Please check to make sure that you are on Mute. Thank you!

3rd Annual EmPOWER Air Data Challenge: Overview of the Challenge and Data Sources

U.S. EPA

CLEAN AIR MARKETS DIVISION (CAMD)

JANUARY 27, 2021

Overview

What is the EmPOWER Air Data Challenge?

CAMD's Power Sector Emissions Data Overview

Clean Air Status and Trends Network (CASTNET) Data Overview

Long Term Monitoring (LTM) Data Overview

How to Apply to the EmPOWER Air Data Challenge

What is the EmPOWER Air Data Challenge?

EmPOWER Air Data Challenge

Seeking proposals from researchers at academic institutions or think tanks for innovative projects using one of the following datasets:

- CAMD's Power Sector Emissions Data: hourly emissions and operating parameters as well as facility information for over 4,000 fossil fuel-fired electric generating units (EGUs)
- Clean Air Status and Trends Network (CASTNET) Data: measures hourly ozone concentrations to support EPA's National Ambient Air Quality Standards (NAAQS) and regional transport evaluations; weekly gaseous (SO_2, HNO_3) and aerosol (SO_4^{2-}, NO_3^-, NH_4^+, K^+, Ca^{2+}, Mg^{2+}, Na^+, Cl^-) concentrations at more than 90 sites
- Long Term Monitoring (LTM) Data: monthly to annual measurements of major water quality parameters, including anions (NO_3^-, SO_4^{2-}, Cl^-), cations (K^+, Ca^{2+}, Mg^{2+}, Na^+), acid neutralizing capacity (ANC), and pH at 171 acidified and acid-sensitive lakes and streams in the Northeast and Mid-Atlantic

EmPOWER Air Data Challenge

Submissions should advance the knowledge, use, and understanding of CAMD data and related information.

Possible project themes:

- Analyzing data
- Enhancing communications
- Developing technology and data mashups
- Promoting environmental education
- Improving data quality

Benefits of Winning the Challenge

CAMD staff expert assigned to your project to assist with accessing and understanding data, as well as answering technical questions and finding other resources within EPA to assist your team

Receive national recognition for your university or organization, students, and project activities by being featured on the EmPOWER Air Data Challenge webpage

Opportunities to speak and network at conferences, events, and/or webinars

Improve understanding of and solve timely and relevant environmental problems

Examples of Past Winners

Georgia Institute of Technology: EmPOWERing Classroom Data Engagement

University of California-Davis: Hourly Average Emissions Factors for the Emissions & Generation Resource Integrated Database (eGRID)

CAMD's Power Sector Emissions Data Overview

CAMD's Power Sector Emissions Data

CAMD collects its Power Sector Emissions Data to ensure compliance with emissions trading and other air quality programs operated by EPA.

EGUs report data to CAMD if they are affected by one of these programs.

- In general, EPA programs apply to EGUs that burn fossil fuels with a nameplate capacity of greater than 25 MW (with some exceptions).

Data must be submitted to EPA within 30 days of the end of each calendar quarter.

CAMD's Power Sector Emissions Data

Emissions (short tons): hourly SO_2, NO_X, CO_2, Hg

Facility information

- Unit type (e.g., steam turbine, combustion turbine, combined cycle)
- Source category (e.g., electric utility, industrial boiler)
- Owner/operator
- Location (latitude/longitude)

Primary and secondary fuel type, including the begin and end dates of use

CAMD's Power Sector Emissions Data

Emissions control devices and installation dates of those devices

Hourly gross electricity generation (e.g., MWh)

Type of monitoring method, including the begin and end dates of use

Quality assurance (QA) test information used to validate hourly emissions data, such as the date of testing, type of test, and the difference in the readings between the monitor and the reference value

EPA Programs Relying on CAMD's Power Sector Emissions Data

Acid Rain Program (ARP)

- SO_2, NO_X, CO_2 emissions
- Some units began in 1995, all units required to report by 2000

Cross-State Air Pollution Rule (CSAPR)

- SO_2 and NO_X emissions
- Program began in 2015, many affected units were already reporting under earlier programs like ARP and/or Clean Air Interstate Rule

Mercury and Air Toxics Standard (MATS)

- Hg emissions
- Went into effect in April 2015; however, some EGUs received extensions to April 2016, and some to April 2017; 2018 is first full year for which the vast majority of sources affected by MATS reported emissions

How to Access Power Sector Emissions Data

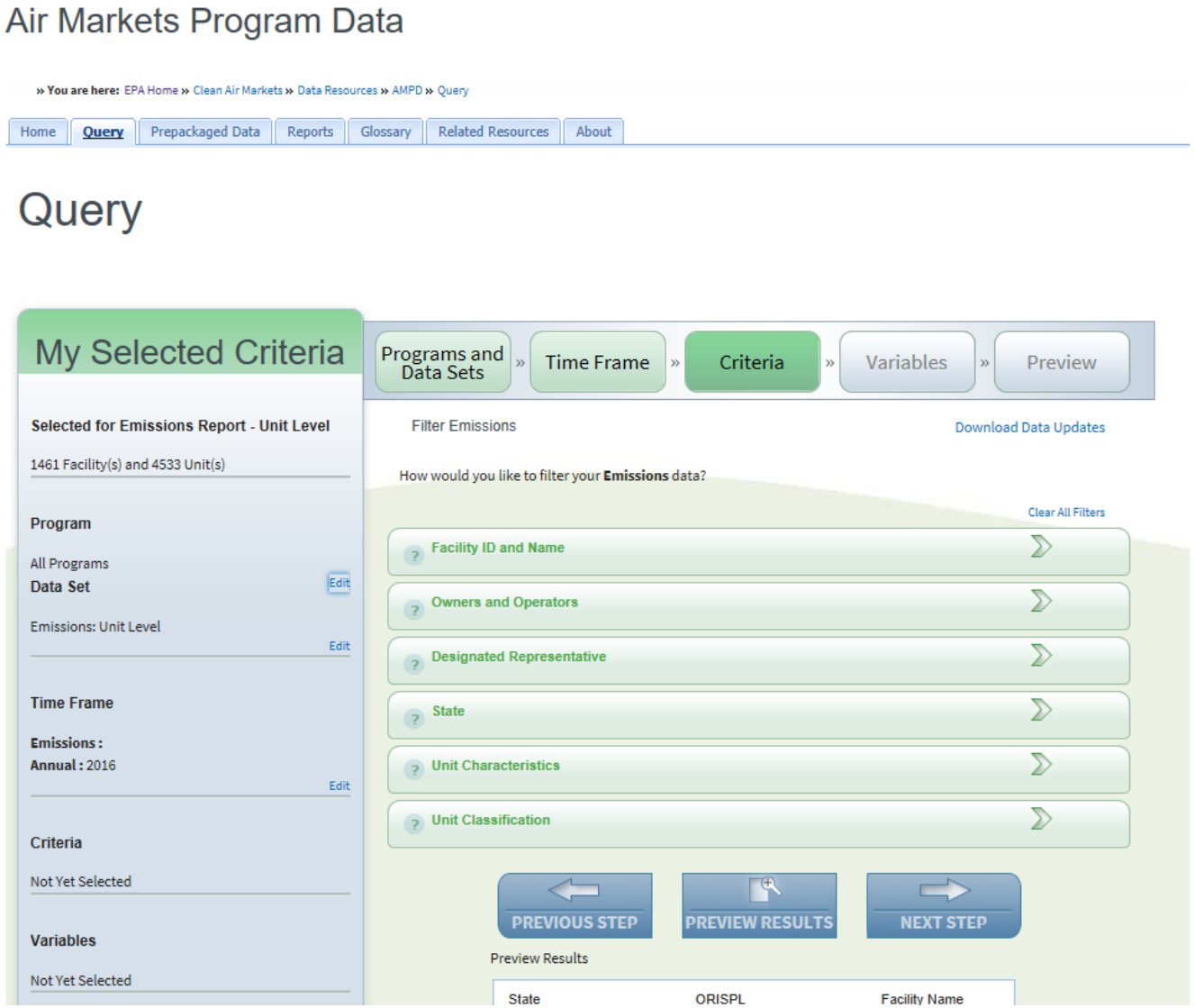
Air Markets Program Data (AMPD)

FTP

Field Audit Checklist Tool (FACT)

FACT Application Programming Interface (API)

Monitoring Plan Viewer



AMPD

Web-based

Create queries to download data

Access emissions, operations, and facility information data; does not allow access to monitoring plan and QA test data

Data back to the 1990s

Note: AMPD only allows the user to pull 30 days of hourly data at a time.

See CAMD's Power Sector Emissions Data Guide for more information.

Index of /DMDnLoad/emissions/hourly/monthly/2018/

[parent directory]

Name	Size	Date Modified
2018al01.zip	755 kB	2/19/19, 7:00:00 PM
2018al02.zip	535 kB	2/19/19, 7:00:00 PM
2018al03.zip	621 kB	2/19/19, 7:00:00 PM
2018al04.zip	626 kB	2/19/19, 7:00:00 PM
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2018al06.zip	743 kB	2/19/19, 7:00:00 PM
2018al07.zip	789 kB	2/19/19, 7:00:00 PM
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2018al10.zip	647 kB	2/19/19, 7:00:00 PM
2018al11.zip	580 kB	2/19/19, 7:00:00 PM
2018al12.zip	594 kB	2/19/19, 7:00:00 PM
2018ar01.zip	298 kB	11/7/18, 7:00:00 PM
2018ar02.zip	239 kB	11/7/18, 7:00:00 PM
2018ar03.zip	253 kB	11/7/18, 7:00:00 PM
2018ar04.zip	254 kB	11/7/18, 7:00:00 PM
2018ar05.zip	324 kB	11/7/18, 7:00:00 PM
2018ar06.zip	356 kB	11/7/18, 7:00:00 PM
2018ar07.zip	363 kB	11/13/18, 7:00:00 PM
2018ar08.zip	348 kB	11/13/18, 7:00:00 PM
2018ar09.zip	295 kB	11/13/18, 7:00:00 PM
2018ar10.zip	269 kB	2/19/19, 7:00:00 PM
2018ar11.zip	252 kB	2/19/19, 7:00:00 PM
2018ar12.zip	248 kB	2/19/19, 7:00:00 PM
2018az01.zip	578 kB	7/16/18, 8:00:00 PM

FTP

Web-based

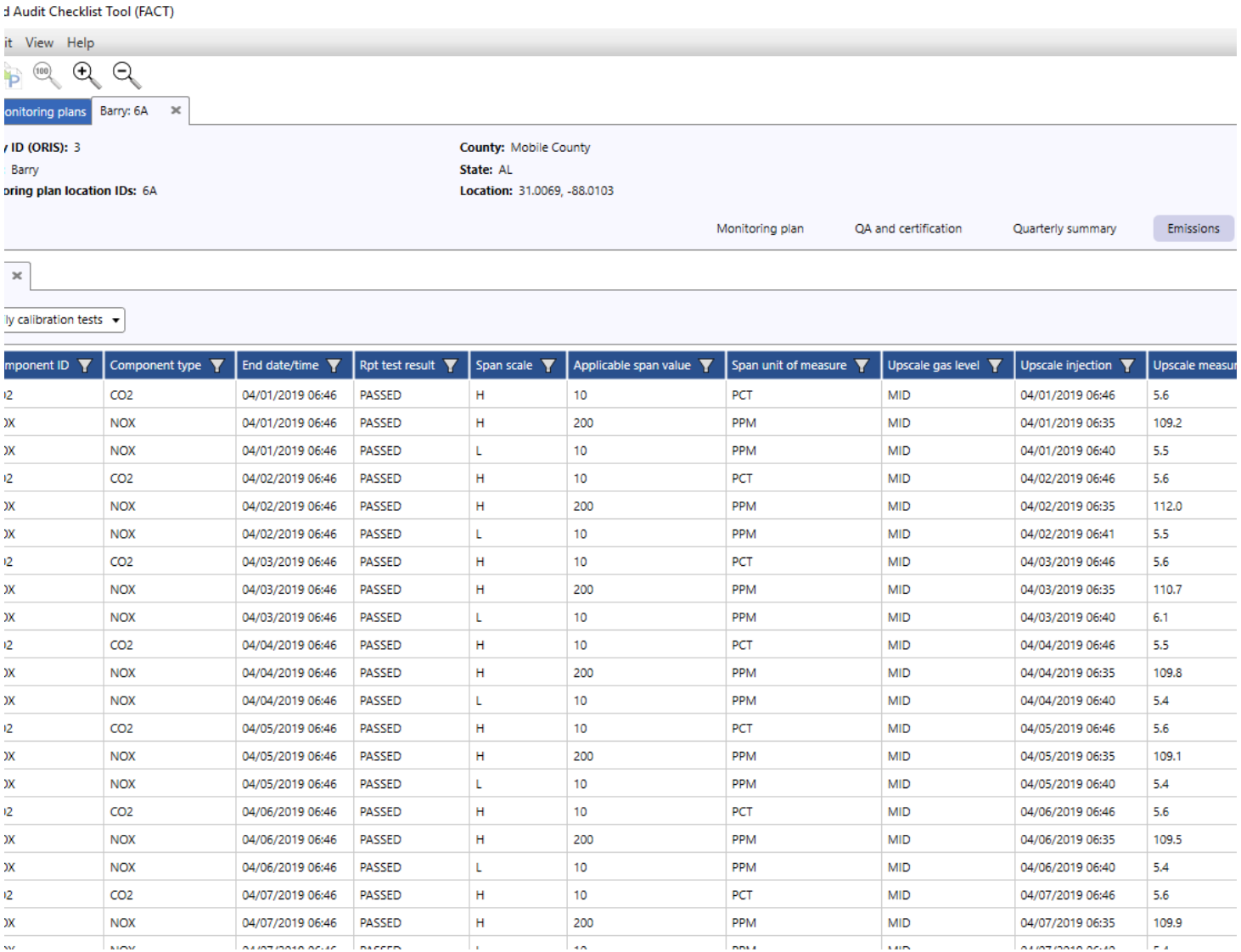
Pre-packaged data

Files contain hourly data for all facilities in a state for each month

Good for somewhat advanced users who need large amounts of hourly data

Data back to 1990s

See CAMD's Power Sector Emissions Data Guide for more information.



mponent ID	Component type	End date/time	Rpt test result	Span scale	Applicable span value	Span unit of measure	Upscale gas level	Upscale injection	Upscale measu
2	CO2	04/01/2019 06:46	PASSED	H	10	PCT	MID	04/01/2019 06:46	5.6
X	NOX	04/01/2019 06:46	PASSED	H	200	PPM	MID	04/01/2019 06:35	109.2
X	NOX	04/01/2019 06:46	PASSED	L	10	PPM	MID	04/01/2019 06:40	5.5
2	CO2	04/02/2019 06:46	PASSED	H	10	PCT	MID	04/02/2019 06:46	5.6
X	NOX	04/02/2019 06:46	PASSED	H	200	PPM	MID	04/02/2019 06:35	112.0
X	NOX	04/02/2019 06:46	PASSED	L	10	PPM	MID	04/02/2019 06:41	5.5
2	CO2	04/03/2019 06:46	PASSED	H	10	PCT	MID	04/03/2019 06:46	5.6
X	NOX	04/03/2019 06:46	PASSED	H	200	PPM	MID	04/03/2019 06:35	110.7
X	NOX	04/03/2019 06:46	PASSED	L	10	PPM	MID	04/03/2019 06:40	6.1
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X	NOX	04/04/2019 06:46	PASSED	H	200	PPM	MID	04/04/2019 06:35	109.8
X	NOX	04/04/2019 06:46	PASSED	L	10	PPM	MID	04/04/2019 06:40	5.4
2	CO2	04/05/2019 06:46	PASSED	H	10	PCT	MID	04/05/2019 06:46	5.6
X	NOX	04/05/2019 06:46	PASSED	H	200	PPM	MID	04/05/2019 06:35	109.1
X	NOX	04/05/2019 06:46	PASSED	L	10	PPM	MID	04/05/2019 06:40	5.4
2	CO2	04/06/2019 06:46	PASSED	H	10	PCT	MID	04/06/2019 06:46	5.6
X	NOX	04/06/2019 06:46	PASSED	H	200	PPM	MID	04/06/2019 06:35	109.5
X	NOX	04/06/2019 06:46	PASSED	L	10	PPM	MID	04/06/2019 06:40	5.4
2	CO2	04/07/2019 06:46	PASSED	H	10	PCT	MID	04/07/2019 06:46	5.6
X	NOX	04/07/2019 06:46	PASSED	H	200	PPM	MID	04/07/2019 06:35	109.9

FACT

Windows desktop application

All data: emissions, operations, facility information, monitoring plans, QA test data

Good when looking at a single EGU

Associated REST API

Data back to 2009

See CAMD's Power Sector Emissions Data Guide for more information.

Clean Air Status and Trends Network (CASTNET) Data Overview

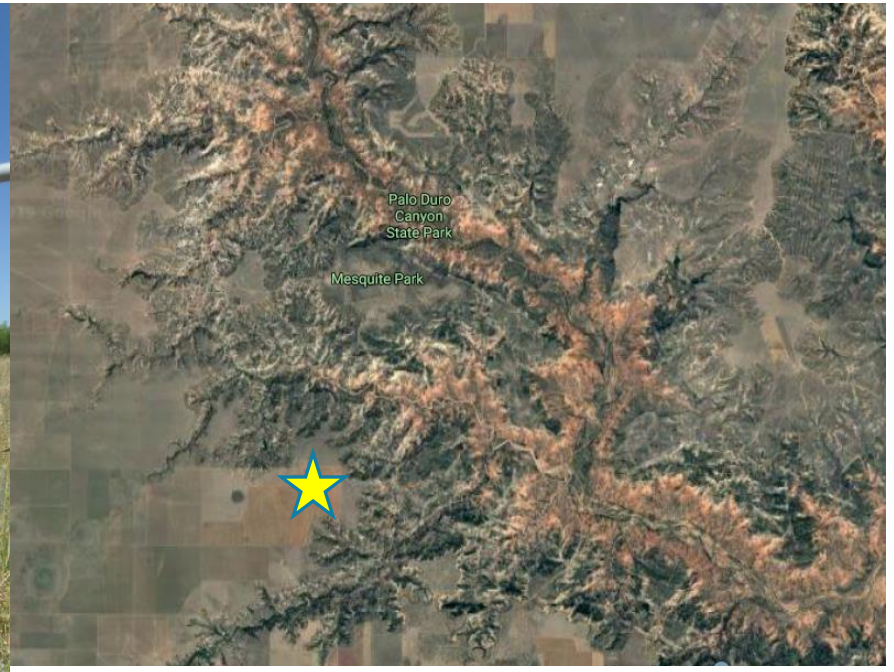
PROVIDES AMBIENT AIR QUALITY DATA FROM 99 MONITORING SITES ACROSS THE U.S. TO ASSESS REGIONAL AIR QUALITY AND DEPOSITION

Overview of the Clean Air Status and Trends Network (CASTNET)

What is CASTNET?

What data are available?

Downloading CASTNET data



Palo Duro Canyon (PAL190), TX is located between the Palo Duro Canyon State Park to the east and agricultural land to the west. The site is operated by Texas A&M Agrilife Research & Extension Center at Amarillo.

CASTNET MONITORING

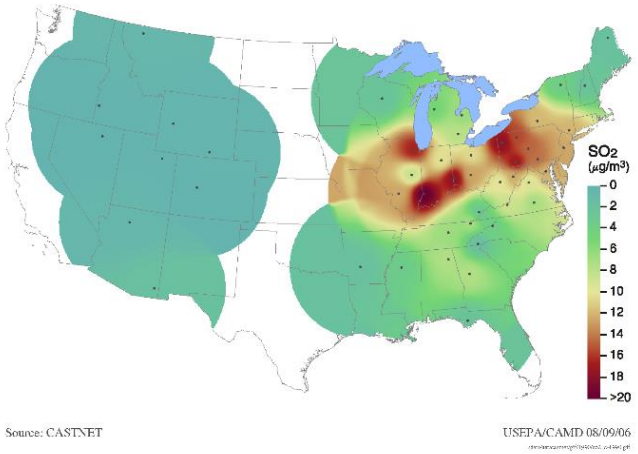
[2019 CASTNET Factsheet]

CASTNET is managed by EPA's CAMD. Sites are operated by EPA, National Park Service and BLM-WY.

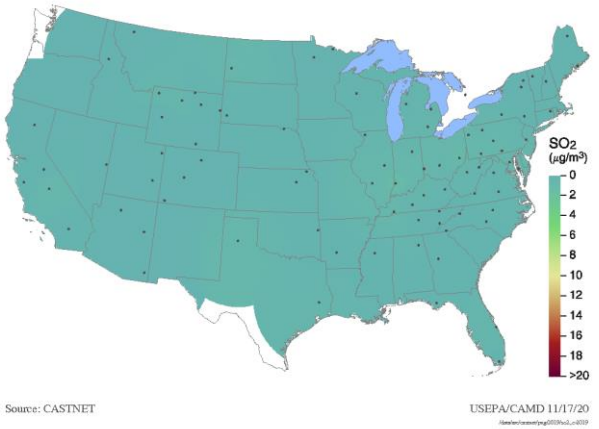
41 sites have operated continuously for 30+ years. Sites are located in rural areas, typically away from emission point sources.

Most sites measure concentrations of sulfur and nitrogen, ozone, and temperature.

Data are used by EPA to assess long-term trends in air quality and deposition, determine NAAQS compliance, evaluate stratospheric ozone intrusion events, and calculate critical load exceedances.



SO_2 CONCENTRATIONS MEASURED AT CASTNET IN 1990 (LEFT) AND 2019 (BELOW). LARGE REDUCTIONS IN SO_2 CONCENTRATIONS ARE A DIRECT RESULT OF SO_2 EGU EMISSION REDUCTIONS.



CASTNET SITES

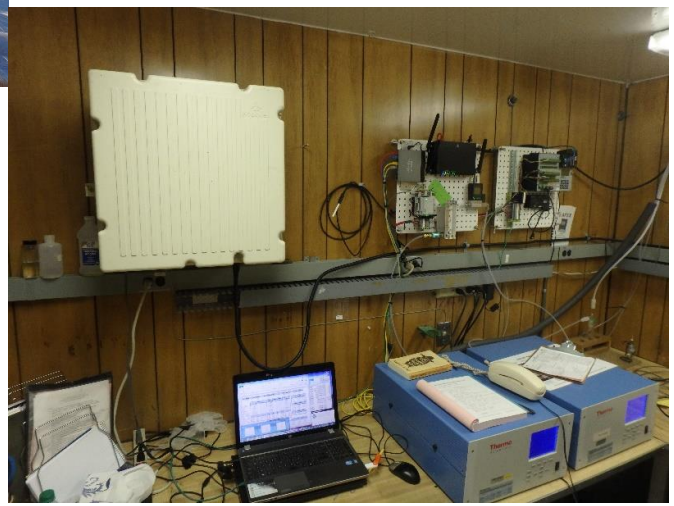
Site operators visit each site every Tuesday morning to change and ship filter packs, perform routine quality assurance checks, and maintain site (i.e. mowing).

A contractor prepares, ships, receives, and analyzes the filters.

Most sites are co-located with the National Atmospheric Deposition Program's National Trends Network (precipitation chemistry) and Ammonia Monitoring Network (ambient ammonia concentrations).

Centennial, WY CASTNET site (CNT169)

TEMPERATURE CONTROLLED SHELTER AND 10M TOWER SHOWN (LEFT) AND O_3 ANALYZER + TRANSFER STANDARD, SITE LAPTOP AND DATA LOGGER/TELEMETRY SHOWN (BELOW)



CASTNET O_3 DATA

87 sites measure ground-level O_3 concentrations

Data are reported as hourly averages (ppb)

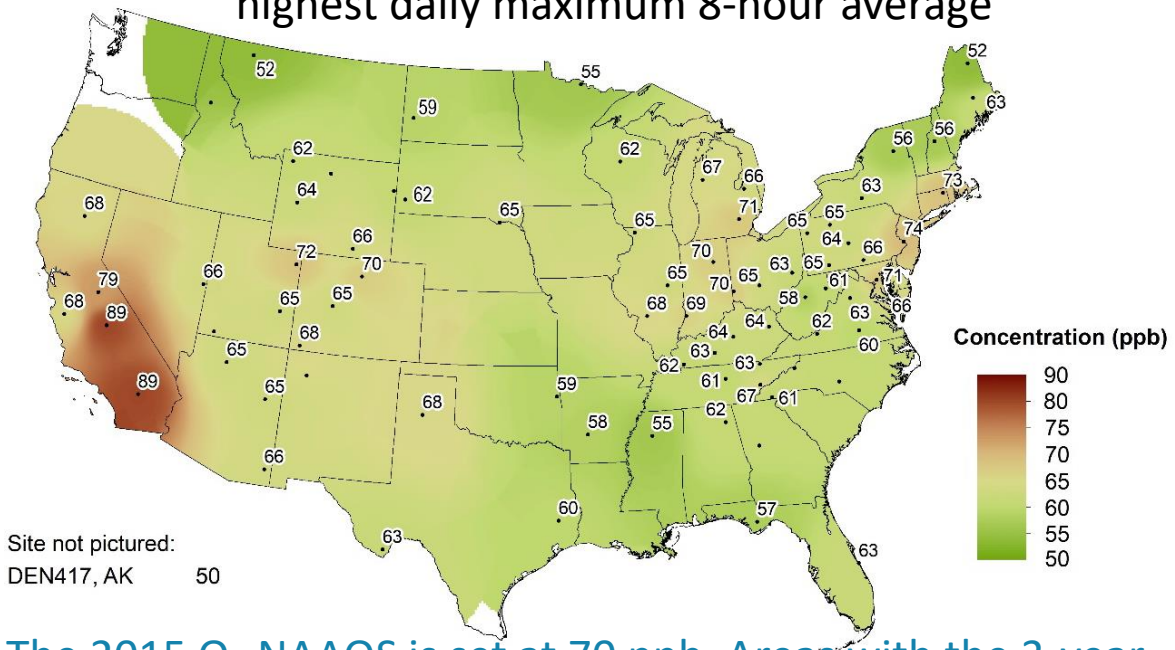
Nightly quality control checks are run with zero air and transfer standard (NIST traceable) to verify instrument is operating within criteria

Systems are operated following 40 CFR Part 58 regulations to support NAAQS decisions

Raw data are loaded into CAMD's database nightly and posted to the website ~2 days after

Validated data are posted ~6 months after

CASTNET O_3 concentrations shown as average (2016-2018) 4th highest daily maximum 8-hour average



The 2015 O_3 NAAQS is set at 70 ppb. Areas with the 3-year average of the 4th highest daily maximum 8-hour average concentrations greater than 70 ppb are exceeding the current standard.

CASTNET FILTER PACK DATA

92 sites collect sulfur and nitrogen measurements with a filter pack

Filter packs are changed weekly (Tuesday – Tuesday)

CASTNET utilizes a 3-stage, open-face filter pack for measuring particles and gases.

- Filter pack is located at 10m.

Concentrations are calculated as measured flow rate (calculated from STP to local conditions) * mass of analyte and reported as µg m^{-3}

Concentration data are reported with flags as final ~6-months after laboratory analysis

- Invalid flags include: **I** (invalid chemistry data and/or less than 75% valid flow for the week), **M** (Missing or completely invalid flow for the week), **N** (Sample not analyzed)

Filters	Analytes
Teflon	SO_4, NO_3, NH_4, Ca, Mg, Na, K, Cl
Nylon	SO_2, HNO_3
Whatman Cellulose	SO_2

DRY AND TOTAL DEPOSITION

Deposition flux = concentration * deposition velocity

Total deposition = Wet deposition + dry deposition

Wet deposition is measured by NADP/NTN

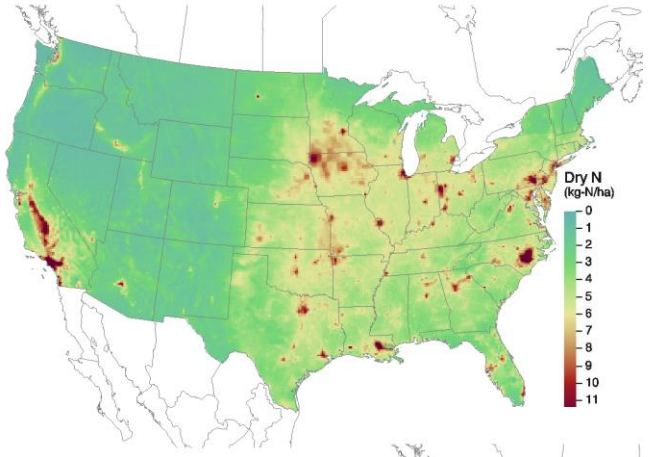
Dry deposition is expensive and labor intensive to measure

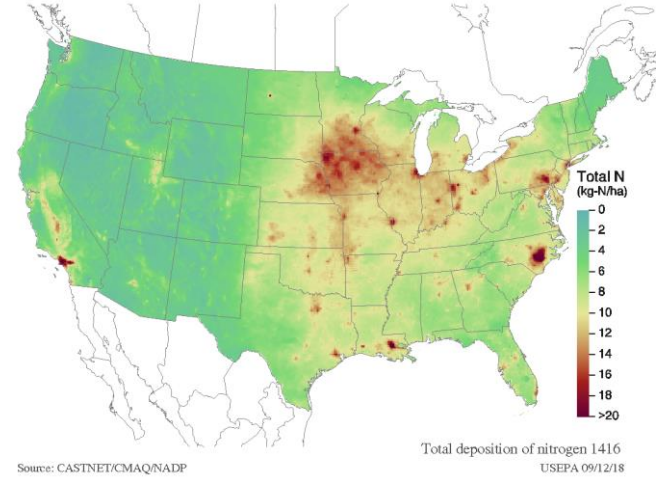
- Meteorology, vegetation impact deposition velocities on a short time scale
- Some pollutants (i.e. NH_3) may be deposited or emitted (bi-directional flux)

CAMD produces annual deposition gridded surface maps

- calculate dry deposition by combining CASTNET concentrations with modeled output from CMAQ (deposition velocities and concentrations where measurements are not available)
- Dry deposition surfaces are combined with wet deposition surfaces to provide total deposition surfaces

Data for CAMD annual dry and total deposition estimates are provided as gridded Arc files and images, and as a data table of estimates at CASTNET site locations





Dry (left) and total (below) nitrogen deposition from 2014-2016

CASTNET Website

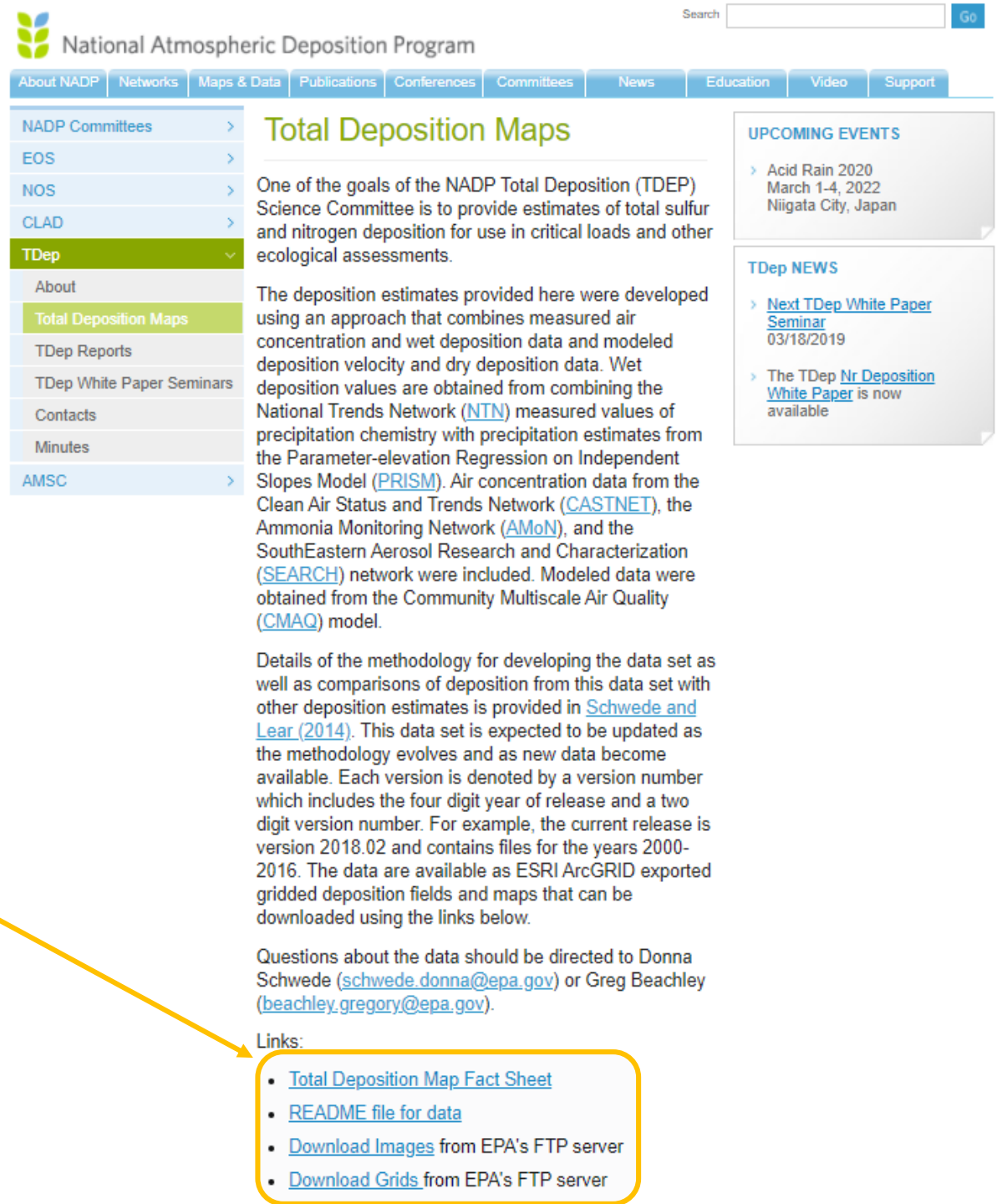
Data may be downloaded for individual sites or time periods using the query tool

Data may be downloaded for entire period or by year using prepackaged data

- Prepackaged zip files include data, column and table metadata (3 csv files)

Total Deposition Grids

Documentation information, the grids (.e00 files), and images of the grids can be downloaded from the NADP Total Deposition page



Long Term Monitoring (LTM) Data Overview

PROVIDES WATER QUALITY DATA FROM 170 LAKES AND STREAMS ACROSS THE MID-ATLANTIC AND NORTHEAST

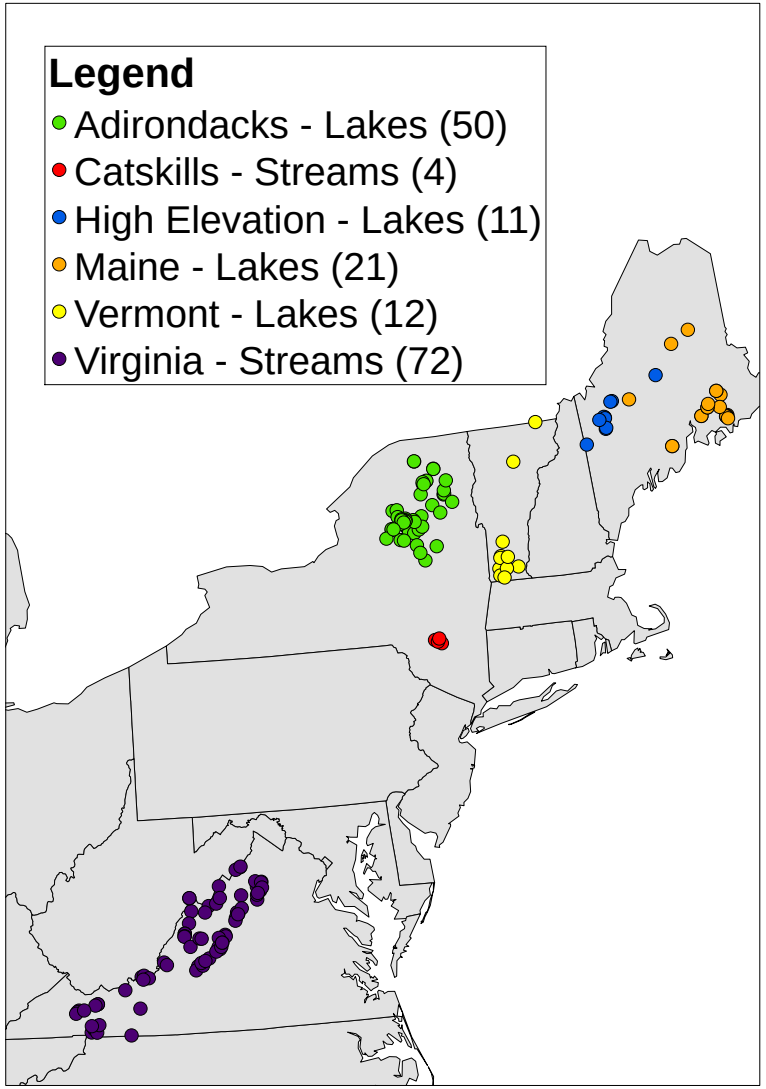
Big Mud Lake, Vermont

What is LTM?

- Network of **remote** lakes and streams sampled 3 – 15 times/year
  - Track changes in surface water chemistry in response to changing air emissions/acid deposition
- Goals:
  - To determine effectiveness of Clean Air Act Amendments (CAAA) in reducing the acidity of surface waters in the following regions:
    - New England
    - Northern Adirondack Mountains
    - Appalachian Plateau
    - Central Appalachians

Sampling at a Virginia stream

Current LTM Network



- 170 locations, approx. 1200 samples annually
- 150+ peer-reviewed publications
- Accomplished cooperatively through our network partners and their labs

Vermont Lakes – 12 lakes , VT Department of Environmental Conservation

Maine/High Elevation Lakes – 32 lakes, US Geological Survey (USGS) and the University of New Hampshire and University of Maine

Adirondack Lakes – 50 lakes, USGS, Adirondacks Lakes Survey Corporation (ALSC), the New York State Department of Environmental Conservation (NYSDEC), & New York Energy and Research Development Authority (NYSERDA)

Catskills Streams – 4 streams, USGS

Ridge and Blue Ridge (VA) Streams –72 streams, Shenandoah National Park and the University of Virginia, many sites on USFS lands

Parameters Sampled

Surface water chemistry

- **NO_3**
- **SO_4^{2-}**
- **NH_4^+**
- **Base Cations (Ca, Mg, Na, K)**
- **Cl^-**
- **Al**
- **PO_4^{2-}**
- **ANC and pH**
- **DOC**

Physical Parameters

- **Water Temperature**
- **Water Color**
- **Water Clarity**
- **Depth**

Biscuit Brook, Catskills, New York

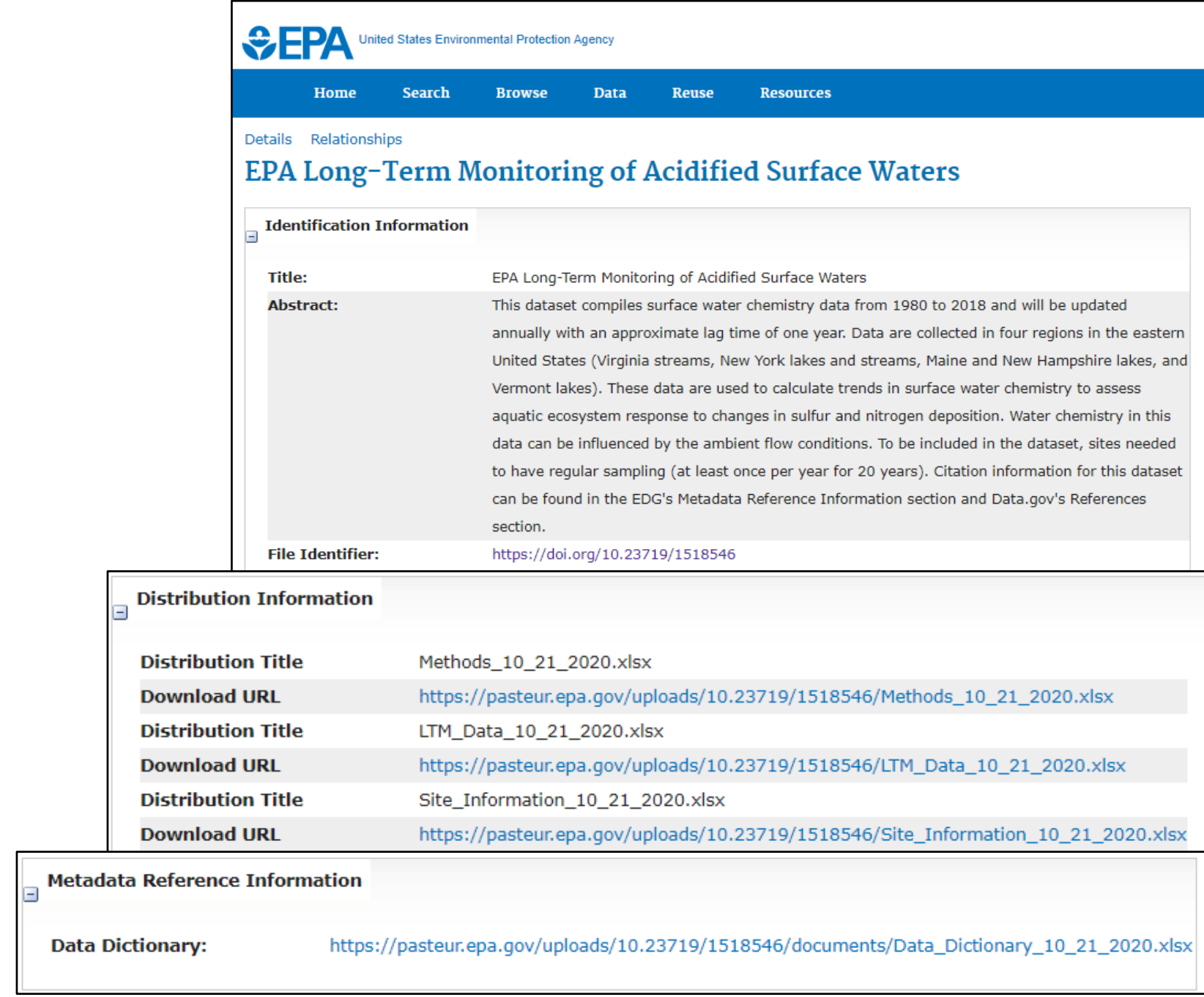
LTM Data Access

Entire dataset (along with methods, site information, and metadata/data dictionary) may be downloaded at:

https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=https://doi.org/10.23719/1518546

This link can also be found on the data tab of the LTM website:

https://www.epa.gov/airmarkets/monitoring-surface-water-chemistry



EPA United States Environmental Protection Agency

Home Search Browse Data Reuse Resources

Details Relationships

EPA Long-Term Monitoring of Acidified Surface Waters

Identification Information

Title:	EPA Long-Term Monitoring of Acidified Surface Waters
Abstract:	This dataset compiles surface water chemistry data from 1980 to 2018 and will be updated annually with an approximate lag time of one year. Data are collected in four regions in the eastern United States (Virginia streams, New York lakes and streams, Maine and New Hampshire lakes, and Vermont lakes). These data are used to calculate trends in surface water chemistry to assess aquatic ecosystem response to changes in sulfur and nitrogen deposition. Water chemistry in this data can be influenced by the ambient flow conditions. To be included in the dataset, sites needed to have regular sampling (at least once per year for 20 years). Citation information for this dataset can be found in the EDG's Metadata Reference Information section and Data.gov's References section.
File Identifier:	https://doi.org/10.23719/1518546

Distribution Information

Distribution Title	Methods_10_21_2020.xlsx
Download URL	https://pasteur.epa.gov/uploads/10.23719/1518546/Methods_10_21_2020.xlsx
Distribution Title	LTM_Data_10_21_2020.xlsx
Download URL	https://pasteur.epa.gov/uploads/10.23719/1518546/LTM_Data_10_21_2020.xlsx
Distribution Title	Site_Information_10_21_2020.xlsx
Download URL	https://pasteur.epa.gov/uploads/10.23719/1518546/Site_Information_10_21_2020.xlsx

Metadata Reference Information

Data Dictionary:	https://pasteur.epa.gov/uploads/10.23719/1518546/documents/Data_Dictionary_10_21_2020.xlsx

How to Apply to the EmPOWER Air Data Challenge

Who can apply?

Anyone who is affiliated with an accredited college or university, or a research organization (e.g., think tank) is encouraged to apply. Applicants may include, but are not limited to:

- Academic faculty and researchers
- Undergraduate/graduate students with faculty leadership
- Ph.D. candidates
- Post-doctoral researchers
- Research fellows

Who can apply?

Applicants may work as individuals or teams.

If applying as an individual, you must meet one of the criteria listed on the previous slide for the duration of the project.

If applying as a team, then the team leader must meet one of the criteria for the duration of the project, but other team members need not be limited to the list on the previous slide.

Teams may be composed of individuals from more than one institution.

You may absolutely apply again if you were not previously selected as a winner.

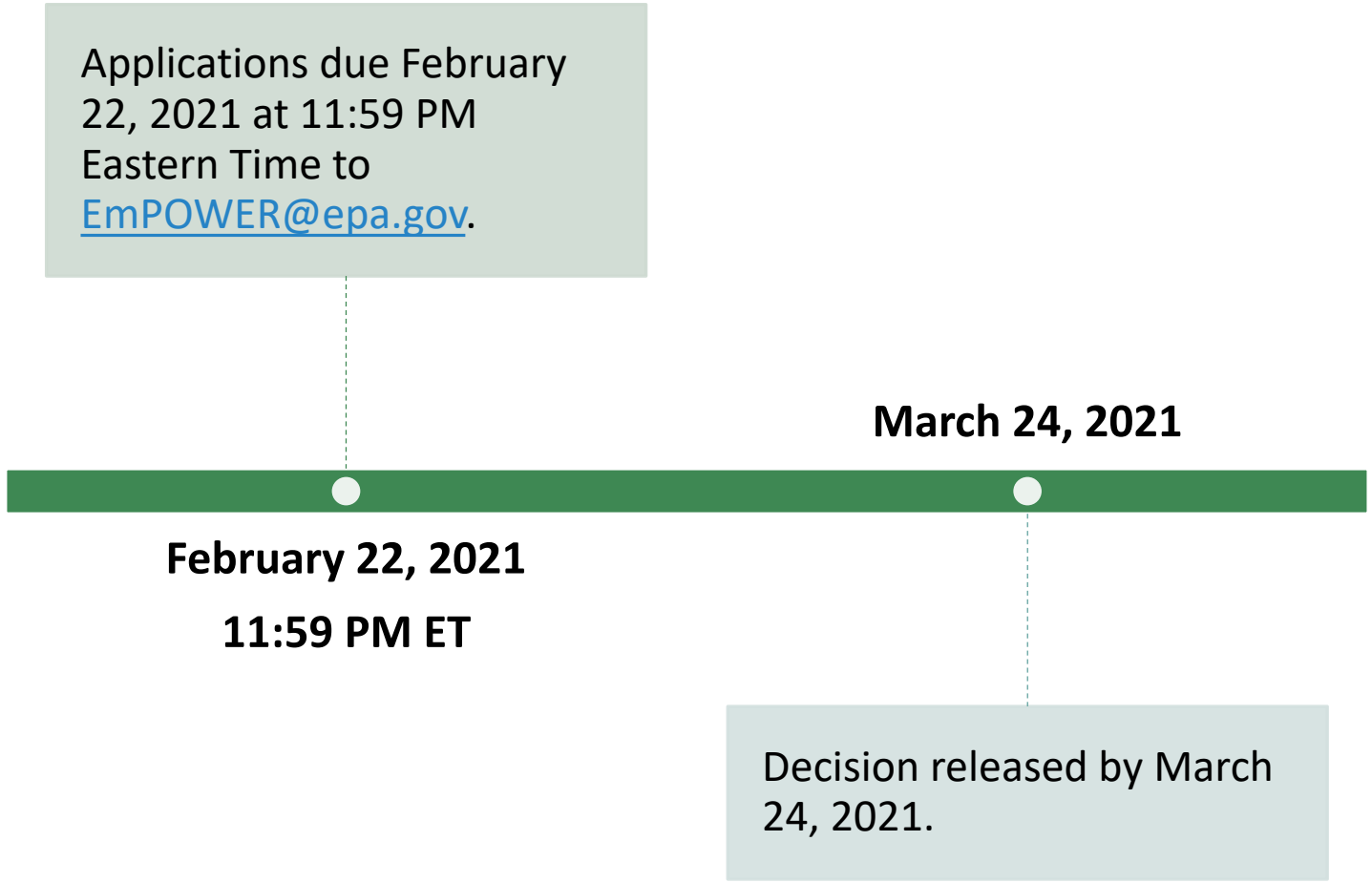
How do I apply?

Submissions should include:

- Application Form (see website)
- Detailed description of the approach of the project and how CAMD data will be used
- Explanation of why the project meets challenge objectives
- A project schedule (2021-2022 academic year)
- Description of the work product(s) and outcome(s)
- Brief bio(s) about applicant(s), including area(s) of expertise

Note: Submissions should not exceed eight pages.

Important Dates



Evaluation Process

- Clarity and Effectiveness of Proposed Approach (40 points)
- Project Outcomes (40 points)
- Applicant Capabilities (20 points)

Application Tips

Make sure all components are included: the complete Application Form and a proposal no longer than eight pages.

Describe a clear plan for incorporating CAMD data (i.e., reference parameters within the dataset, ensure time series is available for parameter).

If incorporating other data sources, cite those sources.

Describe a clear analytical strategy (i.e., if calculating BAU emissions, show how you would calculate).

Include a project schedule.

Questions?

EmPOWER Air Data Challenge FAQs

EmPOWER Air Data Challenge & Power Sector Emissions Data

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CASTNET Data

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LTM Data

Scott Riley
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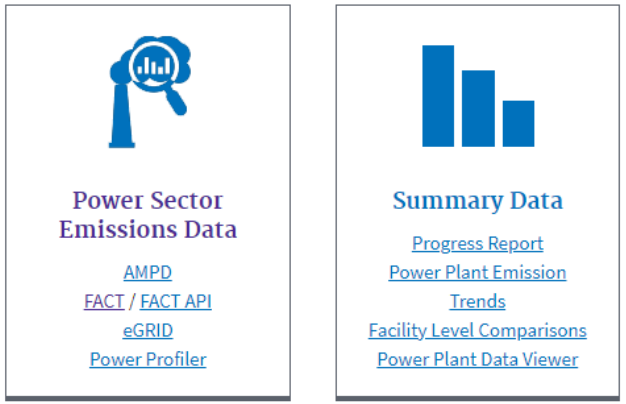
CAMD'S DATA RESOURCES WEBPAGE



Frequent Questions

Which tool is best for me to use?

	AMPD	FACT / FACT API	eGRID	Power Profiler
Hourly Emissions	✓	✓		
Annual Emissions	✓		✓	✓
Unit-Level Data	✓	✓		
Multi-EGU Analysis	✓	✓ (API)	✓	
Download Data	✓	✓	✓	✓

Thank you!

Remember to turn in your applications to EmPOWER@epa.gov by February 22, 2021 at 11:59 PM ET.

Sign up here to stay in touch with EPA on all things related to the EmPOWER Air Data Challenge!