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

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2023 ARM/ASR Joint Facility PI Meeting, Bethesda, MD
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*
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 ($Z_e = aS^b$) are typically applied
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
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
FY24 goal:
- CMAC processing of rest of the campaign

For rainfall,
- comparison of multiple methods for calculating differential phase PhiDP and its range derive 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.

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.
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