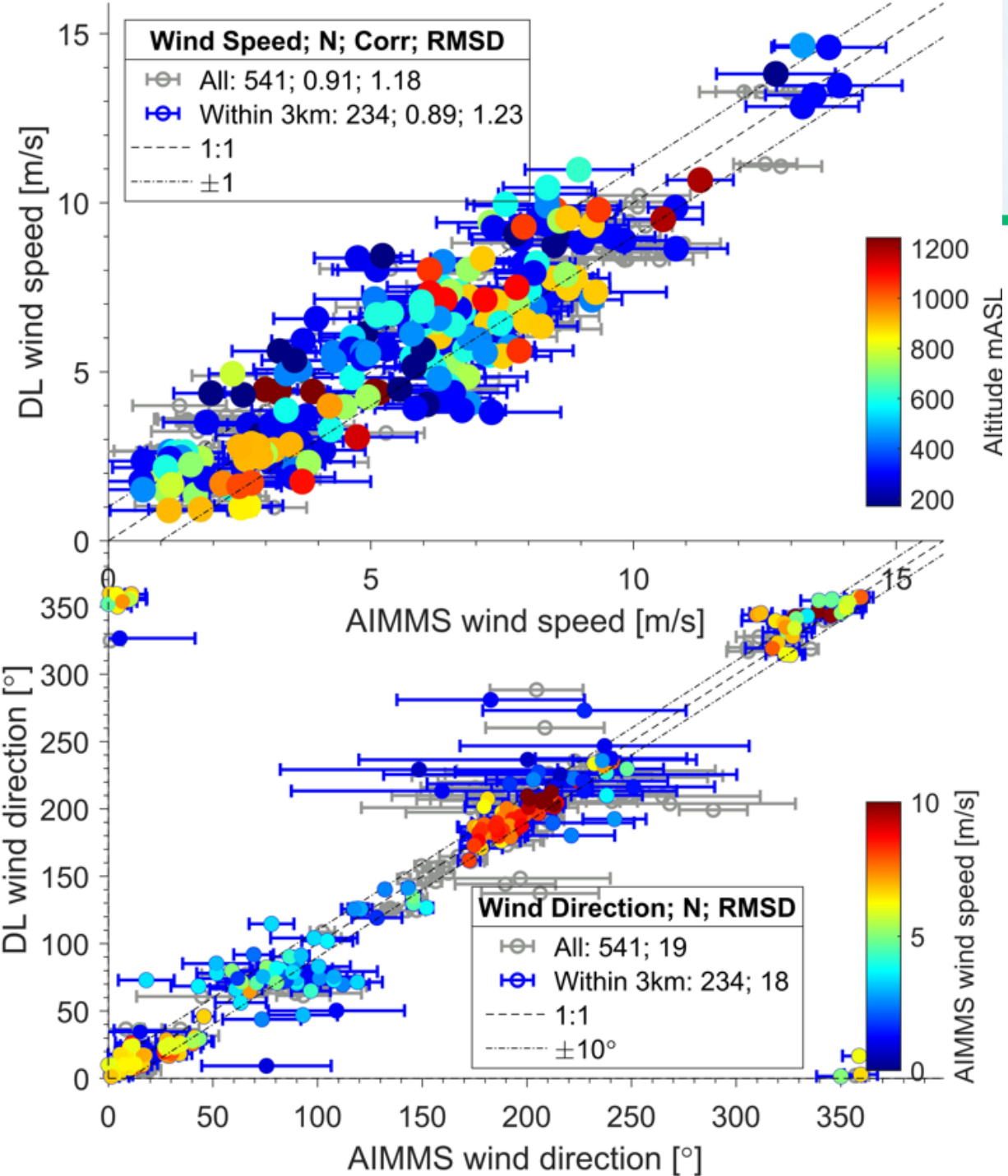
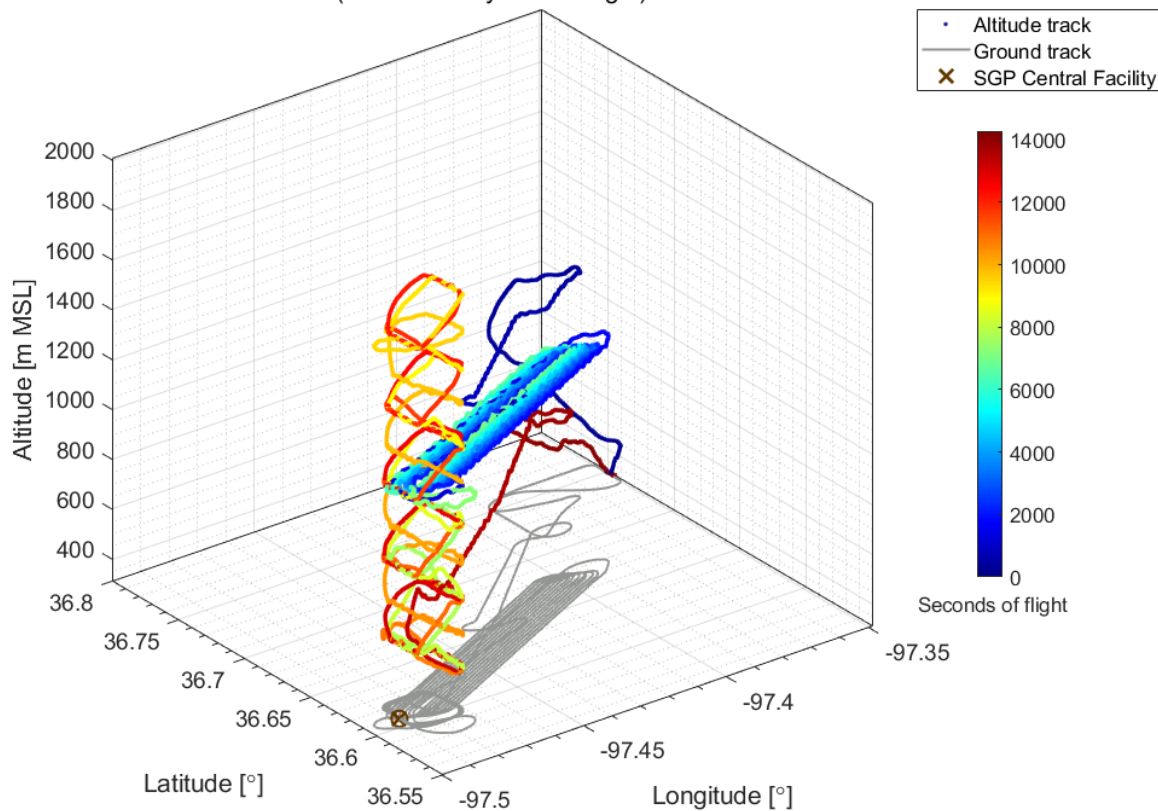
	Instrumentation	Measurements
Aircraft State (100 Hz)	Aircraft Integrated Meteorological Measurement System (AIMMS)-30, VectorNav (VN) 200	Ground velocity, True Air Speed, Altitude, Latitude, Longitude, Heading, and Orientation
Meteorological State	Aircraft Integrated Meteorological Measurement System (AIMMS)-30	Static Pressure (1 Hz), Static Temperature (1 Hz & 50 Hz), RH (1 Hz), Water Vapor Conc. (2 Hz) and 3-D winds (100 Hz)
Flux Measurements	Aircraft Integrated Meteorological Measurement System (AIMMS)-30, Fast Temperature sensor	Momentum (100 Hz) and Heat (50 Hz)
Land Surface Properties	IR Thermometer, ALTUM Camera	Infrared Surface Temperature (1Hz), Multispectral images at 475nm, 560 nm, 668 nm, 717 nm, 842 nm, and Surface temperature at 10.5 μm.

Switchable Aerosol Measurements

	Instrumentation	Measurements
Isokinetic Aerosol Inlet (1 Hz)	PNNL designed community inlet system	Sample line temperature and RH (1Hz)
Package 1: Aerosol Physicochemical Properties (1 Hz)	Advanced Mixing Condensation Particle Counter (MCPC)	Aerosol total number concentration (7-2,000 nm)
	Portable Optical Particle Spectrometer (POPS)	Aerosol Size Distribution (135 - 3,000 nm optical size)
	Miniaturized Optical Particle Counter (MOPC)	Aerosol Size Distribution (180 – 3,000 nm optical size)
	Cloud Droplet Probe (CDP)	Aerosol Size Distribution (1 - 10 μm optical size)
	Single Channel Tricolor Absorption Photometer (STAP) Aerosol Filter Sampler	Aerosol Light Absorption at 450 nm, 525 nm, and 624 nm Eight Samples for Offline Chemical Analysis
Package 2: Aerosol Size Distribution (1 Hz)	Miniaturized Scanning Electrical Mobility Sizer (mSEMS)	Aerosol Size Distribution (10 – 375 nm electrical mobility size)
	Portable Optical Particle Spectrometer (POPS)	Aerosol Size Distribution (135 - 3,000 nm optical size)
	Cloud Droplet Probe (CDP)	Aerosol Size Distribution (2 - 10 μm optical size)

Assuring accuracy: remote sensing validation

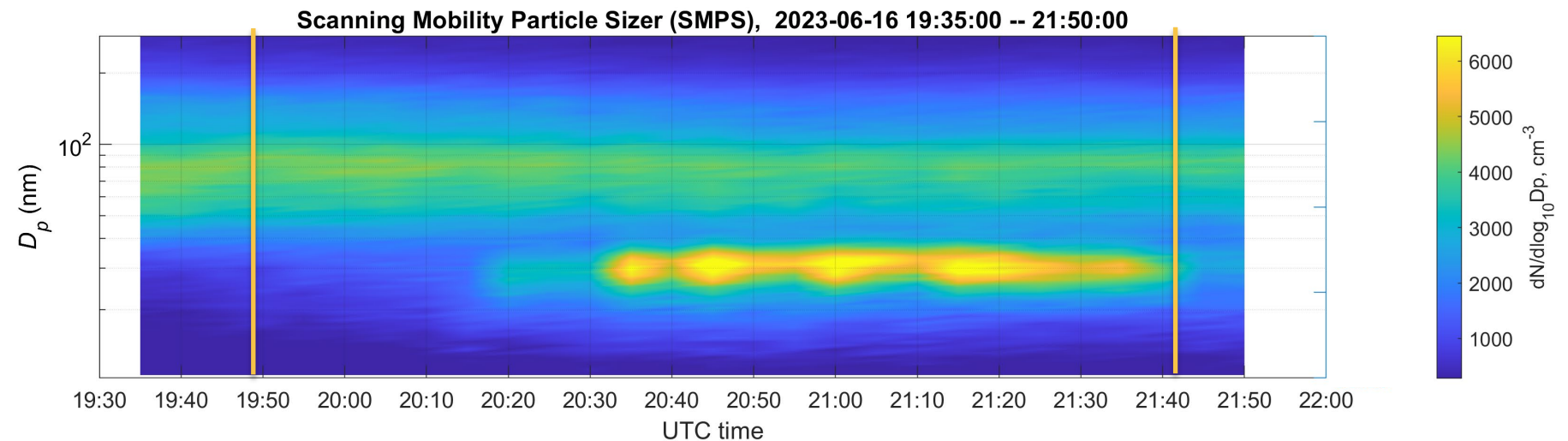
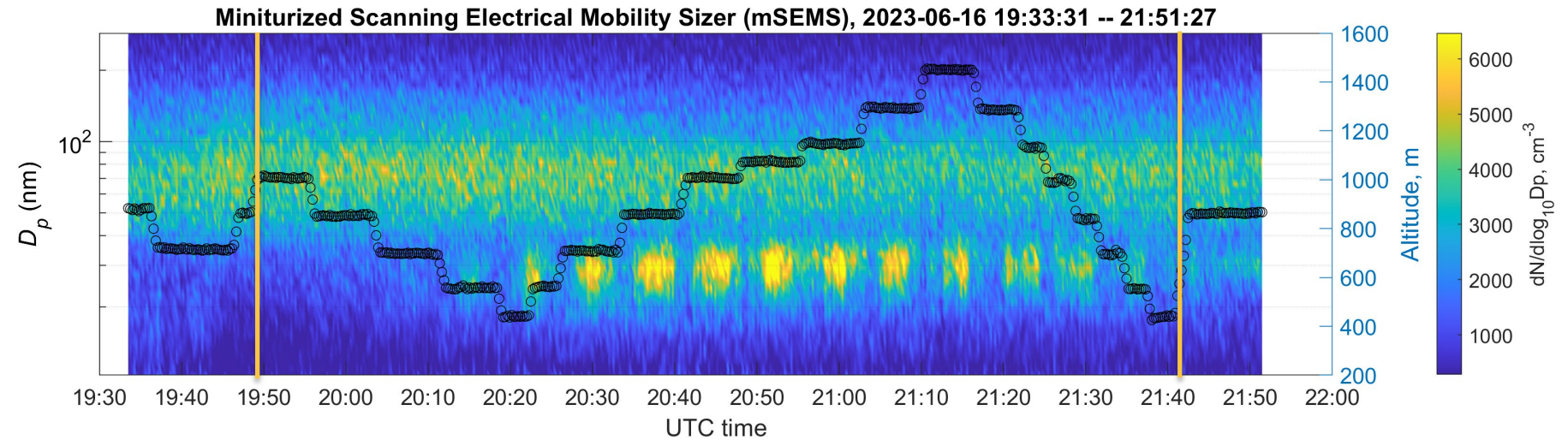
20230314a: ground and 3-D flight tracks
(colorcoded by time of flight)



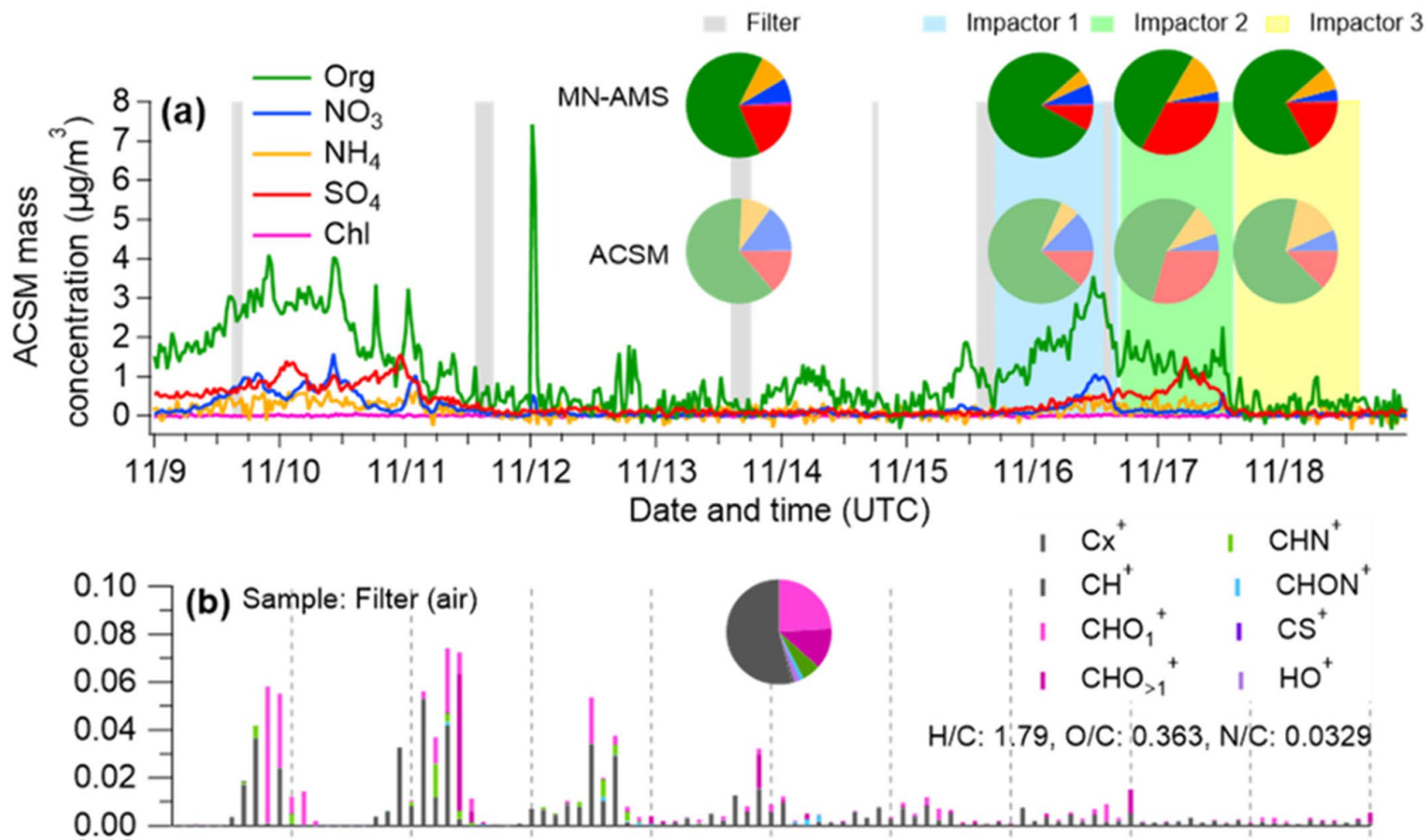
Unleashing possibilities with advanced aerosol size distribution payload



Airborne size distribution from mSEMS mirrors surface-based SMPS measurements suggesting a well-mixed boundary layer



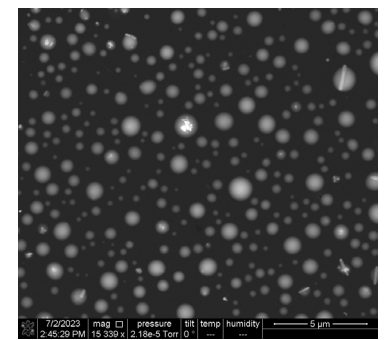
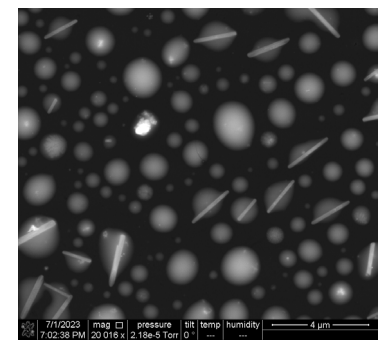
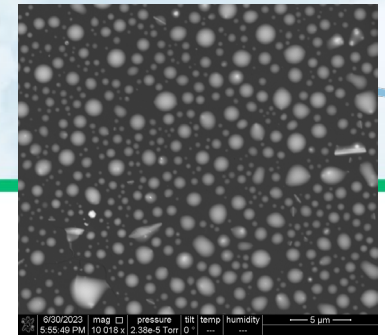
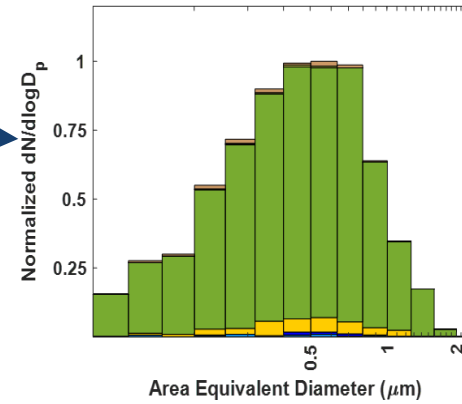
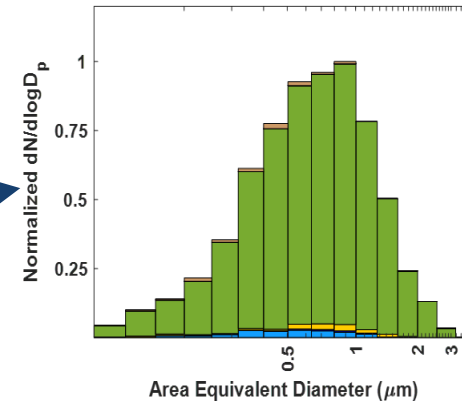
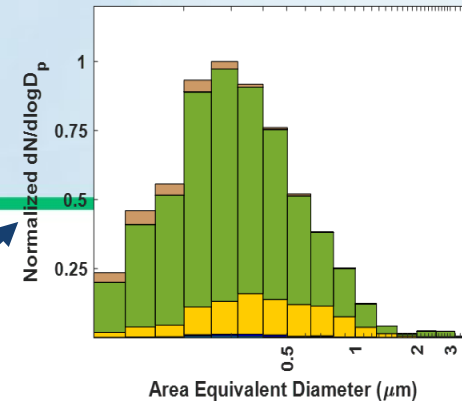
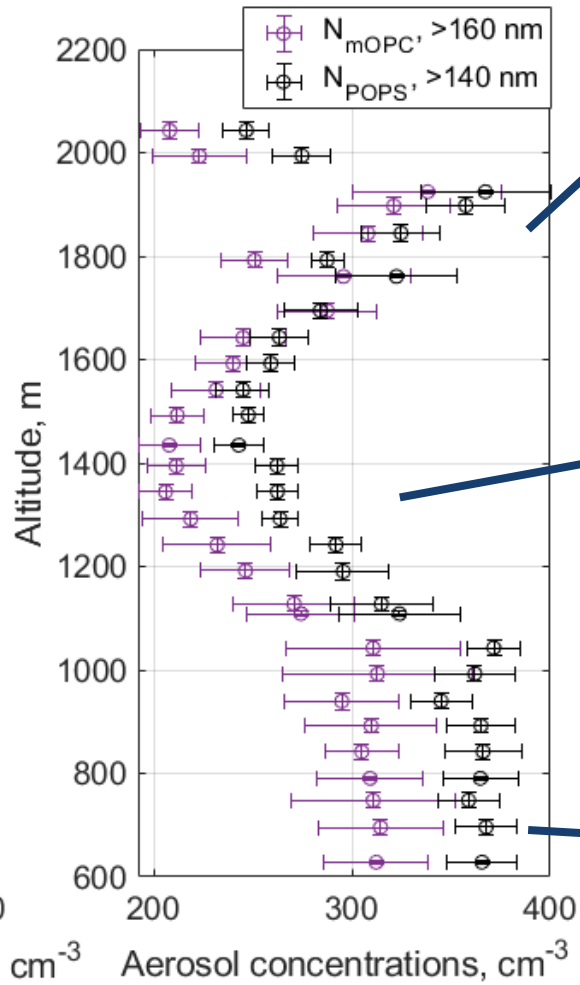
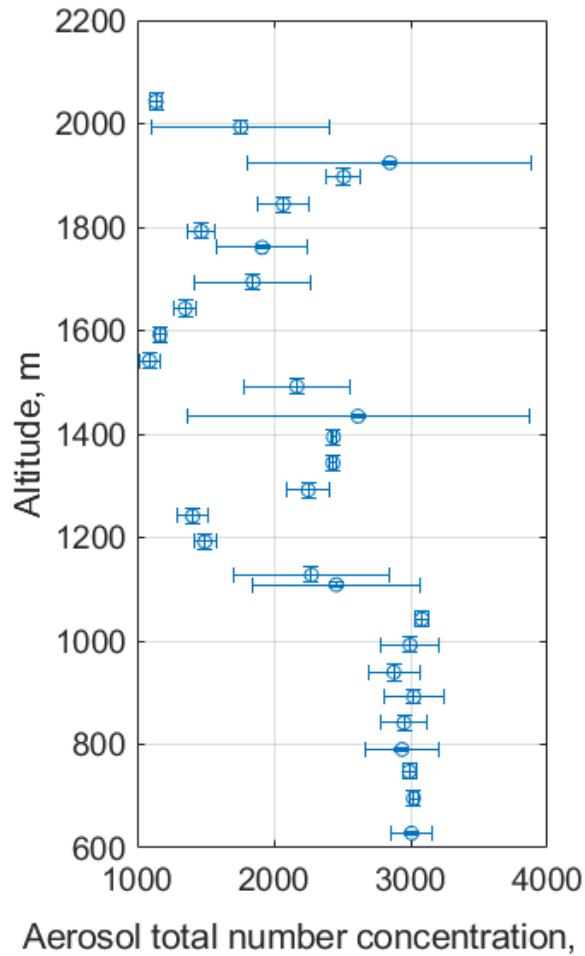
Unraveling chemical composition: advanced offline analysis with Micronebulization AMS



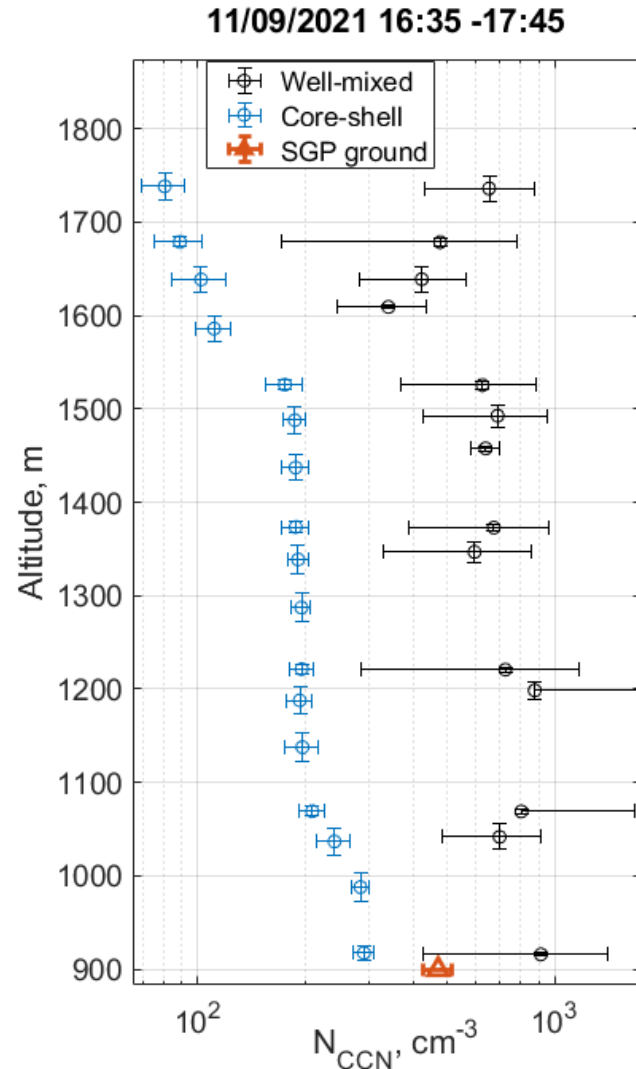
Niedek, C. R., Mei, F., Zawadowicz, M. A., Zhu, Z., Schmid, B., and Zhang, Q.: Quantitative chemical assay of nanogram-level particulate matter using aerosol mass spectrometry: characterization of particles collected from uncrewed atmospheric measurement platforms, *Atmos. Meas. Tech.*, 16, 955–968, <https://doi.org/10.5194/amt-16-955-2023>, 2023.



Exploring vertical chemical composition through scanning electron microscope



Unlocking the skies with vertical cloud condensation nuclei distribution

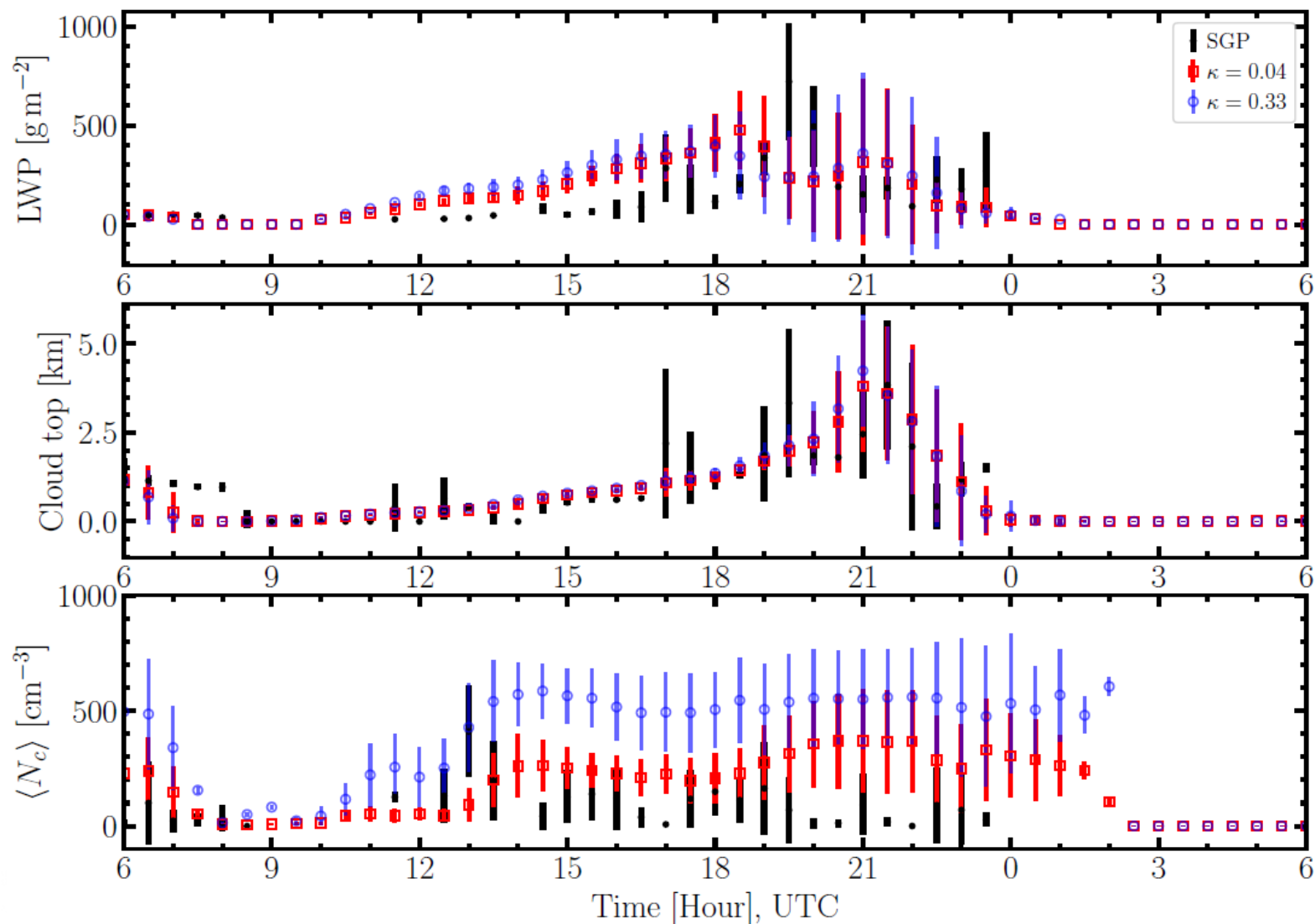


Estimated the vertical profiles of CCN concentrations (at 0.1% supersaturation)

- Aerosol chemical composition measured by MN-AMS
- Aerosol mixing state unveiled by time-of-flight secondary ion mass spectrometry (TOF-SIMS)
- Aerosol size distribution from POPS and mOPC

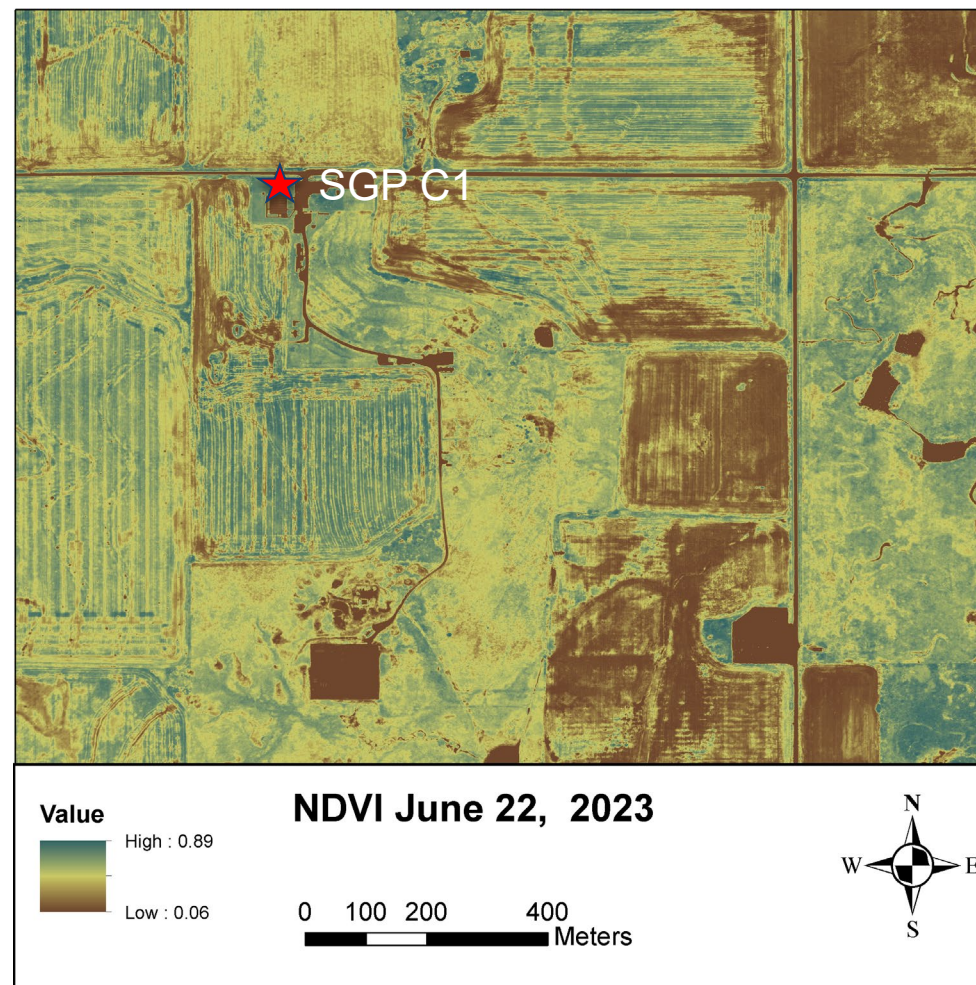
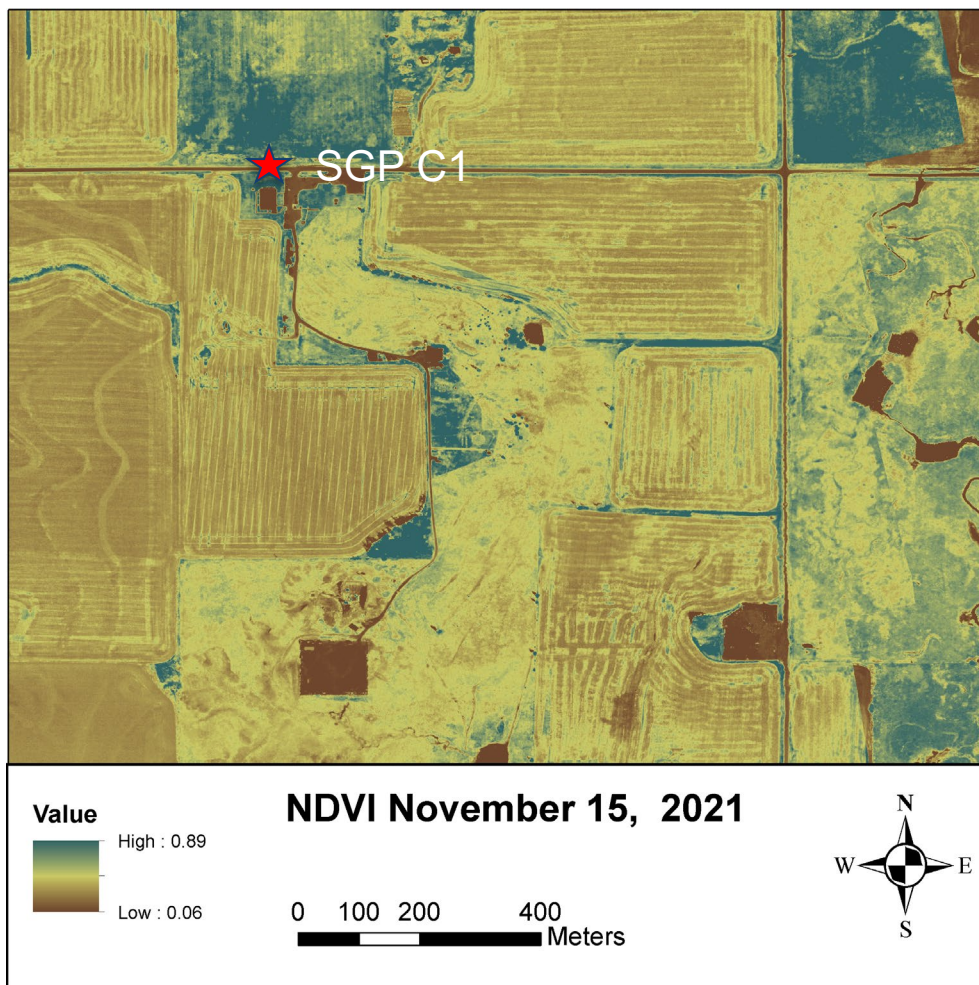


Providing better constrains for WRF – LES simulations

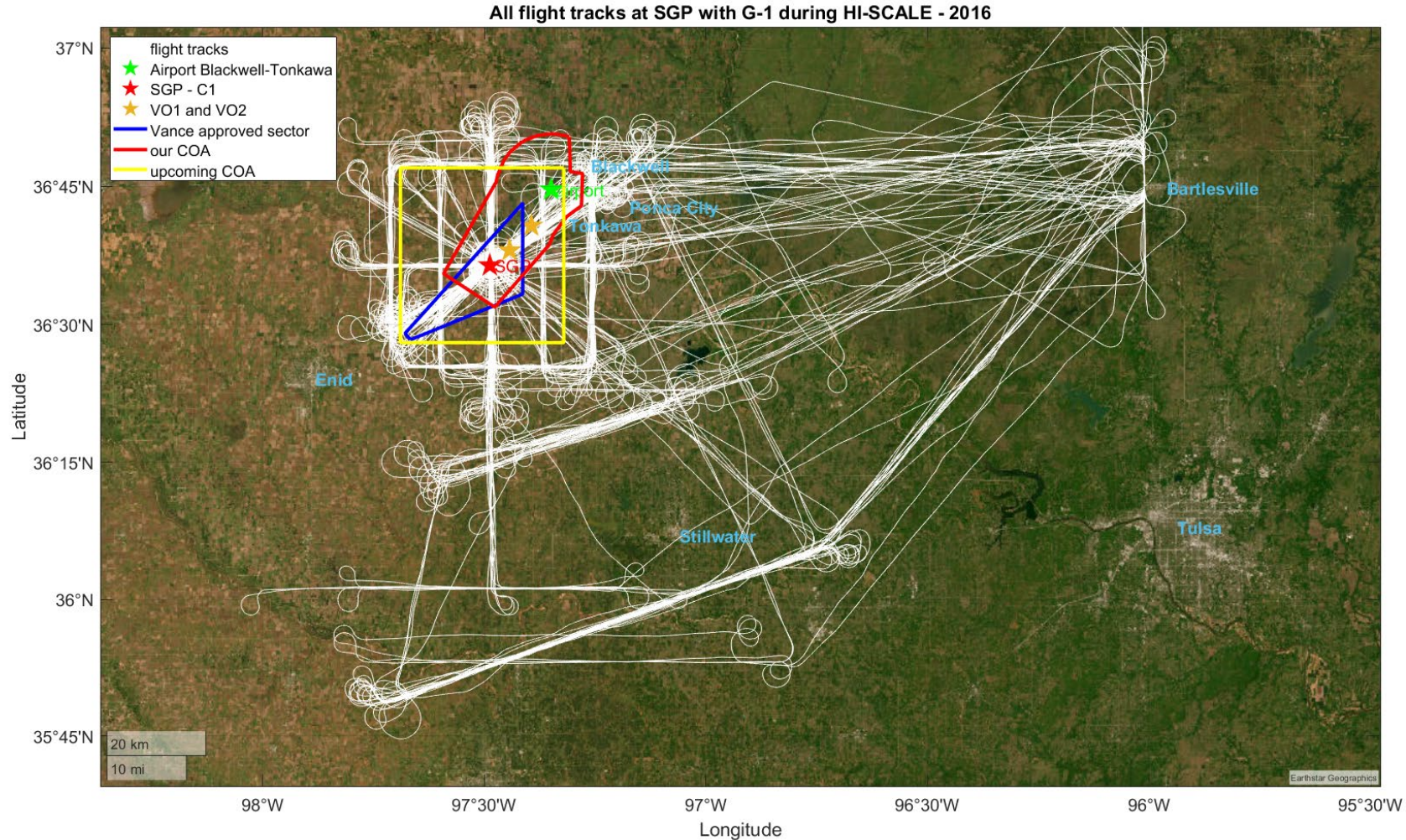


A significant impact of aerosol mixing state assumptions (**well-mixed** or **organic-shell conditions**) on the cloud properties and radiation sensitivity in the simulation.

Acquiring high resolution images for ESM model grid



August 2023: airborne operations with higher altitude and broader range!



Calling all innovators: upcoming Webinar and Proposal Calls for exciting research!



▶ ARM ArcticShark Uncrewed Aerial System Data Webinar

- [Register for the ArcticShark data webinar today.](#)

▶ Proposal Call #1

- Release ~ October 2023
- Flights in FY24 at SGP only
- 2 AAF payloads

▶ Proposal Call #2

- Release ~ January 2024
- Pre-proposals due February 2024
- Flights in FY25 at SGP or BNF
- 2 AAF payloads



Session	Poster Number	Presenter	Abstract Title & Link
1	25	Mei, Fan	Exploring the Potential of Mid-Size UAS for High-Quality Atmospheric Data Collection Abstract Link
3	37	Tomlinson, Jason	ArcticShark Uncrewed Aerial System High Resolution Multispectral Imaging and Turbulent Flux Measurements Abstract Link