

The National Atmospheric Deposition Program (NADP)

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National Atmospheric
Deposition Program



ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

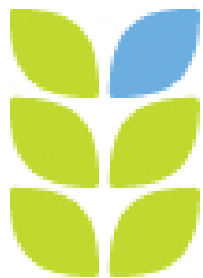
Mission of the National Atmospheric Deposition Program (NADP)

- Provide data on the exposure of managed and natural ecosystems and cultural resources to acidic compounds, nutrients, mercury, and base cations in precipitation.
- Remain one of the nation's premier cooperative research support programs, serving science and education and supporting communication and informed decisions on air quality issues affecting ecosystems and human health.

A Cooperative Research Program

All decisions made by scientific consensus of supporting agencies and individuals
(equal vote, regardless of affiliation)

- Field Equipment
- Analytical Procedures
- Data Analysis



National Atmospheric
Deposition Program

Some of our Funders

(100+ total agencies)



Federal Agency Members



Tribal Organizations



USDA Forest Service
Caring for the Land and Serving People



EPA United States Environmental Protection Agency

Universities



CORNELL UNIVERSITY



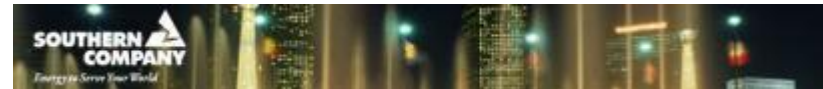
US States



Environment Canada

Environnement Canada

Other Organizations



National Atmospheric Deposition Program (NADP) Stations

NTN – National Trends Network (acidic precipitation), since 1978

MDN – Mercury Deposition Network (mercury in precipitation), since 1995

AIRMoN – Atmospheric Integrated Research Monitoring Network (acidic precipitation events), since 1992

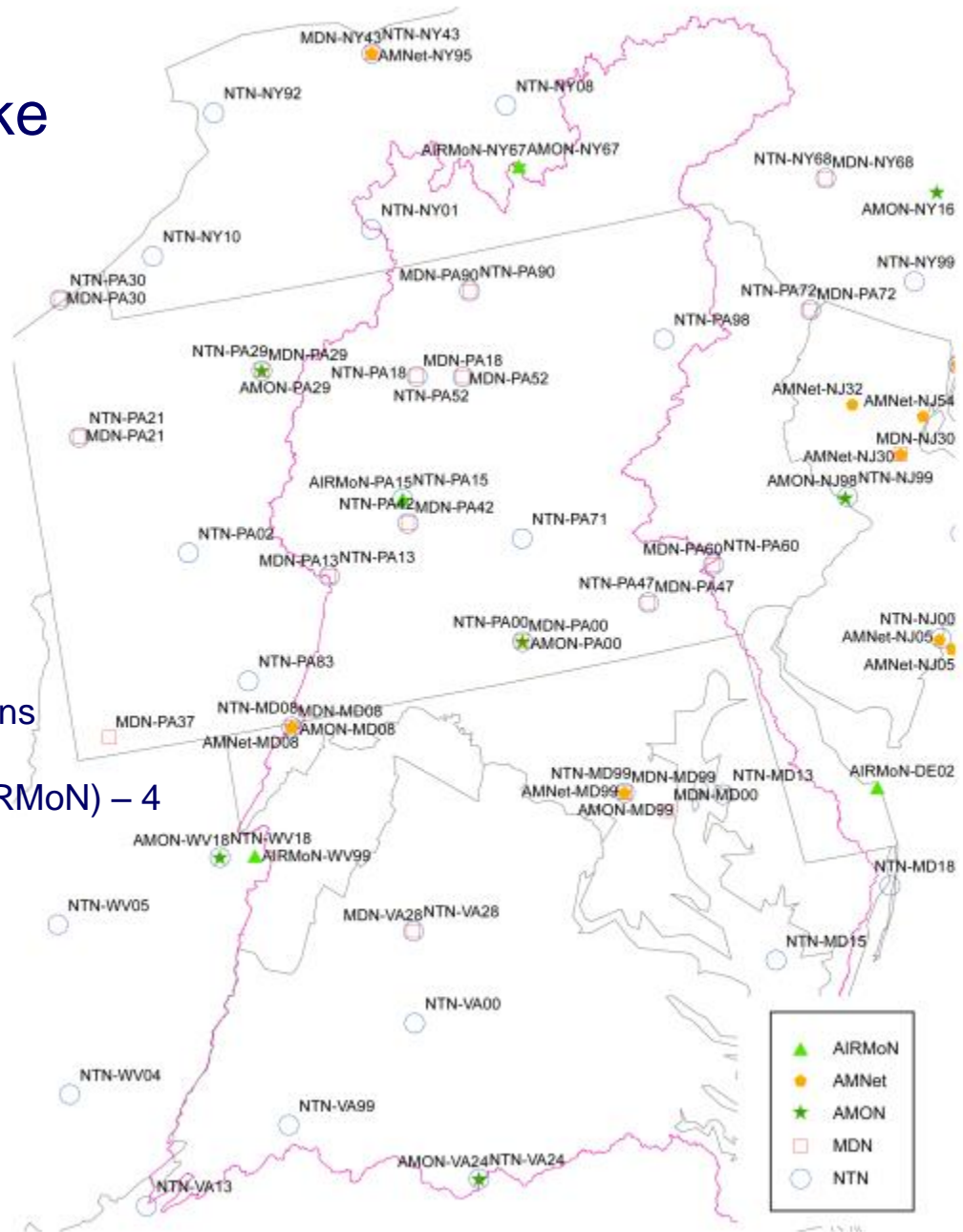
AMNet – Ambient Mercury Network (gaseous mercury), since 2009

AMoN – Ammonia Monitoring Network (gaseous ammonia), since 2007



NADP Monitoring Locations in Chesapeake Bay Watershed

National Trends Network (NTN) ~24 stations
 Mercury Deposition Network (MDN) – 12
 Atmos. Integrated Research Mon. Net. (AIRMoN) – 4
 Atmos. Mercury Mon. Net. (AMNet) – 2
 Ammonia Monitoring Network (AMoN) - 4



DEPOSITION MONITORING PROGRAMS

Programs are inactive unless noted

Regional Programs

- Chester River Association
- Conodoguinet Creek
- EPA-SON
- Jones Falls Watershed
- NJ Network (Active)
- NYADMP (Active)
- PADMN (Active)
- USGS
- VAPN

National Programs

- ▲ NADP (AIRMon; Active)
- ▲ CASTNet (Active)
- ▲ NADP (NTN; Active)
- ▲ NADP (MDN; Active)

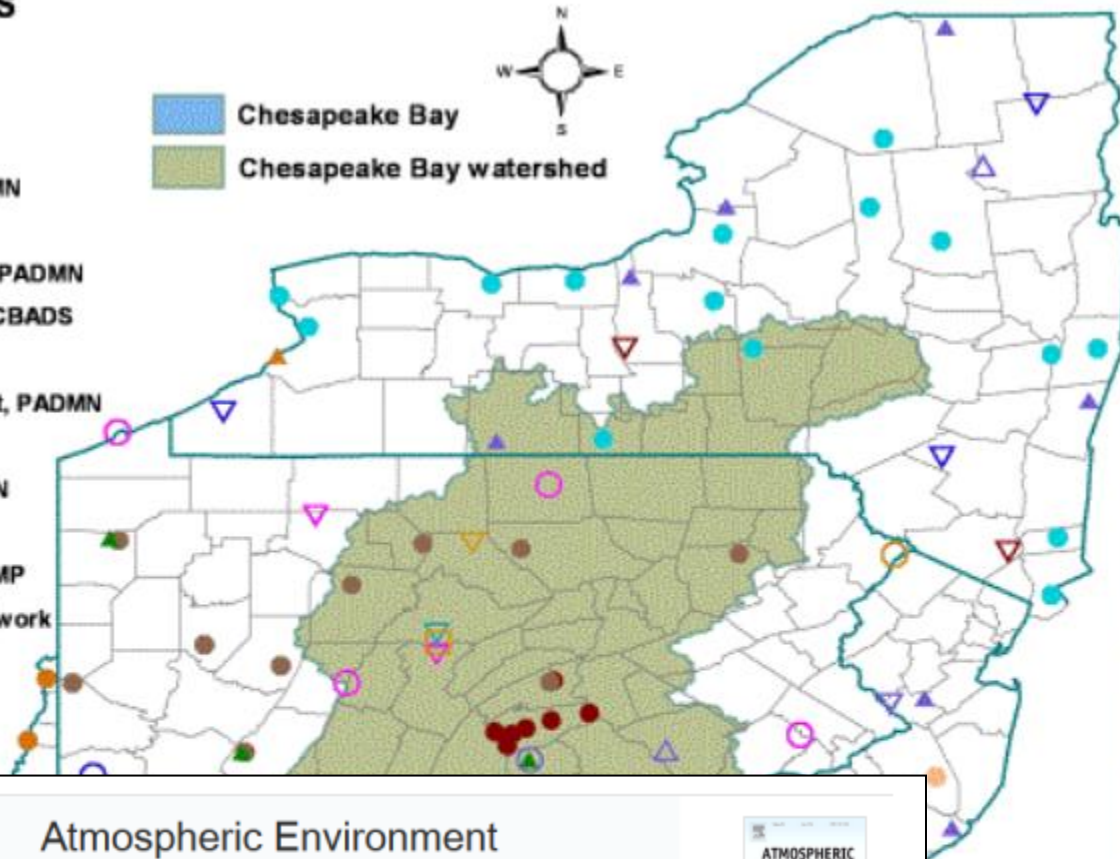
PPRP Programs

- ✦ CBADS
- ✦ Coastal Streams
- ✦ Deep Creek Lake
- ✦ Delmarva
- ✦ I/O Budget.shp
- ✦ PPRP Mercury

Multiple Programs

- HgDepPA, NADP (MDN, NTN)
- HgDepPA, NADP (MDN), PADMN
- HgDepPA, NADP (MDN)
- HgDepPA, NADP (MDN, NTN), PADMN
- △ NADP (MDN, NTN), CASTNet, CBADS
- △ NADP (MDN, NTN)
- ▽ NADP (AirMon, NTN), CASTNet, PADMN
- ▽ NADP (NTN), PADMN
- ▽ NADP (NTN), CASTNet, PADMN
- ▽ NADP (NTN), CASTNet
- ▽ NADP (NTN), CASTNet, NYADMP
- ▽ NADP (NTN), CASTNet, NJ network
- NDAMN, CASTNet, PADMN
- NDAMN, CASTNet

- Chesapeake Bay
- Chesapeake Bay watershed



Atmospheric Environment

Available online 13 April 2014

In Press, Accepted Manuscript — Note to users

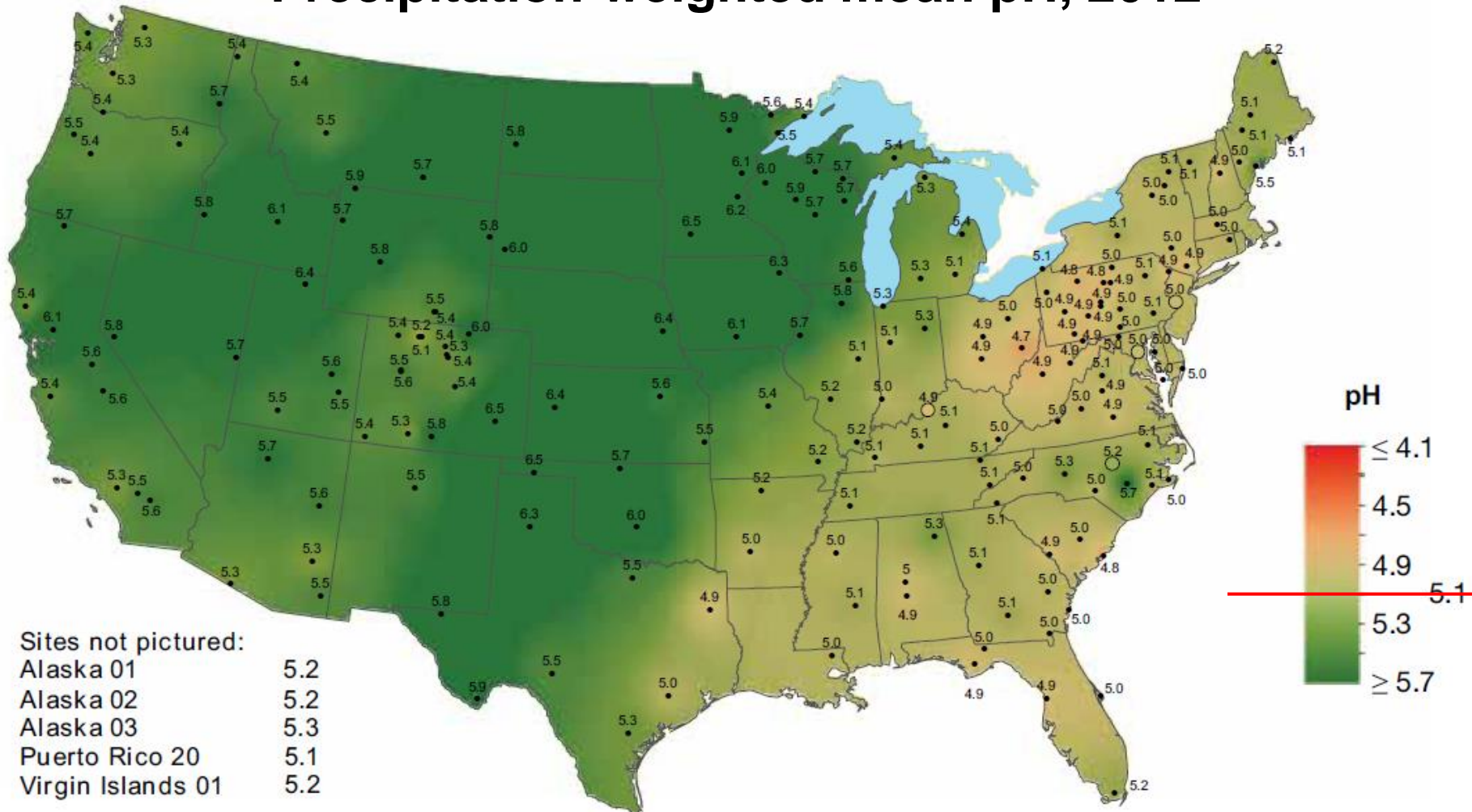


A Novel Hybrid Approach for Estimating Total Deposition in the United States

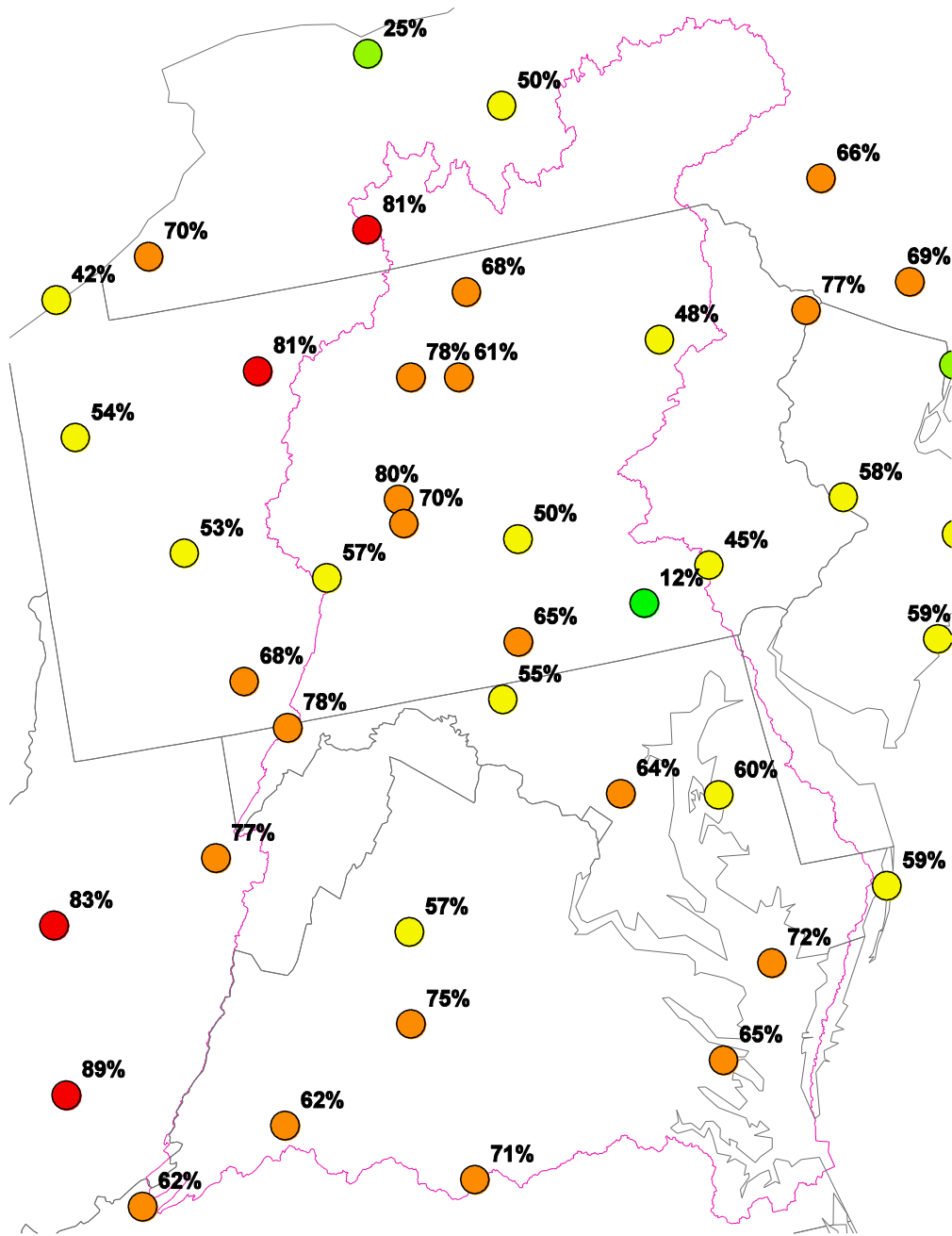
Donna B. Schwede^a, Gary G. Lear^b

Is “Acid Rain” still an issue for the US?

Precipitation-weighted mean pH, 2012



Frequency of Acidic Precipitation (pH < 5.1) in Chesapeake Bay Region, 2010 - 2013



National Trends Network (NTN)

- Operators collect weekly wet deposition sample from NADP wet-dry collector
- Continuous precipitation record
- Chemical Analysis
 - Acids (SO_4^{2-} , NO_3^- , Cl^- , Br^-)
 - Bases (Ca^{2+} , Mg^{2+} , K^+ , Na^+)
 - Nutrients (NH_4^+ , PO_4^{3-})
 - pH
 - Specific Conductivity



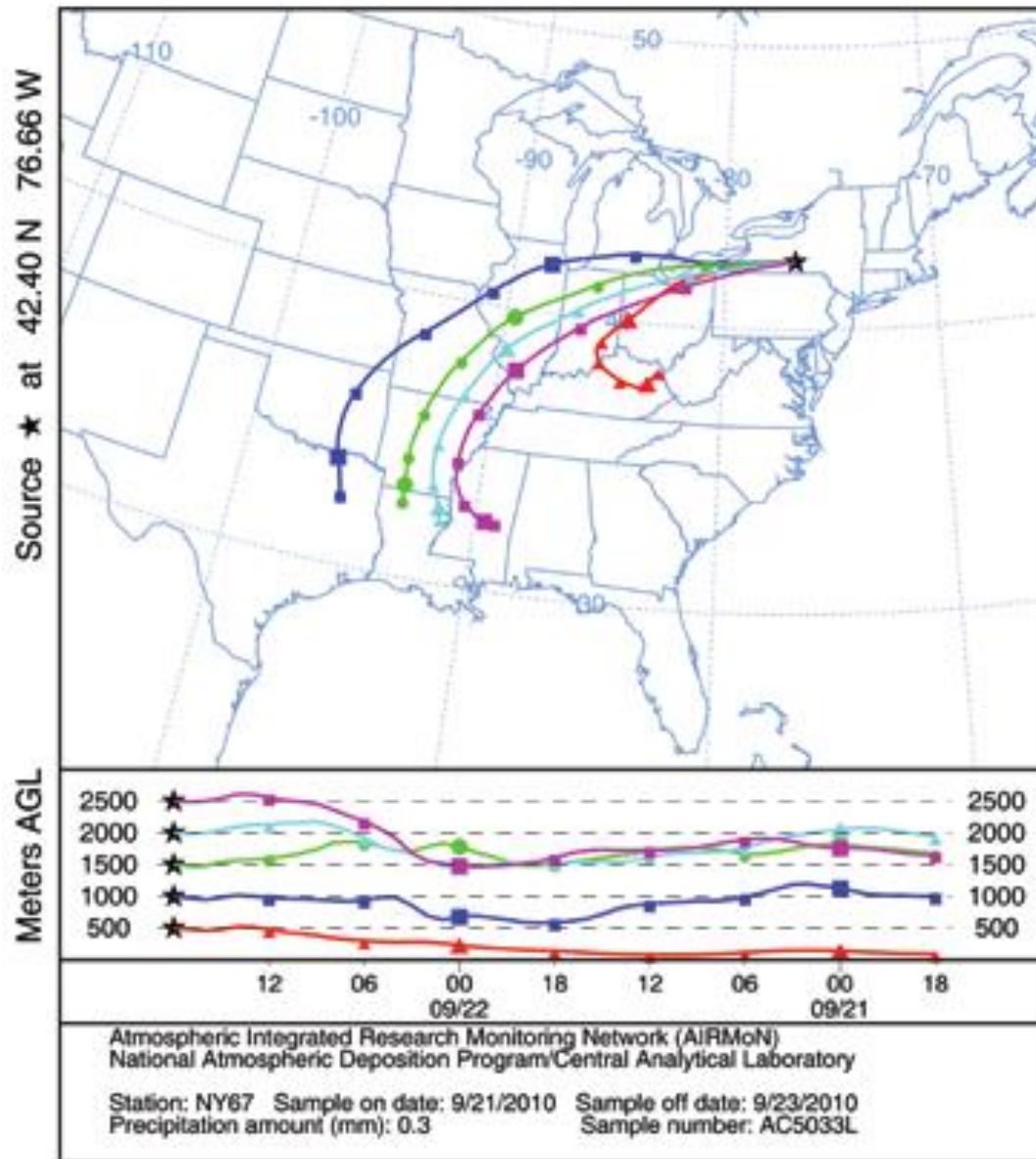
The NADP Networks (I)

1. National Trends Network (NTN)

- Major ions (cations, anions, pH, conductivity)
- 264 sites + 2 QA
- ~380,000+ weekly samples since 1978

2. Atmospheric Integrated Research Monitoring Network (AIRMoN)

- Major ions (cations, anions, pH, conductivity)
- Refrigerated event samples
- 6 sites; ~30,000 samples since 1992



Example back trajectories from the NOAA/HYSPLIT model.

The NADP Networks (II)

3. Mercury Deposition Network (MDN)

- Mercury, methyl mercury concentrations
- 110 sites; ~70,000 samples since 1996

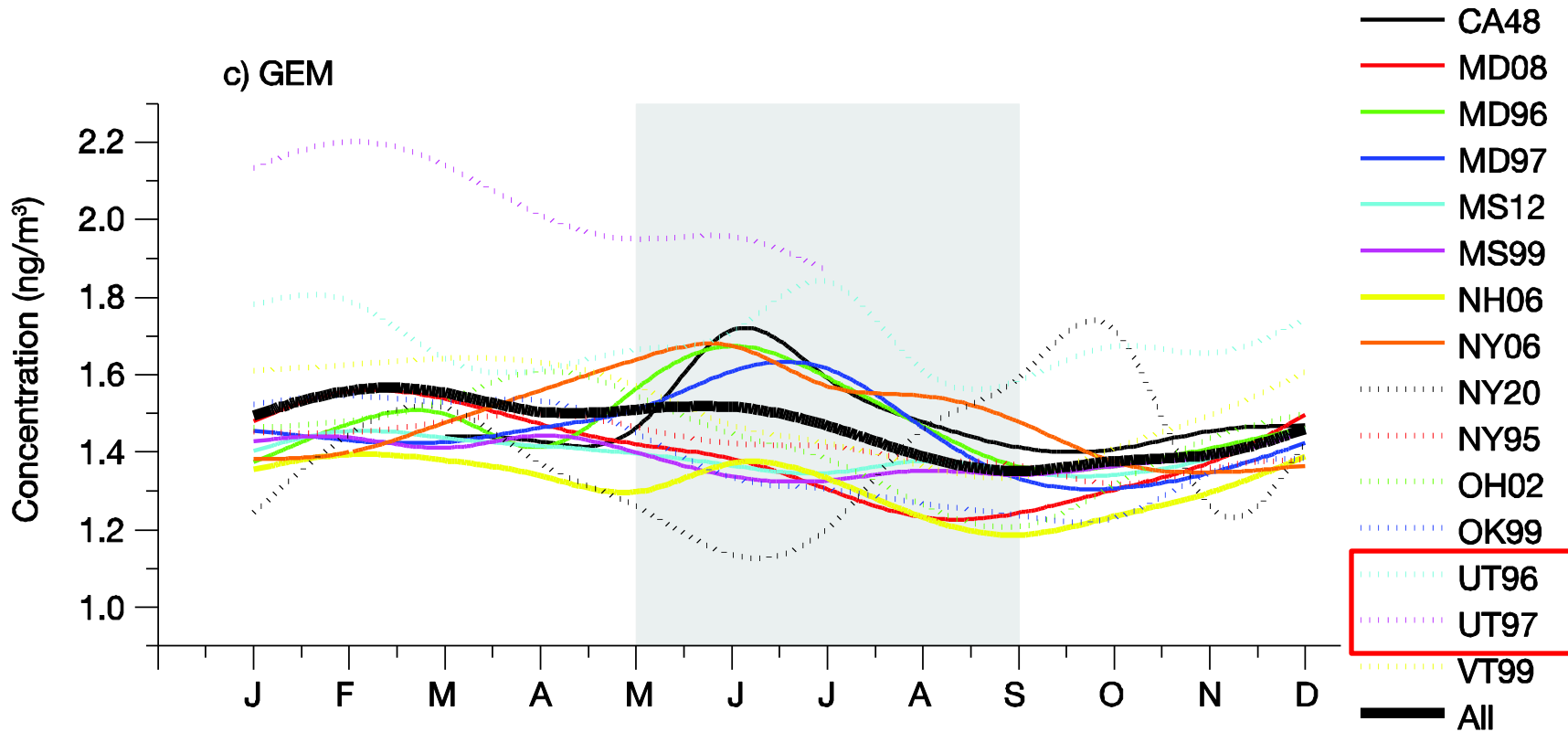
4. Atmospheric Mercury Monitoring Network (AMNet)

- Gas-phase speciated mercury concentrations
- 23 sites; hourly data since 2006

Atmospheric Mercury Monitoring Network (AMNet)



Total Mercury Concentration in Precipitation, 2012



Sites not pictured:

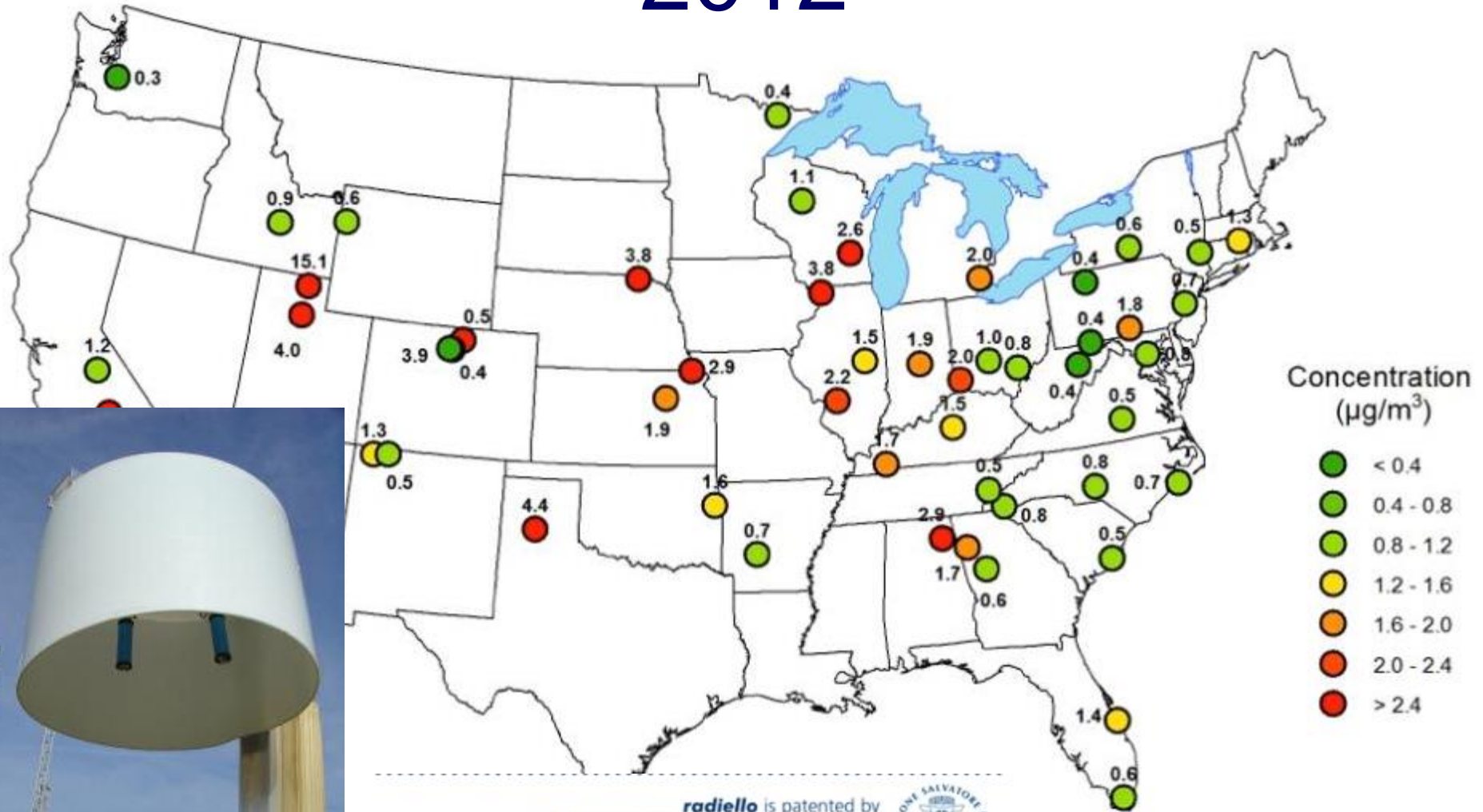
Alaska 00	3.3 ng/L
Alaska 05	2.3 ng/L
Alaska 06	5.9 ng/L
Alaska 98	2.2 ng/L



The NADP Networks (III)

5. Ammonia Monitoring Network (AMoN)
 - Atmospheric ammonia concentrations
 - 64 sites; ~5,500 samples since 2007

AMoN Average Concentration 2012



radiello is patented by
 FONDAZIONE SALVATORE MAUGERI-IRCCS
 Centro di Ricerche Ambientali - via Svizzera, 16 - 35127 PADOVA



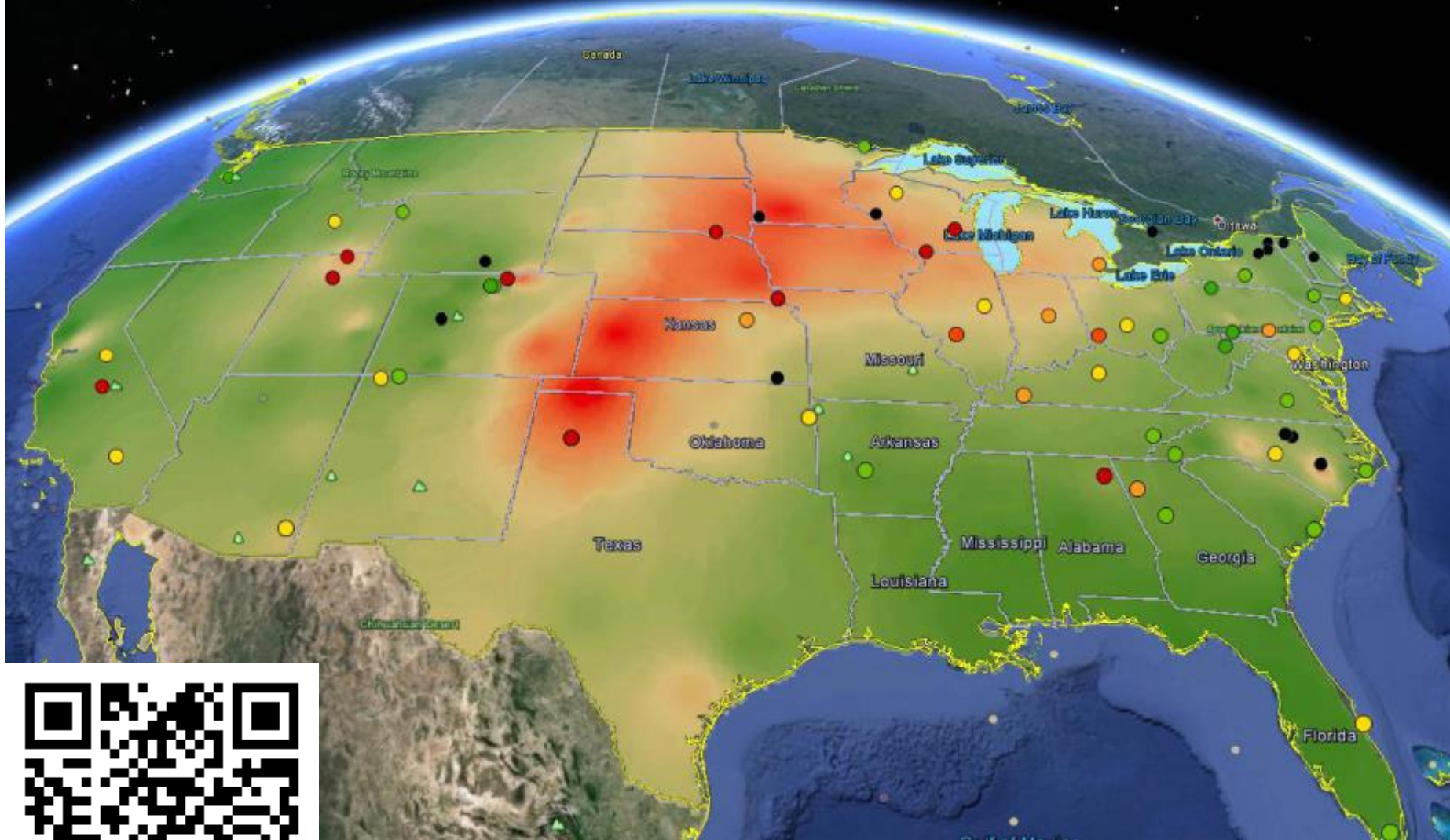
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AMoN Methodology

- Sampler Type
 - Radiello-type passive diffusive sampler (PDS)
- Field Deployment
 - 2 week deployments in NADP-provided field shelter, 2 m height
- Laboratory Analysis
 - Flow injection analysis (FIA) colorimetry for ammonium ion



Map: Precipitation-weighted mean ammonium ion concentration, 2012
Dots: Mean ambient gaseous ammonia concentration, 2012



<http://go.illinois.edu/NADPAmonMap>

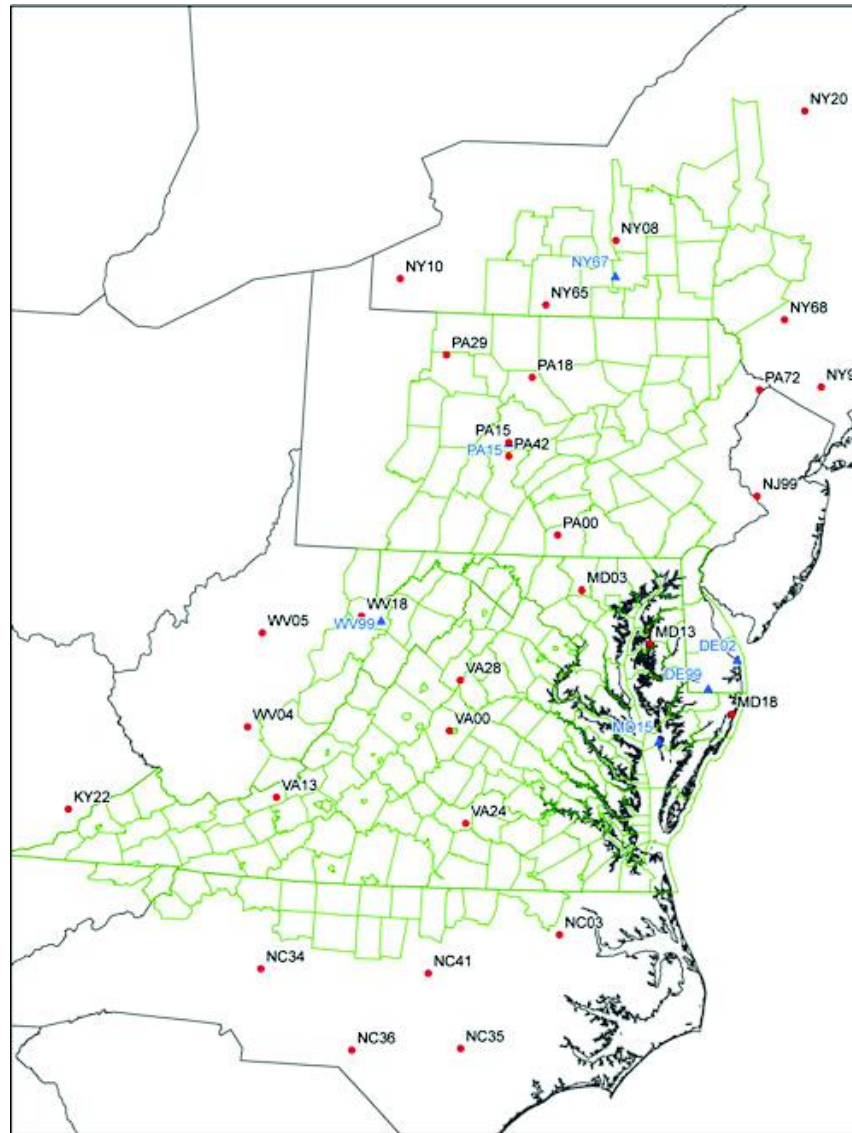
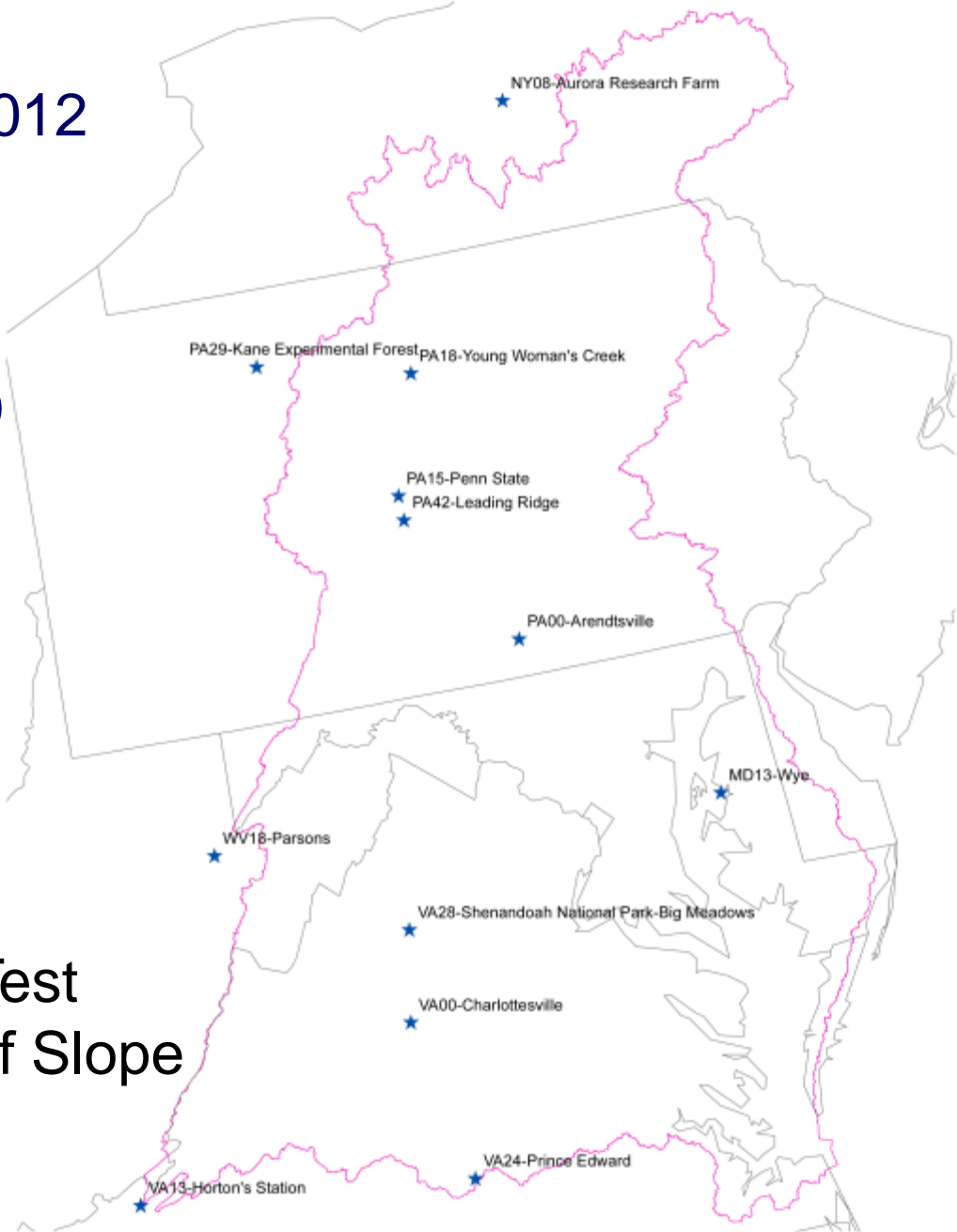


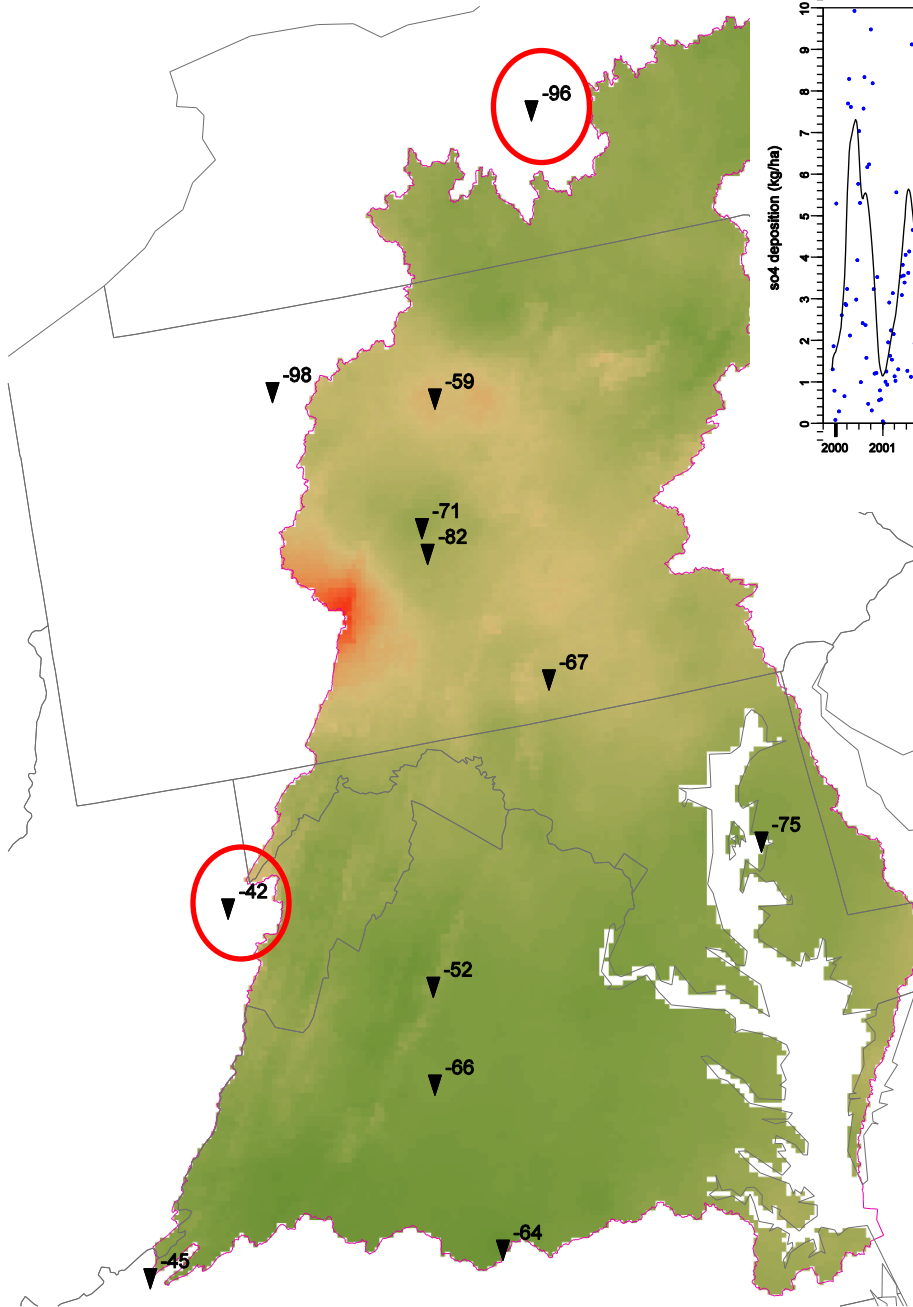
FIGURE 2. Locations of the 29 National Atmospheric Deposition Program/National Trends Network (circle) and 6 AIRMoN (triangle) Precipitation Chemistry Monitoring Sites Used for Development of the Wetfall Regression Model. Figure 2 also shows the land segments of the watershed model, which are the smallest spatial units of atmospheric deposition estimates used in the Chesapeake Total Maximum Daily Load (Shenk and Linker, this issue).

Wet Deposition Trends in Chesapeake Bay, 2000-2012

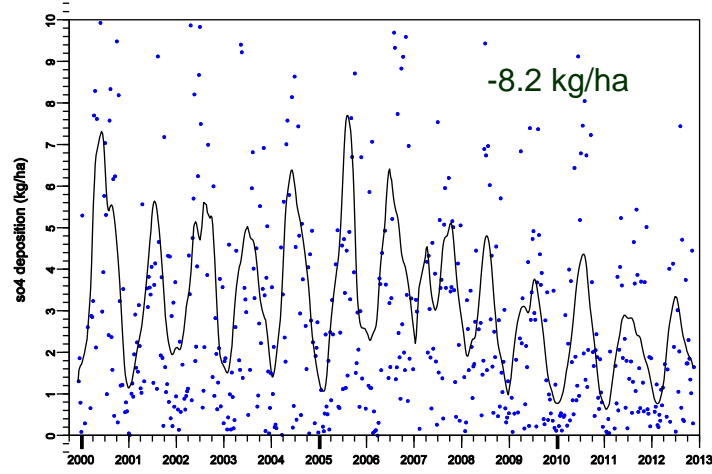
- SO_4
- NO_3
- NH_4
- Inorganic-N (NO_3+NH_4)



Seasonal Kendall Trend Test
Sen's Median Estimator of Slope



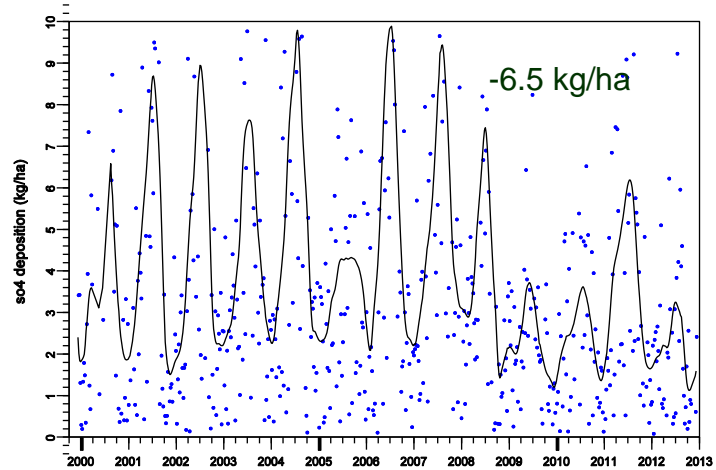
NY08



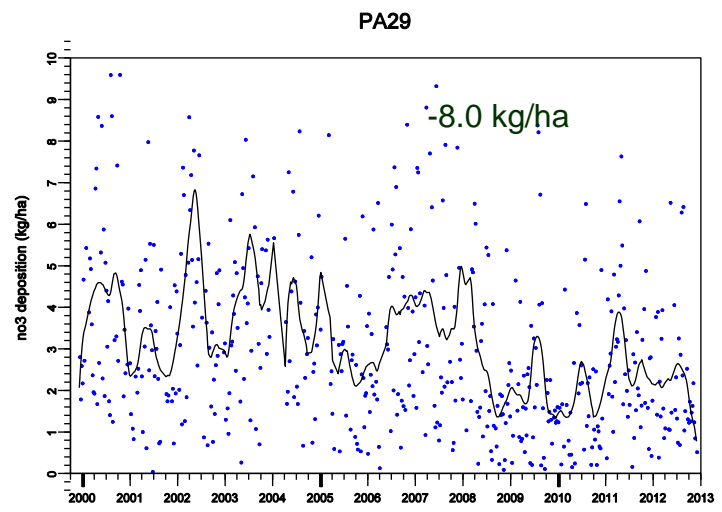
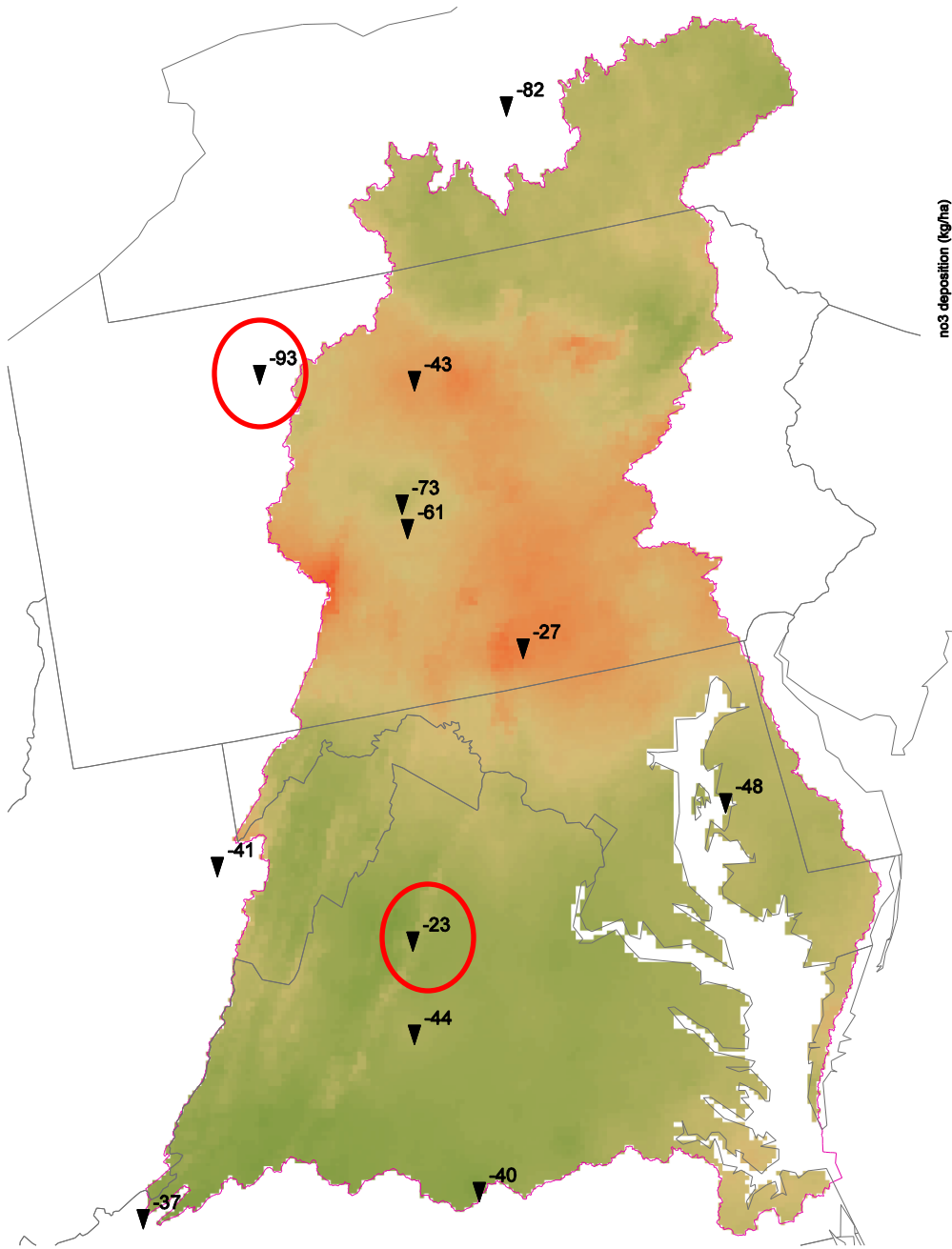
sition, 2012
- 2012

~22% of watershed has
deposition > 10 kg/ha-yr

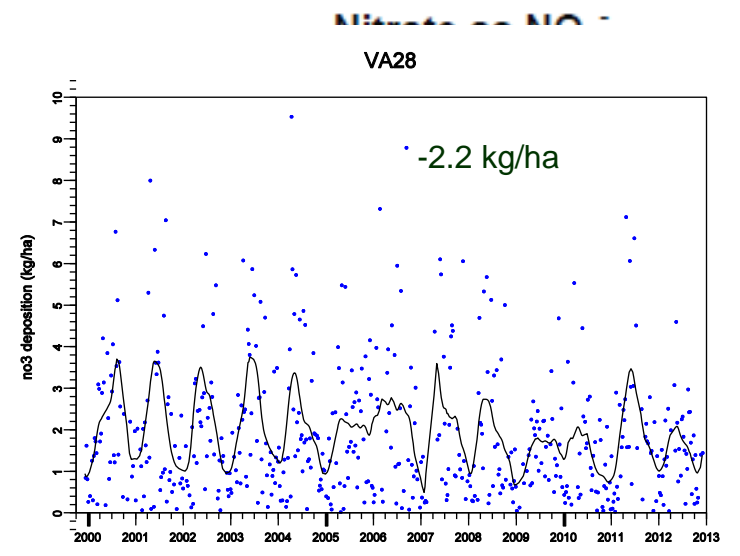
WV18



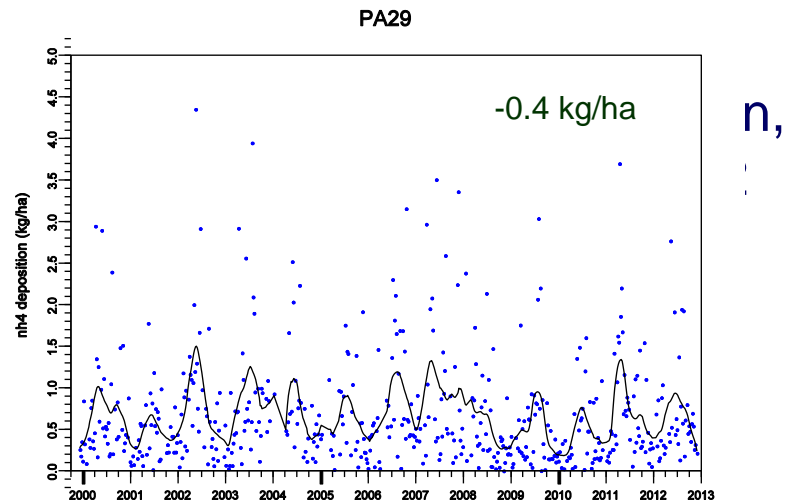
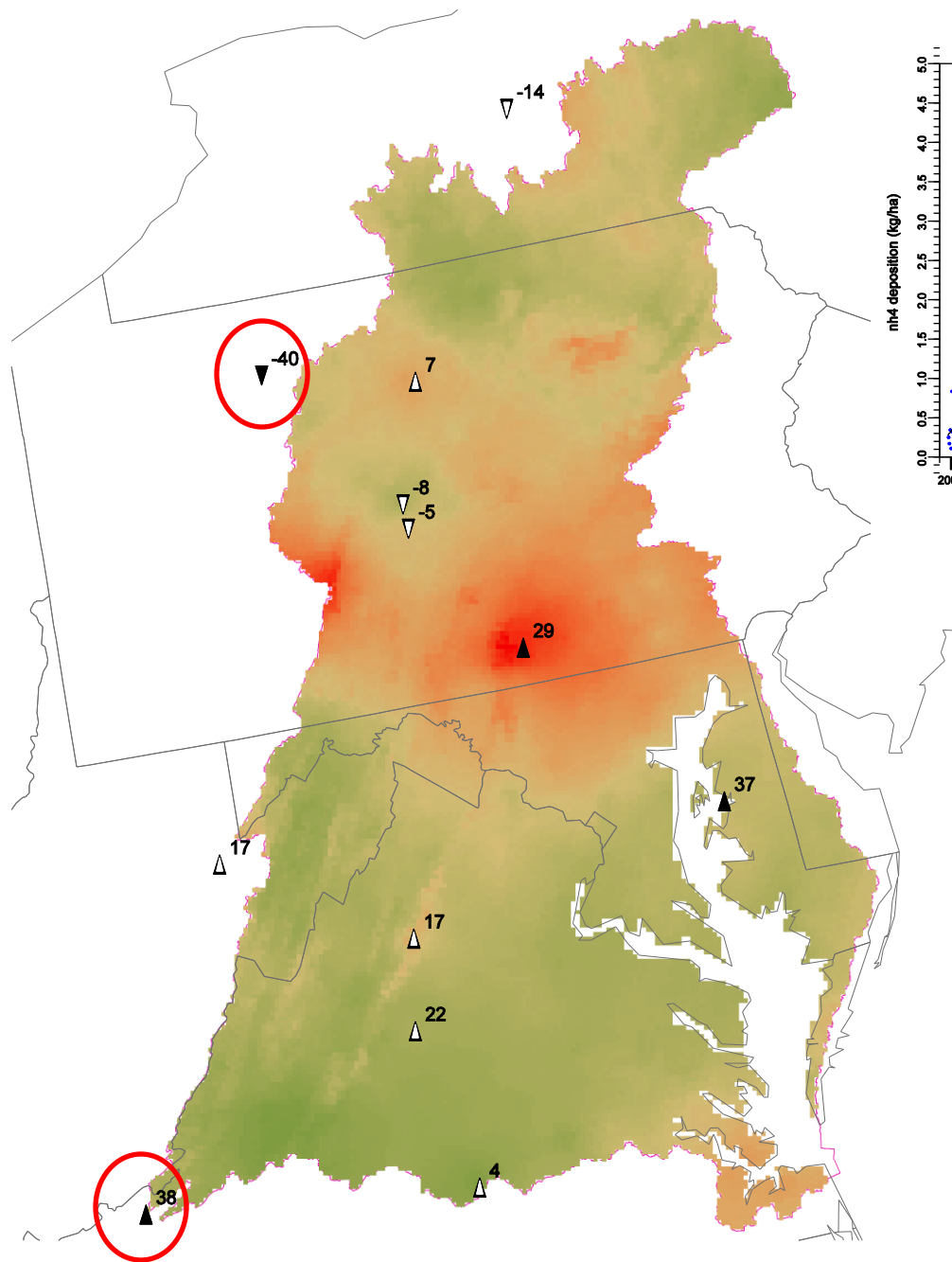
0 ▼ Trend, %



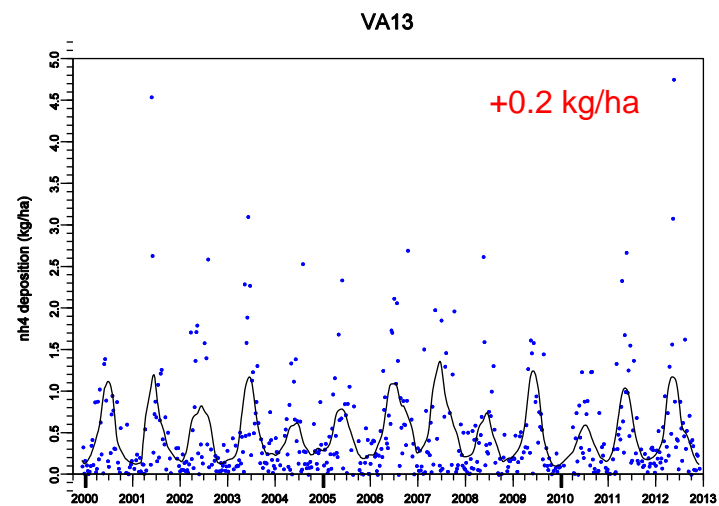
~29% of watershed has deposition > 10 kg/ha-yr



▼ Trend, %

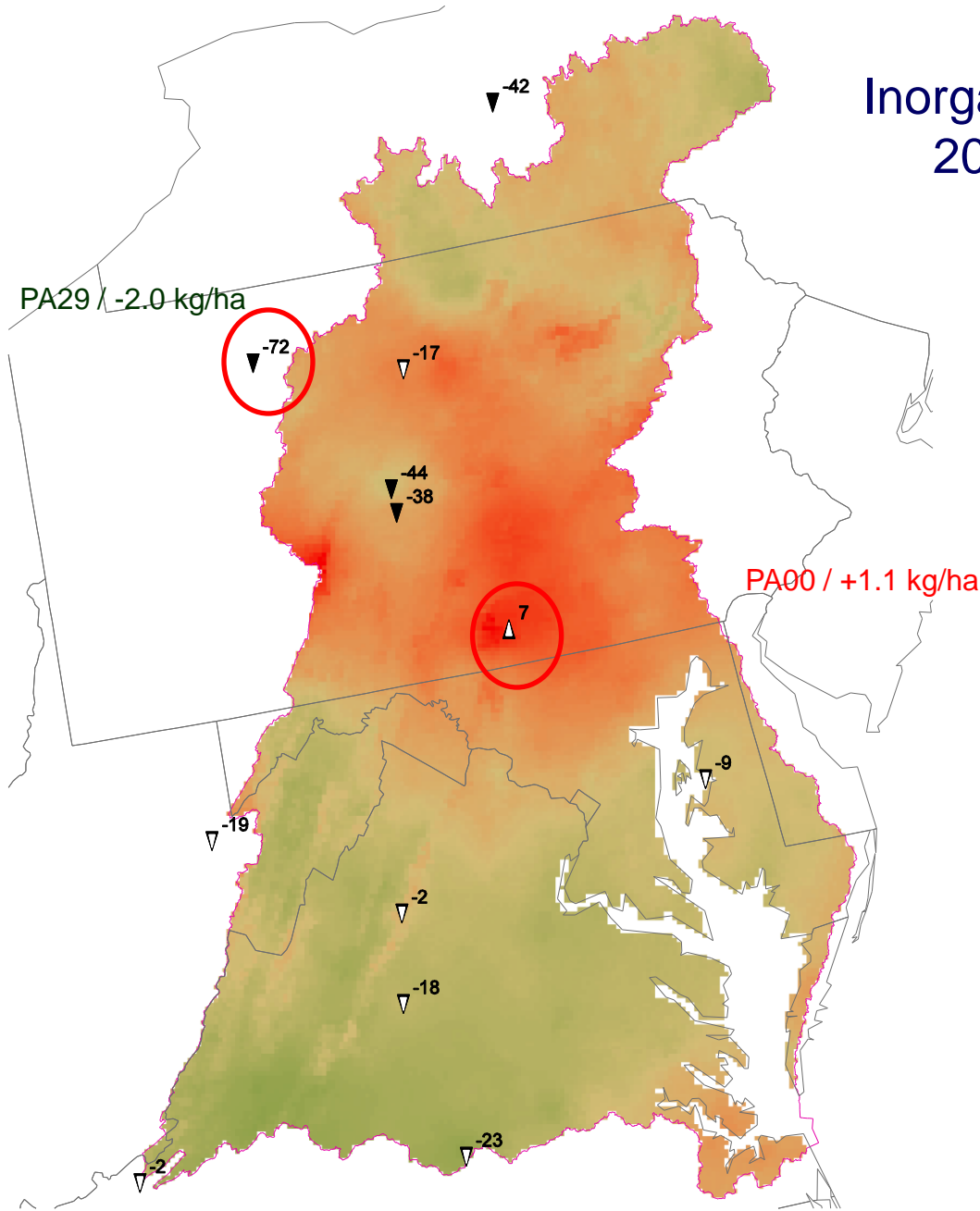


~1% of watershed has deposition > 5 kg/ha-yr



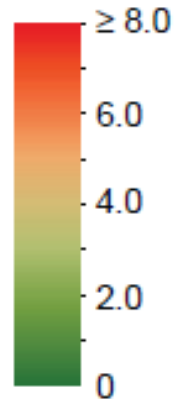
▼ Trend, %

Inorganic Nitrogen Wet Deposition, 2012 and Trend, 2000 -2012



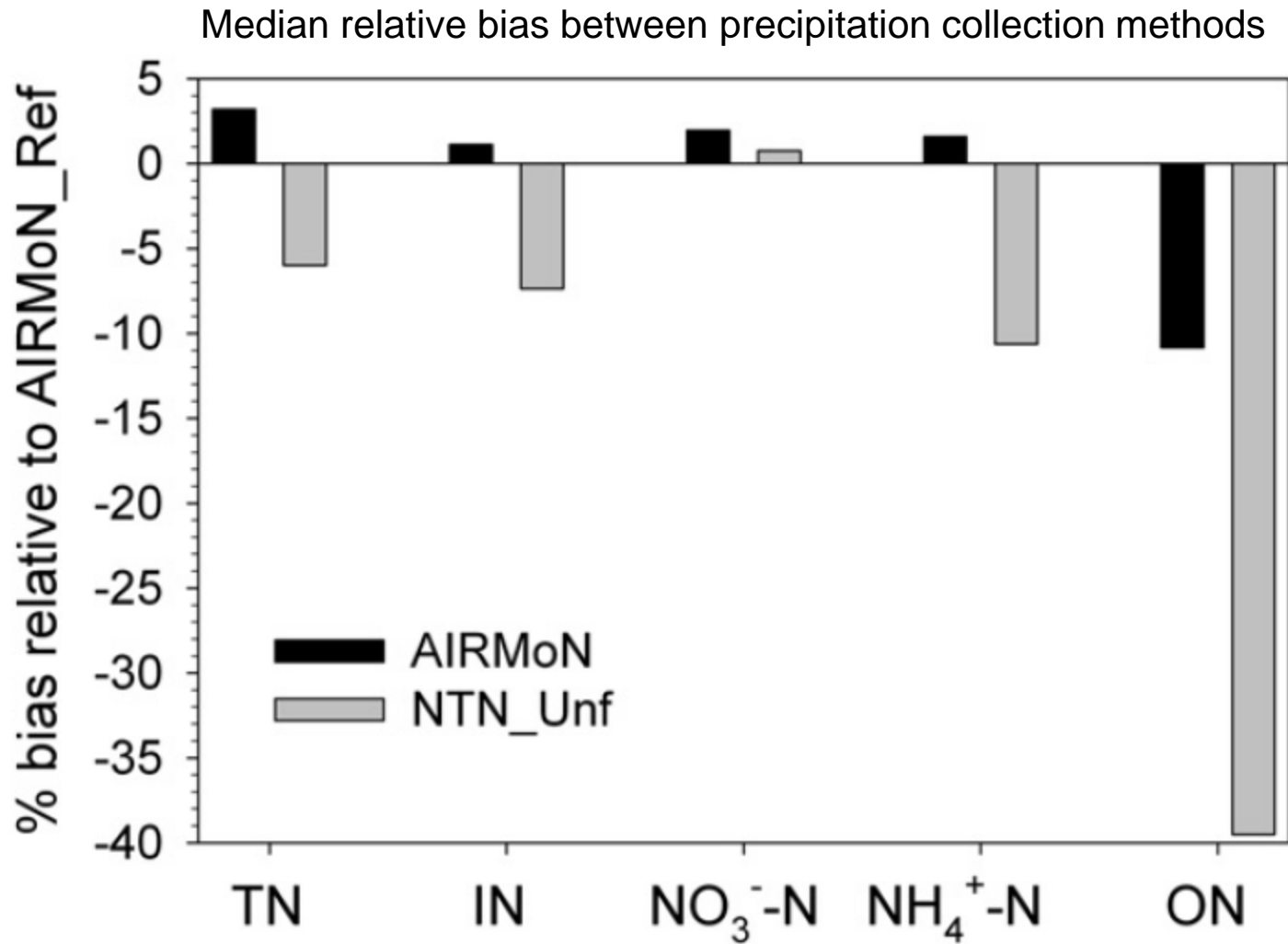
~25% of watershed has deposition > 5 kg/ha-yr

N
(kg/ha)



▼ Trend, %

Stability of Nitrogen in NADP Wet Deposition Samples



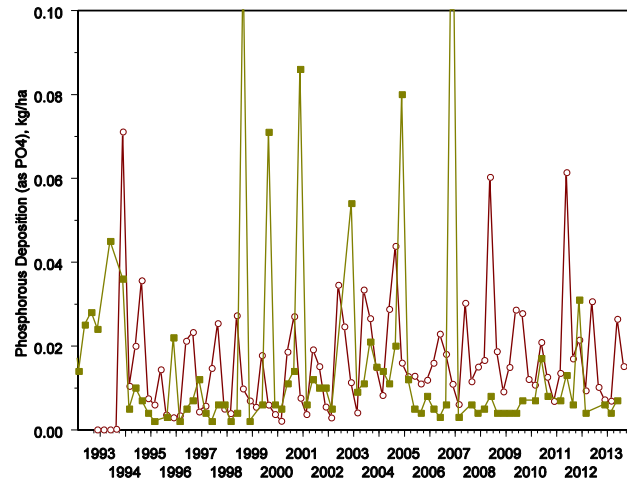
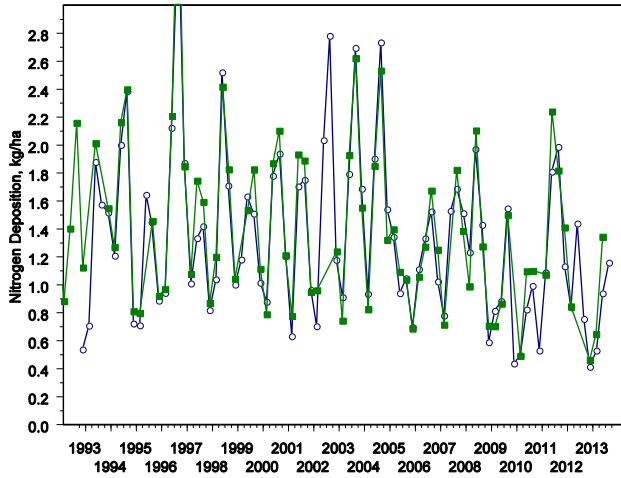
Stability of Nutrients (Inorg-N, PO₄)

Atmospheric Integrated Research Monitoring Network (AIRMoN)

Inorganic Nitrogen

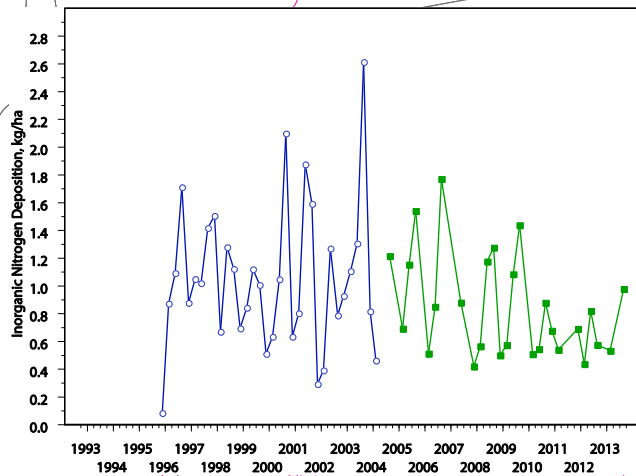
Orthophosphate

PA15

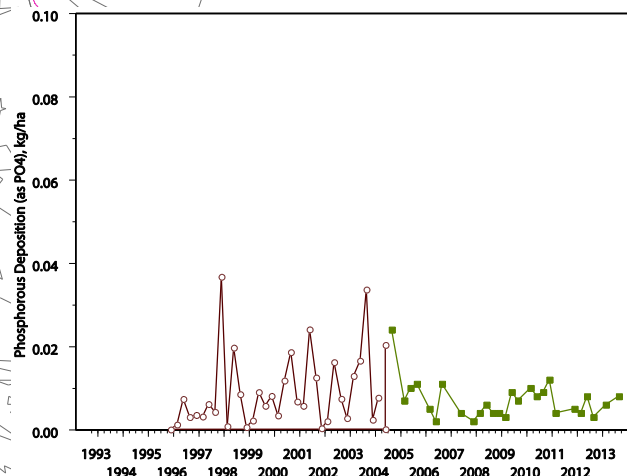


○ - AIRMoN (daily)
■ - NTN (weekly)

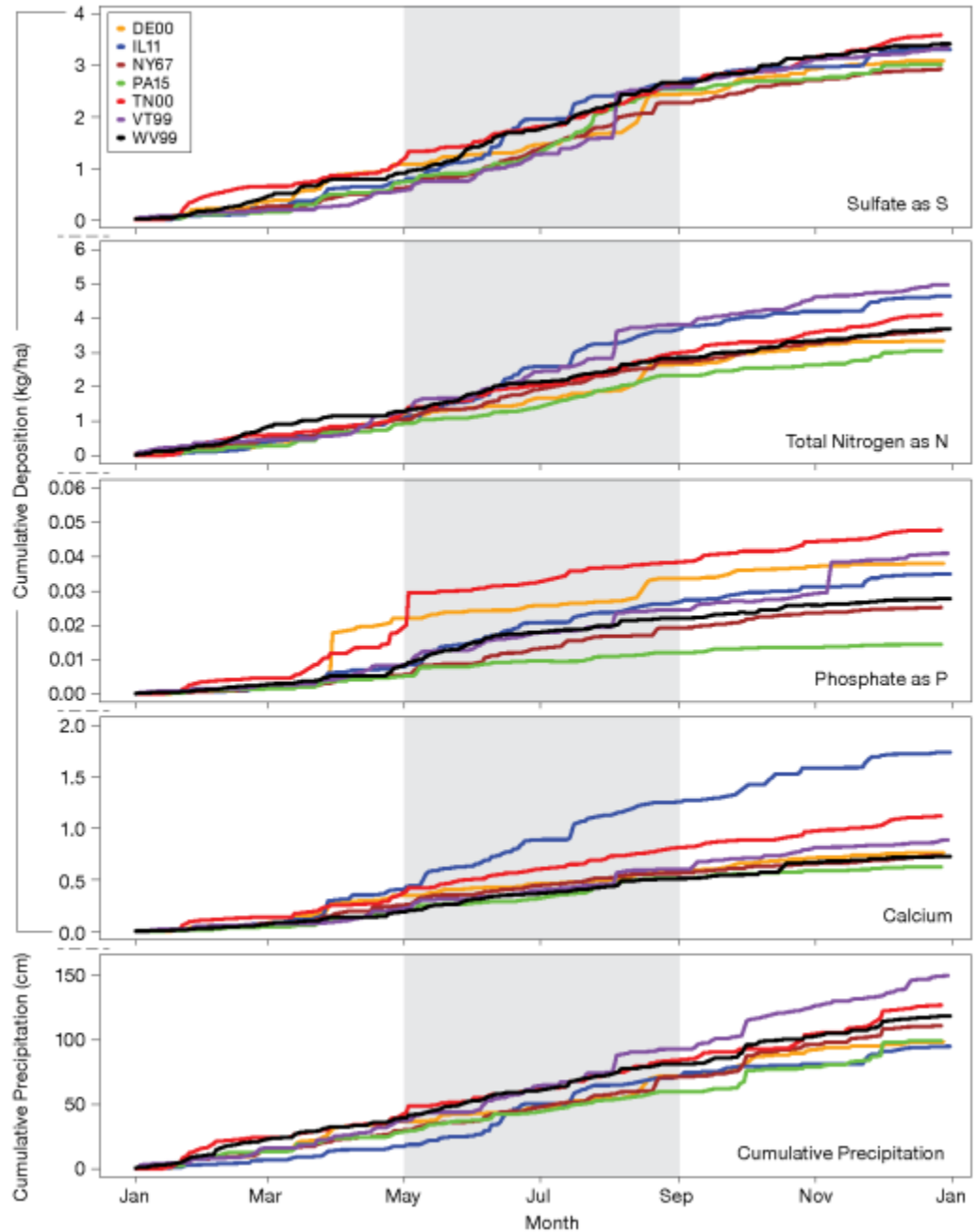
MD99



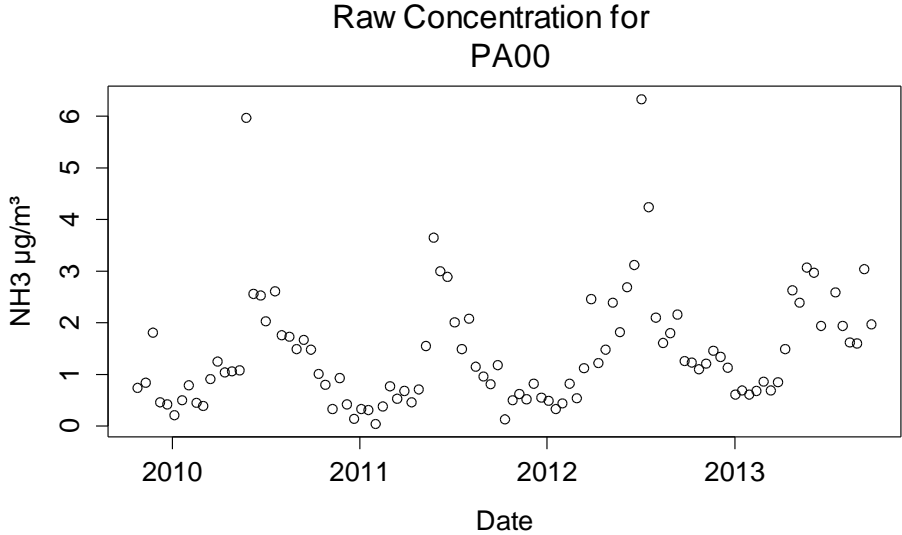
D99



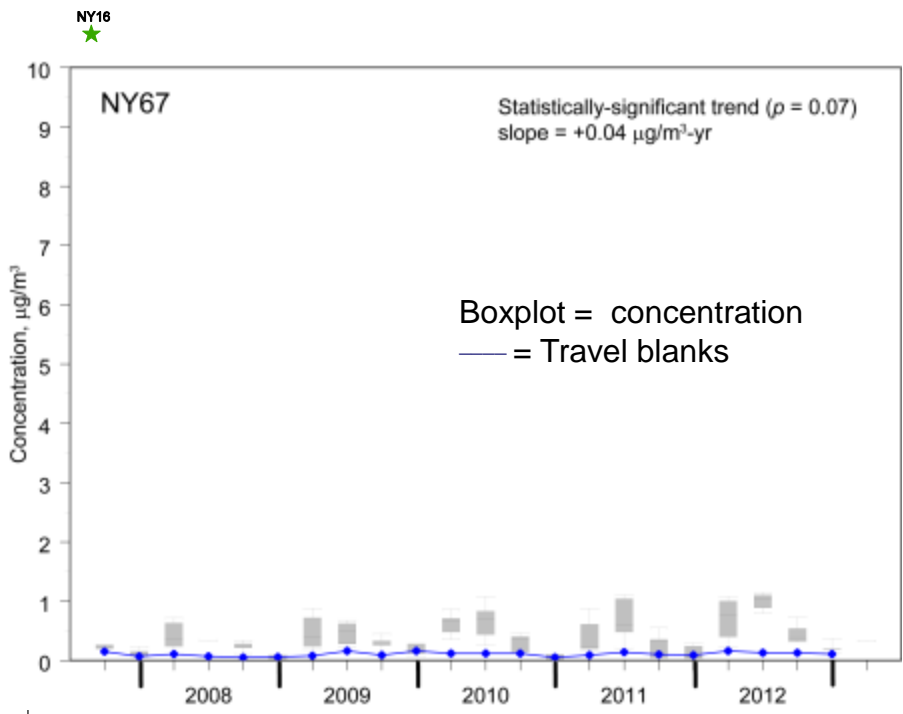
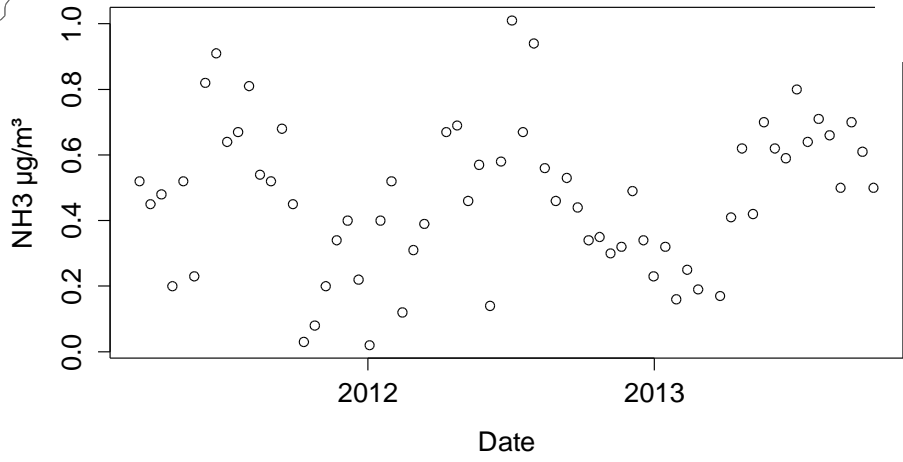
Deposition Accumulation During Year (AIRMoN)



Ammonia Monitoring Network (AMoN)



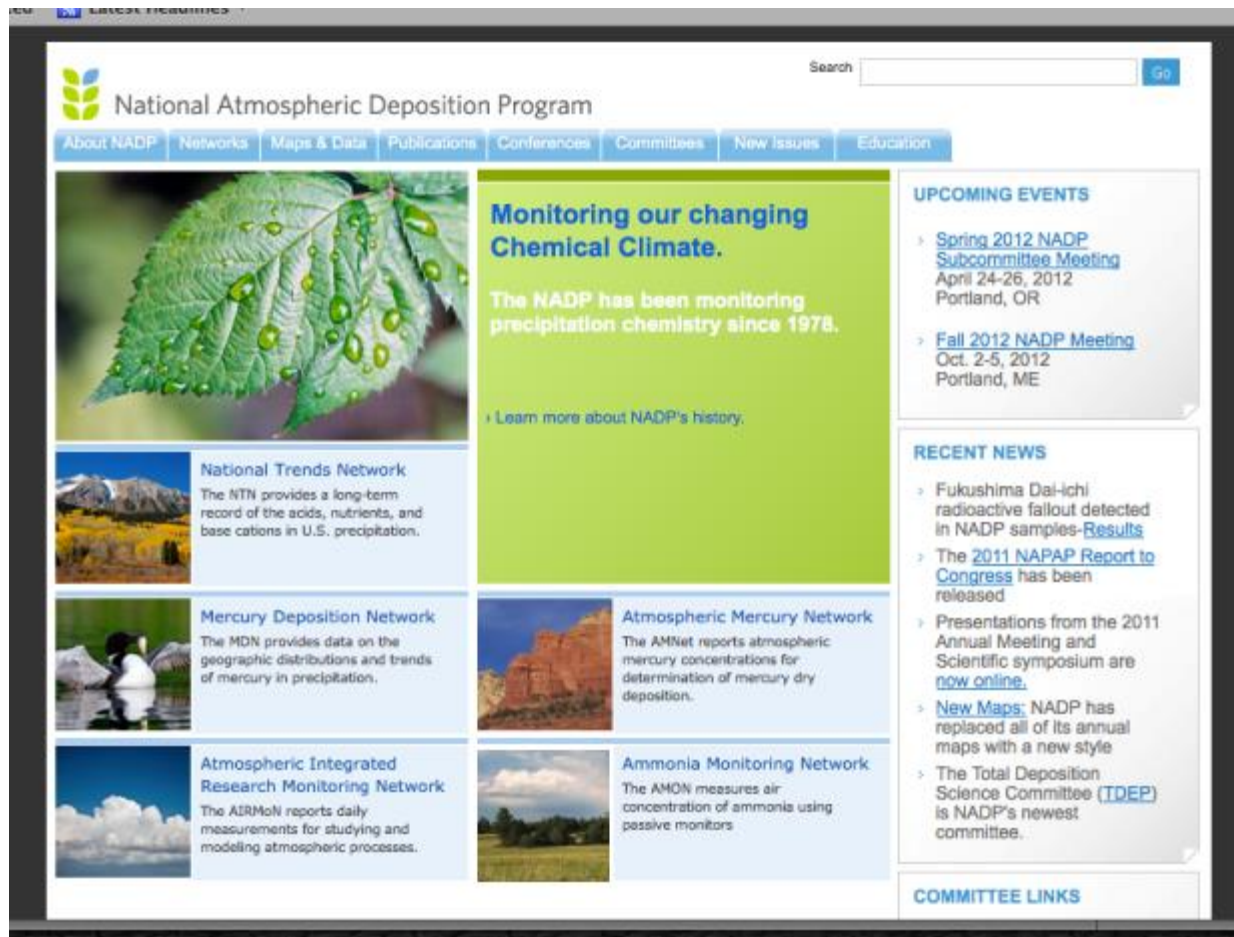
Raw Concentration for VA24



Concluding Remarks about Wet Deposition in Chesapeake Bay Region

- “Acid rain” is still a concern on an episodic basis in the Chesapeake Bay region
- Deposition is not a fixed, annual value!
 - Continued decreasing trends in SO_4/NO_3 through 2012
 - Regional increases in NH_4 and Inorg-N
 - Deposition is episodic
- NADP measurements have bias due to sampling methods (nitrogen, phosphorous losses)

For more information, see
<http://nadp.isws.illinois.edu> or email
clehmann@illinois.edu



The screenshot shows the homepage of the National Atmospheric Deposition Program (NADP). At the top, there is a search bar and a navigation menu with links for About NADP, Networks, Maps & Data, Publications, Conferences, Committees, New Issues, and Education. The main content area is divided into several sections:

- Monitoring our changing Chemical Climate.** A large green box with a leaf image. Text: "The NADP has been monitoring precipitation chemistry since 1978." and a link to "Learn more about NADP's history."
- UPCOMING EVENTS** (Right sidebar):
 - Spring 2012 NADP Subcommittee Meeting, April 24-26, 2012, Portland, OR
 - Fall 2012 NADP Meeting, Oct. 2-5, 2012, Portland, ME
- RECENT NEWS** (Right sidebar):
 - Fukushima Dai-ichi radioactive fallout detected in NADP samples - [Results](#)
 - The [2011 NAPAP Report to Congress](#) has been released
 - Presentations from the 2011 Annual Meeting and Scientific symposium are [now online](#).
 - [New Maps](#): NADP has replaced all of its annual maps with a new style
 - The Total Deposition Science Committee ([TDEP](#)) is NADP's newest committee.
- COMMITTEE LINKS** (Bottom right sidebar)
- Networks** (Left sidebar):
 - National Trends Network**: The NTN provides a long-term record of the acids, nutrients, and base cations in U.S. precipitation. (Image: Mountains)
 - Mercury Deposition Network**: The MDN provides data on the geographic distributions and trends of mercury in precipitation. (Image: Penguin)
 - Atmospheric Mercury Network**: The AMNet reports atmospheric mercury concentrations for determination of mercury dry deposition. (Image: Red rock landscape)
 - Ammonia Monitoring Network**: The AMON measures air concentration of ammonia using passive monitors. (Image: Field)
 - Atmospheric Integrated Research Monitoring Network**: The AIRMoN reports daily measurements for studying and modeling atmospheric processes. (Image: Clouds)