Advancing ARM's Radar Wind Profiler (RWP) Processing

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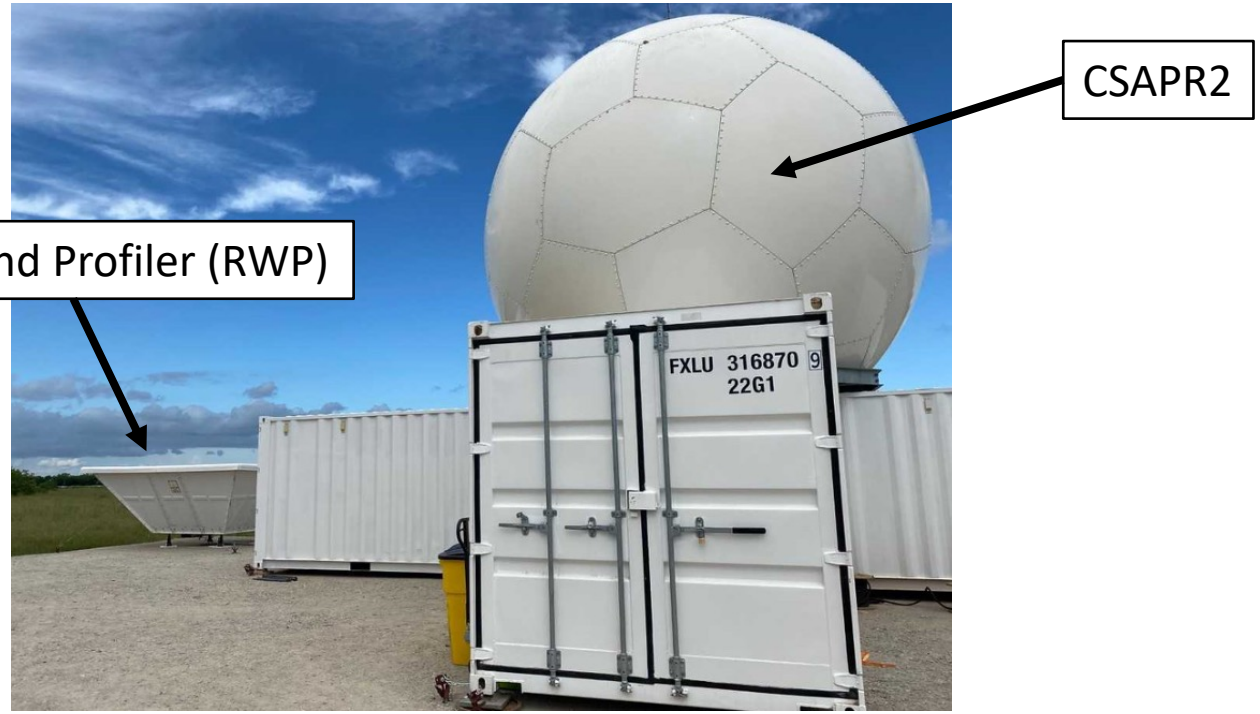
TRACER CSAPR2 Calibration via Disdrometer & RWP

1. Define surface disdrometer as reference

2. Adjust Radar Wind Profiler (RWP) reflectivity to match disdrometer

3. Adjust CSAPR2 reflectivity to match RWP



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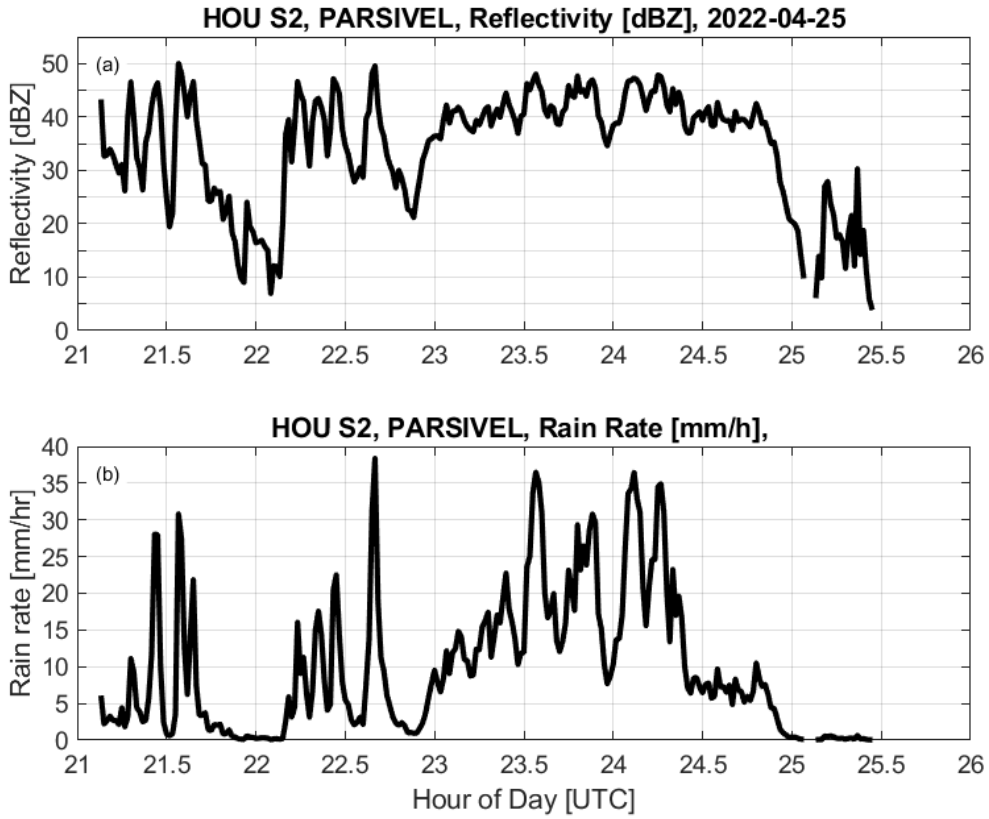
Step #1: Define Surface Disdrometer as Reference

Surface PARSIVEL disdrometer (LDIS and ldquants)

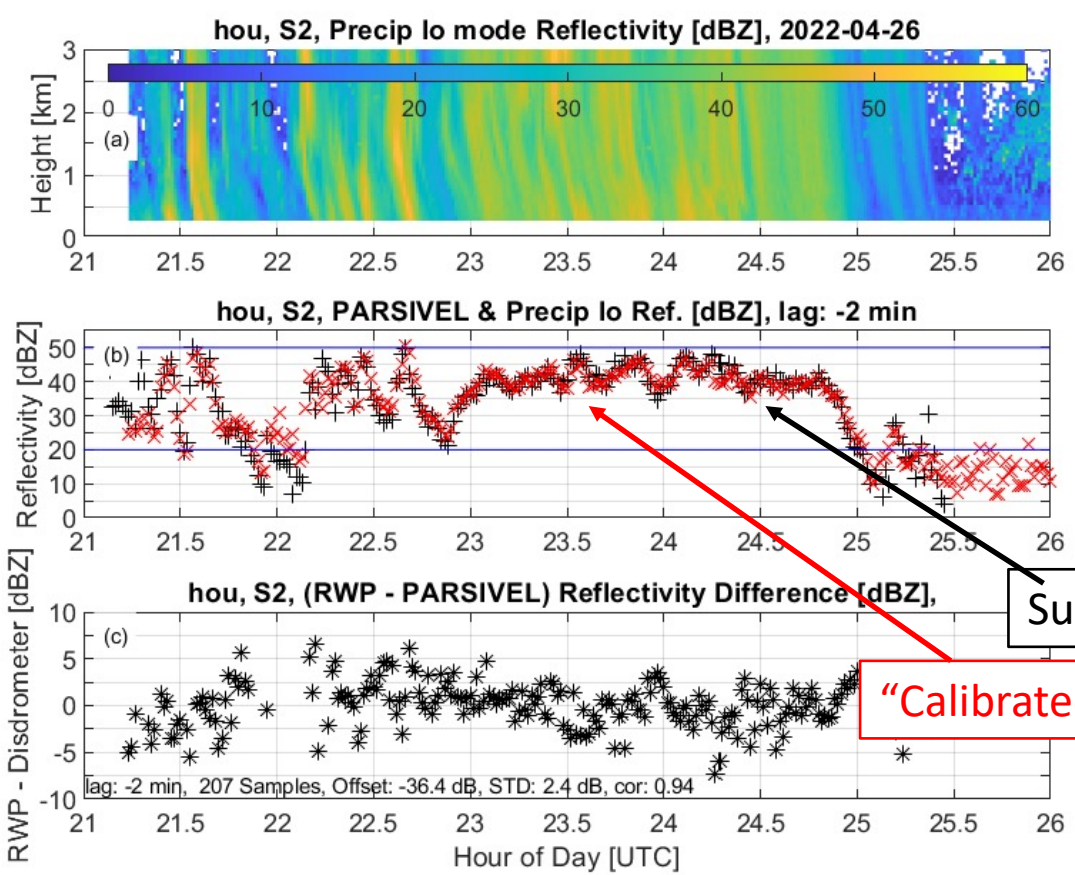


Reflectivity

Rain Rate [mm/h]

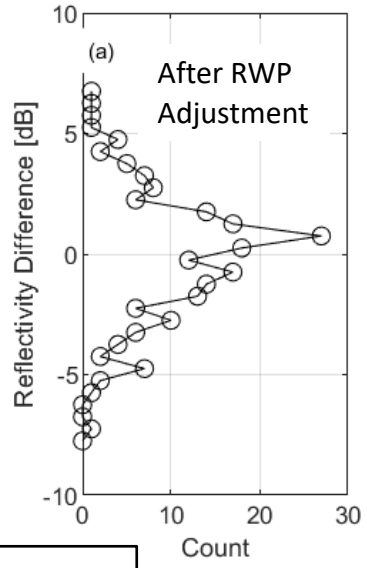
Step #2: Adjust RWP Reflectivity to Match Disdrometer

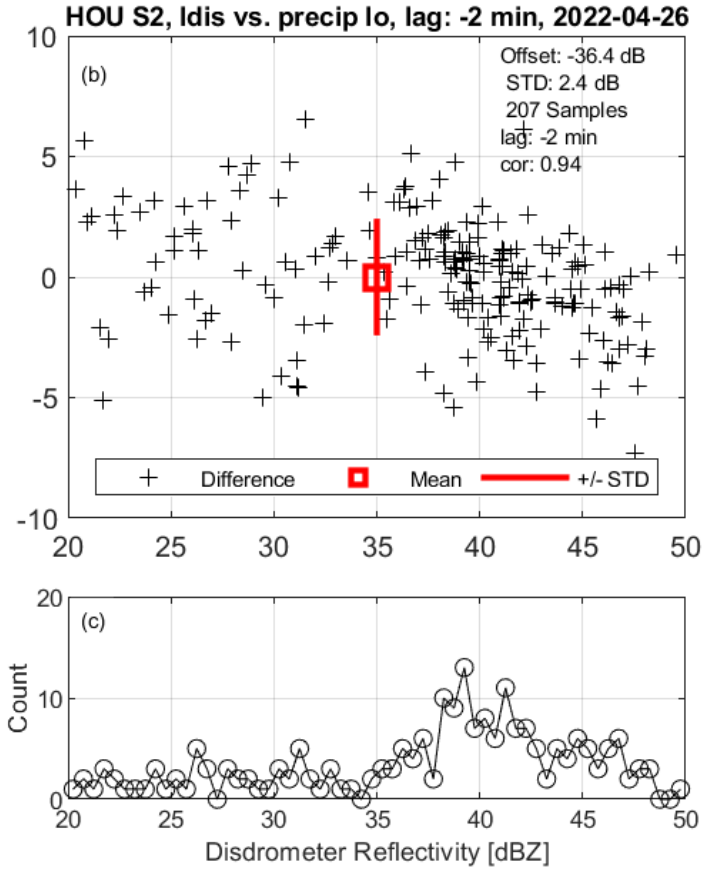
Adjust RWP Calibration Constant to match Disdrometer Reflectivity



Surface PARSIVEL

"Calibrated" RWP @ 500 m





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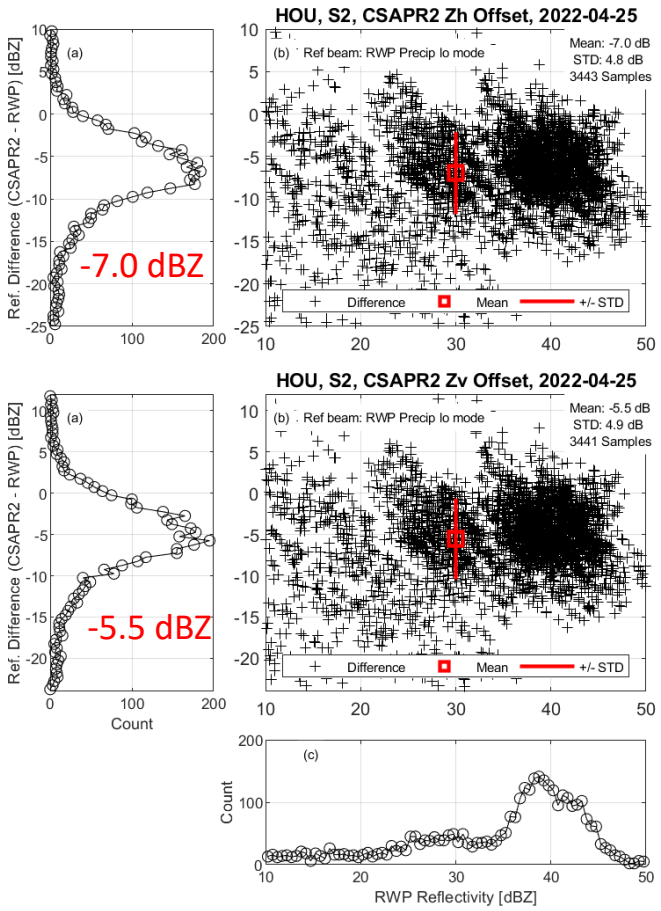
Step #3: Adjust CSAPR2 Reflectivity to Match RWP

Estimate Reflectivity Difference at matched time-height gates



As of May 18th

CSAPR2 Horizontal Polarization

Relative to RWP Reflectivity,

CSAPR2 **Zh is 7.0 dBZ to low**

(STD = 4.8 dBZ)

CSAPR2 Vertical Polarization

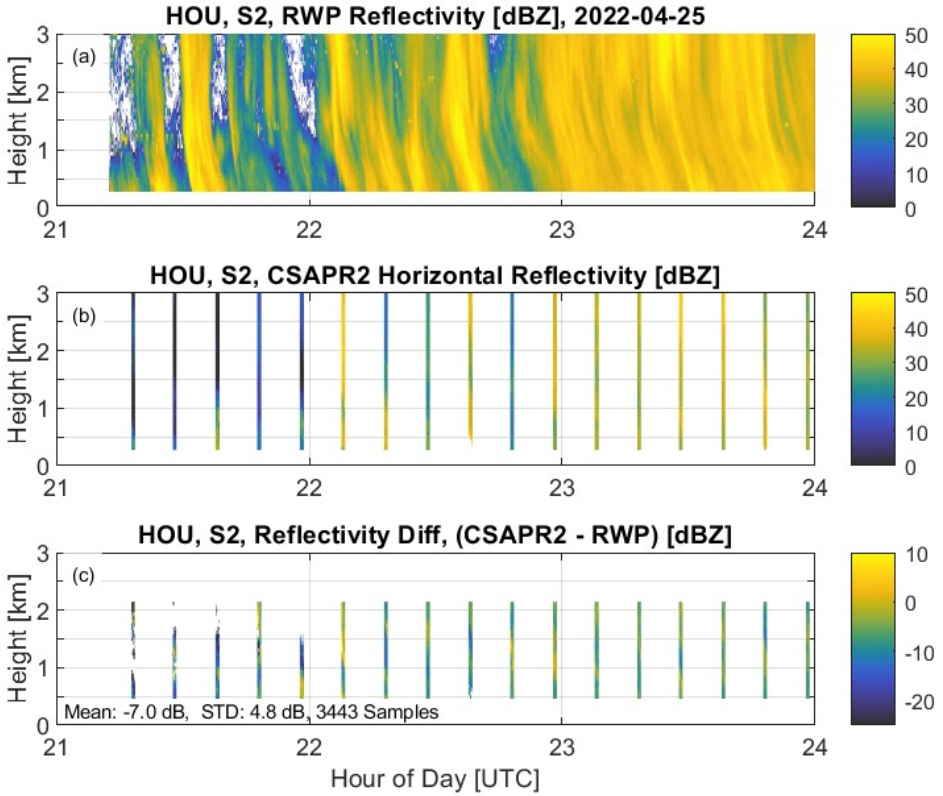
Relative to RWP Reflectivity,

CSAPR2 Zv is 5.5 dBZ to low

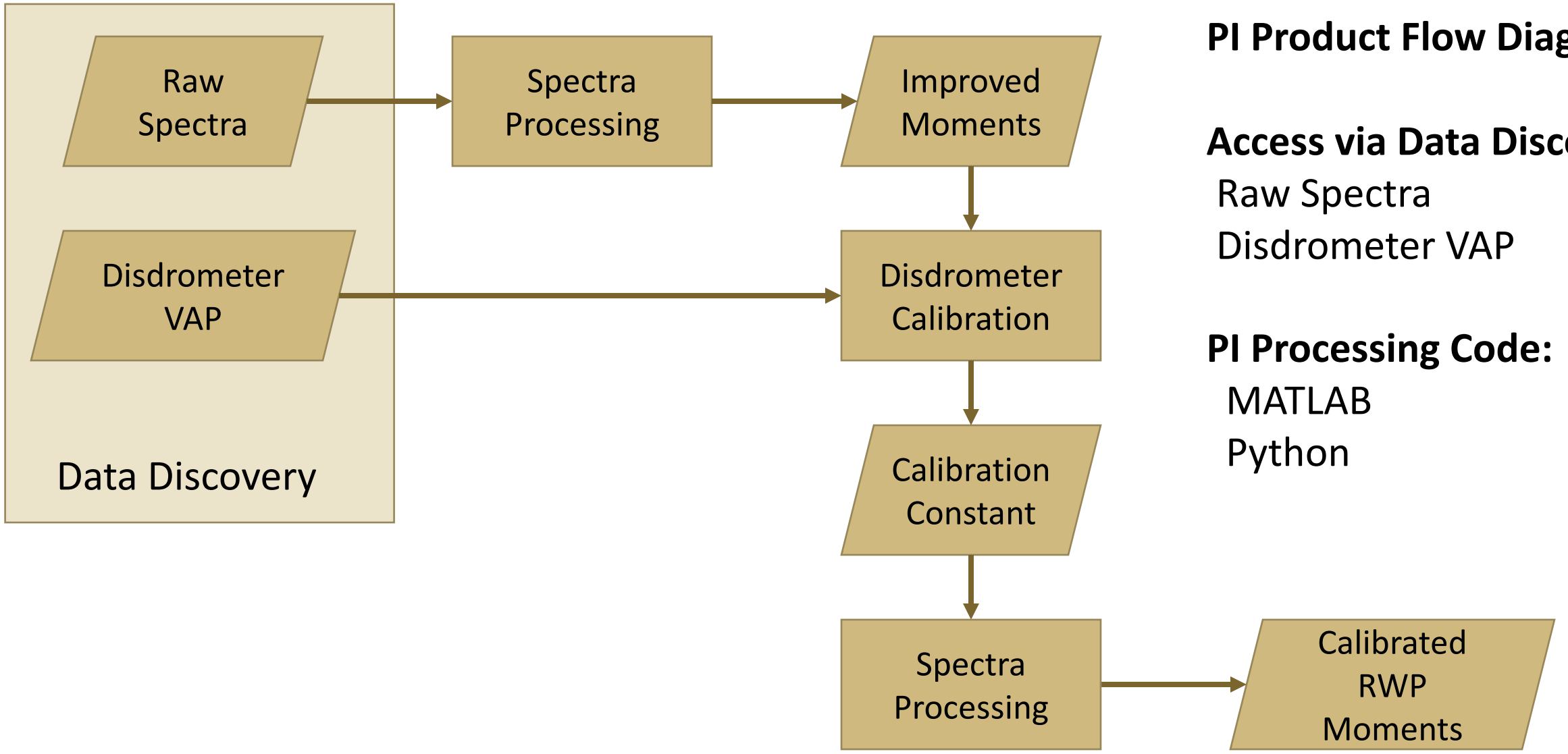
(STD = 4.9 dBZ)

Difference = (CSAPR2 – RWP)

CSAPR2 is vertically pointing for short interval



Signal Processing Flow Diagram – PI Product



PI Product Flow Diagram

Access via Data Discovery:

Raw Spectra

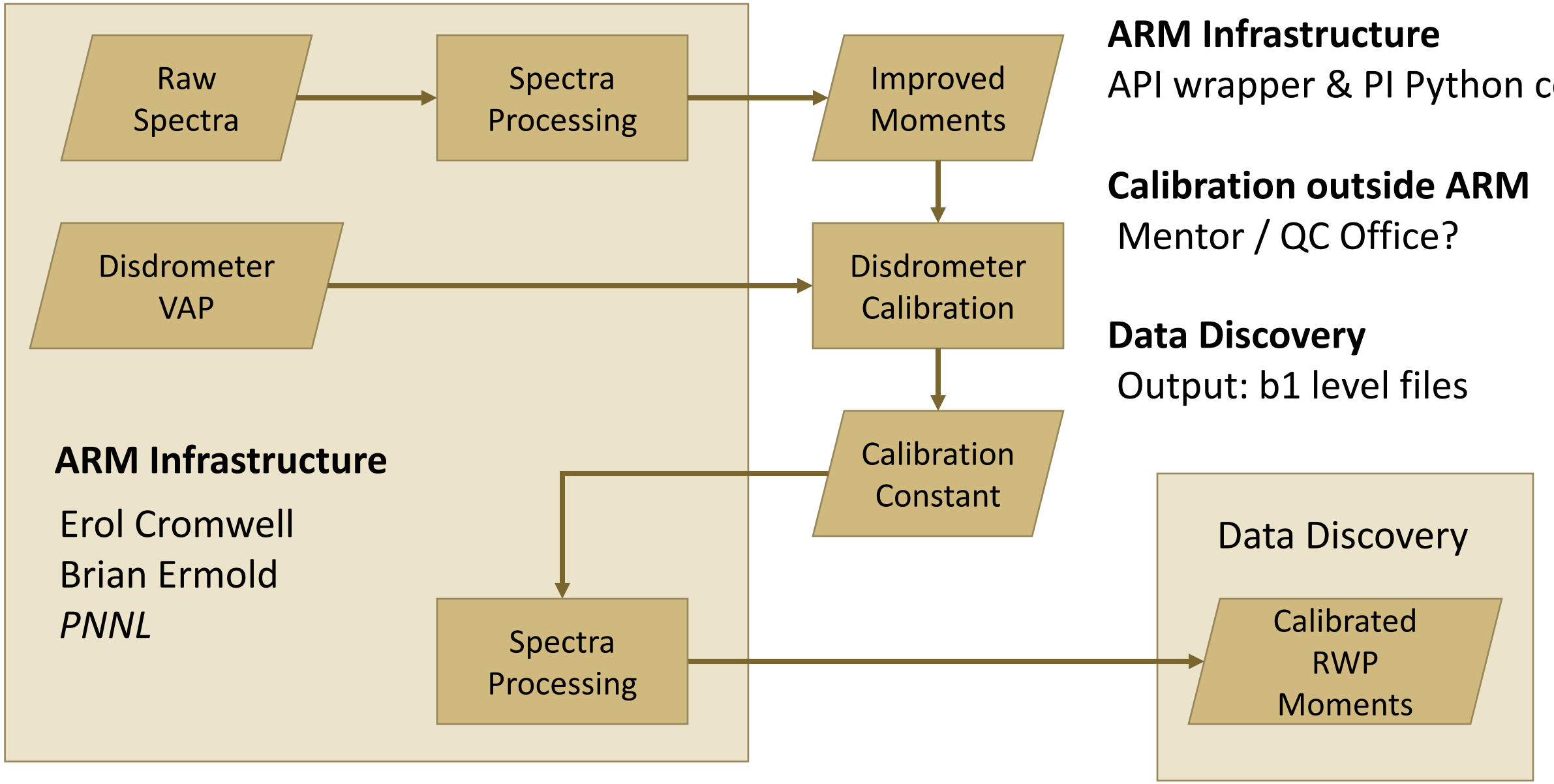
Disdrometer VAP

PI Processing Code:

MATLAB

Python

Signal Processing Flow Diagram – ARM Processing



ARM Infrastructure

API wrapper & PI Python code

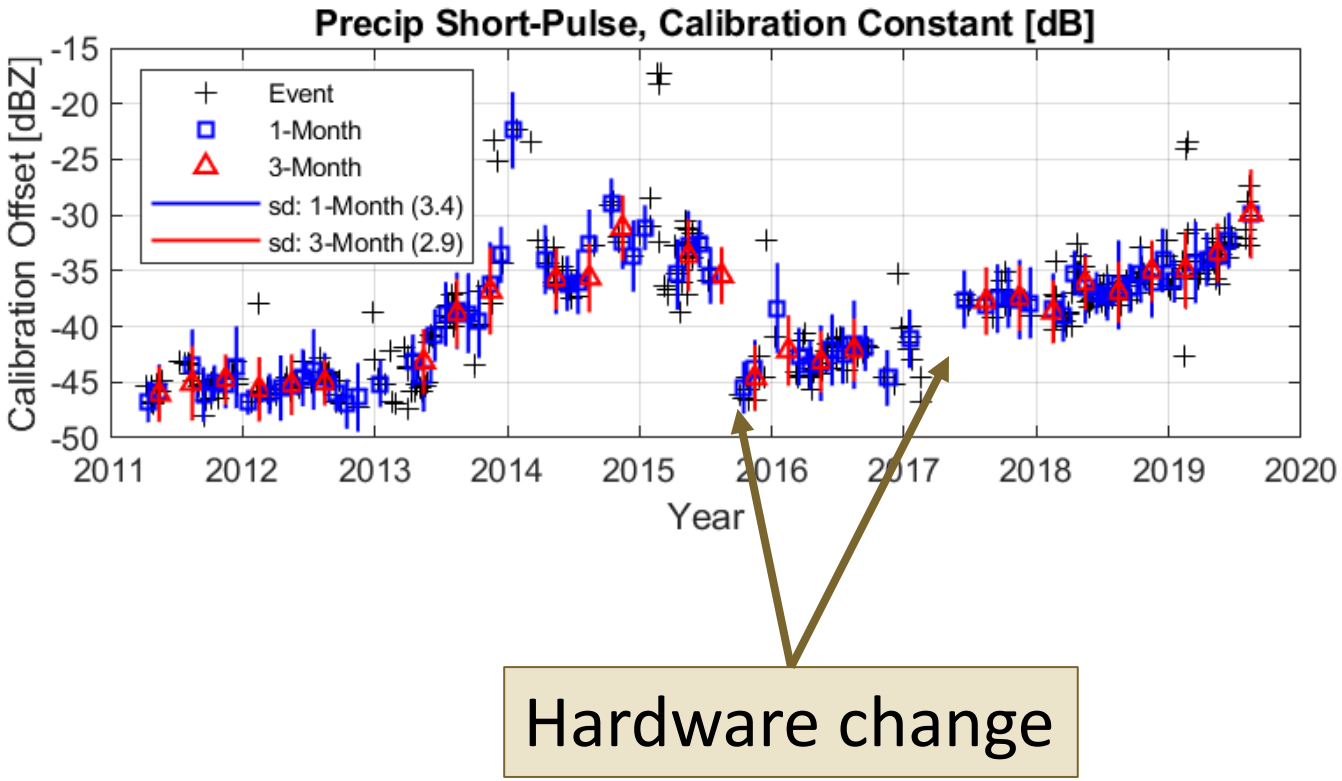
Calibration outside ARM

Mentor / QC Office?

Data Discovery

Output: b1 level files

Calibration for SGP RWP: 2011 to 2019



Short-Pulse Mode Calibration Constant

Sudden jumps in calibration constant occur when new hardware is installed.

Key Results

Over time, the RWP lost sensitivity at a rate of about 3 dB/year due to hardware aging and degradation.

Calibration drift is slow enough that quarterly calibration constants can be determined from multiple rain events.

Concluding Comments

Calibrating Radar Wind Profilers (RWPs) using Disdrometer VAP

- PI Product: Calibrated RWP moments
  - SGP (C1) 2011 -to- 2019
  - TRACER – 3 RWPs

    Future…

    GoAmazon

    ENA

2. PI's Python code being transferred into ARM's Infrastructure API
  - Erol Cromweli & Brian Ermold (PNNL)
  - Need b1 products to use calibrated RWP estimates in other ARM VAPs

Backup Slides

Precipitation Modes

Precipitation Mode (Vertically Pointing Beams)

Short-Pulse

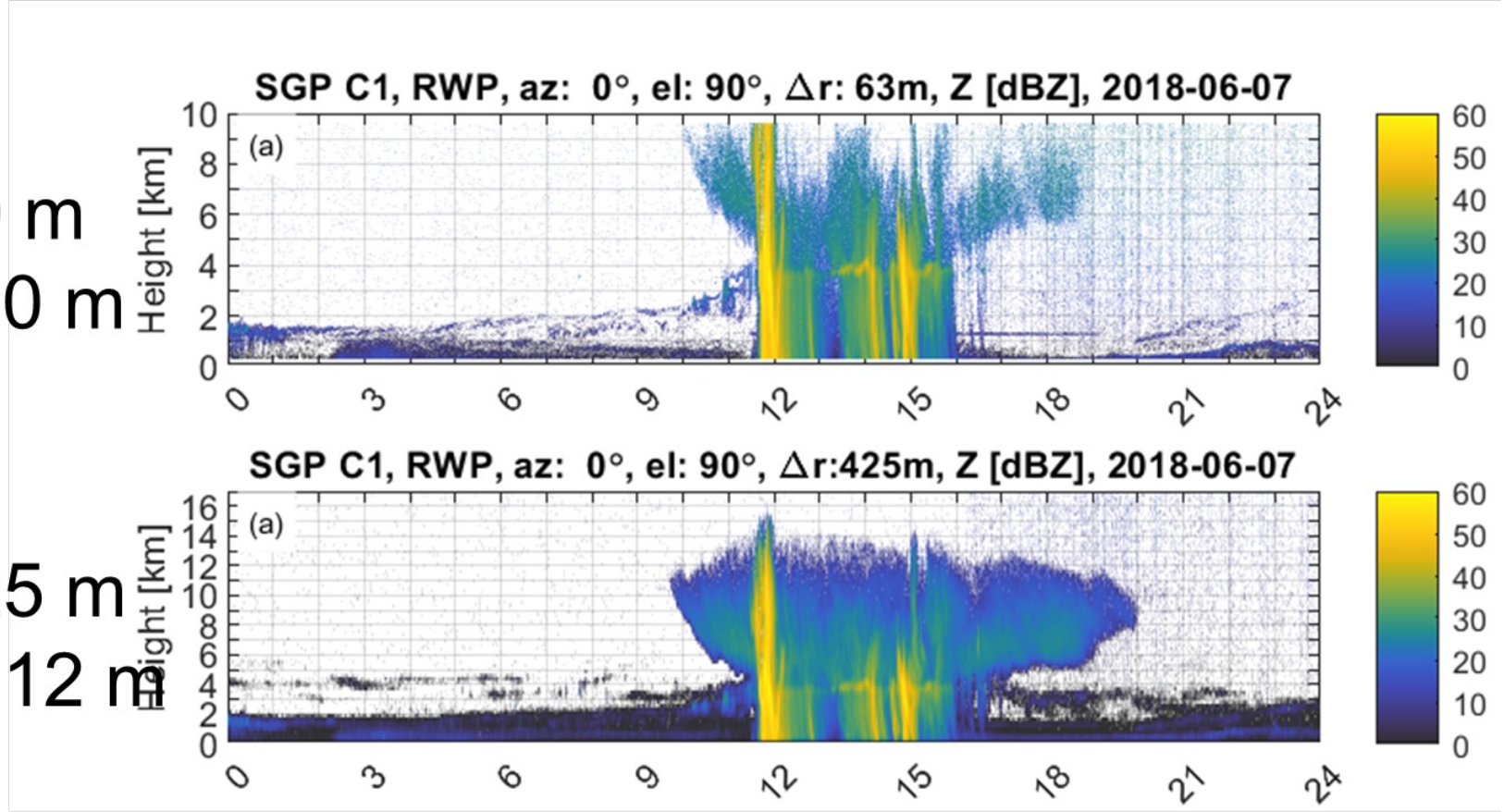
Δr = 60 m

Spacing = 60 m

Long-Pulse

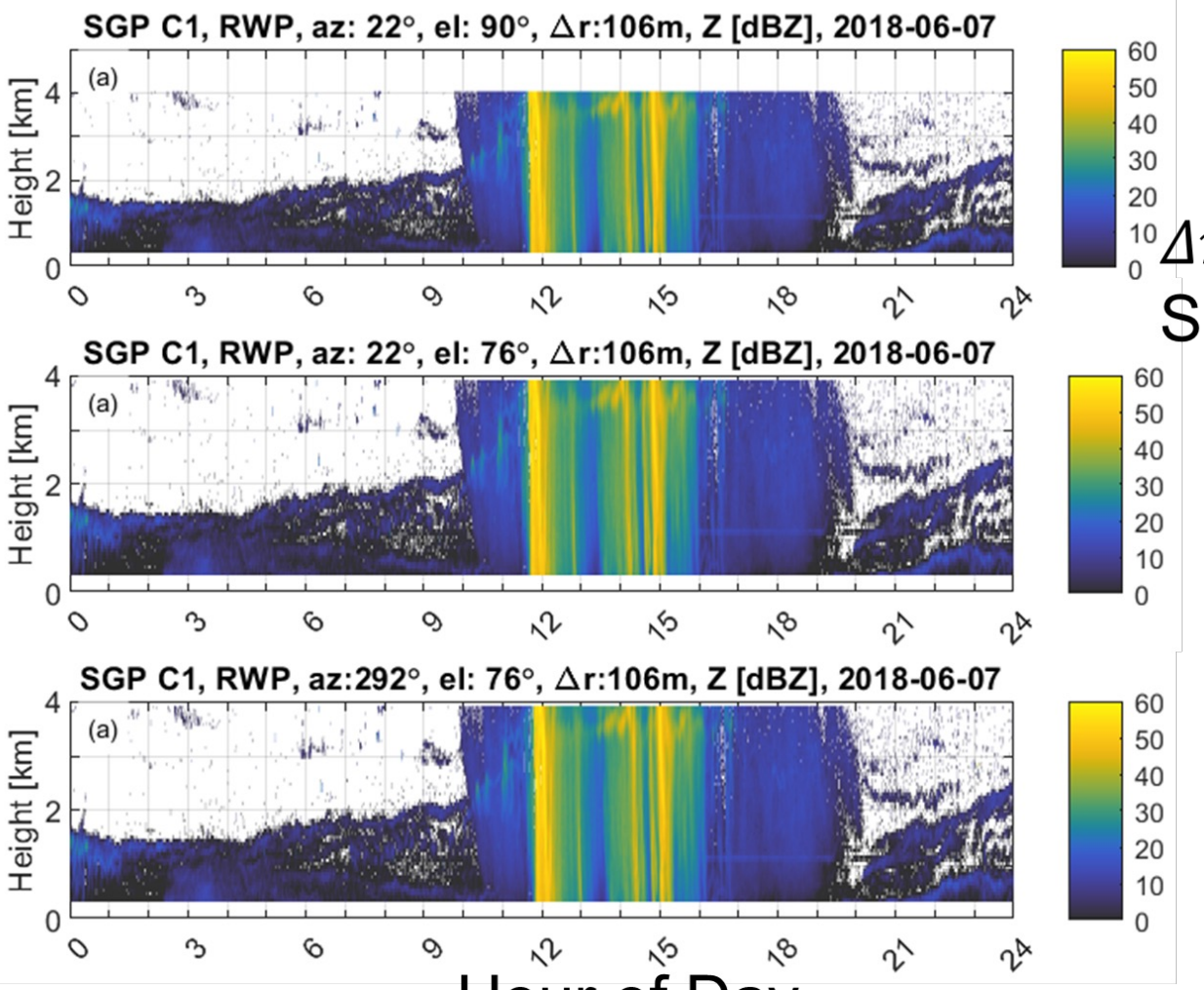
Δr = 425 m

Spacing = 212 m



Wind Modes

Wind Mode (Vertical, North & West Pointing Beams)



Vertical Beam

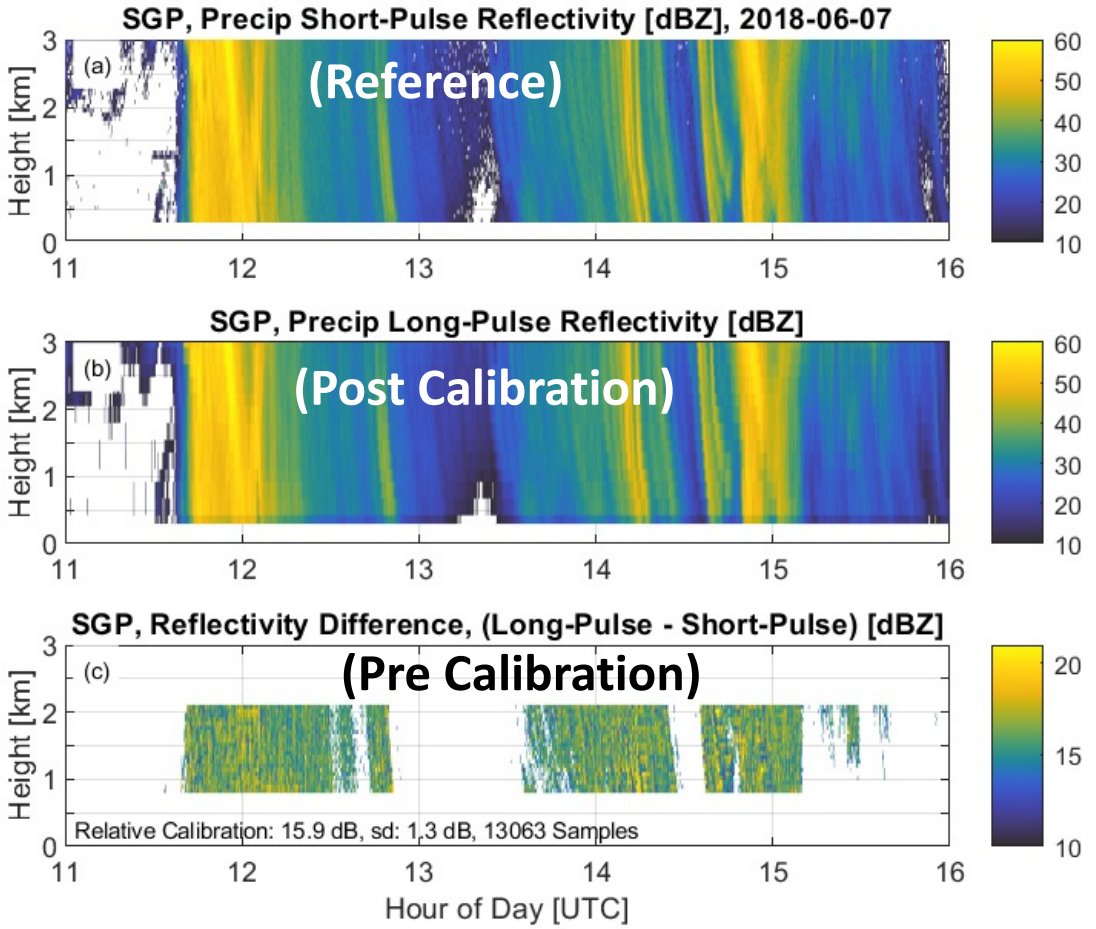
Δr = 100 m

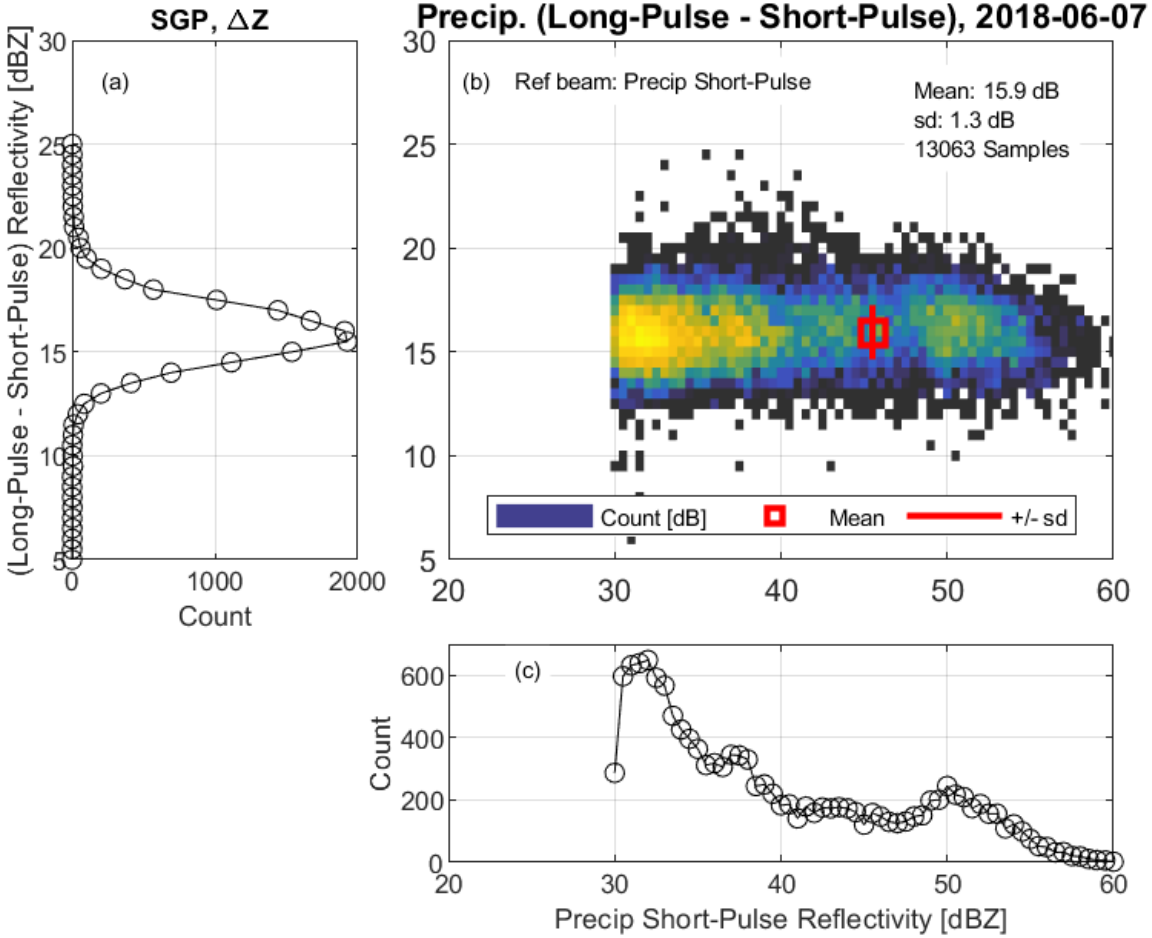
Spacing = 100 m

North Beam

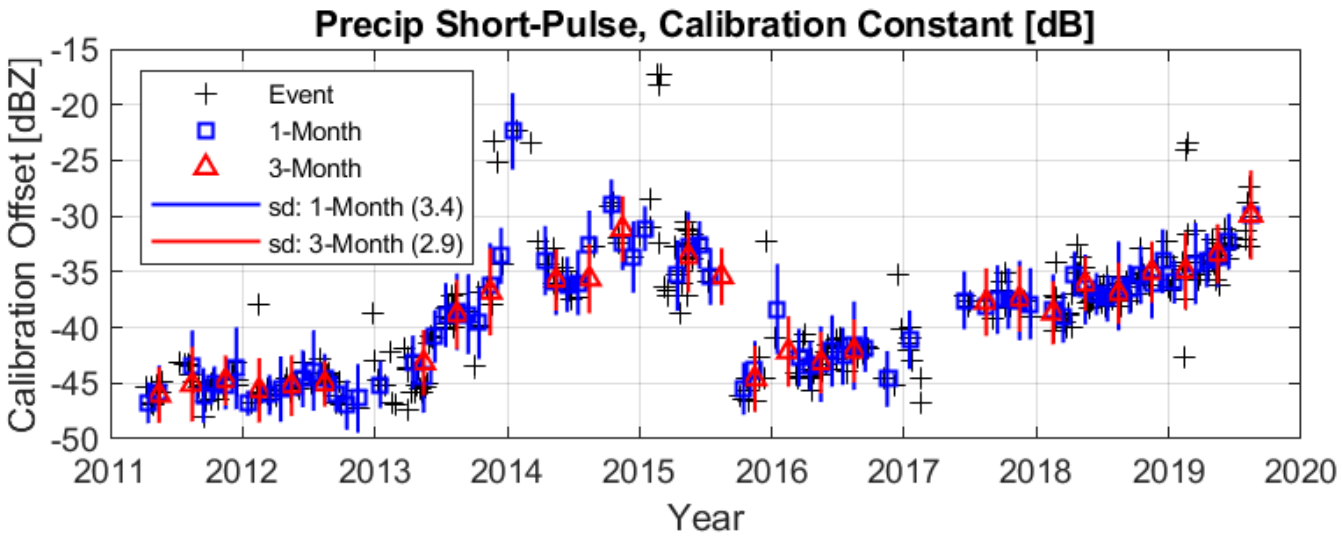
West Beam

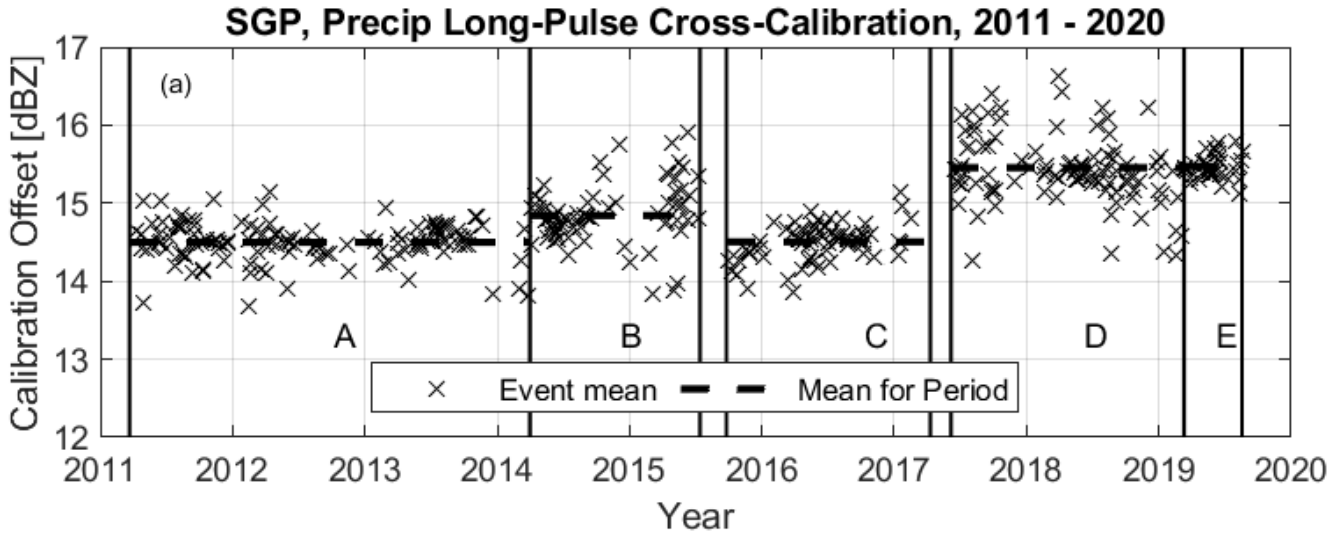
Calibrating Long-Pulse Mode using Short-Pulse Mode





Calibration Stability: SGP 2011 to 2019





Short-Pulse Mode Calibration Constant
Sudden jumps in calibration constant occur when new hardware is installed.

Key Results
Over time, the RWP lost sensitivity at a rate of about 3 dB/year due to hardware aging and degradation.

Calibration drift is slow enough that quarterly calibration constants can be determined from multiple rain events.

Long-Pulse Calibration from 2011 to 2019
Since relative calibration between modes is determined by operating parameters, there is only a small change in calibration when new hardware is installed.