Seasonal Variability within Quantitative Precipitation Estimates for the Surface Atmosphere Integrated Field Laboratory (SAIL) Field Experiment

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OUR ROLE IN SAIL

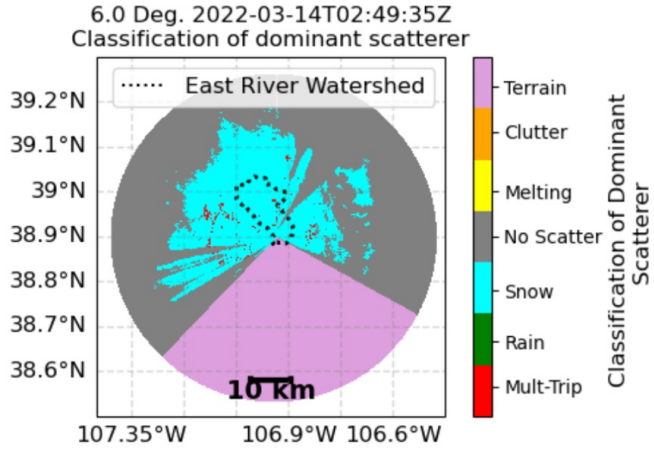
- **Creation of Value Added Products (VAP) for Quantitative Precipitation Estimates (QPE)**
  - CMAC:
    - Corrective Moments to Antenna Coordinates
  - SQUIRE:
    - Surface Quantitative Precipitation Estimate
  - RadCLss
    - Extracted Radar Columns and In-situ Sensors
- **Creation of Open-Source Material for collaborative research**
  - Py-ART
  - ACT
  - Jupyter Notebooks

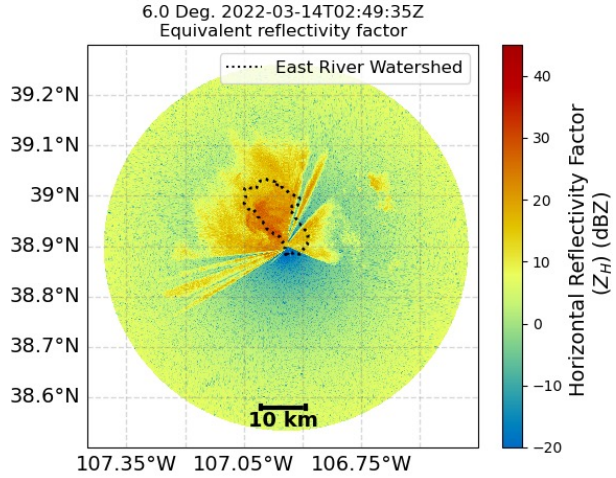
▶ *guccamweathermainS2* GIF: provided by Dan Feldman

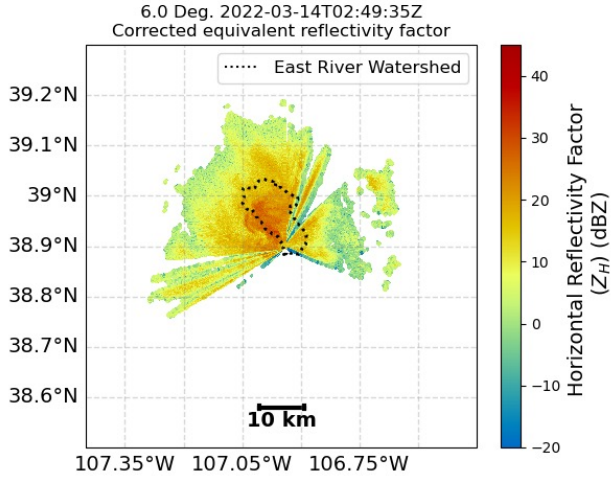
Corrective Moments to Antenna Coordinates (CMAC)

- **At its core is the identification of primary scatterers within a radar gate (i.e. gate ID)**
  - Fuzzy Logic method based on polarimetric radar variables
  - Used to create tags for each gate that are used in downstream processing

- **To estimate precipitation:**
  - Empirical relationships of the equivalent radar reflectivity factor (Z_e) to liquid-equivalent snowfall rates (Ze = aS^b) are typically applied







Surface Quantitative Precipitation Estimation (SQUIRE)

- CMAC radar product that is gridded to a cartesian grid
  - Transformation of native radar antenna coordinates to cartesian coordinates
  - Extraction of the lowest valid gate available for each grid cell
- 250 m grid spacing (horizontal and vertical),
- spatial domain of 20 km (x) x 20 km (y) x 5 km (z), all in units of distance from the radar.
- **Jan – March 2022, Dec 2022 – March 2023 now available**

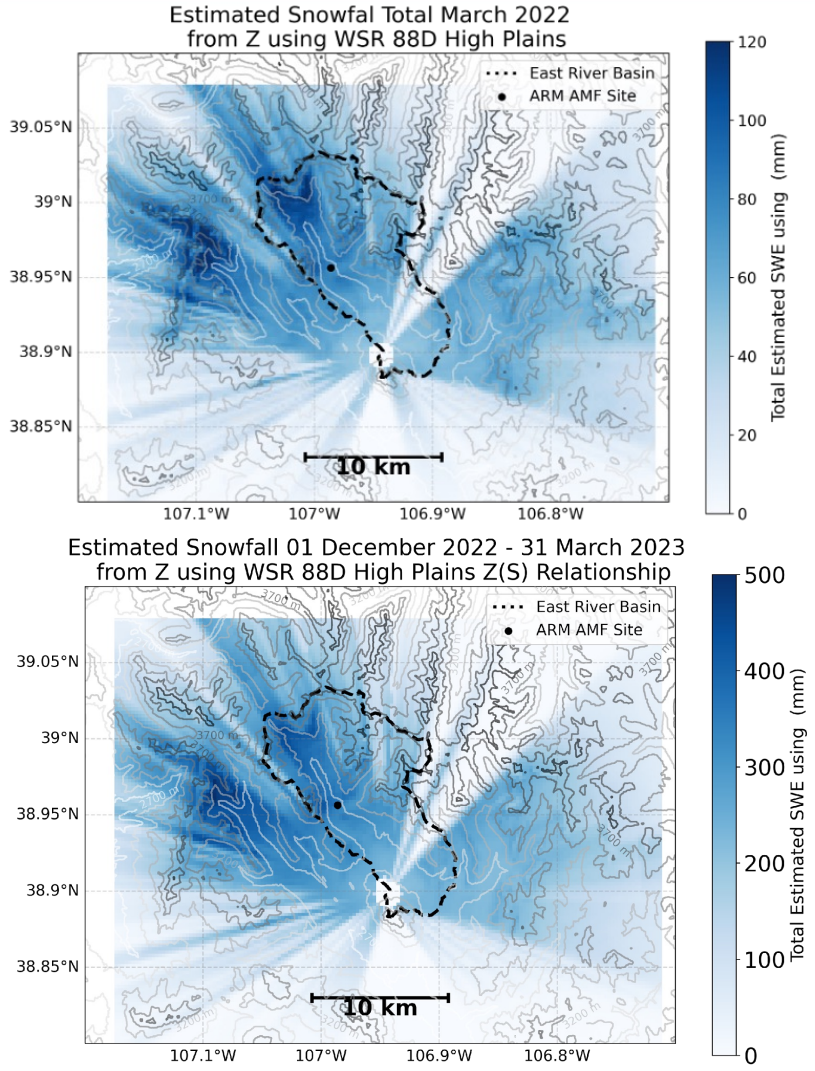
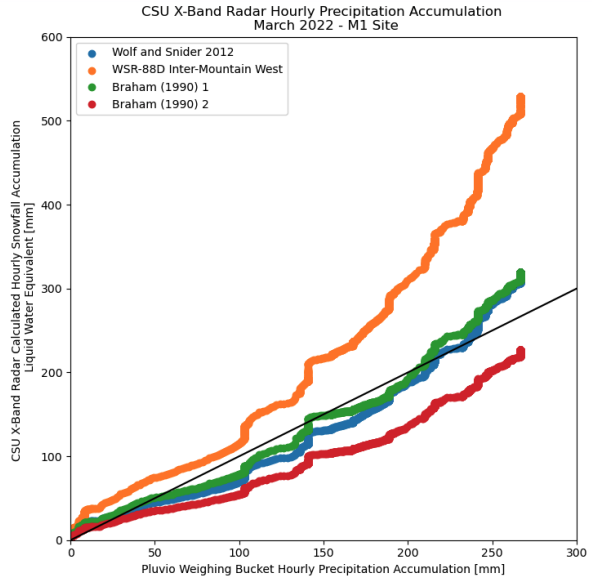
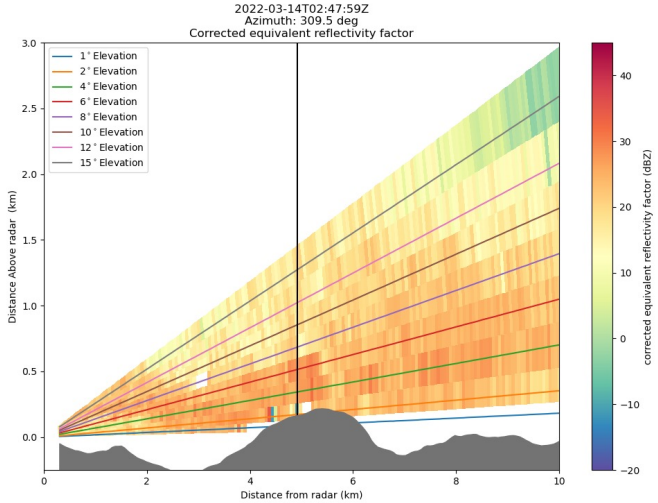


Figure Courtesy of Max Grover

Extracted Radar Columns and In-Situ Sensors (RadCLss)

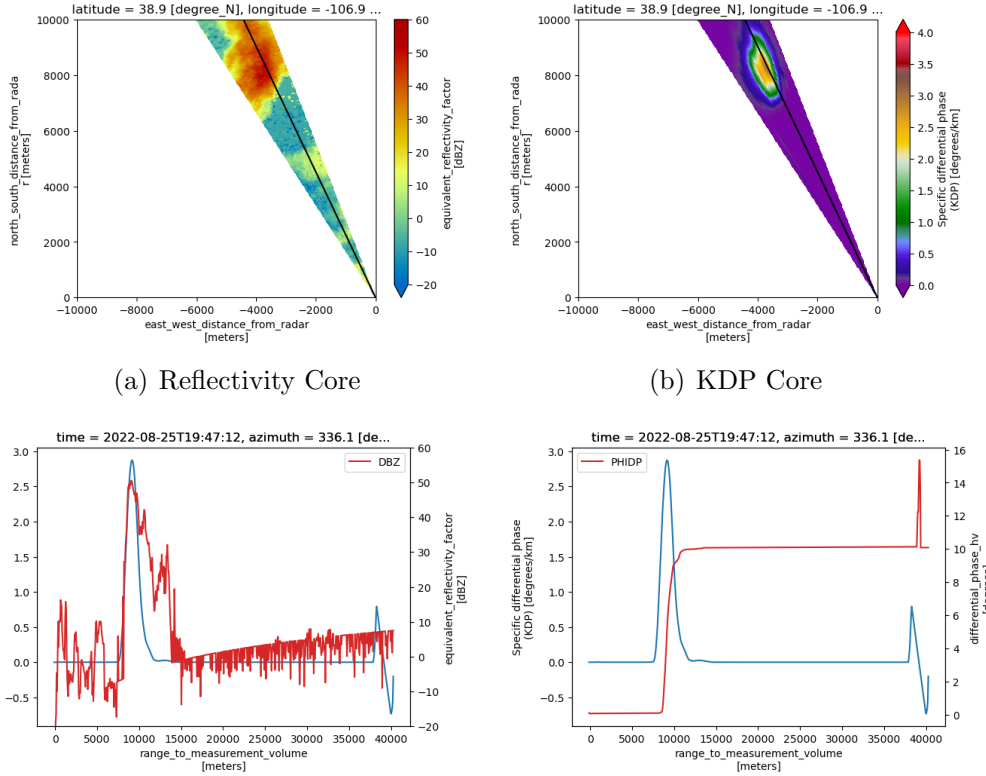
- To allow for direct comparison between radar estimated precipitation and observed precipitation at locations of interest.
- Utilizing Py-ART and ACT:
  - In-situ sensors are collocated with the extracted radar column above the sites
- Winter 2022 Data Available In Coming Weeks





Summer 2022 – Differential Phase Processing

- FY24 goal:
  - CMAC processing of rest of the campaign
- For rainfall,
  - comparison of multiple methods for calculating differential phase PhiDP and its range derivate KDP were conducted for 25 August 2022
  - KDP processing inspired by Giangrande et al. (2013) Linear Programming (LP) method found to be the most robust for conditions observed during SAIL.



(a) Reflectivity Core (b) KDP Core

(c) Reflectivity and KDP LP (d) PhiDP and KDP LP

Fig: Radar reflectivity (a) and KDP LP (b) are plotted along the radar beam through a convective core (c) with KDP and PhiDP (d) on 25 August 2022, 19:46 UTC.

Figure Courtesy of Bhupendra Raut and Max Grover

AMS 2023 ANNUAL MEETING
Open Science in the Rockies

- **All-Day Open Science Workshop**
  - 20 attendees including undergraduate and graduate students
  - Initial analysis of the SAIL dataset
  - Collaboration between ARM field campaign scientists, data translators and developers.

- **ARM Jupyter Hub**
  - Atmospheric Community Toolkit (ACT)
  - Python ARM Radar Toolkit (Py-ART)
  - https://github.com/ARM-Development/open-science-rockies-2022

Grover 2023: "How ARM Rang in the (New) Year of Open Science in the Rockies," ARM News, 14 February 2023