

Mercury Deposition Network Results and Plans

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NATIONAL ATMOSPHERIC DEPOSITION PROGRAM

A Cooperative Research Support Program of the
State Agricultural Experiment Stations (NRSP-3)
Federal and State Agencies
and Private Research Organizations



ILLINOIS

Illinois State
WATER
Survey (1895)

Goal of this Presentation....

- A *short* introduction to the
Mercury Deposition Network.
- A description what we know about the
deposition of mercury and trends
- Plans for estimation of Dry Deposition



What is the *Mercury Deposition Network*?

- A Cooperative Research Program
 - Part of National Atmospheric Deposition Network
 - 105 sites
 - Federal, State, Local and Tribal Governments members, private organizations
 - Measuring wet deposition of mercury

- *Our Charge:*
 - *to determine if trends exist in wet deposition of mercury over time*



Federal Agency Members



The National Park Service

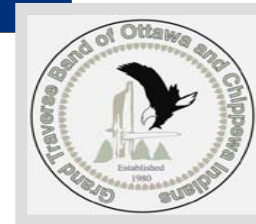


USDA
Forest Service

*Caring for the Land and
Serving People*



States and Tribal Nations



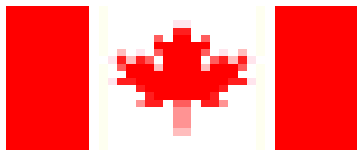
University Members



MIAMI UNIVERSITY

OXFORD, OHIO





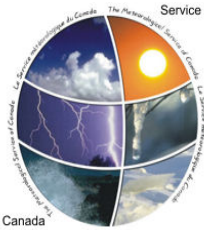
Environnement
Canada

Other Organizations and States

Environnement
Québec



MSC
Meteorological Service of Canada



Service météorologique du Canada
SMC



Audubon Center of the North Woods



Why monitor for Mercury in Precipitation?

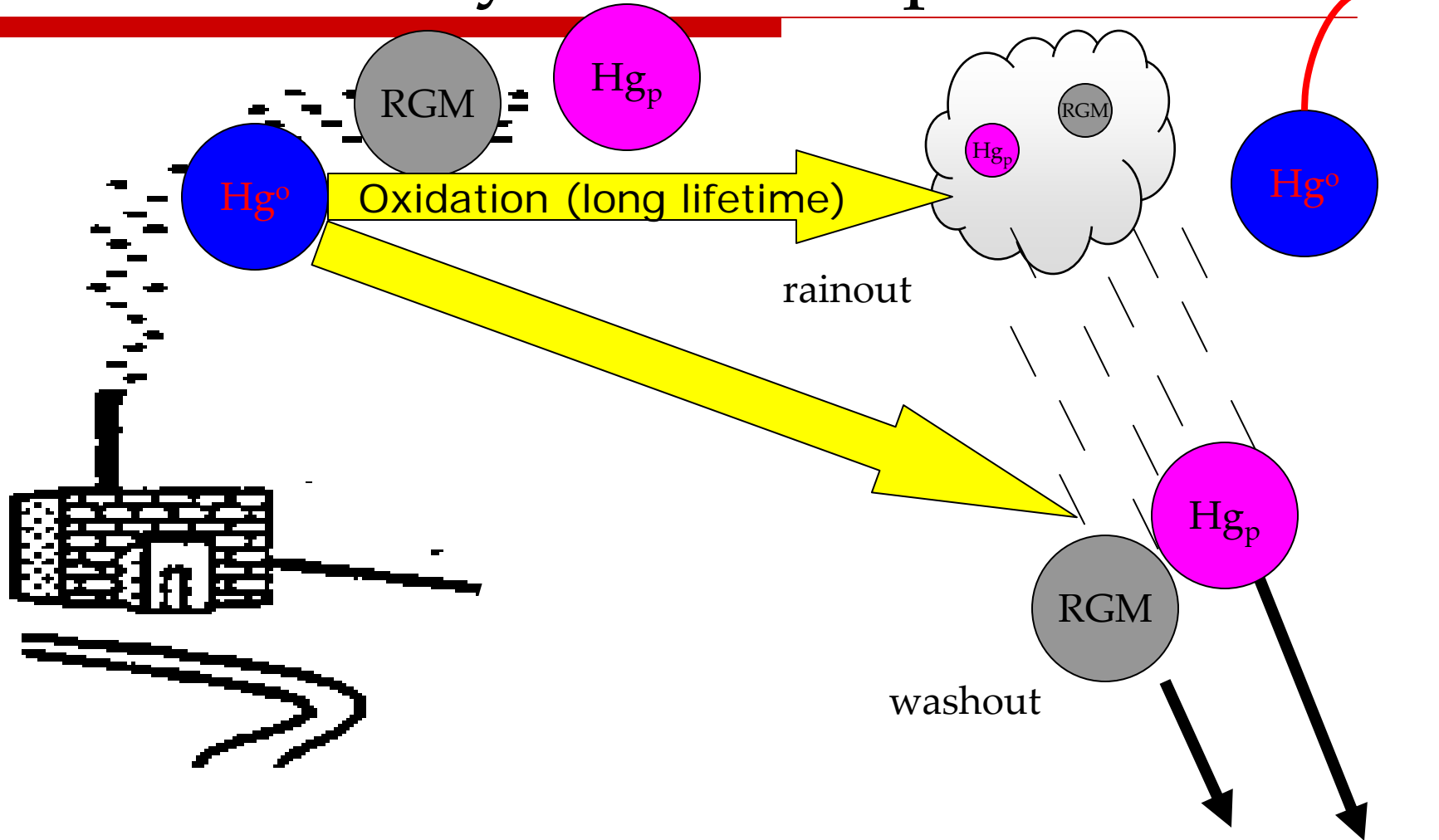
- Atmospheric transport and deposition is the **dominant** pathway to most aquatic ecosystems.
 - Between **40 and 75%** of the mercury input to lakes and streams **is by wet deposition**
 - probably less in the West.

(Sorensen et al., 1997; Scherbatskoy et al., 1997; Lamborg et al., 1995; Mason et al., 1997; Landis and Keeler, 2002)

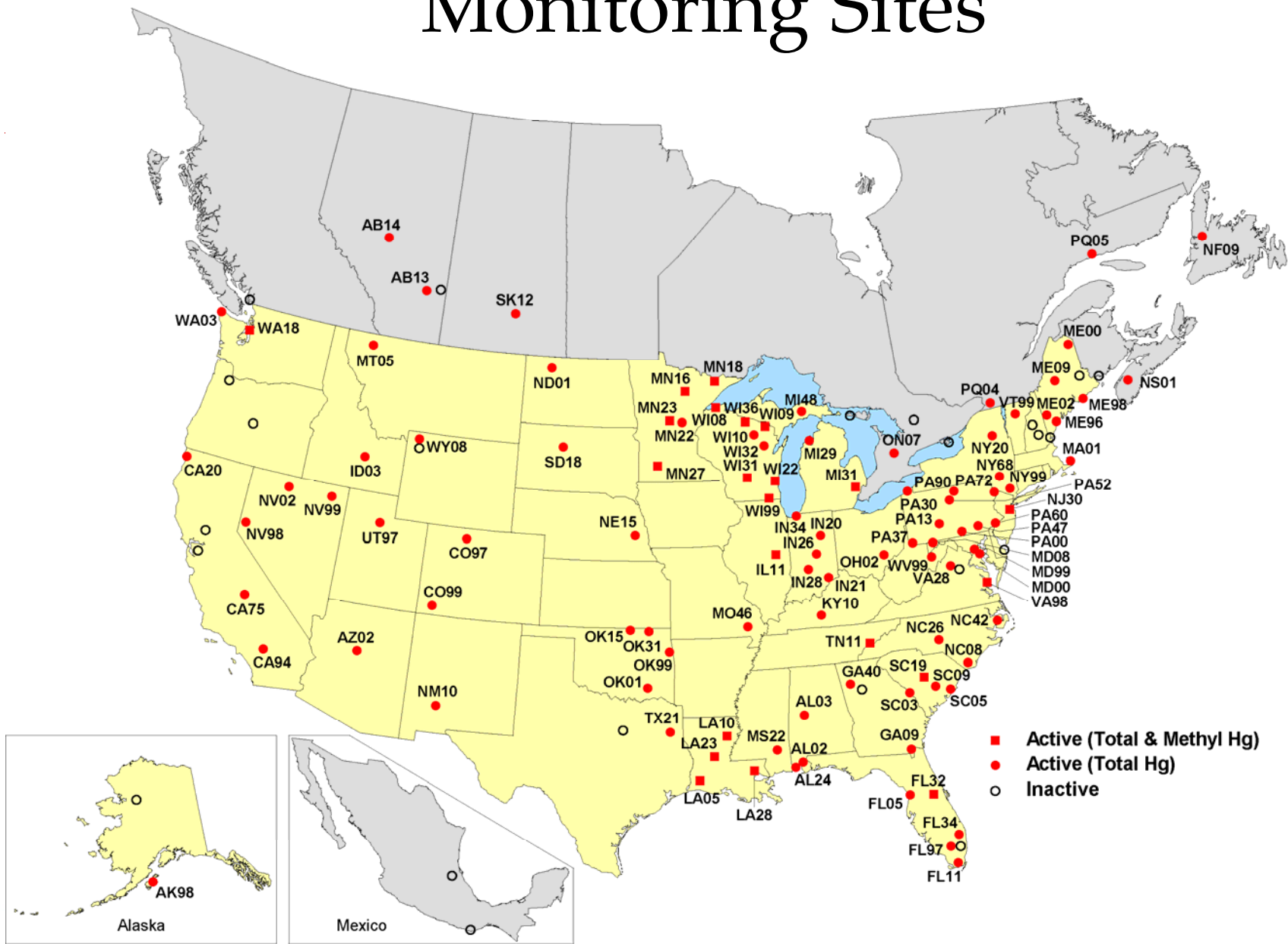
- **“New”** mercury is more likely converted to organic form than **“old”** mercury



How Mercury is Wet Deposited



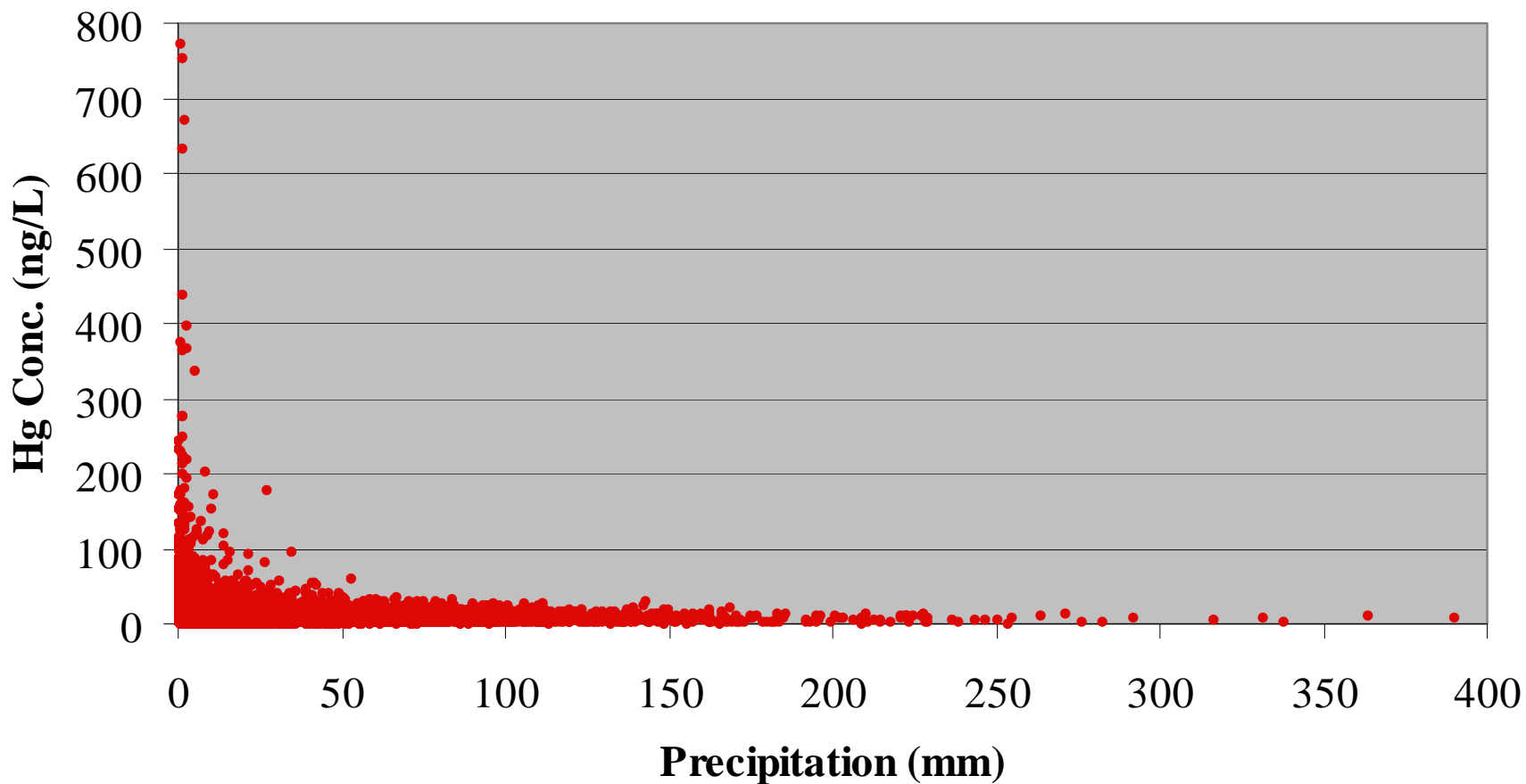
Monitoring Sites



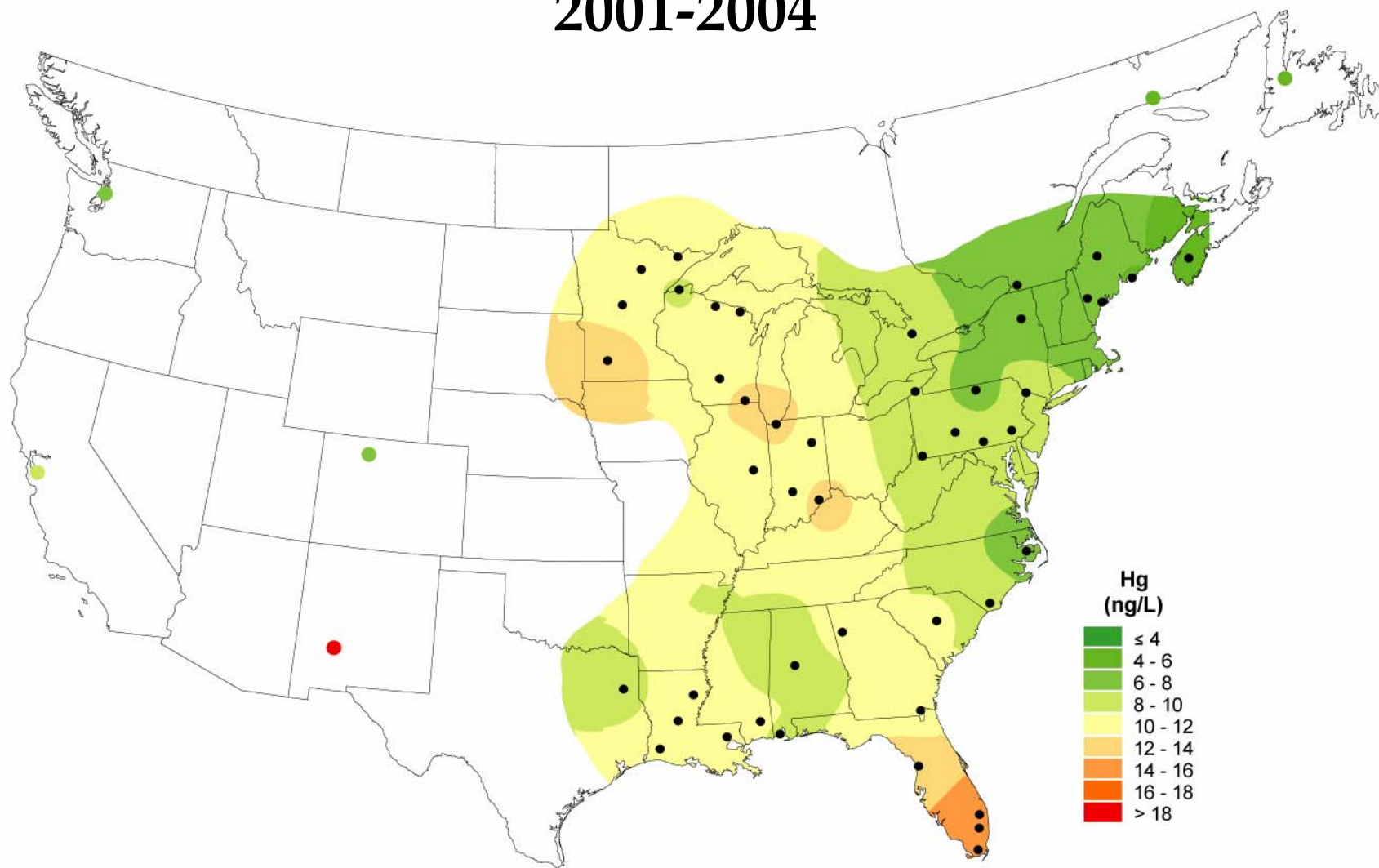
What the Data Show....



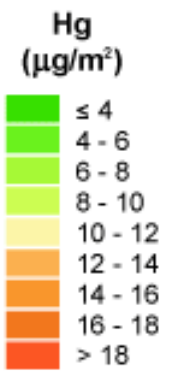
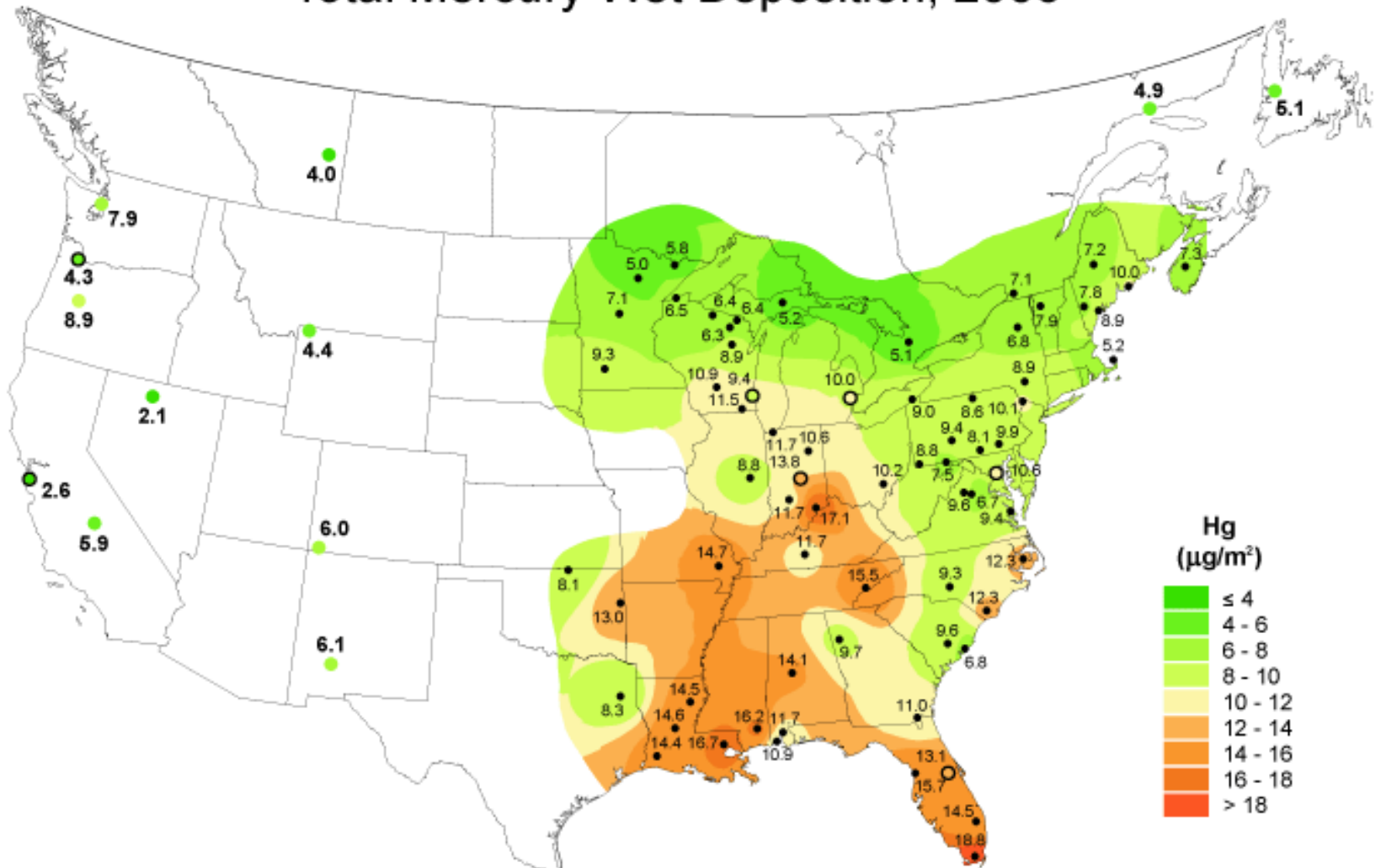
Weekly Total Mercury Concentration vs. Precipitation (1996 to 2005, n=25,681 valid samples)



Average Mercury Concentrations in Precipitation 2001-2004



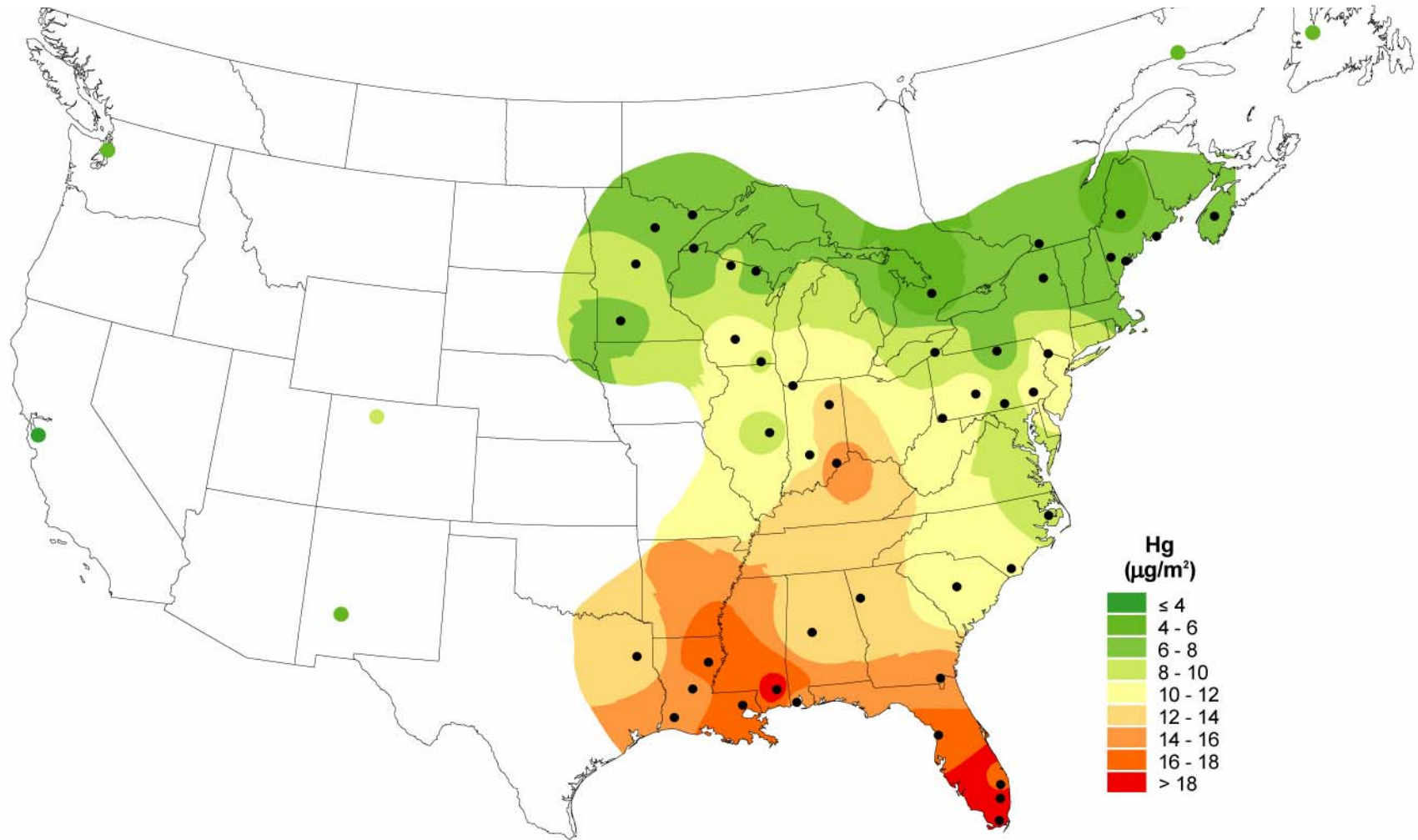
Total Mercury Wet Deposition, 2006



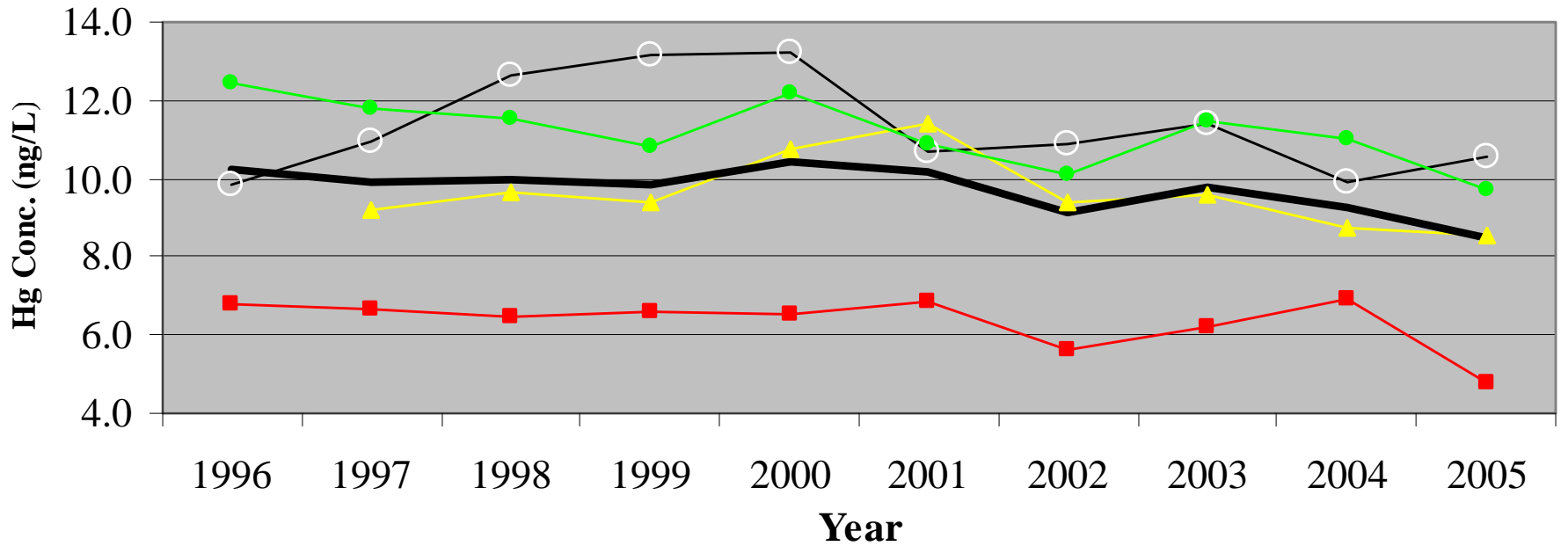
National Atmospheric Deposition Program/Mercury Deposition Network



Average Mercury Wet Deposition 2001 to 2004



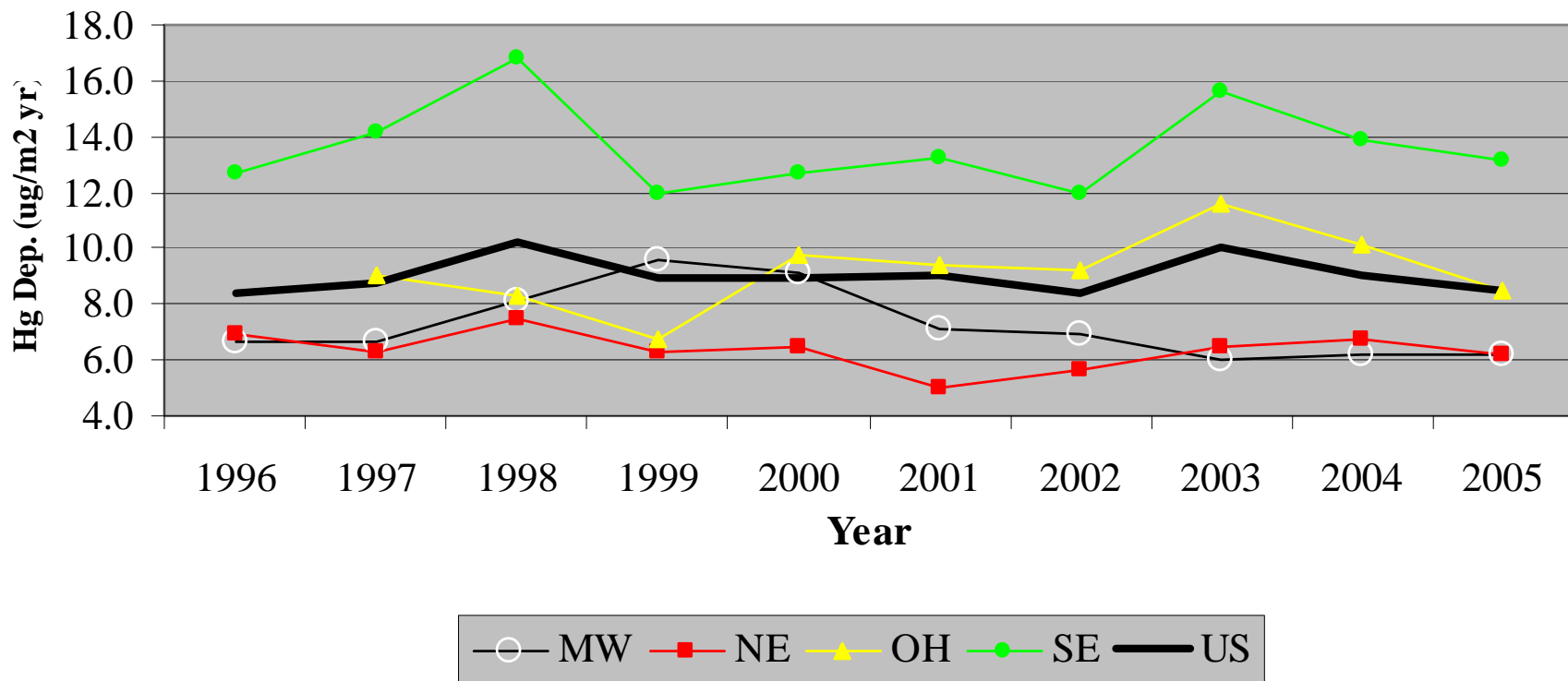
Yearly Average Mercury Concentration



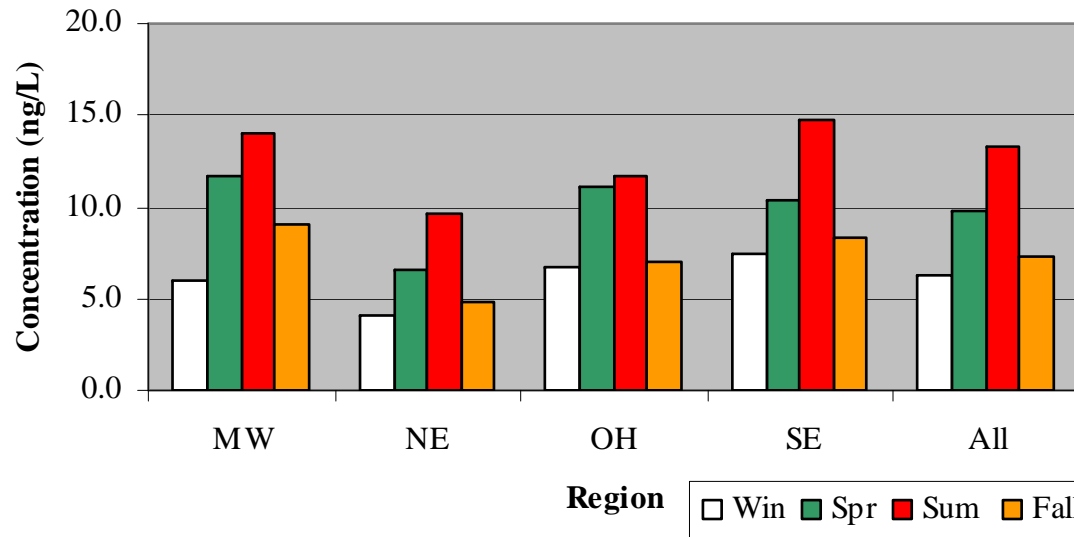
○ MW ■ NE ▲ OH ● SE — US



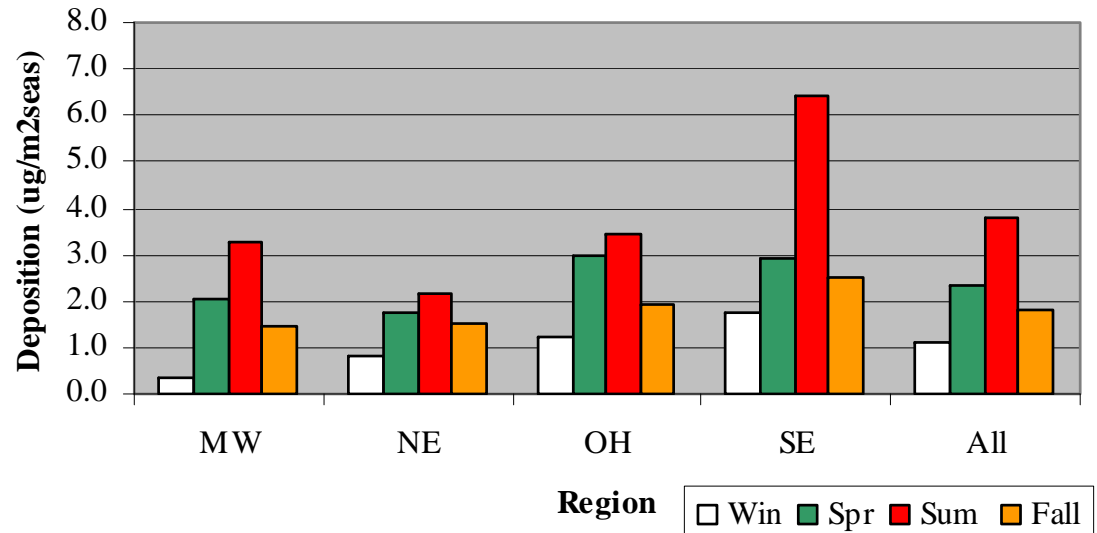
Yearly Average Mercury Deposition



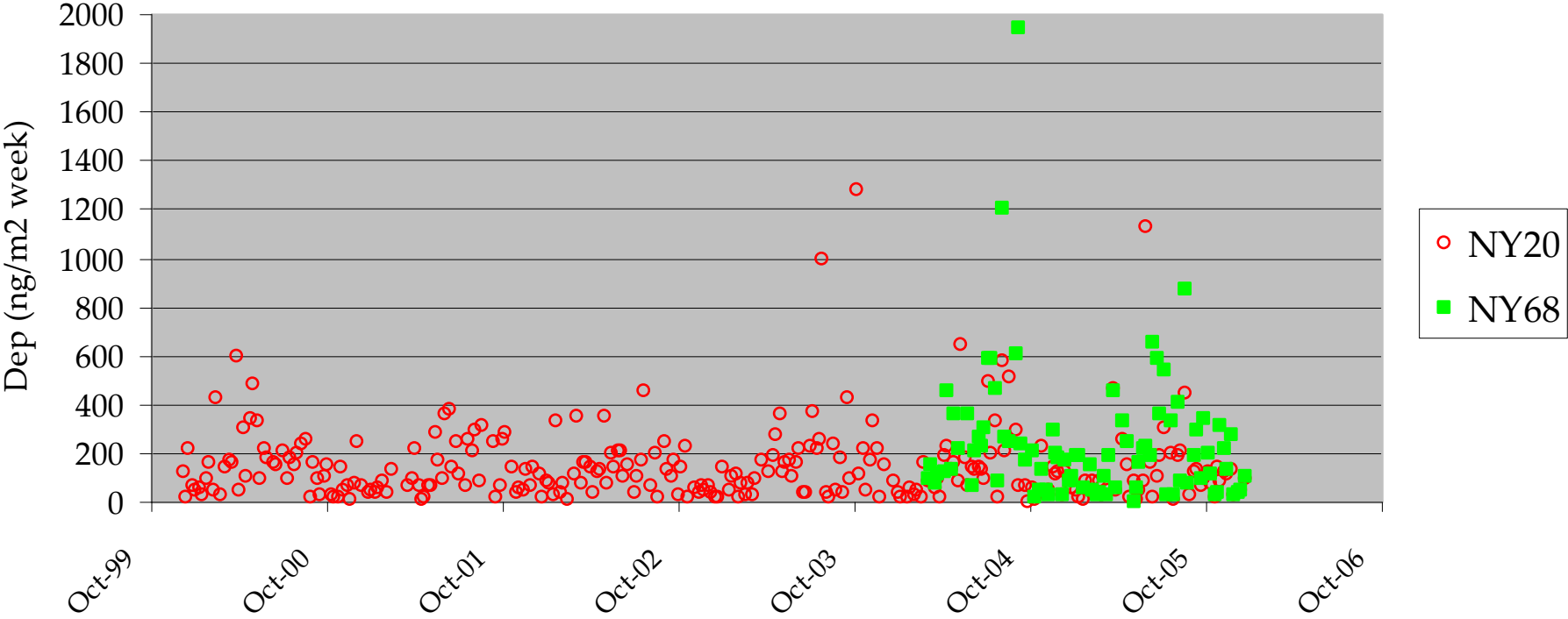
Regional Average Mercury Concentrations



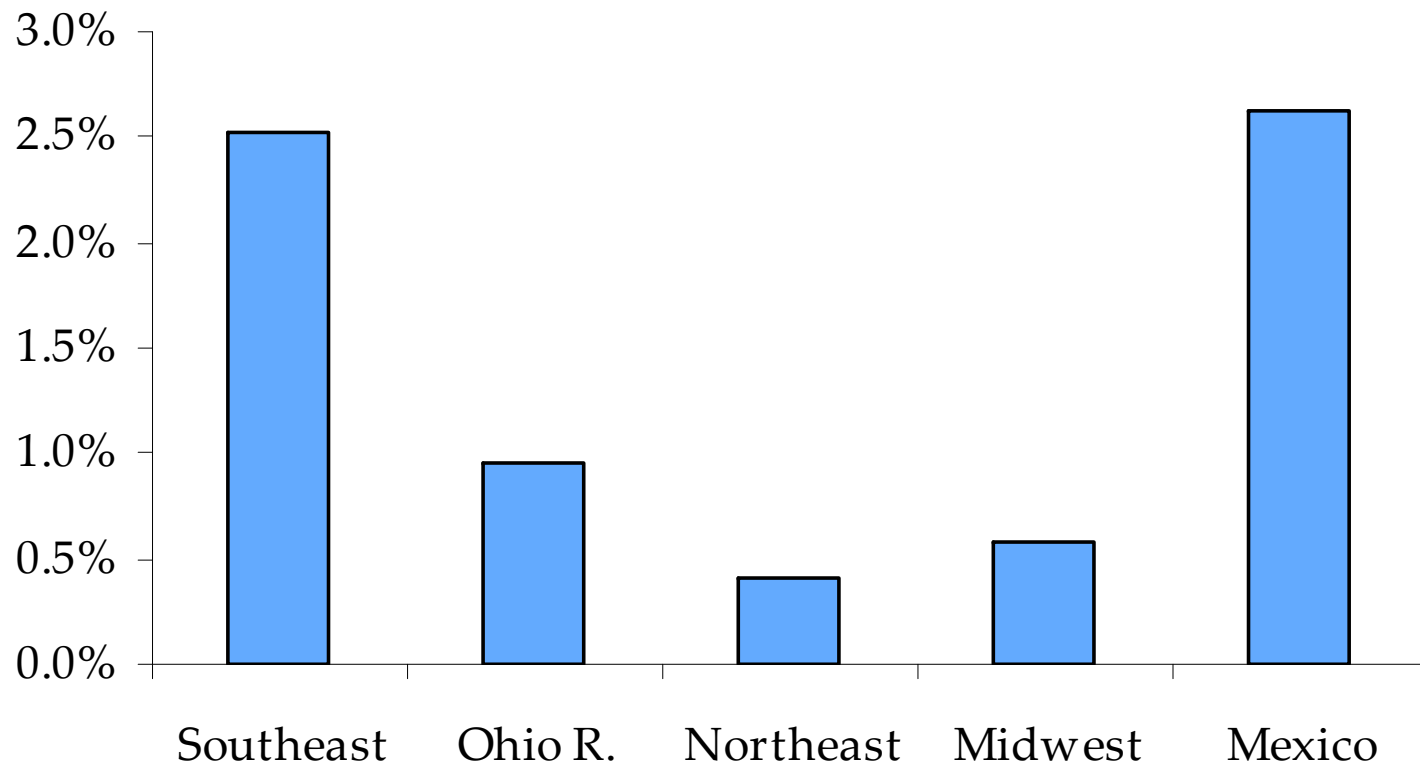
Regional Average Mercury Deposition



New York Weekly Depositions



Regional Rates of High Weekly Deposition (1500 ng per meter² week)



Trends In Wet Deposition



Trend Methods

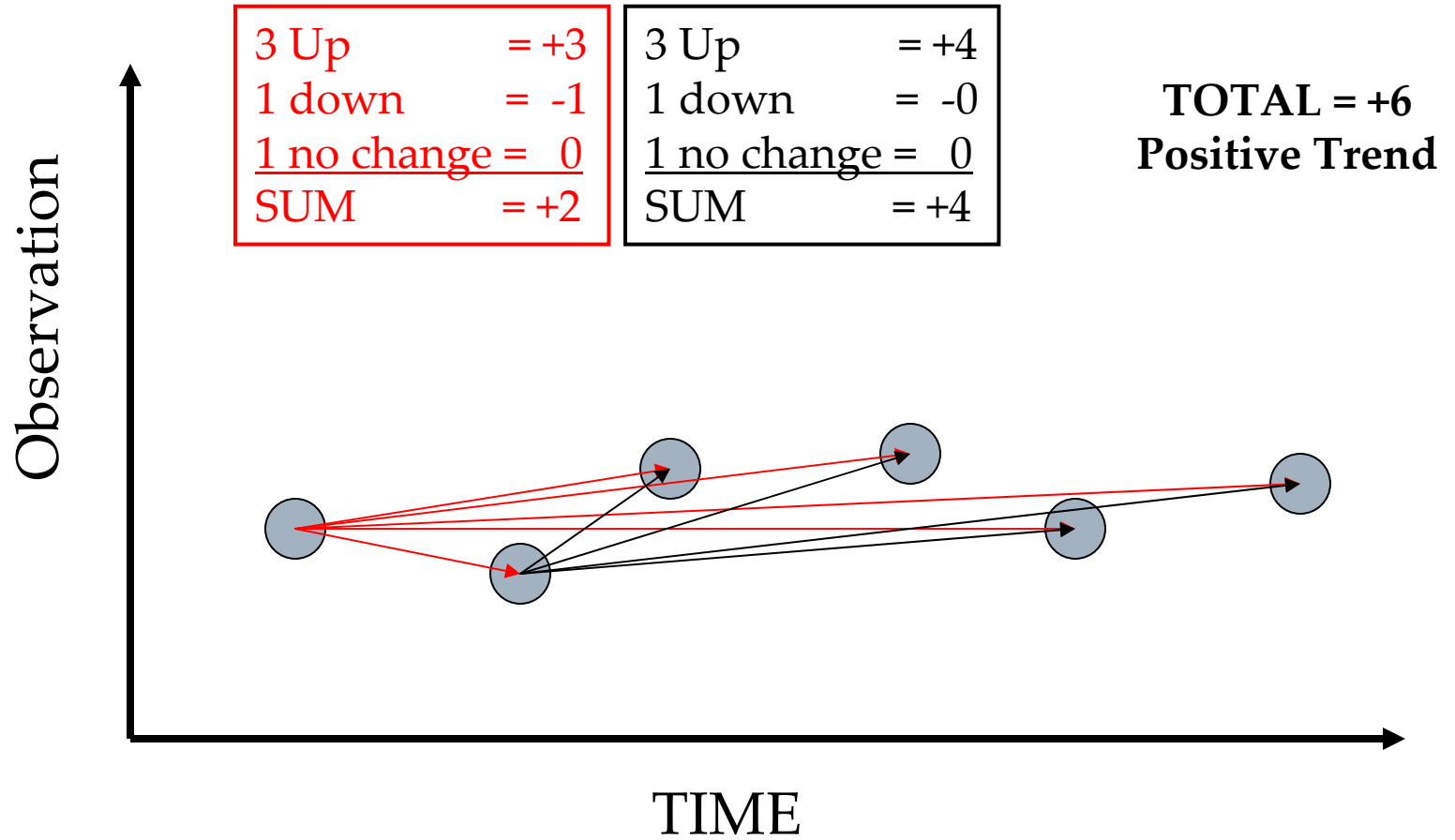
- Seasonal Kendall Test for Trends
- Seasonal Kendall Slope Estimator

- From the “Mann Kendall” as extended by van Belle and Hughes, 1984
- non-parametric, normality not assumed
- allows for seasonality and multiple stations
- allows for missing data
- from “Statistical Methods for Environmental Pollution Monitoring”, R. O. Gilbert, 1987

- Examines differences over time
 - Difference (obs1 – obs2) > 0, then =+1
 - < 0, then =-1
 - = 0, then = 0

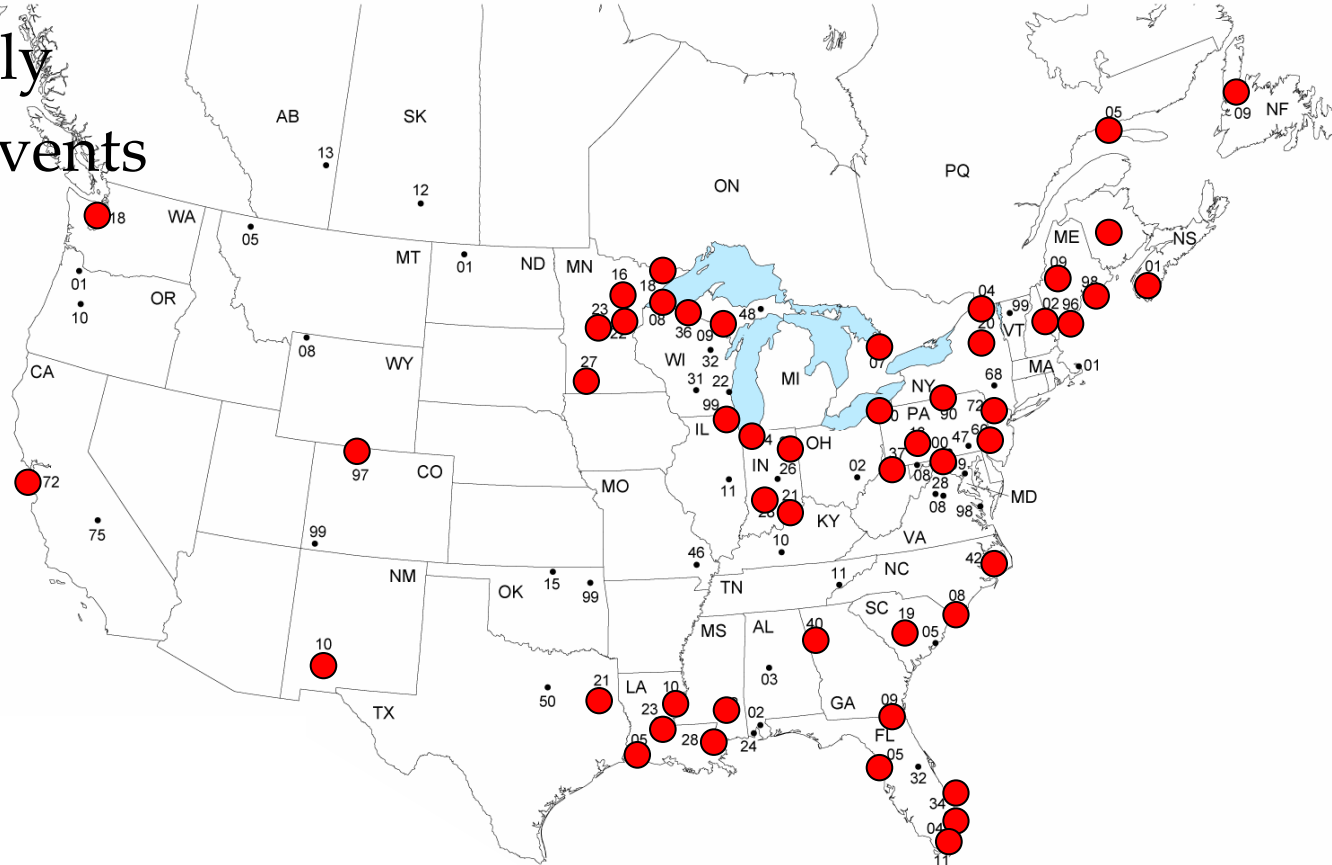


Seasonal Kendall Example

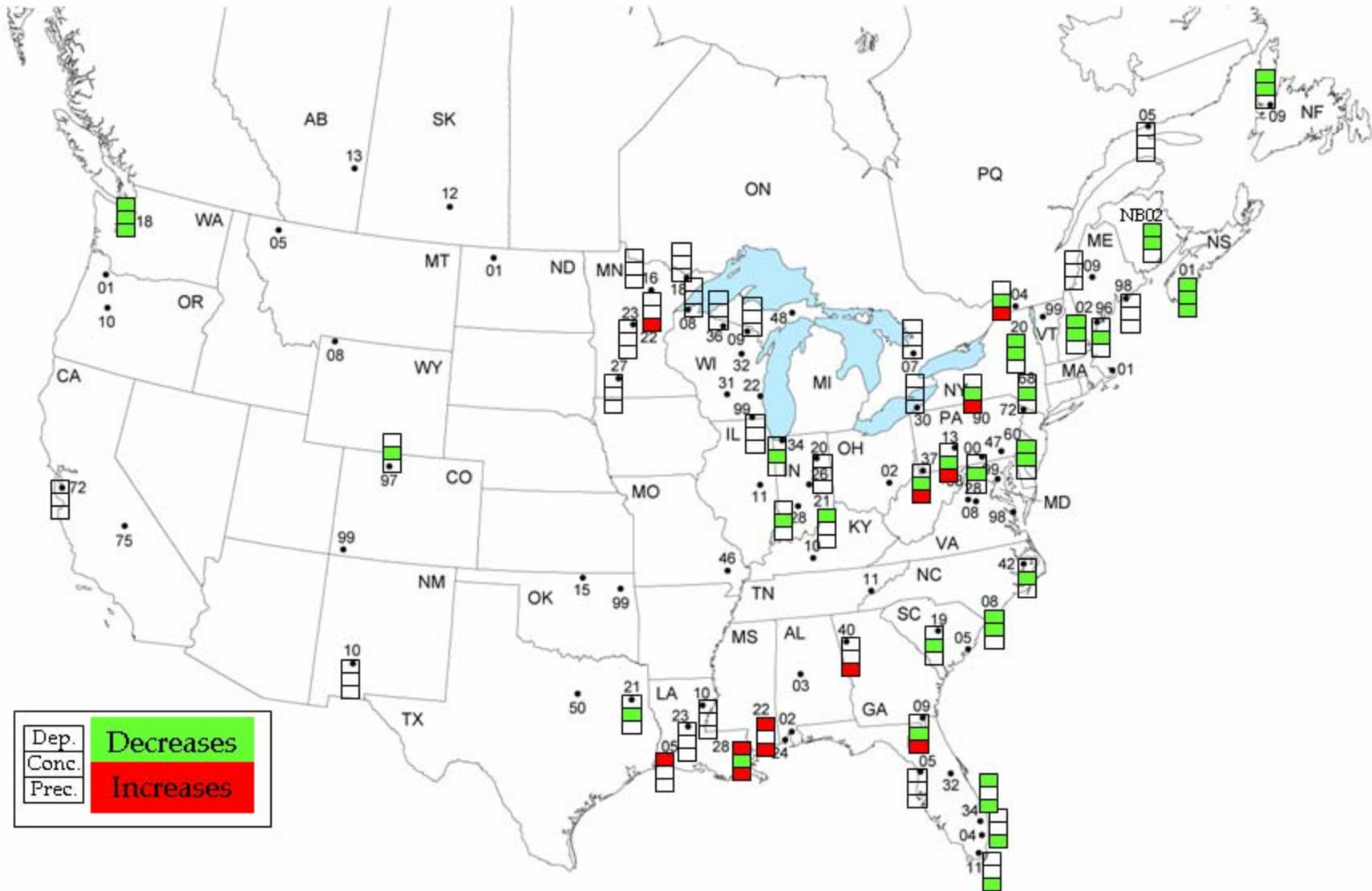


Conditions For Trend Tests

- At least 75% valid observations for 5 or more years
 - 1996 to 2005
- Run seasonally
- No “Trace” events



Trends in Mercury Concentrations



Dry Deposition

?



NADP Plans For Dry Deposition

- A Working Group Formed

Eric Prestbo
Martin Risch
David Schmeltz
Tim Sharac
David Gay

NADP Vice-Chair - Tekran
NADP NOS Chair - USGS
EPA Clean Air Markets Div.
EPA Clean Air Markets Div.
NADP-MDN Coordinator



Our Working Group Goal:

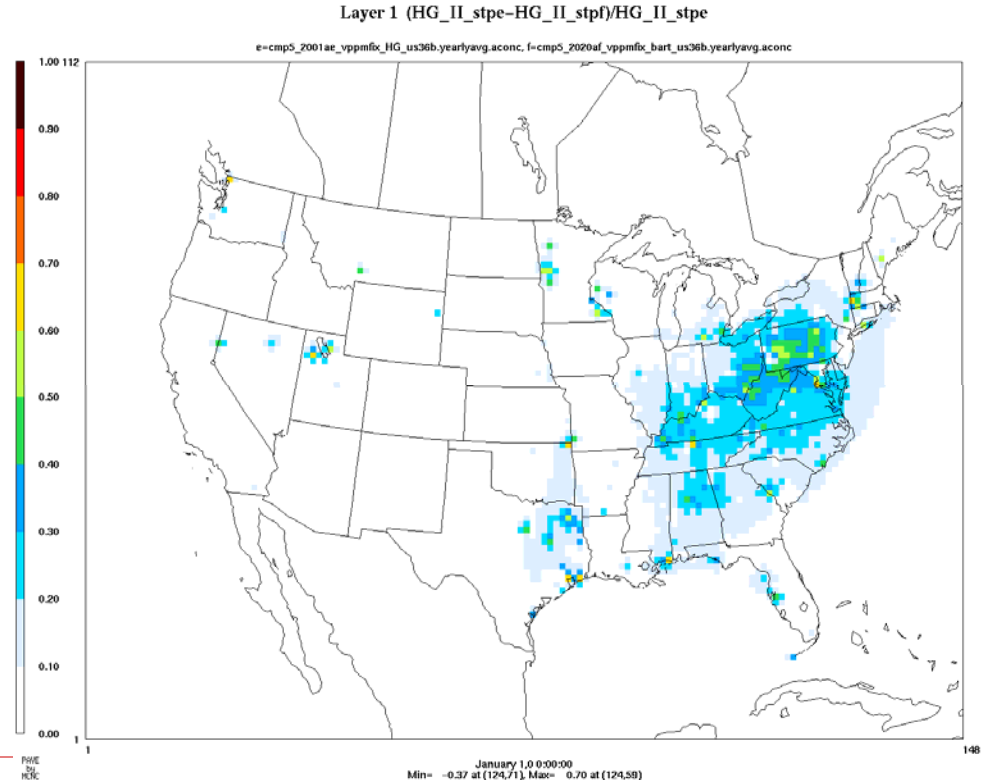
1. Review scientific methods for measuring or estimating dry deposition of Mercury,
2. Determine if these methods can be formalized into a network operation, and
3. Develop Plan
4. Present this network plan for possible NADP acceptance.



Emission Changes/Reductions are coming....

- Federal Changes
 - CAIR/CAMR (cap and trade)
- State Plans (including NY)
 - Facility specific Changes

Regardless of method
monitoring for the change is needed



(Figure courtesy of Russ Bullock, NOAA / EPA)



NADP to Propose a Method

- ❑ Measurement of Atmospheric Concentrations
- ❑ Estimate of losses and/or movement to the ground (deposition velocity)
- ❑ Result is modeled dry deposition from atmospheric concentrations



NADP's Role:

- ❑ standardized methods and operations,
- ❑ internal and external quality assurance,
- ❑ proven data management capability and timely data product web access (modeling data access),
- ❑ Field Support

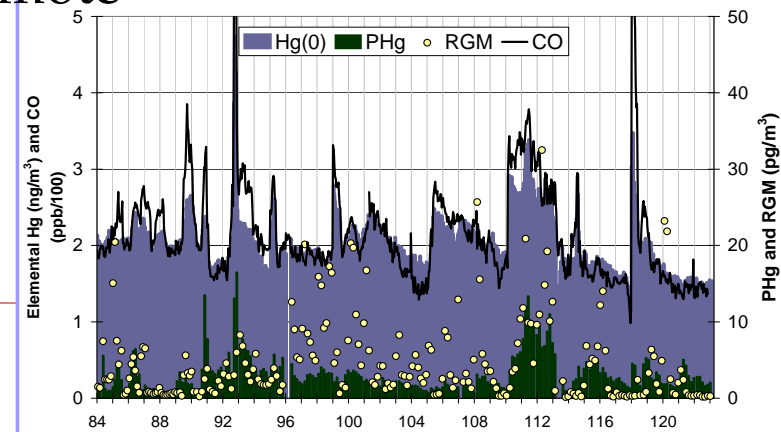


Measurement Plans

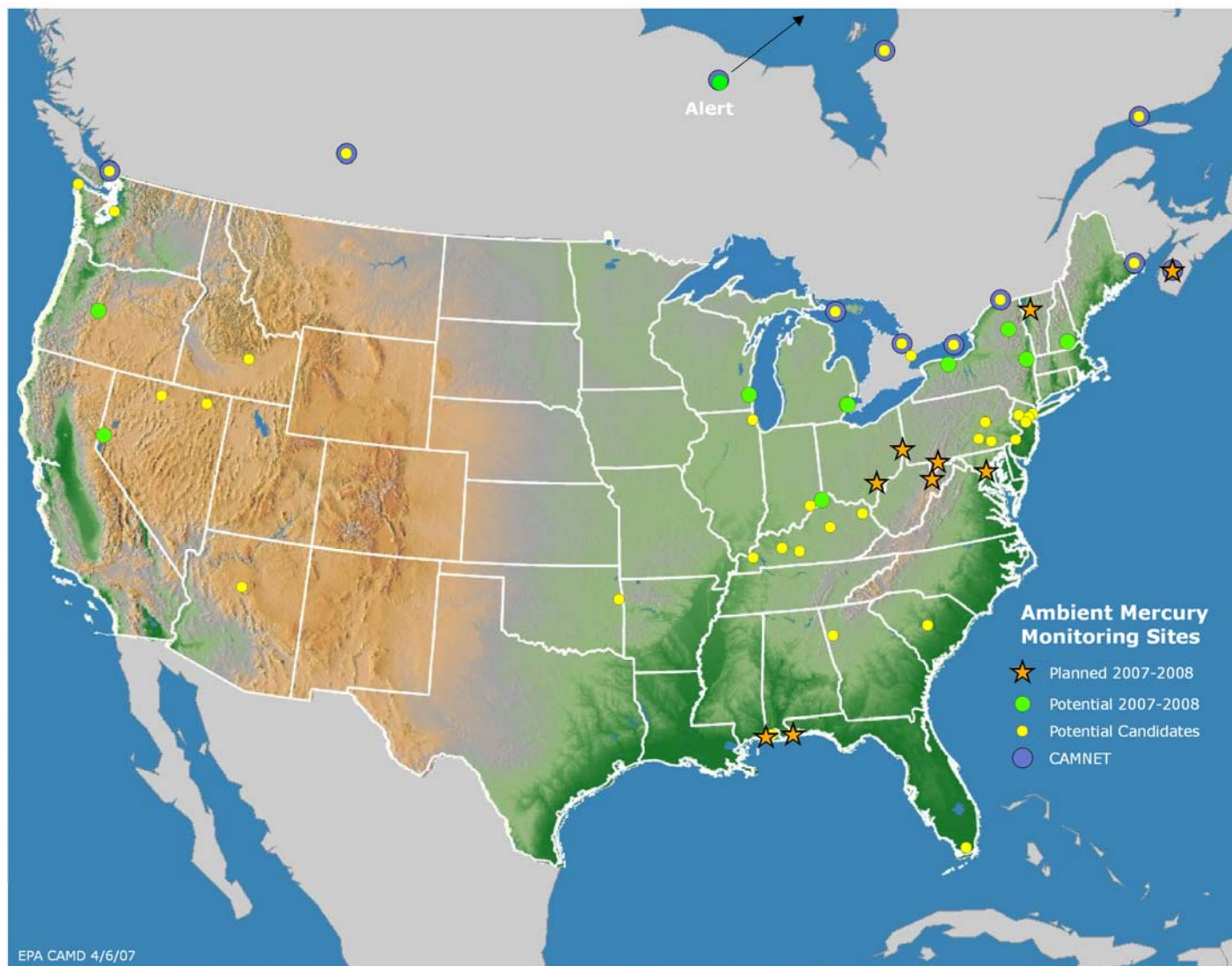
- Measure:
 - wet deposition flux (MDN),
 - Hg species (Tekran system)
 - meteorology and land cover variables

- Immediate priority: areas with strong impact from local and regional Hg sources

- Longer term, other local, regional, remote continental and globally sites.



Candidate 2007-8 NADP Atmospheric Hg Network Sites



Where Are We?

1. Field SOP for Tekran Operation
 - Draft 1, out for review
2. Data on Web
 - Data Management SOP in Draft
3. NADP admin. and cost structure developing
4. Site locations



News:

A New NADP Initiative

A special meeting to consider a proposed new NADP initiative was held on May 1, 2006, in advance of the NADP spring meetings in Riverside, CA. The initiative was presented by the Mercury Dry Deposition Working Group (David Gay - NADP/Asst. Coordinator for Toxics, Eric Prestbo - MDN science advisor, Martin Risch - NADP/Network Operations Subcommittee, David Schmeltz - USEPA Office of Air and Radiation) and would complement the existing MDN, which measures wet-only mercury deposition.

The initiative seeks to measure event-based mercury wet deposition, air concentrations of mercury in its gaseous and particulate forms, and meteorological and land-cover variables needed for estimating dry deposition fluxes. The goals are:

- facilitate the calculation of wet, dry, and total deposition;
- provide data for evaluating predictive and diagnostic models and for assessing source-receptor relationships; and
- build a data set for analyzing spatial and temporal trends.

The initiative proposes a national network of monitoring stations with a broad range of classifications, including: rural, suburban, and urban; near-source/high-emission; sensitive ecosystem; and regionally representative. Stations would follow standard operational procedures, based on methods developed from USEPA and other research efforts. Data would be quality-assured and accessible online from the NADP Web page.

On June 27, 2006, a second meeting was held in Chicago, IL. The focus of this meeting was development of guiding principles for monitoring atmospheric mercury. Please see the [minutes and notes](#) from this meeting, along with the current draft of the [guiding principles](#) for monitoring atmospheric mercury.

How NADP Handles Initiatives

The NADP [Quality Management Plan](#) includes a guide (Appendix D) for the presentation of new initiatives. This guide requires a plan that addresses 12 specific points covering purpose, operations, staffing needs and costs, funding, appropriateness to the NADP mission, etc. The NADP Executive Committee evaluates these plans and approves or rejects initiatives. A [12-point plan](#) has been drafted for the mercury initiative. The plan has not been finalized and comments and suggestions are welcome (contact David Gay: dgay@uiuc.edu or 217-244-0462).

Special Meeting Announcement

April 9-10, 2007
Burlington, VT
[More information](#)

Planning Documents

- [Network Summary](#), (pdf)
- [Meeting Minutes](#), 1 May 2006 (pdf)
- [Meeting Minutes](#), 27 June 2006 (pdf)
- [Draft Guiding Principle](#) (pdf)
- [Network Location Decisions](#) (pdf)

NADP Documents

- [Executive Committee Motion](#) (pdf)
- [Draft 12 point plan](#) (pdf)
- [Quality Management Plan, Appendix D](#) (pdf)

Operation Documents

- Draft Field SOP
- Draft Data Validation SOP

Presentations

- [NADP Initiative December 2006](#) (pdf)
- [NADP Working Group](#), at Fall 2006 NADP meeting (pdf)

Network Locations

- Map
- Table of Site Characteristics

Available Data

- [Beltsville, MD](#)
- [Grand Bay NERR, MS](#)
- [Athens, OH](#)
- Western Maryland
- Canaan Valley, WV

<http://nadp.sws.uiuc.edu/mtn>



List of Participants and Responders

| Participant List | Affiliations | Complete | Participant List | Affiliations | Complete |
|---------------------|--|----------|------------------------|------------------------------|----------|
| Matt Landis | EPA | X | Charles Pietarinen | NJDEP | X |
| Sandy Steffen | Environment Canada | X | Dirk Felton | NYSDEC | X |
| Rob Tordon | | X | | | |
| Laurier Poissant | | . | | | |
| Mark Castro | U Maryland | X | Tom Holson | Clarkson University | X |
| David Krabbenhoft | USGS | X | Charles Driscoll | Syracuse University | X |
| Mark Olson | | | | | |
| Eric Miller, ERG | Ecosystems Research, Inc. | X | Robert Talbot | University of New Hampshire | X |
| Steve Brooks | NOAA | X | Eric Prestbo | Frontier Geosciences | X |
| Jerry Keeler | U Michigan | | Gary Gill | Battelle Marine Sciences Lab | X |
| Eric Edgerton | Atmospheric Research, Inc. | Expected | Xinbin Feng | Chinese Academy of Sciences | X |
| Mae Gustin | U Nevada-Reno | X | George Allen | NESCAUM | N-E |
| Gary Conley | Ohio University | | Bruce Louks | Idaho DEQ | N-E |
| Winston Luke | NOAA | See NOAA | Ronnie Watkins | Alabama DEM | 2537 |
| Rob Mason | U Connecticut | | Tom Atkeson | Florida DEP | N-E |
| Ralf Ebinghaus | GKSS-Germany | 2537 | Susan Zimmer-Dauphinee | Georgia DEP | |
| Christian Temme | | | | | |
| Nicola Pirrone | CNR-Institute for Atmos. | X | Melvin Schuchardt | Illinois EPA | |
| Torunn Berg | Norwegian University of Science and Technology | | Sean Alteri | Kentucky Div. of Air Quality | |
| Kristine Aspomo | | | Andrea Keatley | | |
| John Munthe | IVL Sweden | partial | Philip Frazier | Louisiana | |
| Ingvar Wängberg | | | | | |
| Christophe Ferrari | Laboratoire de l'Environnement | N-E | Amy Robinson | Michigan | N-E |
| Dan Jaffe | U Washington-Bothell | X | Nick Lazor | Pennsylvania DEP | |
| Phil Swartzendruber | | | | | |
| Jamie Schauer | U Wisconsin | See USGS | Kevin Watts | South Carolina DHEC | |
| Mike Abbott | Idaho National Laboratory | X | Robert Brawner | Tennessee | |
| Frank Schaedlich | Tekran | X | Bruce Rodger | Wisconsin DNR | 2537 |
| Alan VanArsdale | US EPA | | Mark Allen | | |



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