



Clean Air Status & Trends Network (CASTNET)

National Air Quality Conference
Ambient Monitoring 2012
Denver, Colorado
Tuesday, May 15, 2012



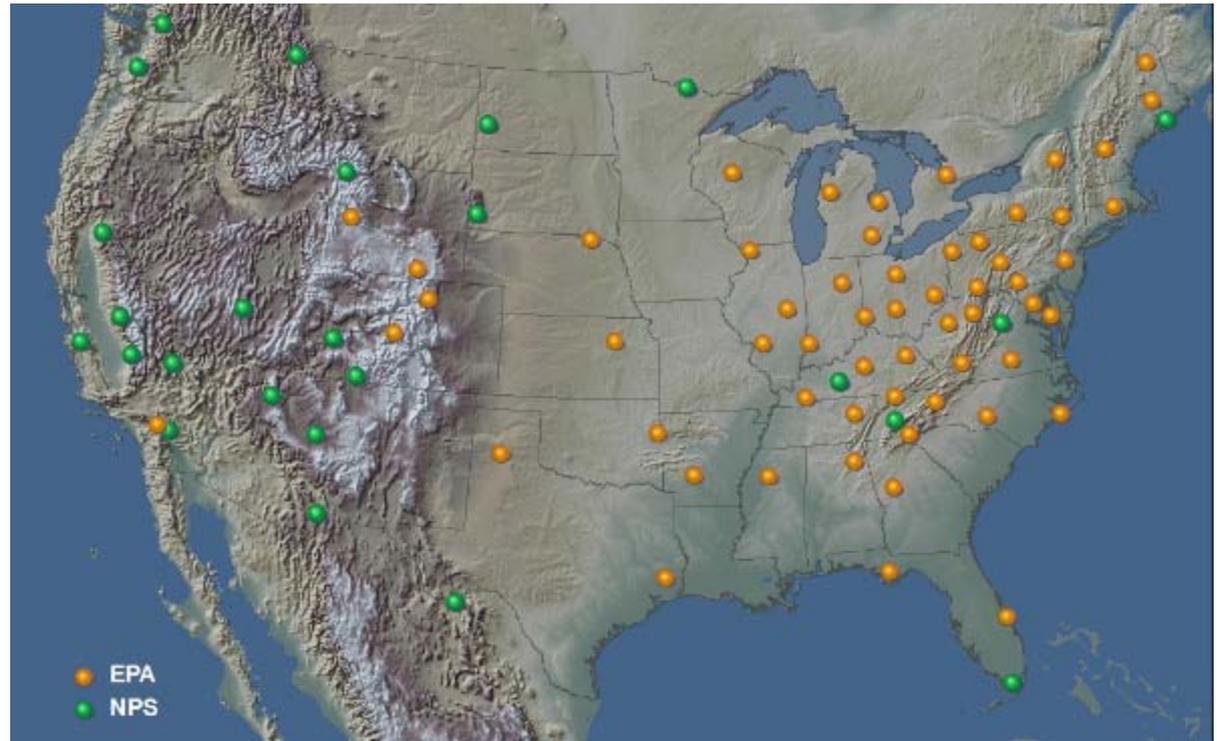
Purpose

Primary purposes of the network

- Monitor the status and trends in regional air quality and atmospheric deposition
- Provide information about complex atmospheric chemistry in rural areas.
- Provide information on the contribution of atmospheric pollution to ecosystem conditions
- Provide measurements for validating and improving atmospheric models

Current CASTNET Monitoring Program

- Operating since 1987
- 83 sites in 44 states/provinces (2 collocated)
- Weekly ambient concentrations
- Continuous (hourly)
- Dry deposition is estimated using an inferential model
- Sites are located in rural and often ecologically important locations, including 25 National Parks

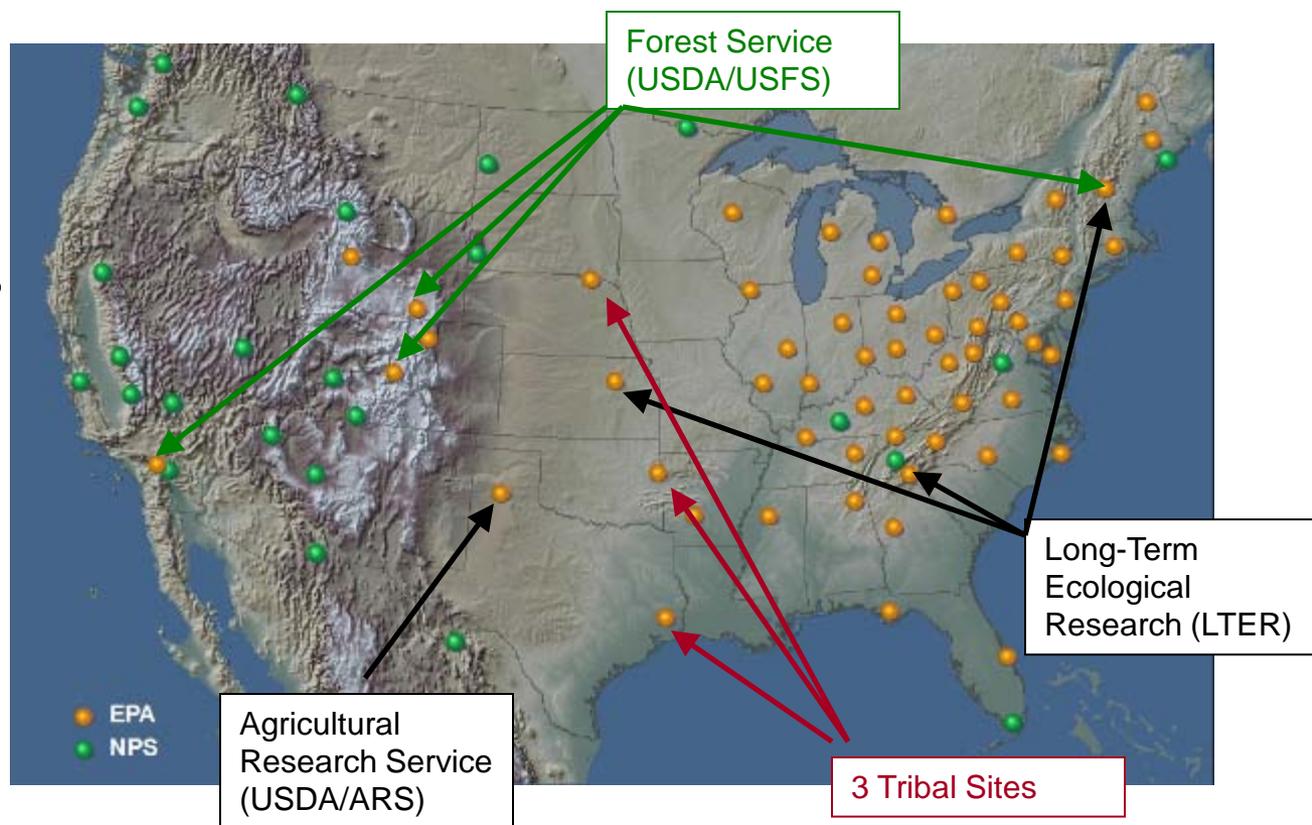


What Makes CASTNET Unique?

- Consistent measurements made for a long time.
- Located in rural areas far from major emission sources.
- Continuous measurements
- Attempts to measure dry deposition
- The cost per site is much lower compared to other continuous monitoring networks.
- Collaboration with other agencies

Cooperation and Capacity Building

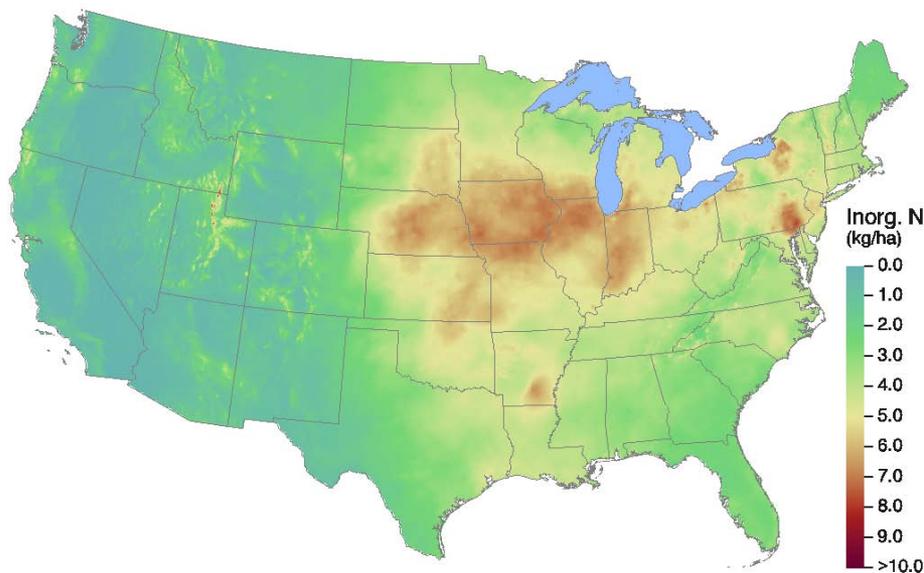
- Fundamental cooperation with NADP
- Numerous agencies contributing resources to CASTNET
- Working with tribal authorities to bring air monitoring to tribal sites in the Midwest



Dry Deposition at CASTNET

CASTNET is the only monitoring network assessing trends in dry deposition of pollutants – critical for ecosystem assessment

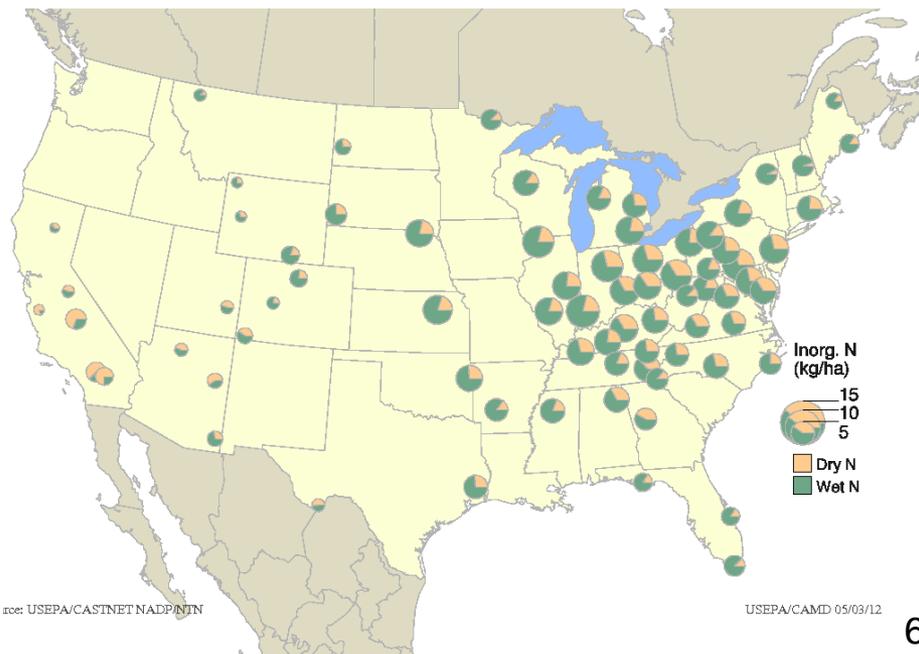
Annual Mean Wet Inorganic Nitrogen, 2007-2009



Source: NADP/NTN & PRISM

USEPA/CAMD 05/03/12
/Assets/prism/img/0709/inorg_n_0709

Annual Mean Wet+Dry Deposition, 2007-2009



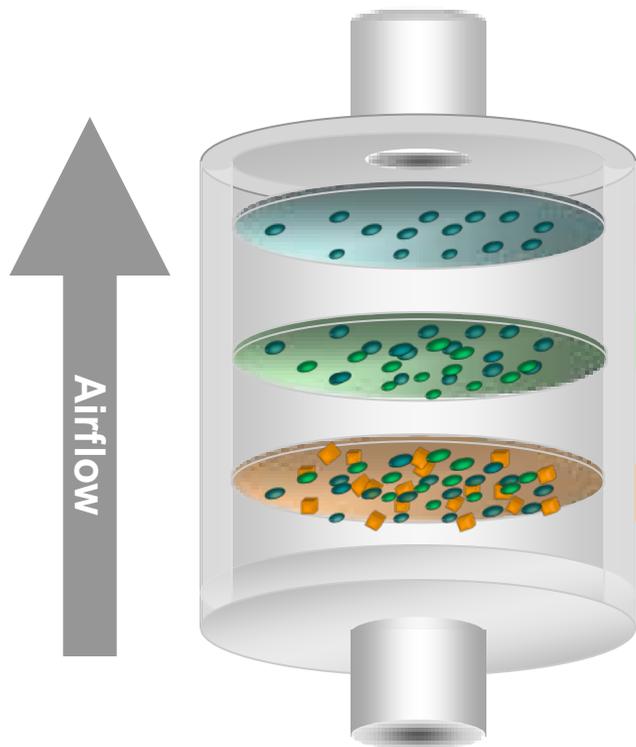
Source: USEPA/CASTNET NADP/NTN

USEPA/CAMD 05/03/12

Simple and cheap technology used to measure air quality

Three air filters collect the pollutants over 1-week

Gas and particle concentrations in air are measured by filter packs and then used to estimate daily dry deposition



Whatman	Gaseous • SO ₂
Nylon	Gaseous • HNO ₃ • SO ₂
Teflon	Particulate • SO ₄ ²⁻ • NO ₃ ⁻ • NH ₄ ⁺ • Ca, Na, Mg • Cl

Filter packs are open-faced, with no size exclusion

- 20% of S and N deposition can be from coarse particles
- HNO₃ reacts with inlets

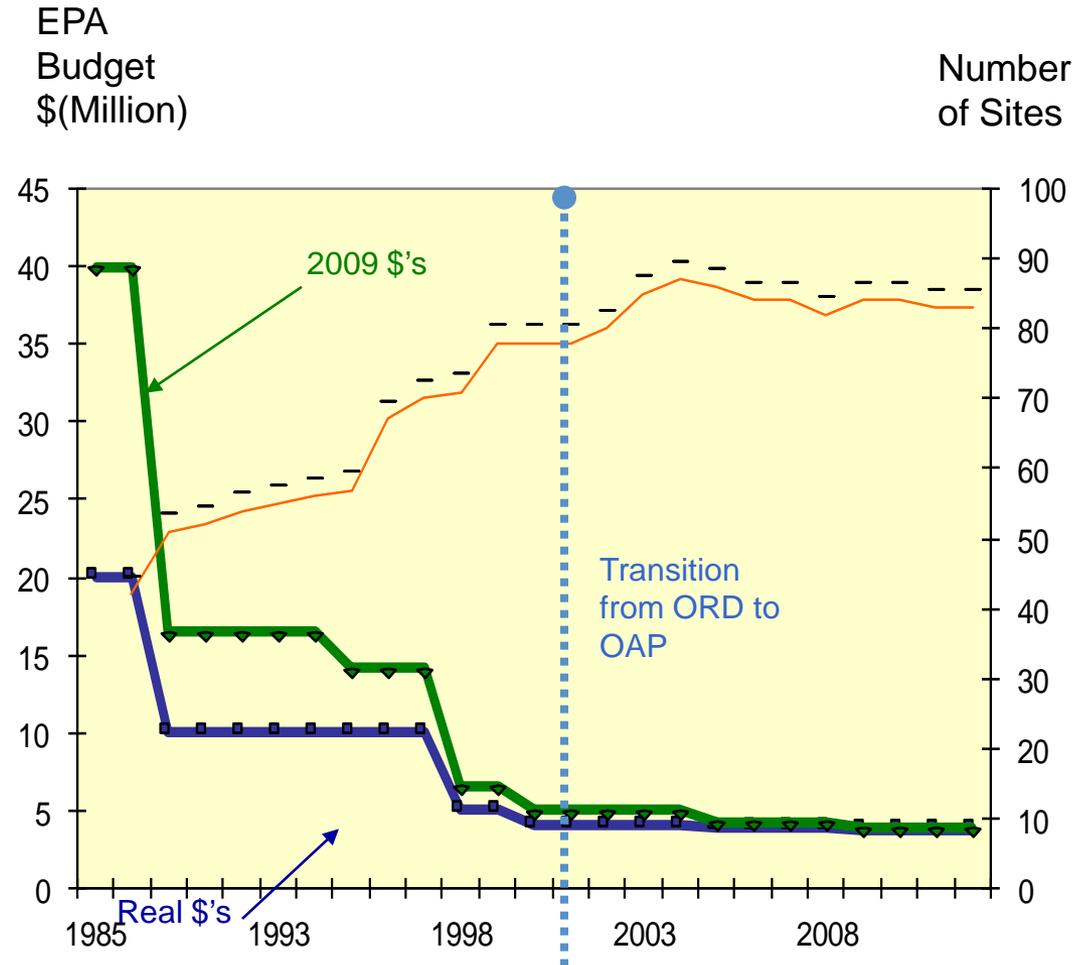


What does CAMD do for CASTNET?

- Manage all associated contracts, IAGs, and budgets.
- Provide technical direction to ensure smooth, continuous operation of the entire network.
- Provide public access to all data, reports, and documentation via Web.
- Manage a comprehensive database of results and operational history
- Assess and report on the quality of the data.
- Provide data analysis used in assessment reports
- Help guide Agency policy decisions (e.g., ozone, secondary NAAQS, and ammonia)
- Support instrument development

Cost Effective but Nothing to Spare

- CASTNET has become increasingly cost-effective with time
- The number of sites has increased over time, while the budget has decreased
- Additional cuts or continued stagnant funding will likely result in site closures

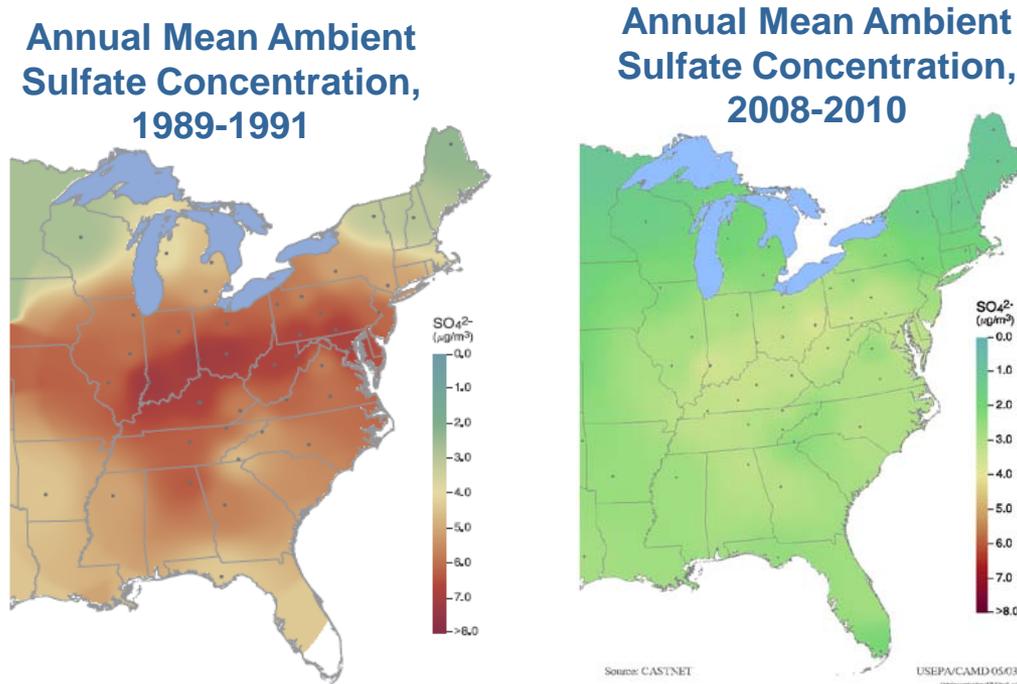


How Do We Support OAR?

- Program assessment
 - Acid Rain Program
 - NOx Budget program
 - Ozone
 - Ecological assessment
- Information to support
 - Model development and assessment
 - Policy decisions
- Monitoring method development

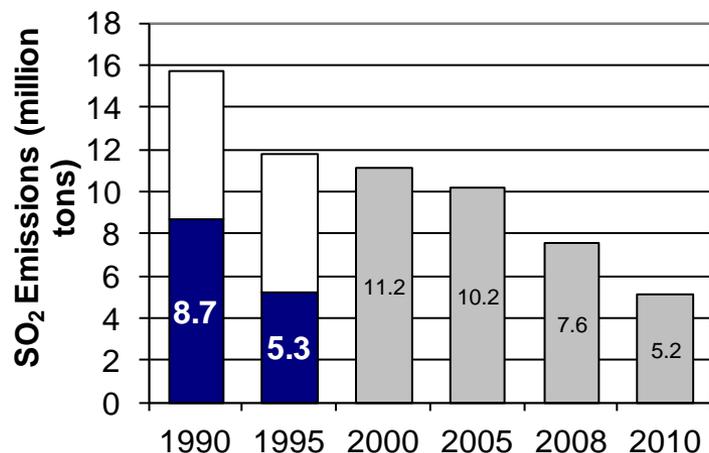
Assessment of Trends Using CASTNET

- Consistent measurements for over 20 years (see above)
 - Measurements are comparable over temporal and spatial scales
 - Many long-term sites
 - Enables comparisons over long time-periods. Relative effects of different programs can be directly compared.



Accountability and Assessment: An Acid Rain Example

SO₂ Emissions Under the ARP



Acid Lake Response

Table 2: Regional Trends in Sulfate, Nitrate, ANC, and DOC at Long-term Monitoring Sites, 1990–2009

Region	Water Bodies Covered	% of Sites with Improving Sulfate Trend	% of Sites with Improving Nitrate Trend	% of Sites with Improving ANC Trend	% of Sites with Improving Base Catons Trend	% of Sites with Improving DOC Trend
Adirondack Mountains	50 lakes in NY	94%	48%	60%	74%	48% (29 sites)
Catskills/N. Appalachian Plateau*	9 streams in NY and PA	80%	30%	55%	80%	25% (9 sites)
New England	26 lakes in ME and VT	96%	33%	20%	57%	26% (15 sites)
Central Appalachians	66 streams in VA	12%	50%	17%	12%	NA

Notes:

- Trends are determined by multivariate Mann-Kendall tests.
- Trends are significant at the 95 percent confidence interval ($p < 0.05$).
- DOC was only examined in low-ANC waterbodies (ANC less than 25 $\mu\text{eq/L}$).
- DOC is not currently measured in Central Appalachian streams.

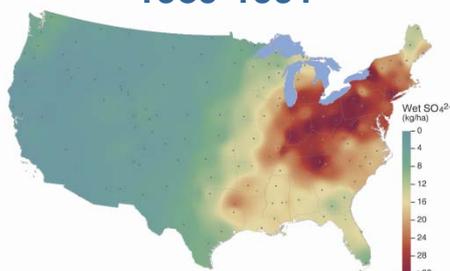
*Data for streams in N. Appalachian Plateau is only through 2008.

Source: EPA, 2011

Data comes from many partners and is transparent and accessible for all to use

Wet Sulfate Deposition

Annual Mean Wet Sulfate Deposition, 1989-1991



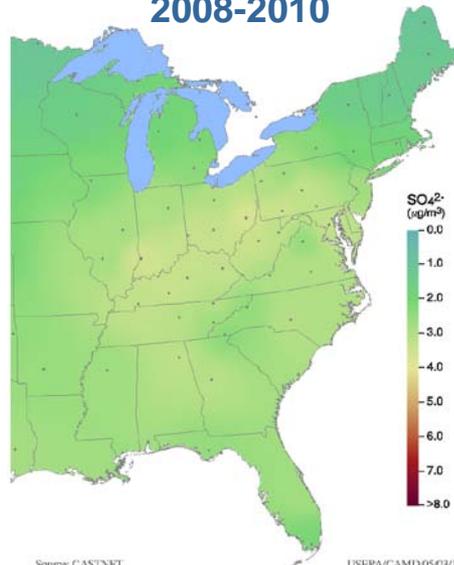
Annual Mean Wet Sulfate Deposition, 2008-2010



Assessment of New Trends Using CASTNET

- We know the current air quality status today. CASTNET is in position to assess the affects on air quality and deposition of new rules and changes in NAAQS (e.g., CAIR, etc).
- Other networks do not continuously monitor and are generally not located in locations away from major sources. This can lead to significant biases.

Annual Mean Ambient Sulfate Concentration, 2008-2010



Annual Mean Ambient Sulfate Concentration, 2012-2014

?

Model Uses and Evaluation

- Numerical air quality models are used to help inform decision-making.
 - OAP, OAQPS, OTAQ rely on air quality estimates during air rule development
 - Decisions worth over \$16 billion are made on Agency model results
- Every model revision is compared to CASTNET monitoring results for operational and dynamic model evaluations
 - Are we getting the intended results?
- At a recent workshop on CASTNET, Agency modelers...
 - Highlighted the importance & current uses of CASTNET
 - Called for expansion of the network for future model development

Ozone

- CASTNET is the primary source of rural O₃ monitoring data for the Agency
 - Provides data where the urban AQS network does not
 - Used to assess benefits of NOx Budget Program
 - Supports development of secondary standards
- Recently, CASTNET monitors were requested to become 40 CFR Part 58 Compliant
 - All CASTNET sites are submitting data to AQS (started in 2011)
 - All CASTNET sites are 40 CFR Part 58 compliant

Efforts to Attain 40 CFR Part 58 Compliance

- All 78 CASTNET ozone monitoring sites became Part 58 compliant in 2011
- March 2012 – CASTNET summit with EPA, NPS, AMEC, and ARS - discussed the final edits to the CASTNET Plan for Part 58 Compliance document
- April 2012 - CASTNET Plan for Part 58 Compliance v.1.012 was released to EPA regions and OAQPS
- May 2012 – 2011 CASTNET Ozone Network Summary Report is being finalized
- May 2012 – AQS AMP 255 and AMP 450 reports are being finalized

40 CFR Part 58 Compliance

Benefits to states:

- Better confidence in rural ozone measurements
 - Now that CASTNET data are subject to Part 58 compliance; their data are subjected to the same site performance audits as SLAMS sites
 - Regular NPAP, PE, and TSA audits
- Additional monitoring data
 - Better capacity to compare regional data (e.g., exceptional events) with nearby SLAMS sites
- Cost sharing with site audits

What Does the Future of Monitoring Look Like?

- Rural monitoring locations – CASTNET is well-positioned for new Agency monitoring needs (e.g., potential new NAAQS Ozone and Secondary SO_x that could affect rural areas).
- Further substantial regional and national SO₂ & NO_x reductions:
 - Acid Rain Program
 - CAIR and CSAPR
 - Utility MACT
 - Ozone NAAQS
 - PM NAAQS
 - Secondary SO_x/NO_x NAAQS?
 - Potential multi-pollutant control legislation?
- Thinking bigger – ammonia? Total reactive N?
- And bigger – coupled biogeochemical cycles?
 - C, N, S – separate in policy, but not in nature

This will be discussed in more detail later in the presentation

The Future

What improvements could we make at CASTNET sites?

Results of a recent workshop on CASTNET:

- Complete the N budget by adding new reactive N (all but N₂) measurements
- Add high time resolution monitoring instruments
- Add multi-pollutant instruments at selected CASTNET sites

NO_x/SO_x Secondary Standard Proposal

- Proposal to use the CASTNET filter pack for measuring SO₂, SO₄²⁻, and T-NO₃⁻ in sensitive ecosystems
- CASAC letter to EPA was, in general, supportive of using CASTNET as a platform for monitoring
 - CASTNET filter pack methods are acceptable for use in the secondary standard
 - More collaboration between partners – states, local agencies
- Recommended including NH₃ measurements (AMoN) even though NH₃ won't be a requirement

New CASTNET Website

- Data query wizard
- Possibility of adding CMAQ deposition velocity grids
- New site pages including satellite maps, panoramic photos (soon)
- Cloud deposition database available (soon)
- “Meet the CASTNET partner” page (soon)

Site Information

Site ID	CTH110
Site name	Connecticut Hill
County	Tompkins
State abbreviation	NY
Latitude; decimal degrees	42.4006
Longitude; decimal degrees	-76.6538
Elevation; m	501
Operating agency	EPA
Start date	08/21/1987
Primary Land Use	Forest
Terrain surrounding site	Rolling
NADP site code	NY67 EXIT EPA
Distance to nearest NADP site; km	.429
Does site conform to assumptions of MLM?	No

Site Photos

Graphical Results

Composition of total nitrogen deposition by species

Trends in total nitrogen deposition

Trends in wet and dry nitrogen deposition

Composition of total sulfur deposition by species

Trends in total sulfur deposition

Trends in wet and dry sulfur deposition



Outreach

If you have any interest in supporting or developing a CASTNET site, please contact:

Gary Lear – EPA/OAR/OAP/CAMD

lear.gary@epa.gov

Melissa Puchalski – EPA/OAR/OAP/CAMD

puchalski.melissa@epa.gov

Timothy Sharac – EPA/OAR/OAP/CAMD

sharac.timothy@epa.gov