



Chemical Speciation Network

Data Validation & DART

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UCDAVIS

AIR QUALITY RESEARCH CENTER

DART Status and Plans

Support for DART currently in “Maintenance” mode

- Fixing bugs and other software issues
- Answering user’s questions
- Updating the general DART users guide for CSN

Logging potential changes and recommendations from users for next iteration of changes planned for FY 2020

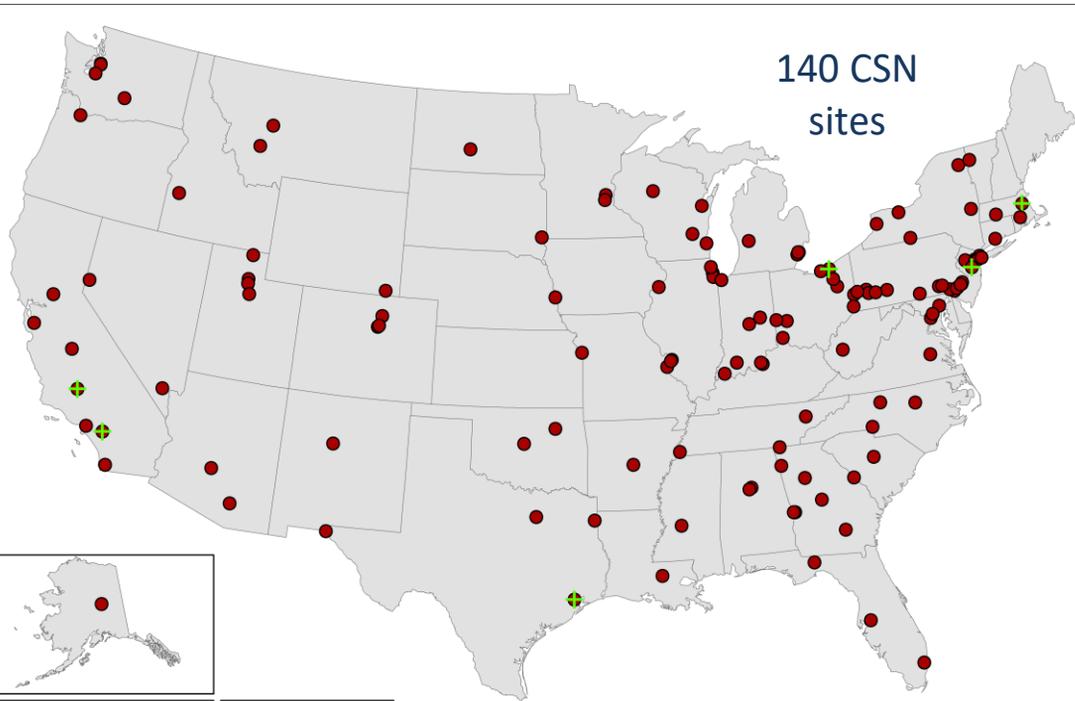
If you have suggestions for changes to DART, let us know.

You can reach the entire CSN team (EPA, UC Davis, Sonoma Tech) at CSNSupport@sonomatech.com for questions, support, and recommendations.

Chemical Speciation Network (CSN)

EPA established in 2000 as part of PM_{2.5} NAAQS review

Routine monitoring of speciated PM_{2.5} in urban areas across US



Long-term PM_{2.5} chemical composition data to better understand air quality & human health concerns

Objective
● Primary
+ Collocated

Effective 6/21/2019

CSN filters & sampling schedule

Two instruments

MetOne SASS

URG

Three different filter types

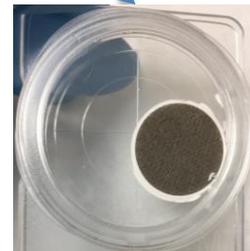
Polytetrafluoroethylene (PTFE)

Nylon

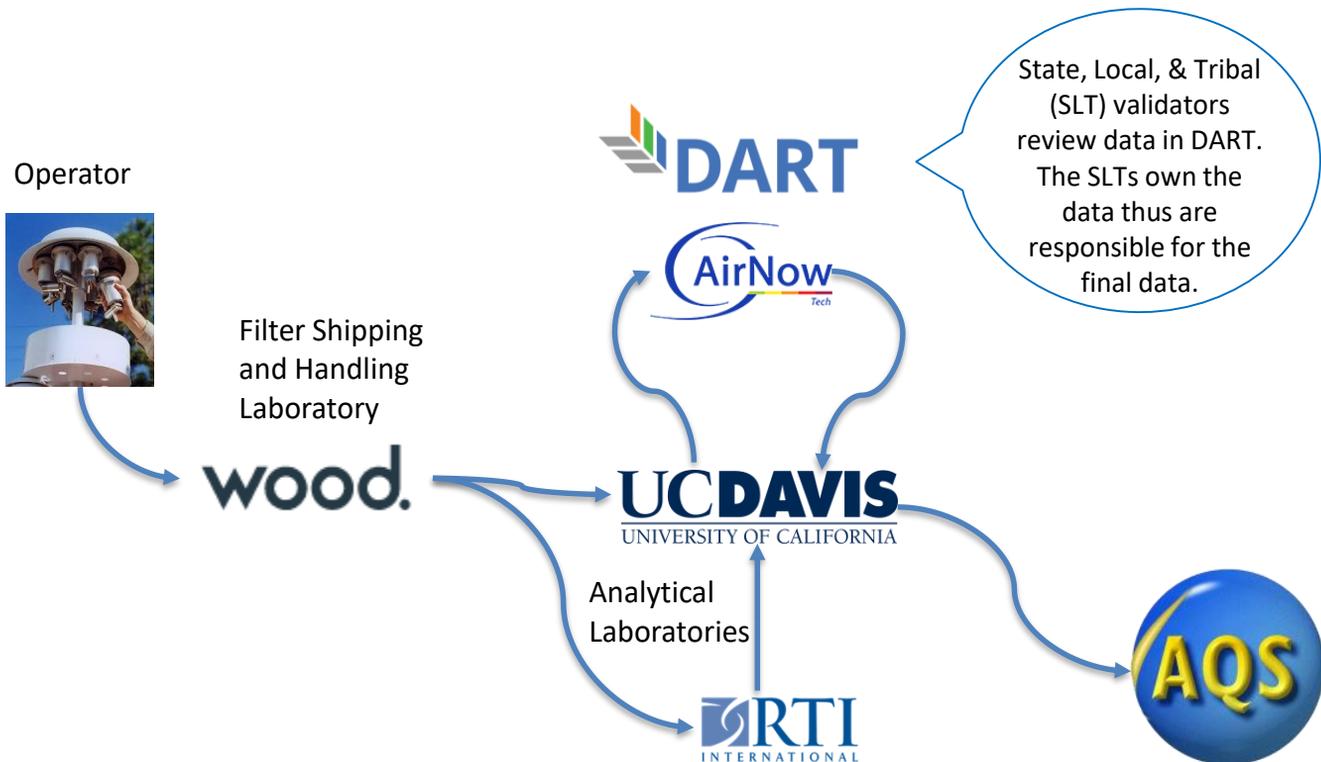
Quartz

24-hour $PM_{2.5}$ samples
every 3 or 6 days

Field blanks
once a month



CSN Data Pathway & Validation Process



CSN Measurements

PTFE Filters



X-Ray Fluorescence

Elements

S, K, Cl,...

Soil (*Fe, Al, Si,...*)

Metals (*Ni, V, Mg,...*)

Nylon Filters

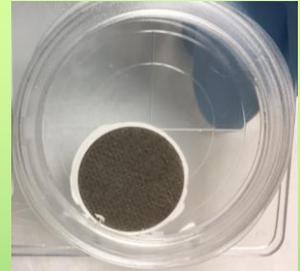


Ion Chromatography

Ions

*Ammonium, sodium,
potassium, nitrate,
sulfate, chloride*

Quartz Filters



Thermal/Optical Analysis

Organic Carbon

Elemental Carbon

Fractions

Reported parameters: analysis data

Elements		
Aluminum	Cobalt	Selenium
Antimony	Copper	Silicon
Arsenic	Indium	Silver
Barium	Iron	Sodium
Bromine	Lead	Strontium
Cadmium	Magnesium	Sulfur
Calcium	Manganese	Tin
Cerium	Nickel	Titanium
Cesium	Phosphorus	Vanadium
Chlorine	Potassium	Zinc
Chromium	Rubidium	Zirconium

Ions
Ammonium
Chloride
Potassium
Sodium
Sulfate
Nitrate

Carbon	
Reported to	Parameter
DART and AQS	EC TOR
	OC TOR
	EC TOR (unadjusted)*
	OC TOR (unadjusted)*
AQS only	OC1
	OC2
	OC3
	OC4
	OP TOR
	OP TOT
	EC1
	EC2
	EC3
	OC TOT
EC TOT	

* Unadjusted data are delivered to AQS for all parameters but also to AQS for these two parameters for FIELD BLANKS only

Reported parameters: operational & calculated

Reported to	Parameter	Reported per	
DART and AQS	Operational	Avg. ambient pressure*°	
		Avg. ambient temperature*°	
		Flow Rate CV	Filter type
		Sample Volume	
	PM2.5 mass	Measurement (where available)	
DART only	Calculated	Ammonium nitrate	
		Ammonium sulfate	
		Organic Mass by Carbon	Sampling event
		Soil	
		Reconstructed Mass	
AirNow-Tech Mass	Sampling event (where available)		
	Transport temperature	Filter Type	

* Reported only for PTFE but represents both filters from the SASS i.e. PTFE and nylon

° These are average values reported by the sampler.

N.B.: This is not the average of the min and max values reported by the sampler.

CSN flags

Two flag types

Qualifiers flags

Null codes

Application types

Parameter specific

Analytical species

Operational data

Whole filter

Whole sampling event

'validity flags'
informational

*e.g. local conditions,
sampling abnormalities,
instrument discrepancies*

invalidate data

*e.g. instrument malfunctions,
human errors, power failures*

Can depend on values

*e.g. sulfate concentration
below MDL → 'MD' qualifier
applied to sulfate only*

May be parameter specific

*e.g. flow rate CV not recorded
but all other data valid → apply
null code to flow rate CV only*

All filter types
(typically three) for a
given sampling day

*e.g. power failure (>1hr)
on site, no filters ran
properly → invalidate all
data from this day*

Something occurred
during analysis

*e.g. Teflon filter dropped in lab
so flag all elemental species*

Includes both operational
& species parameters

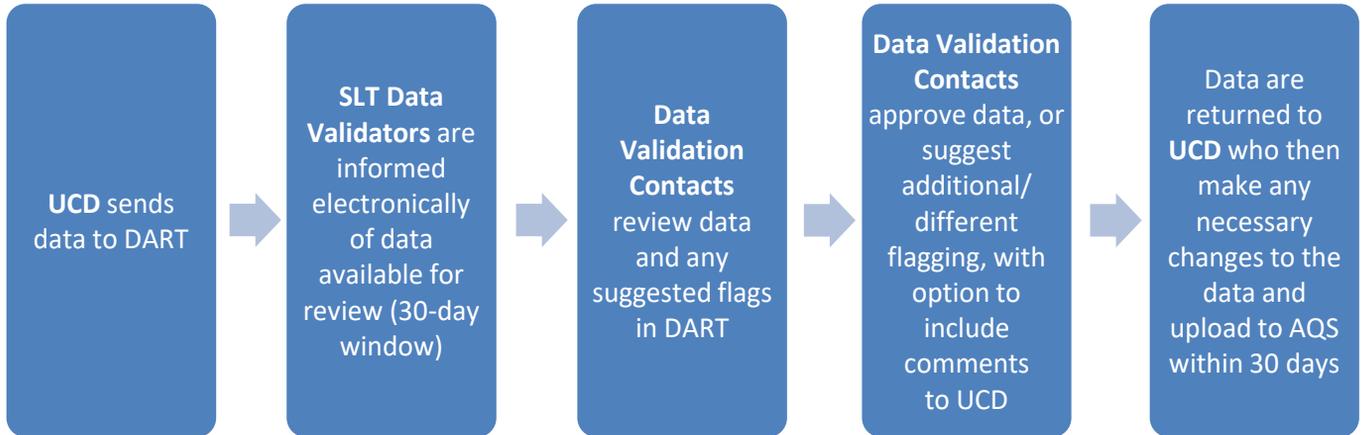
*e.g. Filter did not run, no
values recorded for operational
parameters, species
concentrations cannot be
calculated → invalidate all
parameters*

- Application of some flags may depend on certain criteria and/or value ranges (N.B. application may be automatic during processing)
- Review all flags to confirm application & address data

CSN in DART



CSN Data Flow to and from DART



Accessing DART Via AirNow-Tech



The image shows a screenshot of the AirNow-Tech website. On the left, the main navigation bar includes the AirNow-Tech logo and links for Dashboard, Data, Navigator, Forecasts, Polling, Notifier, and Tools. Below this is a login section titled "Please log in to use AirNow-Tech" with fields for Username and Password, a "Log In" button, and a "Forgot your password?" link. A red box highlights the "Request an AirNow-Tech Account" link below the login section. A large red arrow points from this link to the right-hand side of the image, which shows the "Request an AirNow-Tech Account" form. This form includes fields for First Name, Last Name, Login Name, Password, Verify Password, E-mail Address, and Phone. There is also a large text area for a Comment and a dropdown menu for Agency selection. At the bottom of the form, there is a "Terms of Use / Privacy Policy" section with a checkbox indicating that the user has read the terms, and a "Send Request" button.

Request an AirNow-Tech Account

Request an AirNow-Tech Account

First Name:

Last Name:

Login Name:

Password:

Verify Password:

E-mail Address:

Phone:

Comment:

Agency:

Terms of Use / Privacy Policy

The AirNow-Tech system is operated for the United States Environmental Protection Agency (EPA) AirNow program and is for authorized use only. Unauthorized access or use of this computer system may subject violators to criminal, civil, and/or administrative action. All information on this computer system may be monitored, recorded, read, copied, and disclosed by and to authorized personnel for official purposes, including law

I have read the Terms of Use / Privacy Policy:

All Fields Required

Request an AirNow-Tech account
at <https://www.airnowtech.org>

DART – AirNow-Tech Login and Welcome Page



Welcome, Dart User #1! | [My Account](#) | [Contact Us](#) | [Log Out](#)

DART

Two red arrows point from the 'DART' text to the right and then down and to the left.



[Manage](#) | [Explore](#) | [Validate](#) | [Export](#) | [Help](#)

DART is your personal platform for air quality data validation and analysis!

You can upload your own air quality data or request it from AQS Data Mart.

Create graphs and use custom screening checks for data validation.

And use the DART export to prepare data for AQS submission.

Watch an introductory webinar on DART from May 2015 [here](#)



DART – Manage Page

Your Air Quality Agency

Data Sets

Date Received	Type	Data Set Name	Date Range (LST)	Data Status	Download	Approval Status
05/24/2018	Lab - CSN	CSN Data	01/04/2013 - 12/30/2017	Ready for use		
06/11/2018	Lab - CSN	CSN Data	01/04/2013 - 12/30/2017	Ready for use		
07/12/2018	Lab - CSN	CSN Data	01/01/2013 - 12/30/2017	Ready for use		
07/12/2018	Lab - CSN	CSN Data	01/04/2013 - 12/27/2017	Ready for use		

Show entries

Previous 1 Next

AQS Site Code(s)

My Data Sets

[add data +](#)

Date Received	Type	Data Set Name	Date Range (LST)	Data Status	Download	Delete
04/04/2016	AQS	My Sample Data Set	11/18/2011 - 12/10/2011	Ready for use		

Show entries

Previous 1 Next



Batch Needs Approval



Approved Batch

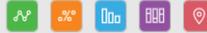


Locked Batch

DART WORKSPACE

Default CSN Workspace

ADD PLOTS



Save

Approval Mode |

CSN Data

BATCH CREATED:

20 Jul 2018

Select Batch

REVIEW BY:

21 Aug 2018

BATCH SUMMARY

JANUARY 2018

Total Samples:
10

Total Qualifiers:
C1 (1) FX (26) IB (1) MD (290) MX (47)
QT (1) X (3)

Total Null Codes:
AA (1) AC (1) AJ (41) AQ (11)

Status	Date	Total Qualifiers	Total Null Codes
98%	Jan-02	37 (FX QT MD IB MX C1)	1 (AC)
100%	Jan-05	29 (MD)	0
100%	Jan-08	27 (MD)	0
82%	Jan-11	40 (MD X MX)	11 (AQ)
	Jan-14	27 (MD)	0
	Jan-17	62 (MD MX)	0
	Jan-20	46 (FX MD)	0
	Jan-23	38 (MD MX)	0
	Jan-26	9 (MD MX)	42 (AA AJ)
	Jan-29	41 (MD MX)	0

Configure and save custom workspaces

Select CSN batch to review

View data completeness and hover over the icon to view additional information



Batch Data

Filter:

Reviewed	Date	Parameter	POC	Value	Ptile	MDL	Unc.	Unit	Null Code	Qual. Code	Comments
<input checked="" type="checkbox"/>	Dec-03	Aluminum PM2.5 LC	6	-0.0198	2	0.03218	0.02019	ug/m3		MD	
<input type="checkbox"/>	Dec-03	Aluminum PM2.5 LC	7	-0.00975	7	0.03215	0.0197	ug/m3		MD	
<input type="checkbox"/>	Dec-03	Ammonium Ion PM2.5 LC	6	1.58629	99	0.00835	0.11274	ug/m3			
<input type="checkbox"/>	Dec-03	Ammonium Ion PM2.5 LC	7	1.74778	100	0.00835	0.1242	ug/m3			
<input type="checkbox"/>	Dec-03	Ammonium Nitrate PM2.5 LC	6	3.74778	99	0.0539	0.28671	ug/m3			
<input type="checkbox"/>	Dec-03	Ammonium Nitrate PM2.5 LC	7	3.55887	99	0.05391	0.27245	ug/m3			
<input type="checkbox"/>	Dec-03	Ammonium Sulfate PM2.5 LC	6	3.9635	84	0.01532	0.24591	ug/m3			
<input type="checkbox"/>	Dec-03	Ammonium Sulfate PM2.5 LC	7	4.52537	93	0.0153	0.28073	ug/m3			
<input type="checkbox"/>	Dec-03	Antimony PM2.5 LC	6	-0.01856	4	0.03878	0.02403	ug/m3		MD	

 Select All

Mark Reviewed

Undo

Restore

Null and/or qualifier codes are editable using the "Edit Batch" window

Default CSN Workspace

Save

Batch Data

Filter:

Reviewed	Date	Parameter
<input type="checkbox"/>	Feb-02	Arsenic PM2.5
<input type="checkbox"/>	Feb-02	Average Ambient Temperature for URG3000N
<input type="checkbox"/>	Feb-02	Average Ambient Temperature for MetOne SASS
<input checked="" type="checkbox"/>	Feb-02	Avg Ambient Temperature for MetOne SASS
<input type="checkbox"/>	Feb-02	Barium PM2.5
<input type="checkbox"/>	Feb-02	Bromine PM2.5
<input type="checkbox"/>	Feb-02	Cadmium PM2.5
<input type="checkbox"/>	Feb-02	Calcium PM2.5

Select All

TIME SERIES



Edit Batch

Help

Recent Comment:

Comment has not been added yet.

Sample Date(s):

Feb 2, 2019



Advanced

Apply to:

Apply to Selected Species

 Overwrite Codes

Edit Null Code:

AN - Machine Malfunction

Added: AN

Edit Qualifier Code:

Preview:

Original

New

Average Ambient Temperature for MetOne SASS/SuperSASS: [], []



Average Ambient Temperature for MetOne SASS/SuperSASS: [AN], []

Edit Comment:

Applied the AN null code to the average ambient temperature parameter for the Teflon filter only for 12/3/2017 because the temperature sensor was not working correctly on

Cancel

Save

Qual. Code

Comments

MD

MD

MD

MD

Undo

Restore

TIME SERIES KEY



Default CSN Workspace

Save

Batch Data

Filter:

Select the parameter(s) to edit.

Edit Batch

Help

Recent Comment:

Comment has not been added yet.

Sample Date(s):

Feb 2, 2019



Advanced

Apply to:

Apply to Selected Species

 Overwrite Codes

Edit Null Code:

AN - Machine Malfunction

Added: AN

Edit Qualifier Code:

Preview:

Original

New

erature for MetOne SASS/SuperSASS: [], []



erature for MetOne SASS/SuperSASS: [AN], []

Edit Comment:

Applied the AN null code to the average ambient temperature parameter for the Teflon filter only for 12/3/2017 because the temperature sensor was not working correctly on

Cancel

Save

Qual. Code

Comments

MD

MD

MD

MD

Undo

Restore

TIME SERIES



TIME SERIES KEY



Note about selecting parameters to edit in the “Edit Batch” Window

- Null and/or qualifier codes are editable using the “Edit Batch” window:
 - Click on the icon in the null code or qualifier code column in the row of the “Batch Data” table for the species that you would like to edit.
- Null and/or qualifier code changes in the “Edit Batch” window can be applied to:
 - Only the selected species in the selected sample
 - All species in the selected sample
 - All elements, ions, or carbon species in the selected sample (**only** applies to the analytical species for each filter type)

Edit Batch

DART WORKSPACE
Default CSN Workspace

Edit Batch [Help] [X]

Recent Comment:
"Site: Disposed of one leaking ice pack - UCD: After reviewing the data, the S/SO4 time series suggested that one of the teflon or nylon filters had been swapped between 1/20/18 and 1/23/18. UCD checked various details and discussed with Wood and it appears that the teflon was swapped in their labs. The filter and analysis data should now be correct."
07/21/2018 01:50

Sample Date(s):
Jan 20, 2018
Jan 23, 2018

Apply to:
Apply to Selected Species [v] Overwrite Codes [v]

Edit Null Code:
No null code [v]

Edit Qualifier Code:
[]

Preview:

Original	New
Jan 20, 2018 Aluminum PM2.5 LC: [], []	Jan 20, 2018 Aluminum PM2.5 LC: [], []
Jan 23, 2018 Aluminum PM2.5 LC: [], []	Jan 23, 2018 Aluminum PM2.5 LC: [], []

Edit Comment:
[]

[Cancel] [Save]

Batch Data
Filter: Jan-20

Reviewed	Date	Parameter
<input checked="" type="checkbox"/>	Jan-20	Aluminum PM2.5 LC
<input type="checkbox"/>	Jan-20	Ammonium Nitrate
<input type="checkbox"/>	Jan-20	Ammonium Nitrate
<input type="checkbox"/>	Jan-20	Ammonium Nitrate
<input type="checkbox"/>	Jan-20	Antimony PM2.5 LC
<input type="checkbox"/>	Jan-20	Arsenic PM2.5 LC
<input type="checkbox"/>	Jan-20	Average Amt for URG3000
<input type="checkbox"/>	Jan-20	Average Amt Temperature
<input type="checkbox"/>	Jan-20	Avg Ambient MetOne SAS

[Select All] [Mark Reviewed]

January 2018

Sun	Mon	Tue	Wed	Thu	Fri	Sat
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	1	2	3
4	5	6	7	8	9	10

[Advanced]

[Undo] [Restore]

TIME SERIES **TIME SERIES.KEY**

Click "Advanced" to view a calendar and select additional dates for editing.

Preview edits before clicking "Save"

“Edit Batch” Reminders

- A species measured in a sample can have either a null code or qualifier code(s), but not both:
 - To apply a null code to a selected species that already has a qualifier code(s), first remove the qualifier code(s) by clicking the “x” next to the code in the qualifier drop-down menu)
 - To apply a qualifier code(s) to a selected species that already has a null code, first remove the existing null code by selecting “No null code” from the null code drop-down.
- If a parameter value is missing, which displays as the value -999 in DART, a null code is required.
- If a null data code has been applied (e.g. AM – misc void) but you have additional information available, please update to a more specific null code (e.g. AV – power failure)

Edit Values

Batch Data

Filter:

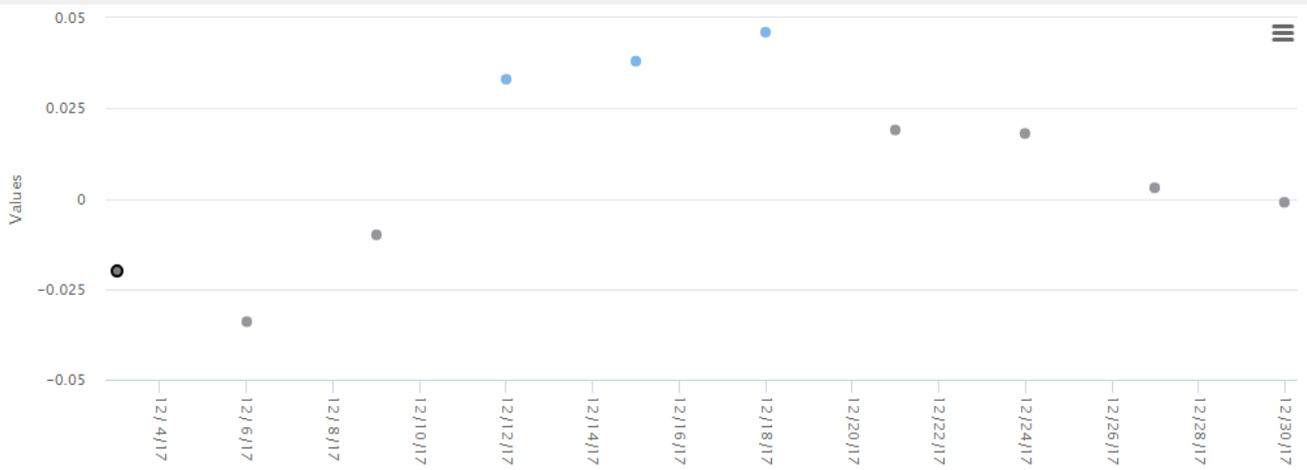
Reviewed	Date	Parameter	POC	Value	Ptile	MDL	Unc.	Unit	Null Code	Qual. Code	Comments
<input type="checkbox"/>	Dec-03	Arsenic PM2.5 LC	5	-1.1E-4	4	0.00186	0.00113	ug/m3	<input type="text" value=""/>	MD	<input type="text" value=""/>
<input type="checkbox"/>	Dec-03	Average Ambient Pressure for URG3000N	5	<input type="text" value="-999"/>	41	0.0		mmHg	<input type="text" value="AJ"/>	<input type="text" value=""/>	<input type="text" value=""/>
<input checked="" type="checkbox"/>	Dec-03	Average Ambient Temperature for URG3000N	5	<input type="text" value="-999"/>	29	0.0		°C	<input type="text" value="AJ"/>	<input type="text" value=""/>	<input type="text" value=""/>
<input type="checkbox"/>	Dec-03	Avg Ambient Pressure for MetOne SASS/SuperSASS	5	<input type="text" value="749.0"/>	11	0.0		mmHg	<input type="text" value=""/>	<input type="text" value=""/>	<input type="text" value=""/>
<input type="checkbox"/>	Dec-03	Avg Ambient Temperature for MetOne SASS/SuperSASS	5	<input type="text" value="16.2"/>	33	0.0		°C	<input type="text" value=""/>	<input type="text" value=""/>	<input type="text" value=""/>
<input type="checkbox"/>	Dec-03	Barium PM2.5 LC	5	-0.01484	8	0.08	0.0487	ug/m3	<input type="text" value=""/>	MD	<input type="text" value=""/>
<input type="checkbox"/>	Dec-03	Bromine PM2.5 LC	5	0.00819	100	0.00454	0.00302	ug/m3	<input type="text" value=""/>	<input type="text" value=""/>	<input type="text" value=""/>
<input type="checkbox"/>	Dec-03	Cadmium PM2.5 LC	5	-0.00145	16	0.01577	0.0096	ug/m3	<input type="text" value=""/>	MD	<input type="text" value=""/>
<input type="checkbox"/>	Dec-03	Calcium PM2.5 LC	5	0.0431	81	0.02498	0.01683	ug/m3	<input type="text" value=""/>	<input type="text" value=""/>	<input type="text" value=""/>

Select All

Graphical Review

TIME SERIES

TIME SERIES KEY



CSN Data - Aluminum PM2.5 LC (ug/m3) 24 Hrs POC: 6

Date Range

12/03/2017 00 to 12/30/2017 00

Hide missing values

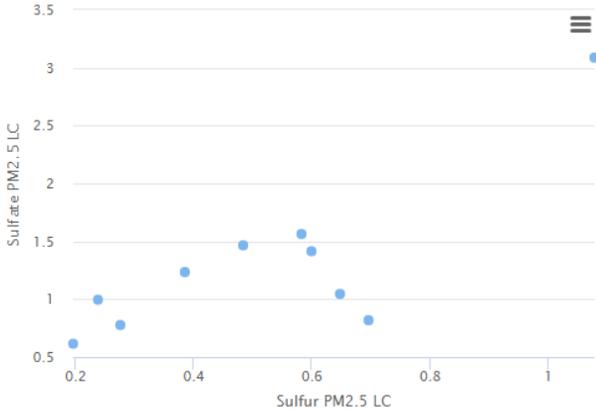
Fixed Y Axis 1

-0.05 0.05

Update Graph

Graphical Review

SCATTER PLOT



Filter By:

- Season
- Month
- Day Of Week

Color By:

- None
- Current Batch
- Season
- Month
- Day Of Week

CSN Data – Sulfur PM2.5 LC
CSN Data – Sulfate PM2.5 LC

Date Range

11/03/2017 00 to 11/30/2017 00

X Axis

Sulfur PM2.5 LC 0.196 1.078 Fixed

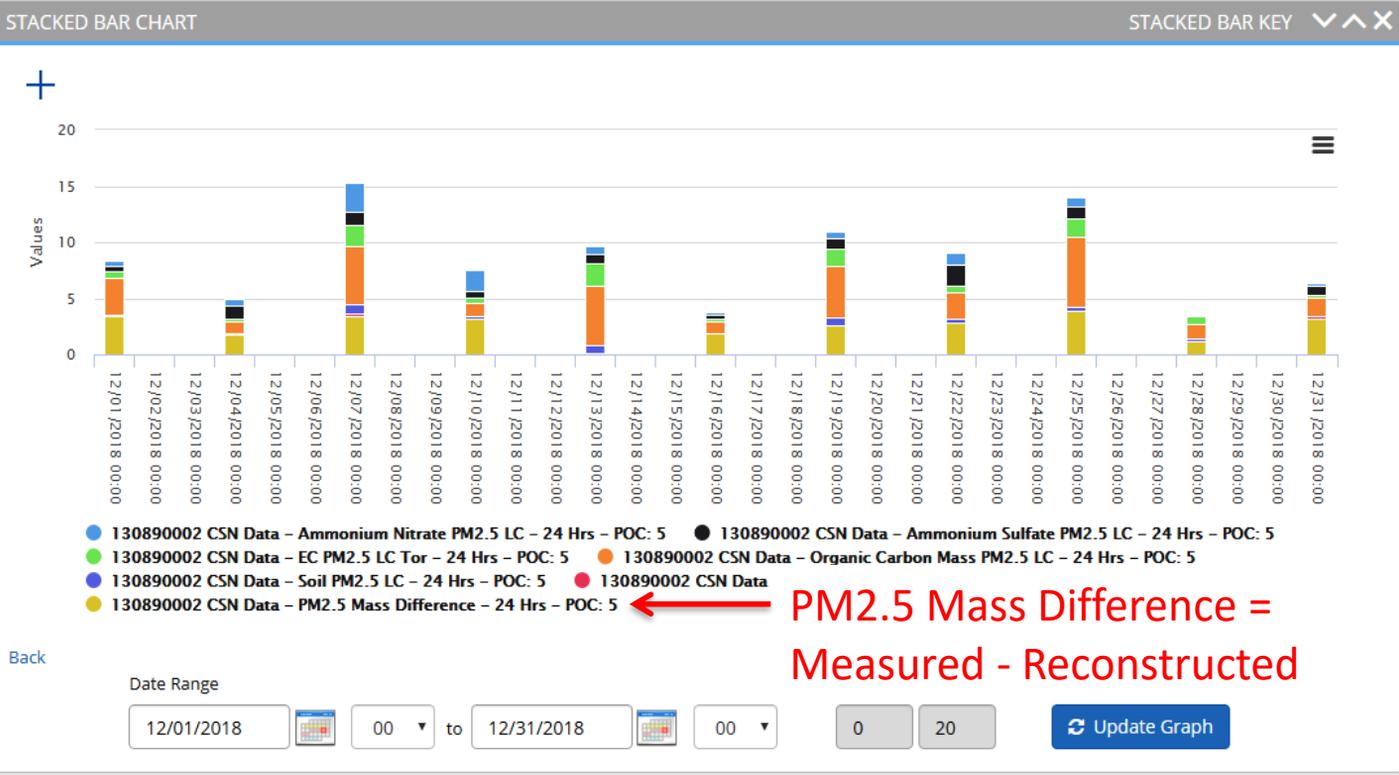
Y Axis

Sulfate PM2.5 LC 0.5 3.5 Fixed

Linear Regression

Update Graph

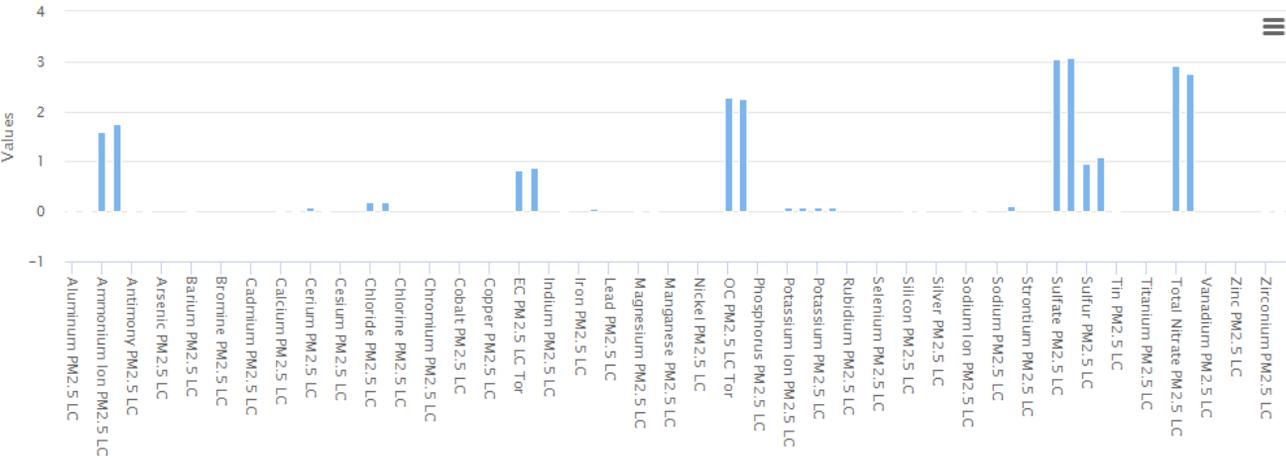
Graphical Review



Default plot includes major components of reconstructed mass:
Ammonium Sulfate, Ammonium Nitrate, Soil, OCM,
Chloride * 1.8, EC, Mass Difference

Graphical Review

FINGERPRINT PLOT



● 12/03/2017 00:00

Date Range

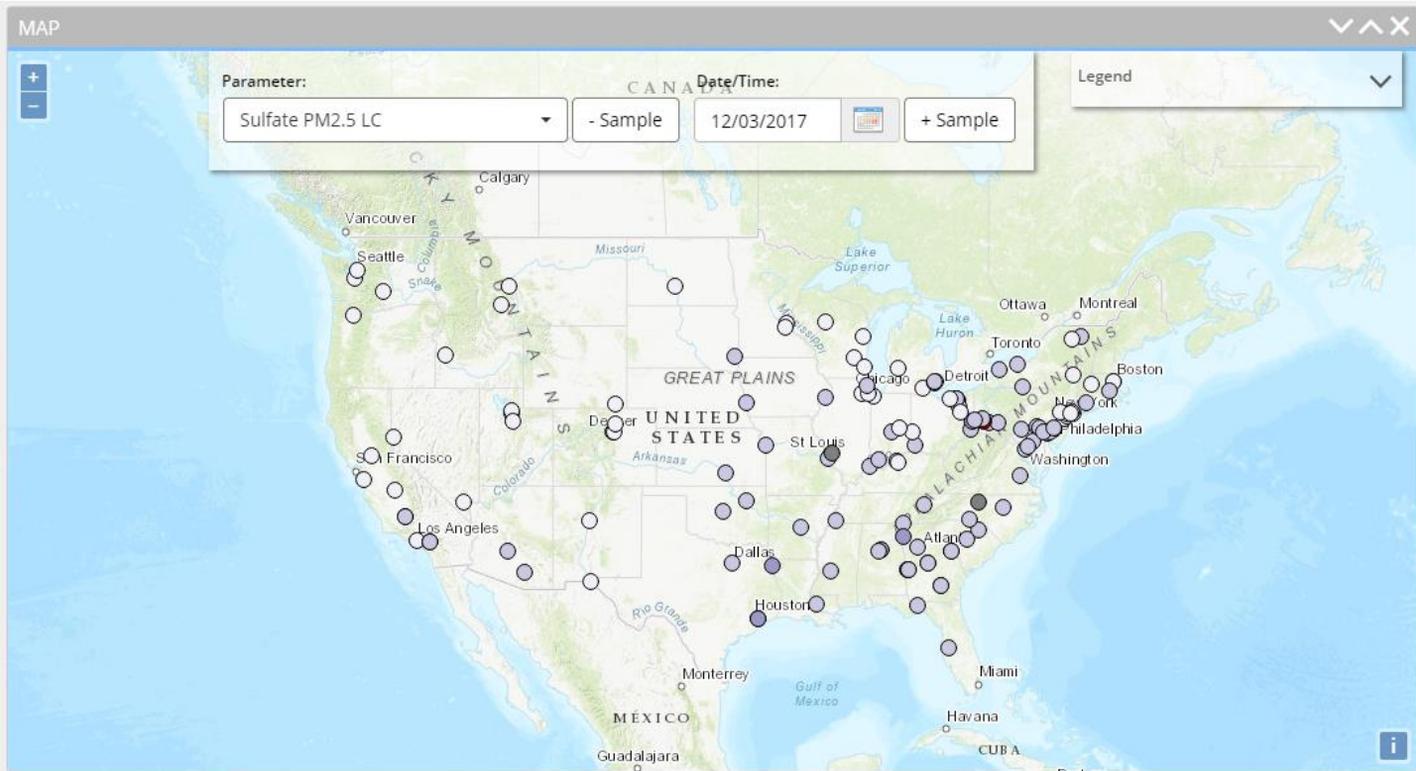
12/03/2017 00 to 12/30/2017 00

Logarithmic Y Axis
Fixed Y Axis

-1 4

Update Graph

Next



- Default map displays Sulfate concentrations across the network
- Toggle parameter and sample date
- Hover over or click on points to view additional information and time series

Suggested DART Practices

- Review all comments, field sheets, and/or FSCOC to confirm flow rate &/or issues requiring flags
- Review summary table to prioritize flagged samples
- Look for Wood/UCD questions by sorting/filtering the batch data table
- Review incomplete samples
- Review extreme high/low values
- Evaluate long-term trends with addition of new data
- For any changes made in DART, leave a comment detailing the changes made and what parameters/filters/sample dates the changes should apply to.

CSN flags: acceptable ranges & flag application

Parameter	URG 3000N	Met One SASS/Super SASS	AQS Flag	Flag Type	URG 3000N	Met One SASS/Super SASS	AQS Flag ^{*2}	Flag Type
	Acceptable Range for CSN				Acceptable Range for AQS			
Average Ambient Temperature	-20 to 45 °C	-30 to 50 °C	QT	Qualifier	-40 to 55 °C	-40 to 55 °C	AN	Null Code
Average Ambient Pressure	600 to 810 mmHg	600 to 810 mmHg	QP	Qualifier	450 to 1000 mmHg	450 to 850 mmHg	AN	Null Code
Sample Flow Rate* ¹	19.8 to 24.2 LPM	6.0 to 7.4 LPM	AH	Null Code	N/A	N/A	N/A	N/A
Sample Flow Rate CV	0 to 2 %	0 to 5 %	AH	Null Code	0 to 20 LPM	0 to 20 LPM	AN	Null Code
Sample Volume	28.5 to 34.9 m ³	8.6 to 10.6 m ³	SV	Null Code	0 to 35 m ³	0 to 25 m ³	AN	Null Code
Sample Time	1380 to 1500 minutes	1380 to 1500 minutes	AG	Null Code	N/A	N/A	N/A	N/A

Flag application is flag/case specific → flag may be applied to a specific parameter(s), all but one or two parameters, or be applied to all parameters.

^{*1} Specific parameter not reported to DART/AQS

^{*2} Null code applied if not already invalid

CSN flags overview: Common flags requiring action

'A1' & 'B1' – Changed by Wood, Changed by UCD

Manually applied by Wood ('A1') or UCD ('B1') to indicate changes made → resulting data may be different to field COC. See comments for details.

“ *Changed by Wood: it is apparent that the site operator switched the flow and CV. Corrected them and assigned A1 flag.* ”

'C1' - Flagged for Review

Manually applied by UCD ('C1') to highlight data that requires attention. Detailed comments provided.

“ *Adding the C1 flag because the field blank mass loading is unusually high for this site and the network.* ”

'TT' – Transport temperature is out of specs

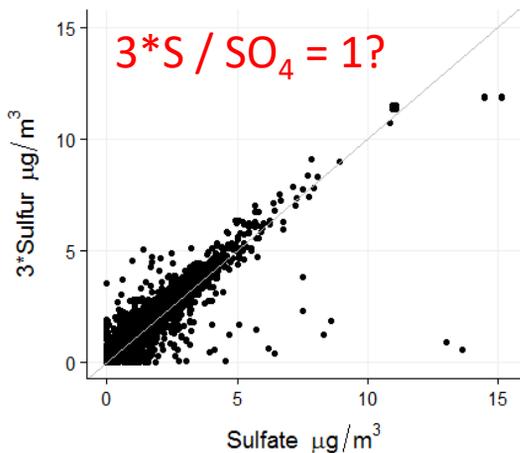
Receipt temperature at sample handling lab > 4 °C

QualifierCodes TT - Transport Temperature is Out of Specs.

DeliveryTemperature 5.90 °C

CSN flags overview: Common flags requiring action (2)

'5' – 'Outlier'

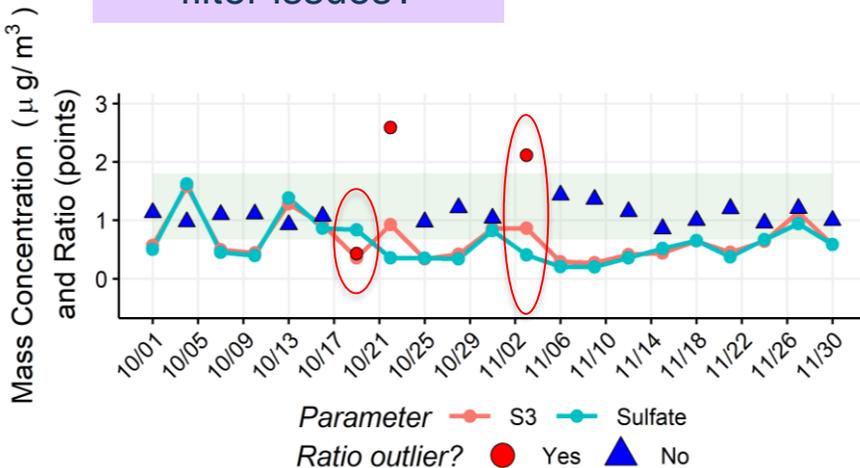


Reasonable data?

Compare with carbon & external data

Comments indicate filter issues?

$3 \times S / SO_4$ ratio out of range
→ '5' applied to all elemental and ions species

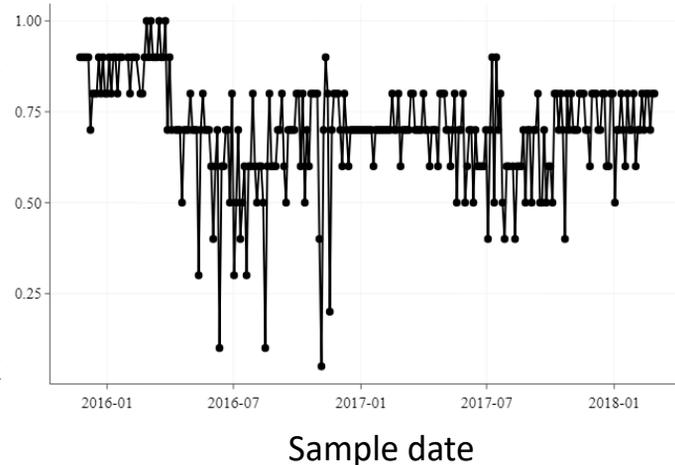
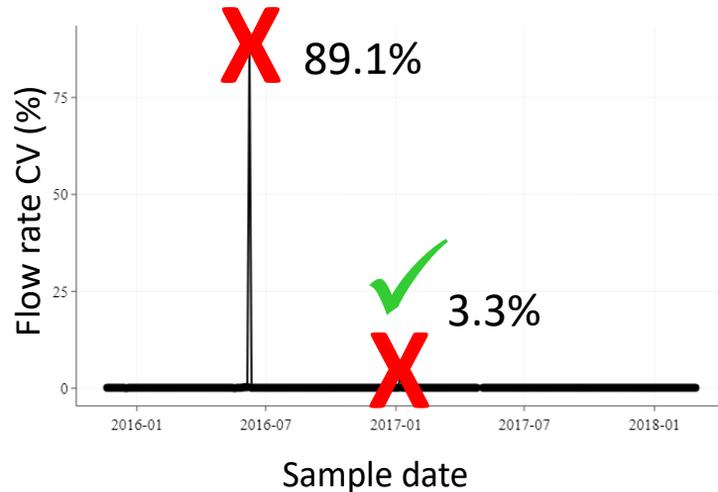


CSN flags overview: Common flags requiring action (3)

'AH' – 'Sample Flow Rate or CV out of Limits'

Flow rate CV: > 2% for quartz sample
> 5% for PTFE or nylon samples

Flow rate coefficient of variation (CV = standard deviation of flow rates / mean 24-hour flow rate) → used to evaluate flow rate stability.



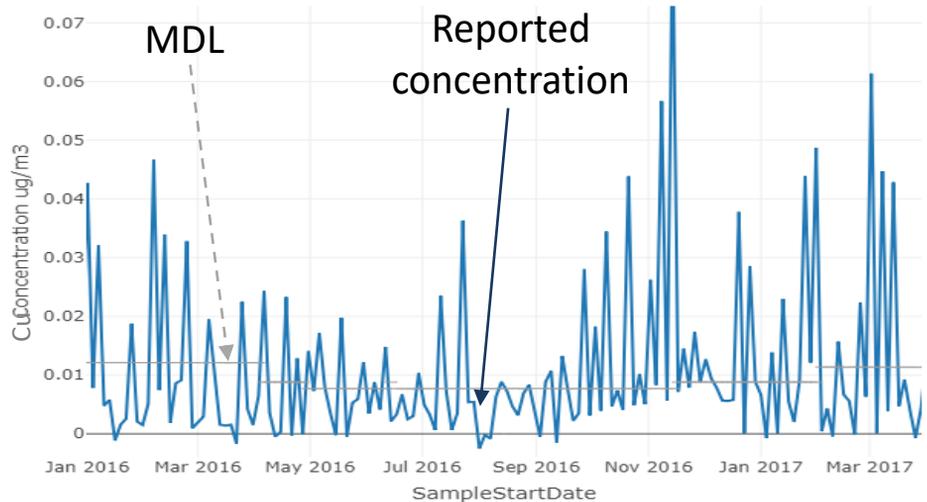
Things to double check on field COC:

Flow rate & flow rate CV written in correct boxes.

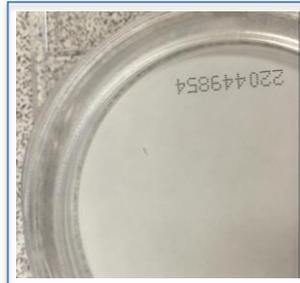
Flow rate CV is recorded, not standard deviation (~order of magnitude different)

CSN flags overview: Common flags not requiring action

'MD' – Value less than MDL



'FX' – Filter Integrity Issue
Observable issues



CSN flags overview: Common flags not requiring action

'MX' – Matrix Effect

Detectable influence by mineral particles on quartz filters



'LJ' - Identification Of Analyte Is Acceptable; Reported Value Is An Estimate

Applied applied to quartz filters (from November 2018 onwards) by the analysis lab based on analysis results.

This flag is applied based on limitations in the determination of the OC/EC split point, and is most often associated with heavily loaded filters with high EC concentrations. In these cases, the quantification of total carbon is still accurate.

DART Approval Mode - Outlier and Common Qualifier Codes/Flags

Batch Data

Filter:

Reviewed	Date	Parameter	POC	Value	Ptile	MDL	Unc.	Unit	Null Code	Qual. Code	Comments
<input type="checkbox"/>	Dec-27	Organic Carbon Mass PM2.5 LC	5	1.35878	12	0.12071	0.17386	ug/m3	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>	Dec-27	Phosphorus PM2.5 LC	5	2.0E-5	75	0.00207	0.00126	ug/m3	<input type="text"/>	MD	<input type="text"/>
<input type="checkbox"/>	Dec-27	PM2.5 Mass Difference	5	0.97408	40	0.0		ug/m3	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>	Dec-27	PM2.5 Raw Data	5	4.4	15	0.0		ug/m3	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>	Dec-27	Potassium Ion PM2.5 LC	5	0.00671	6	0.06064	0.03688	ug/m3	<input type="text"/>	5	<input type="text"/>
<input checked="" type="checkbox"/>	Dec-27	Potassium PM2.5 LC	5	0.01834	3	0.005	0.00361	ug/m3	<input type="text"/>	5	<input type="text"/>
<input type="checkbox"/>	Dec-27	Reconstructed Mass PM2.5 LC	5	3.42592	14	0.0	0.21321	ug/m3	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>	Dec-27	Rubidium PM2.5 LC	5	-9.1E-4	16	0.00889	0.00541	ug/m3	<input type="text"/>	MD	<input type="text"/>
<input type="checkbox"/>	Dec-27	Sample Flow Rate CV - Std. Dev. Filter	5	<input type="text" value="0.9"/>	11	0.0		%	<input type="text"/>	<input type="text"/>	<input type="text"/>

Select All

DART Approval Mode - Outlier and Common Qualifier Codes/Flags (2)

Batch Data

Filter:

Reviewed	Date	Parameter	POC	Value	Ptile	MDL	Unc.	Unit	Null Code	Qual. Code	Comments
<input type="checkbox"/>	Dec-27	Selenium PM2.5 LC	5	0.00145	82	0.00527	0.00322	ug/m3	<input type="checkbox"/>	MD	<input type="checkbox"/>
<input type="checkbox"/>	Dec-27	Silicon PM2.5 LC	5	0.01579	12	0.01374	0.00869	ug/m3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Dec-27	Silver PM2.5 LC	5	-0.00361	12	0.01643	0.01003	ug/m3	<input type="checkbox"/>	TT	<input type="checkbox"/>
<input type="checkbox"/>	Dec-27	Sodium Ion PM2.5 LC	5	0.00604	4	0.00963	0.00604	ug/m3	<input type="checkbox"/>	MX	<input type="checkbox"/>
<input checked="" type="checkbox"/>	Dec-27	Sodium PM2.5 LC	5	-0.00289	4	0.08865	0.05389	ug/m3	<input type="checkbox"/>	FX	<input type="checkbox"/>
<input type="checkbox"/>	Dec-27	Soil PM2.5 LC	5	0.04684	3	0.07092	0.06481	ug/m3	<input type="checkbox"/>	MD	<input type="checkbox"/>
<input type="checkbox"/>	Dec-27	Strontium PM2.5 LC	5	0.00248	85	0.00723	0.00444	ug/m3	<input type="checkbox"/>	MD	<input type="checkbox"/>
<input type="checkbox"/>	Dec-27	Sulfate PM2.5 LC	5	0.9312	30	0.02865	0.04884	ug/m3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Dec-27	Sulfur PM2.5 LC	5	0.29423	24	0.00372	0.01838	ug/m3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Select All

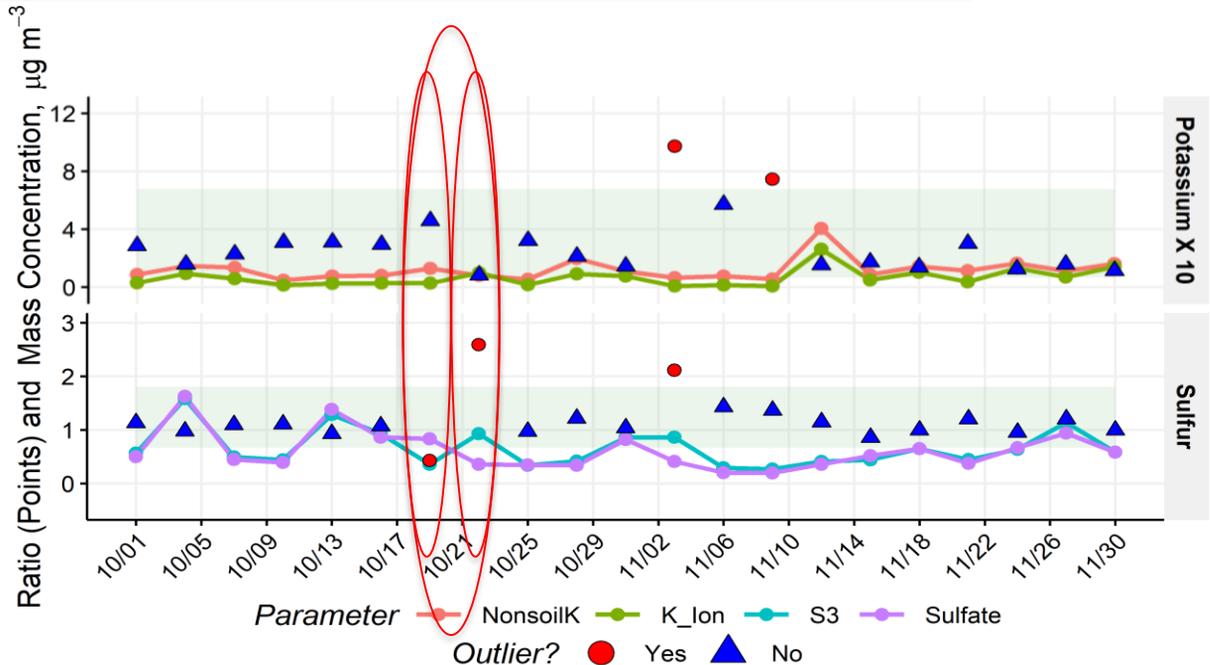
Mark Reviewed

Undo

Restore

Filter swaps (1)

Swapped in field, sample handling lab, analysis labs



Swapped between dates, between sites, with field blanks

Filter swaps (2)

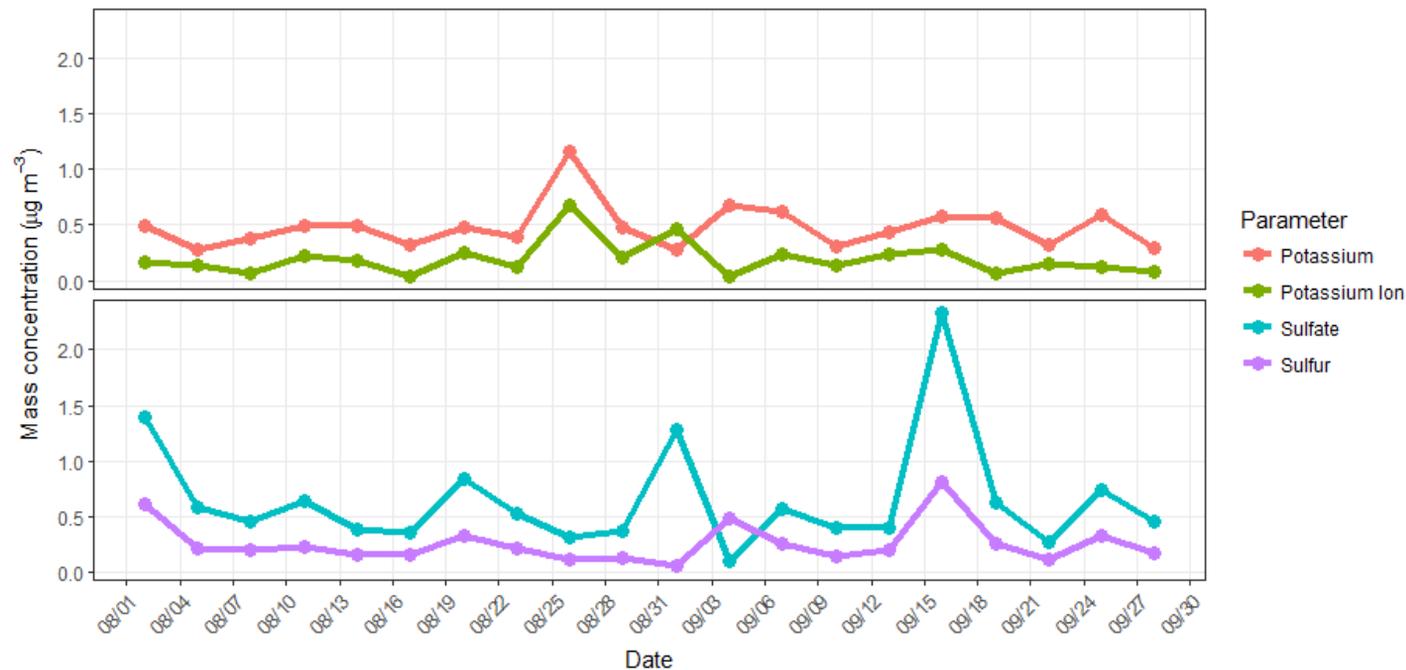
Note: If the sample volume is changed in DART, UCD will recalculate the concentrations for the affected species accordingly once the validation window has closed.

Further investigate by....

Plot $3 \cdot S / SO_4$
time series

Compare with
carbon time
series

Compare sample & field
blank concentrations
from same day



Filter swaps (2)

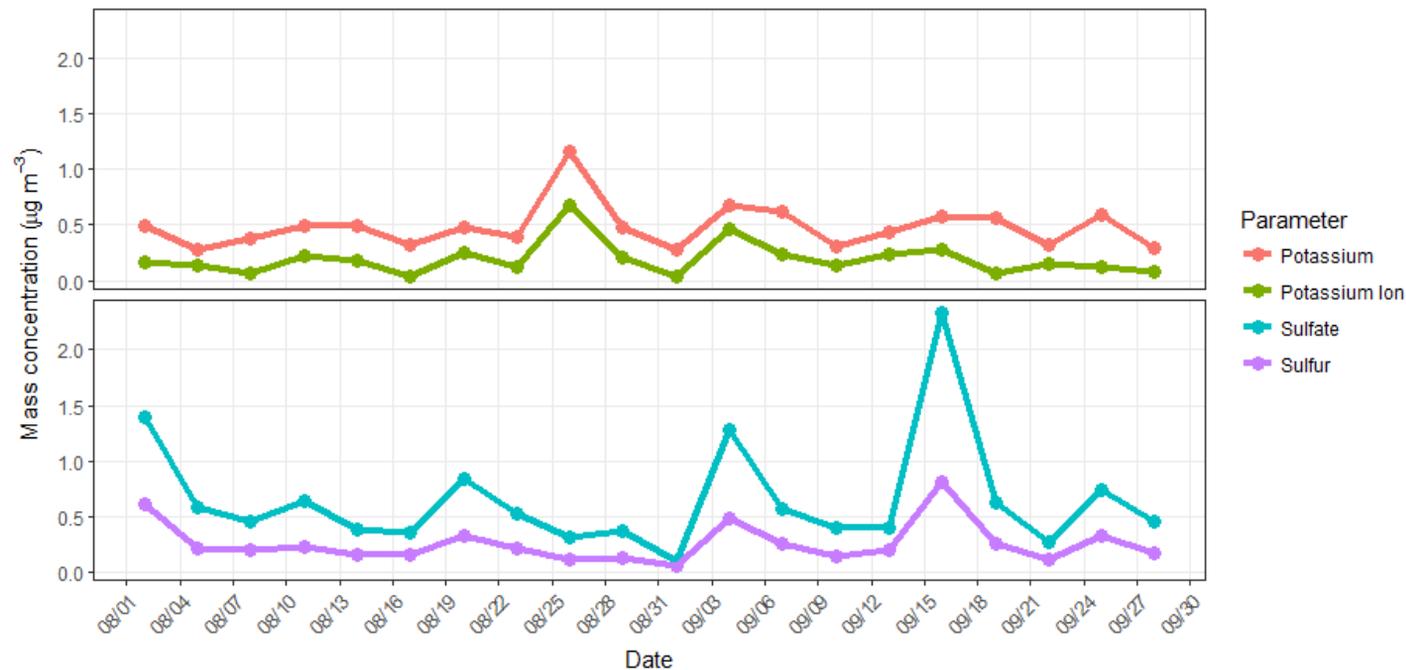
Note: If the sample volume is changed in DART, UCD will recalculate the concentrations for the affected species accordingly once the validation window has closed.

Further investigate by....

Plot $3 \cdot S / SO_4$
time series

Compare with
carbon time
series

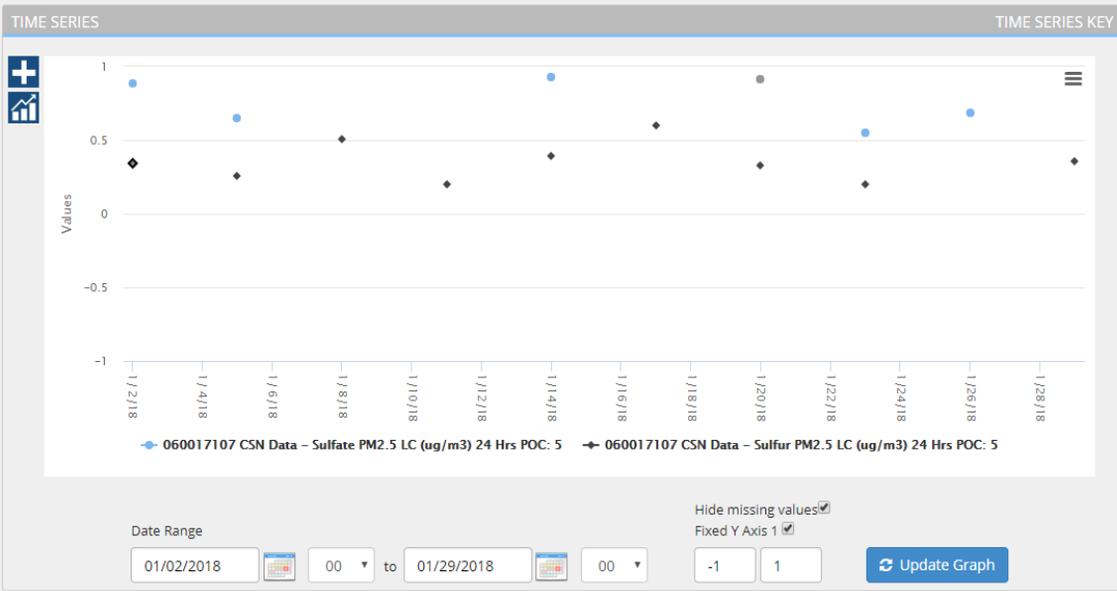
Compare sample & field
blank concentrations
from same day



DART Approval Mode – Filter Swap Data and Qualifier Codes/Flags

<input type="checkbox"/>	Jan-02	Sulfate PM2.5 LC	5	0.88782	41	0.04452	0.05124	ug/m3			
<input checked="" type="checkbox"/>	Jan-02	Sulfur PM2.5 LC	5	0.34192	40	0.00371	0.02132	ug/m3		C1	
<input type="checkbox"/>	Jan-02	Tin PM2.5 LC	5	0.01912	86	0.04873	0.03001	ug/m3		MD	

Select All Mark Reviewed Undo Restore



“Flagged
For
Review”
Qualifier
Code – C1

High field blank loadings

Run with flow:
'swap'

Parameter	NA	NA
AqsNullCodeId	NA	NA
FilterPurpose	Sample	Field Blank
Ammonium	1.666	0.013
Chloride	0.213	0.503
Nitrate	1.206	0.181
PotassiumIon	0.142	0.758
SodiumIon	0.343	0.332
Sulfate	6.859	16.642

Compare field blank with associated sample

Run with flow:
'duplicate'

Parameter	NA	NA
AqsNullCodeId	NA	NA
FilterPurpose	Sample	Field Blank
Ammonium	13.157	10.243
Chloride	1.619	5.034
Nitrate	33.664	44.625
PotassiumIon	0.366	0.255
SodiumIon	0.619	4.748
Sulfate	16.797	15.339

Compare with previous field blanks

Low flow or high background

Parameter	NA	NA
AqsNullCodeId	NA	NA
FilterPurpose	Sample	Field Blank
Ammonium	1.251	0.847
Chloride	0.368	0.577
Nitrate	7.969	6.191
PotassiumIon	0.142	0.065
SodiumIon	0.104	0.134
Sulfate	10.688	5.209

Confirm channel has no flow

Currently no automated flagging/invalidation or commenting.

DART Approval Mode – Field Blank Data and Qualifier Codes/Flags

Batch Data

Filter:

Reviewed	Date	Parameter	POC	Value	Ptile	MDL	Unc.	Unit	Null Code	Qual. Code	Comments
<input type="checkbox"/>	Dec-21	Avg Ambient Temperature for MetOne SASS/SuperSASS	5	16.5	34	0.0		°C			
<input type="checkbox"/>	Dec-21	Barium PM2.5 LC	5	-0.0133	10	0.07992	0.04863	ug/m3		MD	
<input type="checkbox"/>	Dec-21	Barium PM2.5 LC (Field blank)	5	0.11712	75	0.08083	0.0528	ug/m3			
<input type="checkbox"/>	Dec-21	Bromine PM2.5 LC	5	0.00149	37	0.00453	0.00276	ug/m3		MD	
<input type="checkbox"/>	Dec-21	Bromine PM2.5 LC (Field blank)	5	0.0045	75	0.00458	0.00287	ug/m3		MD	
<input type="checkbox"/>	Dec-21	Cadmium PM2.5 LC	5	0.00718	83	0.01576	0.00975	ug/m3		MD	
<input type="checkbox"/>	Dec-21	Cadmium PM2.5 LC (Field blank)	5	0.03327	100	0.01594	0.01277	ug/m3			
<input type="checkbox"/>	Dec-21	Calcium PM2.5 LC	5	0.01066	30	0.02496	0.01528	ug/m3		MD	
<input type="checkbox"/>	Dec-21	Calcium PM2.5 LC (Field blank)	5	0.00154	63	0.02524	0.01535	ug/m3		MD	
<input type="checkbox"/>	Dec-21	Calcium PM2.5 LC	5	0.0025	0	0.00510	0.00215	ug/m3			

Select All [Mark Reviewed](#)

[Undo](#)

[Restore](#)

“Flagged For Review” Qualifier Code – C1

Dates in CSN

- Several dates associated with a given filter:
 - Expected use date – based on site sampling frequency
 - Intended use date – generated when the physical filter is created
 - Run date/time – date/time the filter actually began to be run
 - End date/time – date/time the filter finished running
- Only ONE date/time gets delivered to DART & AQS - usually the run date/time
- Filters may not run for 24 hours
 - If $< \pm 1$ hr from target 24hrs \rightarrow data flagged with 'Y – Elapsed Sample Time Out of Spec.' qualifier
 - If $> \pm 1$ hr from target 24hrs \rightarrow data invalidated with 'AG – Sample Time out of Limits' null
- Filter may not run on the intended use date
 - Data flagged with '2 – Operational Deviation' qualifier. N.B. applies to samples only
 - Data may be reported as invalid due to how filters are processed if a filter runs in a different month
 - A run date/time may be entered if empty to avoid apparent duplicate issues with other filters that run on different days that happen to be sampling days
- Filter never generated (e.g. sampler is down for repairs so filter shipment paused)
 - Empty records reported by UCD for completeness based on expected use dates

CSN Data Validation in DART: final notes

Items to Check

- ✓ Consistency with field logs
- ✓ Null & qualifier flags
- ✓ Comments & flags from labs & UCD
- ✓ Invalid samples
- ✓ Sampling anomalies
- ✓ Operational parameter values
- ✓ Field blanks
- ✓ Recurring issues
- ✓ Consistency with other measurements
- ✓ Historical measurements

Please...

- write clear & detailed comments
- change the “AM” null code to a more detailed code
- add qualifiers (there is space for 10)
- invalidate samples with a serious sampling problem
- be careful when applying flags to multiple parameters
- get in touch if you have a question!

Anticipated DART data availability & AQS availability

Sampling month	Data from UCD to DART	Data available in AQS
January 2019	-	7/12/2019
February 2019	-	8/1/2019
March 2019	7/15/2019	9/1/2019
April 2019	8/12/2019	9/29/2019
May 2019	9/9/2019	10/27/2019
June 2019	10/14/2019	12/1/2019
July 2019	11/11/2019	12/29/2019
August 2019	12/9/2019	1/26/2020

Q & A

STI & UCD

DART and Data Validation Resources

Data Validation Users Guide

- <https://aqrc.ucdavis.edu/documentation>

DART Users Guide

- <https://dart.airnowtech.org/documentation/Default.htm> (accessible only to CSN Data Validators with AirNowTech DART account)

DART Webinar July 2018 <https://youtu.be/pFT9hEal9X0>

DART Webinar Fall 2017 <https://youtu.be/70Cmkh7r9-4>

DART Webinar Fall 2016

- <https://www.youtube.com/watch?v=kEghZVBOs8s&feature=youtu.be>

NAAMC Data Validation Training 2018

- https://projects.erg.com/conferences/ambientair/conf18/Young_Chemical%20Speciation%20Network.pdf

NAAMC Data Validation Training 2016

- <https://www.epa.gov/amtic/data-validation-training-2016-naamc>

Acknowledgements

EPA

UC Davis Air Quality Research Center

Collaborators and colleagues at STI, DRI, and Wood PLC

Thank you!

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