



The ARM Data Quality Office: A Summary of Current Tools and Capabilities

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CIWRO, University of Oklahoma

2023 ARM/ASR PI Meeting

What is the ARM Data Quality Office (ARM DQO)?

- The DQO is an ARM user facility program located at the Cooperative Institute for Severe and High-Impact Weather Research and Operations (CIWRO) at the University of Oklahoma, now contracted through Argonne National Lab

What is the main goal of the ARM DQO?

- The DQO serves as the first line of defense for data quality issues. It's our job to characterize the quality of ARM data to provide the best possible data to end users.

But most importantly....

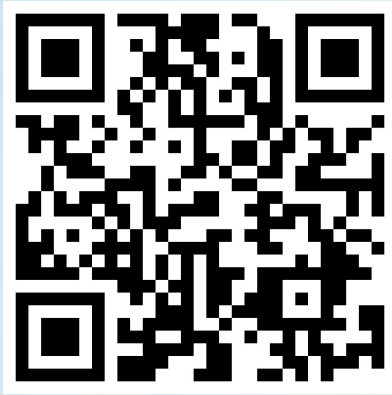
How can we help??

- By offering up a plethora of web-based tools that can be used by anyone:
 - DQ-Explorer
 - DQ-Plotbrowser
 - DQ-Zoom
- One-off projects and requests
- Data reviews, Data Quality Problem Reports (DQPRs), and Data Quality Reports (DQRs)
- Slurm processing
- Integration with other science groups and calls, including:
 - AMMSG working group
 - CPMSG working group
 - ARM OPS calls, ACT calls, radar data conference Calls, etc.

dq.arm.gov



DQ-Explorer



A tool designed to visualize instrument data and QC information through the use of plots and metrics tables

DQ-Explorer



Request Selection

Query user database? ✕

sgpmetE13.b1

OR

sgp

met

E13

b1

2023-07-01

2023-07-07

Add to Queue

Request Queue

sgpmetE13.b1

20230701 - 20230707 📄



Submit

DQ-Explorer



Welcome, Alyssa

Request Menu Metrics Favorites

Sign Out

	Hours (hr)																							
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
atmos_pressure																								
logger_temp																								
logger_volt																								
org_precip_rate_mean																								
pwd_cumul_rain																								
pwd_cumul_snow																								
pwd_err_code																								
pwd_mean_vis_10min																								
pwd_mean_vis_1min																								
pwd_precip_rate_mean_1min																								
pwd_pw_code_15min																								
pwd_pw_code_1hr																								
pwd_pw_code_inst																								
rh_mean																								
tbrg_precip_total																								
tbrg_precip_total_corr																								
temp_mean																								
vapor_pressure_mean																								
wdir_vec_mean																								
wspd_arith_mean																								

Good 97%

Value is not failing any performed QC tests.
Time: (0-33,36-59)

Bad

DQO: Data failing persistence test. Standard Deviation over a window of 10 values less than 0.0001.
Time: (34-35)

Good 57%

Value is not failing any performed QC tests.
Time: (0-20,35,45-46,48-53,55-58)

Indeterminate 43%

DQO: Difference between wdir_vec_mean and sgpmaawsC1.b1.wind_direction greater than 60 degree
Time: (21-34,36-44,47,54,59)



DQ-Explorer



DQ Explorer
Diagnostic Plots Comparison Plots
Prev Day Next Day
Home, Any...

Request Menu Metrics Favorites
Sign Out

2023-07-02

	00	01	02
atmos_pressure			
logger_temp			
logger_volt			
org_precip_rate_mean			
pwd_cumul_rain			
pwd_cumul_snow			
pwd_err_code			
pwd_mean_vis_10min			
pwd_mean_vis_1min			
pwd_precip_rate_mean_1min			
pwd_pw_code_15min			
pwd_pw_code_1hr			
pwd_pw_code_inst			
rh_mean			
tbrg_precip_total			
tbrg_precip_total_corr			
temp_mean			

meteogram

SGPE13 Mean Temperature and Relative Humidity for 20230702

SGPE13 Mean Wind Direction & Speed for 20230702

SGPE13 Mean Atmospheric and Vapor Pressure for 20230702

4.52-0.e17

22 23

57%

QC tests.

43%

c_mean and
ater than 60

DQ-Plotbrowser



Efficiently view plots generated by the
DQO's Python scripts

DQ-Plotbrowser



DQ-Plotbrowser

Request Options 1

SITE

sgp

CLASS

met

FACILITY

E13

LEVEL

b1

INCLUDE COMPARISON PLOTS

PLOT TYPE

All

START DATE

2023-07-01

END DATE

2023-07-07

Get Plots

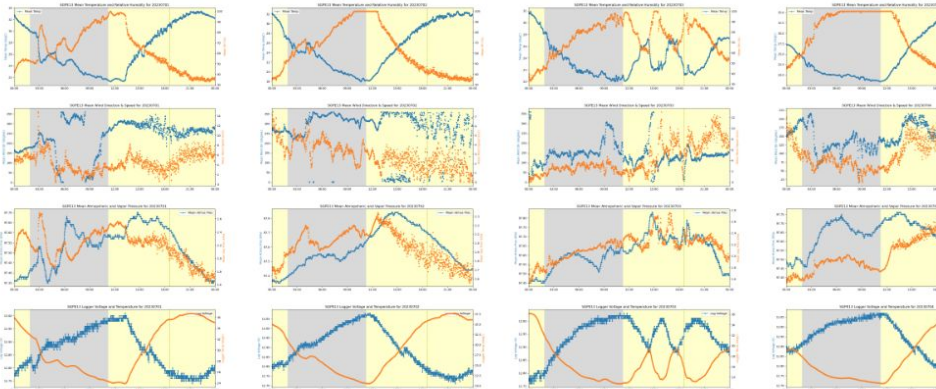


prev 7 days

next 7 days



Datastream: sgpmetE13.b1
meteogram



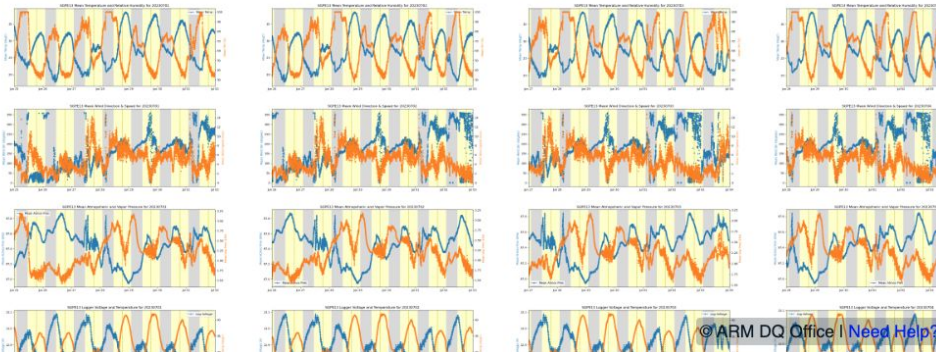
20230701

20230702

20230703

20230704

meteogram_week



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DQ-Plotbrowser



DQ-Plotbrowser

Request Options ⓘ

SITE: sgp

CLASS: met

FACILITY: E13

LEVEL: b

INCLUDE COMPARISON PLOTS:

PLOT TYPE: All

START DATE: 2023-07-01

END DATE: 2023-07-07

Get Plots

prev 7 days next 7 days

Datastream: sgpmetE13.b1

SGPE13 Mean Temperature and Relative Humidity for 20230702

SGPE13 Mean Wind Direction & Speed for 20230702

SGPE13 Mean Atmospheric and Vapor Pressure for 20230702

SGPE13 Logger Voltage and Temperature for 20230702

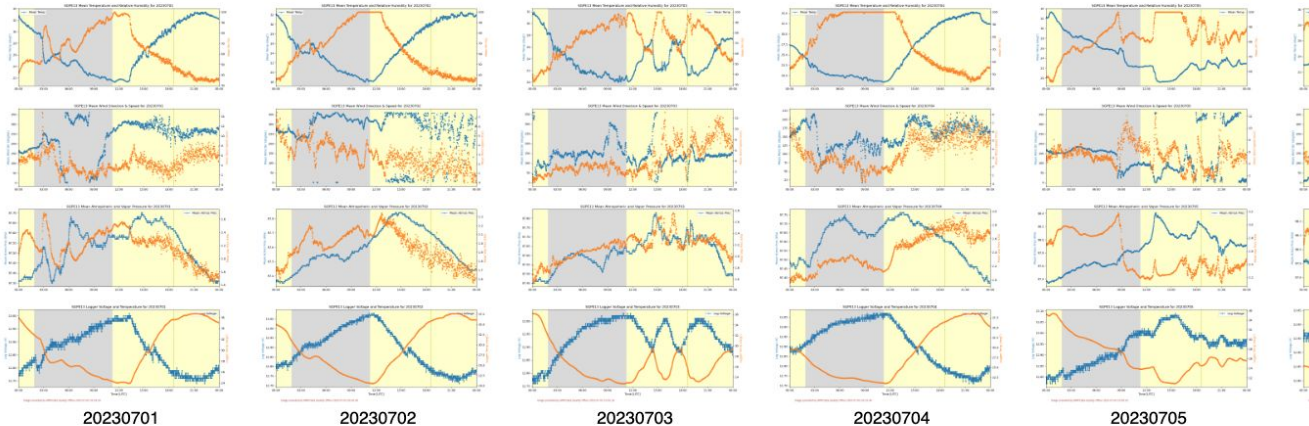
20230702 2 of 7

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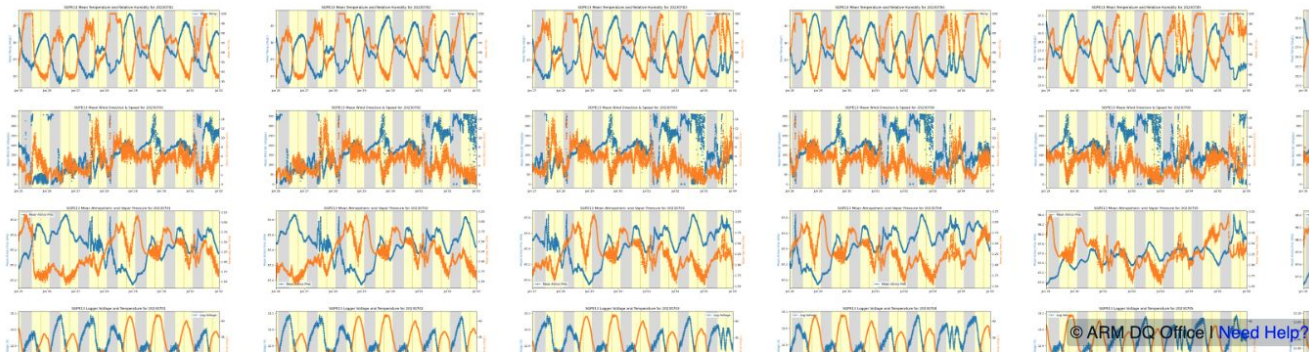
DQ-Plotbrowser



Datastream: sgpmetE13.b1
meteogram

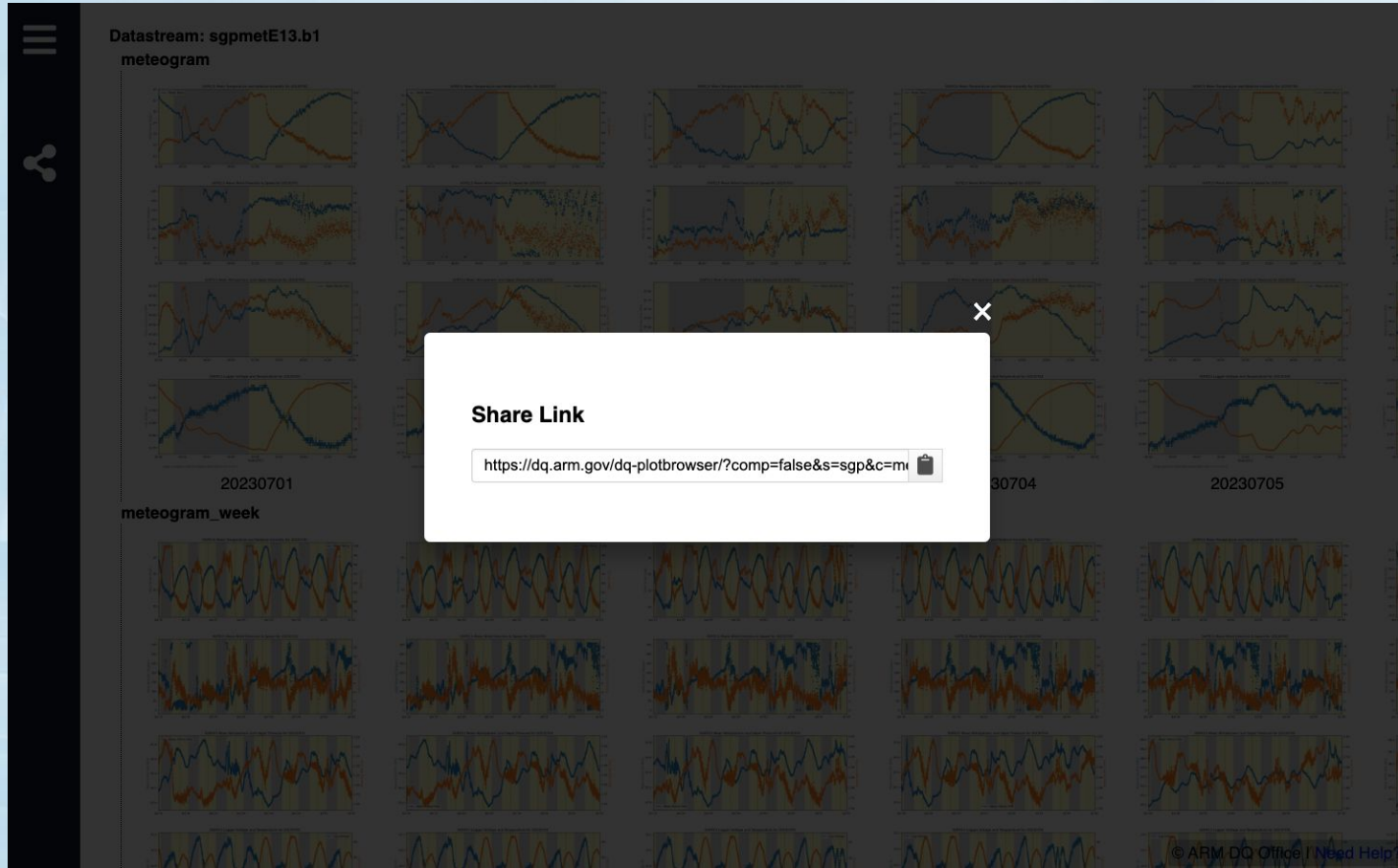


meteogram_week



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DQ-Plotbrowser



DQ-Zoom



A tool designed to dynamically visualize
ARM data on the fly by directly reading the
netCDF files

DQ-Zoom



ARM
DQ-Zoom Plotter

Welcome, Alyssa Sockol

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DATASTREAM
sgpmetE13.b1

7394 available datastreams

SITE
SGP

DATASTREAM CLASS
met

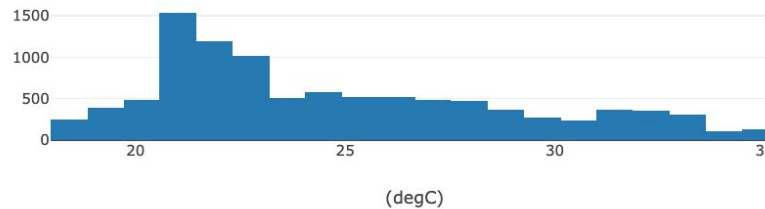
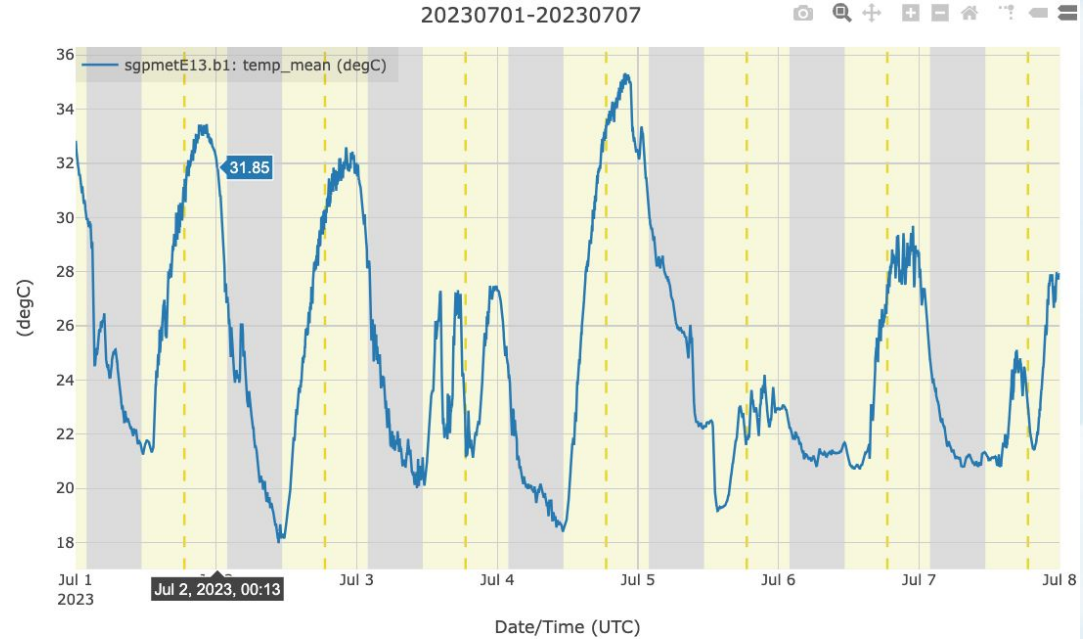
FACILITY
E13

LEVEL
b1

START DATE: 2023-07-01
END DATE: 2023-07-07

Data available from 1993-07-21 to 2023-07-18

VARIABLE
temp_mean



Show File Header

Min: 17.98
Max: 35.33
Mean: 24.76
Stdev: 4.195

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DQ-Zoom



ARM x

DQ-Zoom Plotter

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VARIABLE

temp_mean

46 available variables

Embed QC:

ALL: Overlay Remove

BAD: Overlay Remove

IND: Overlay Remove

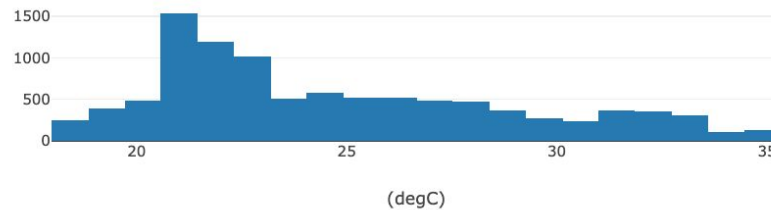
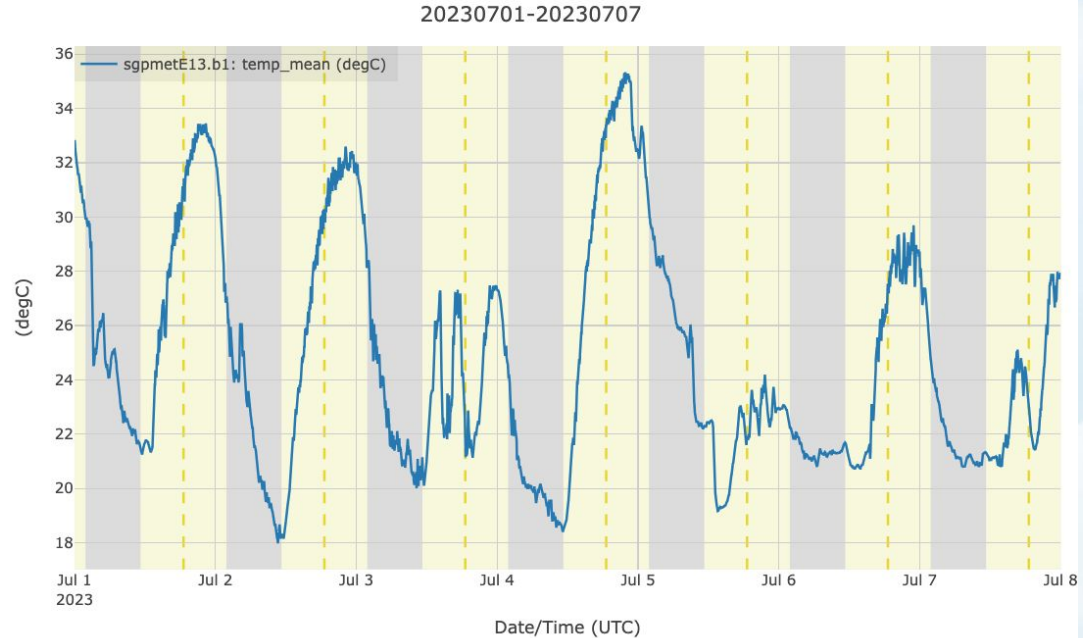
[Generate Plot](#)

[Add to Plot](#)

TIME LOGGING

Y-AXIS LOG SCALE

[Clear Plot](#)



[Show File Header](#)

Min: 17.98
Max: 35.33
Mean: 24.76
Stdev: 4.195

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DQ-Zoom



ARM ×

DQ-Zoom Plotter

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VARIABLE

rh_mean ▾

46 available variables

Embed QC:

ALL: Overlay Remove

BAD: Overlay Remove

IND: Overlay Remove

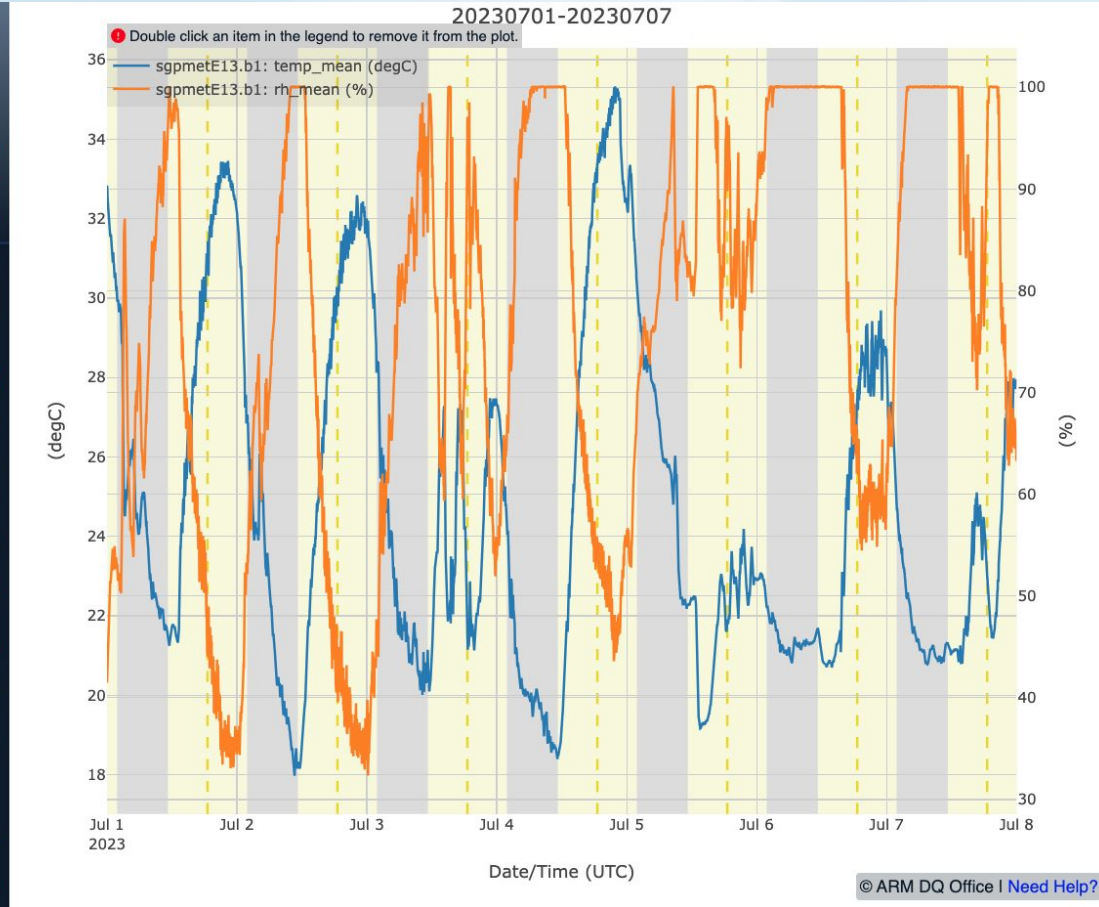
[Generate Plot](#)

[Add to Plot](#)

TIME LOGGING

Y-AXIS LOG SCALE

[Clear Plot](#)



DQ-Zoom



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[Log Out](#)

DATASTREAM
sgpkazrcfrgeC1.a1

7394 available datastreams

SITE
SGP

DATASTREAM CLASS
kazrcfrge

FACILITY
C1

LEVEL
a1

START DATE
2023-07-20

END DATE
2023-07-20

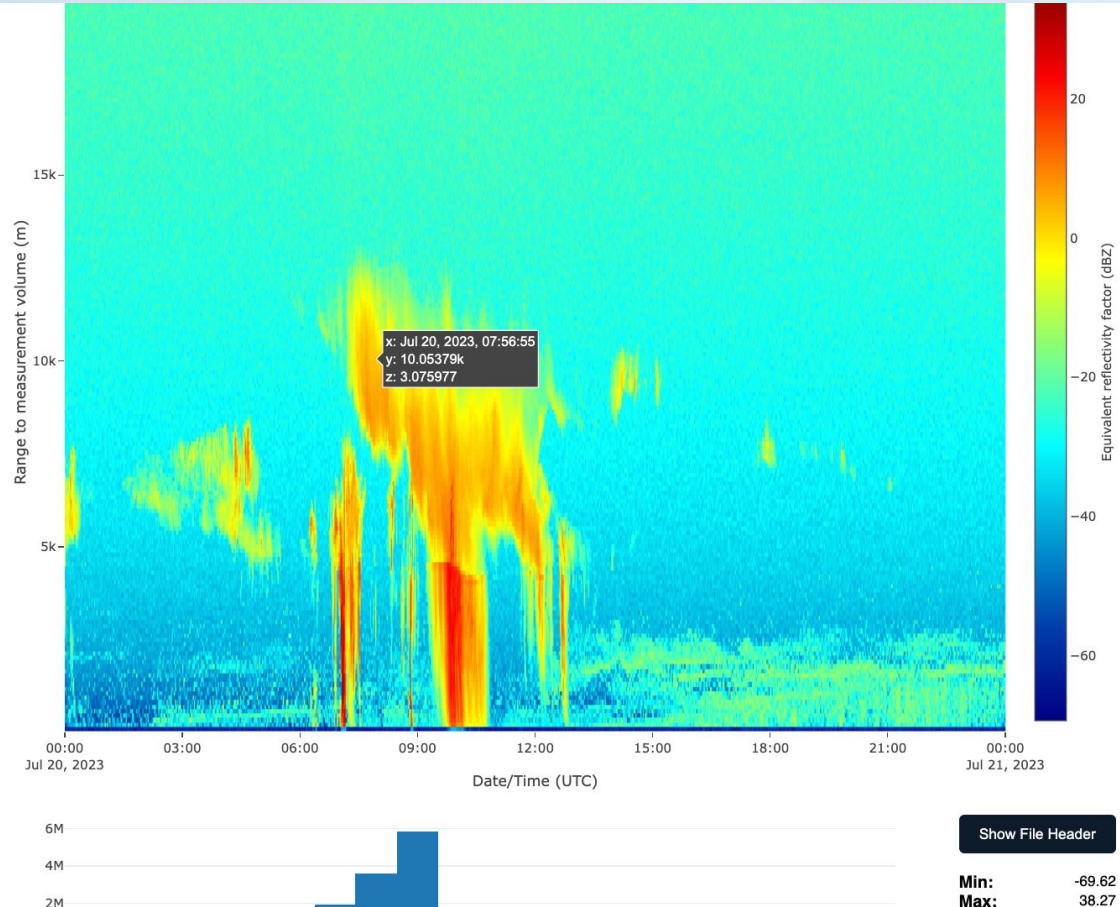
Data available from 2019-02-14 to 2023-07-21

VARIABLE
reflectivity (2D)

21 available variables

RANGE (M)
ALL (2D Plot)

[Generate Plot](#)



One-Off Projects and Requests

Created plotting code for ARM Kiosk plots

ARM The world's premier ground-based observations facility advancing atmospheric and climate research

U.S. DEPARTMENT OF **ENERGY** Office of Science

ATMOSPHERIC OBSERVATORIES

SGP NSA ENA AMF1 AMF2 AMF3

ARM
Atmospheric Radiation Measurement User Facility



NORTH SLOPE OF ALASKA

KAZR Reflectivity

No Data Available over Last 24 Hour Period

Doppler Lidar Wind Profiles

Solar Radiation

SOUTHERN GREAT PLAINS

KAZR Reflectivity

Doppler Lidar Wind Profiles

Solar Radiation

EASTERN NORTH ATLANTIC

KAZR Reflectivity

Doppler Lidar Wind Profiles

Solar Radiation

Plots are created by the DQ Office using the ACT software.

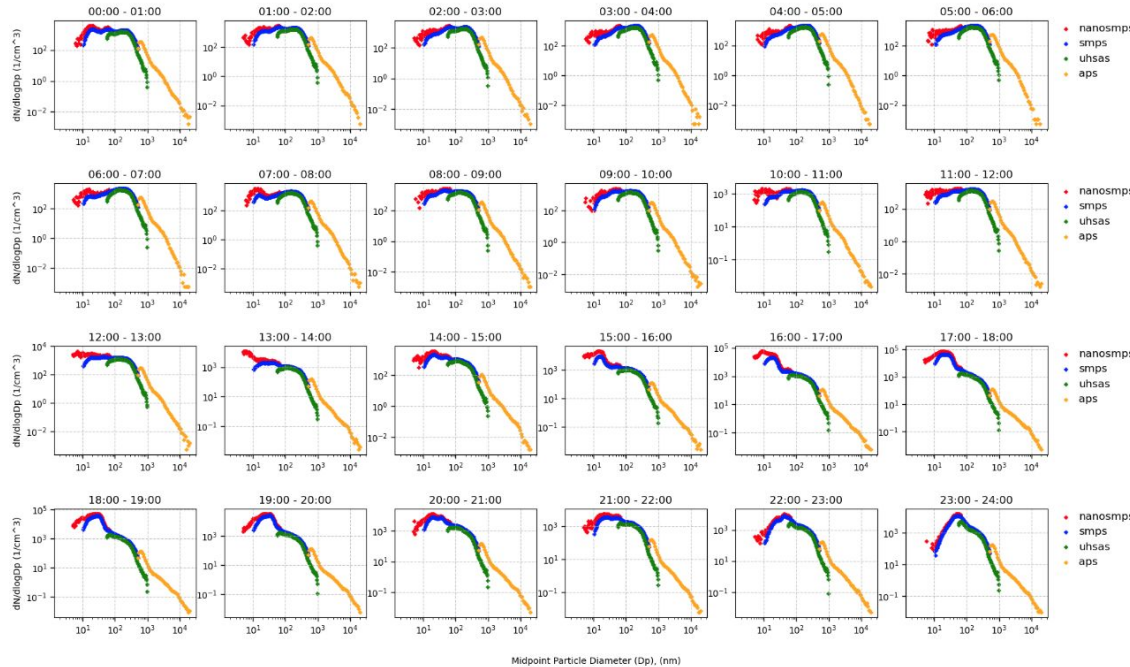


One-Off Projects and Requests

Created new hourly size distribution plots at mentor request

In addition, we can....

b1 Level SGP Hourly dN/dlogDp Comparison at E13 on 20230508



Midpoint Particle Diameter (Dp, nm)

- Create new QC checks for testing in DQ Explorer
- Send email and/or Slack alerts for specific QC flags
- Create data used for comparisons

The DQO and Problem Resolution

- Data Reviews
 - Pre-deployment of AMFs
 - Ingest changes to existing instruments at fixed sites
- DQPRs
 - Alerts appropriate ARM staff of potentially unacceptable data
 - DQPR site enables online discussion and suggested actions from all involved
 - Tracks problem from detection through resolution to final documentation
- DQRs
 - Written statements of DQ for affected ARM datastreams over specified time ranges, accompanied by a quality category and description of the issue
 - Included with user data order

Additional Capabilities and Roles

- Slurm processing
 - The DQ Office has access to ARM shared Slurm processing, allowing for significant processing capabilities
- DQO integration with other science working groups and calls, including:
 - AMMSG working group
 - CPMSG working group
 - ARM Operations calls, ACT calls, radar data conference calls, ingest development calls, etc.
- Machine Learning capabilities
 - Anomaly Detection: Identify unusual patterns in both real-time streaming data and archived historical data
 - Immediate Alerting: Notify instrument mentors promptly when specific data quality issues are detected, allowing for timely intervention to prevent extended data loss, eg. data drifts, spikes in a time series

Thank you! Any Questions?

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