

The Mercury Deposition Network (MDN) - National Status and Trends

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National Atmospheric Deposition Program (NADP) Networks

- Begun in 1978, the National Trends Network (NTN) monitors acidity, nutrients and base cations at ~250 sites across the U.S.
- Begun in 1995, the Mercury Deposition Network (MDN) monitors for total mercury at nearly 100 sites and methyl-mercury at about 20 sites in the U.S. and Canada.

All NADP Networks

- Long-term multi-decade monitoring
- Multi-tiered support
 - ◆ Federal, state, private, academic & tribal
- Sites are typically regionally representative
- Identical sampling equipment and methods are used within each network
- Single analytical laboratory
- Rigorous field and laboratory QA/QC
- Open availability of all data via the Internet

Objectives for the MDN Database

- Geographic distribution of mercury deposition
- Seasonal and long-term trends in mercury deposition
- Better understanding of the relation between mercury emissions and deposition
- “Ground truth” for model development
- Baseline data to gauge effectiveness of future controls

Mercury Concentration and Deposition

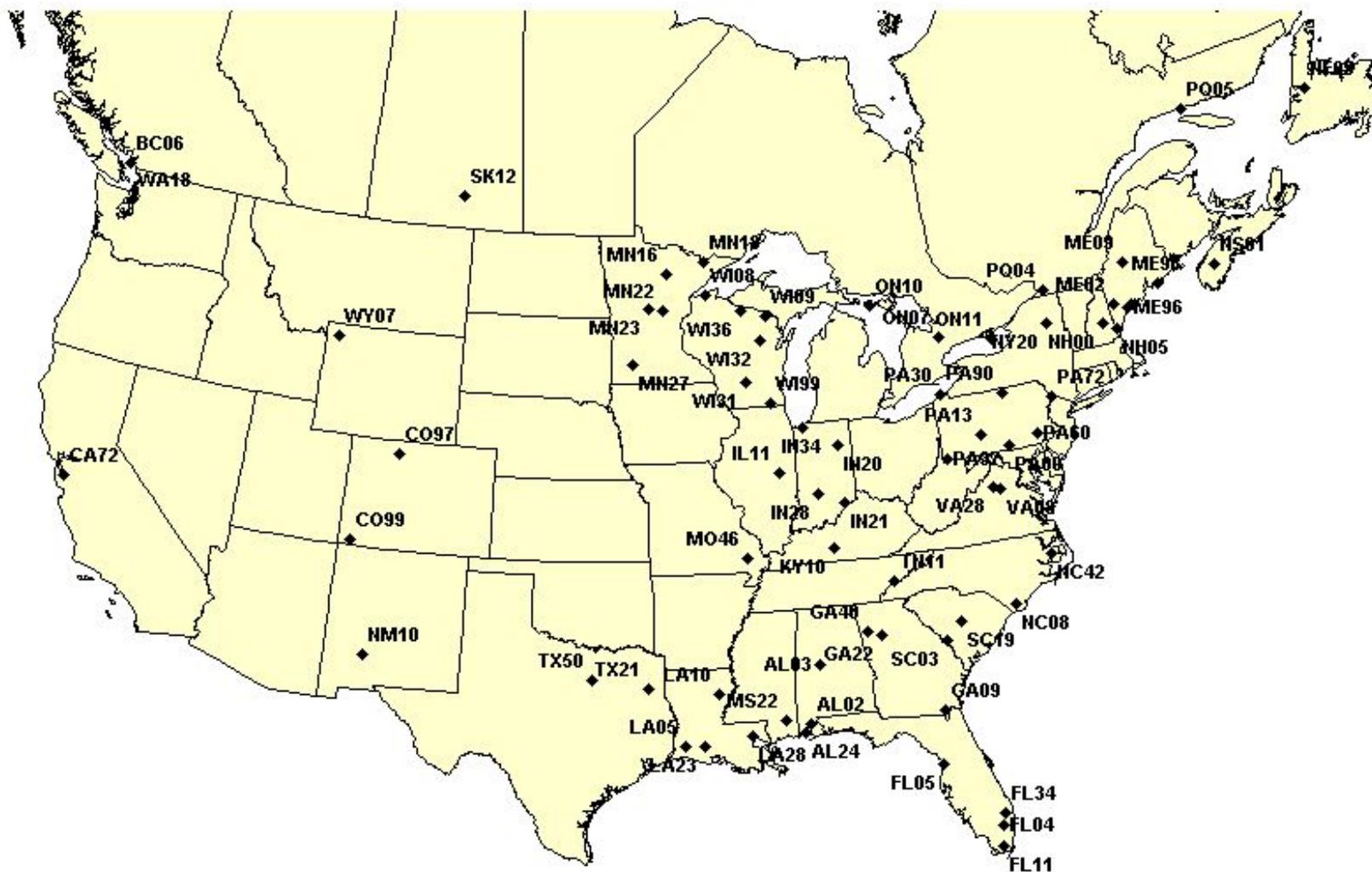
- Median concentration all sites ~ 10ng/L
- Highest concentrations typically in the Southeast, upper Midwest and Southwestern regions of the U.S.
- Highest deposition in the Southeastern U.S.
- Strong seasonality: higher concentration and deposition in the warmer months

A Typical NADP/MDN Site

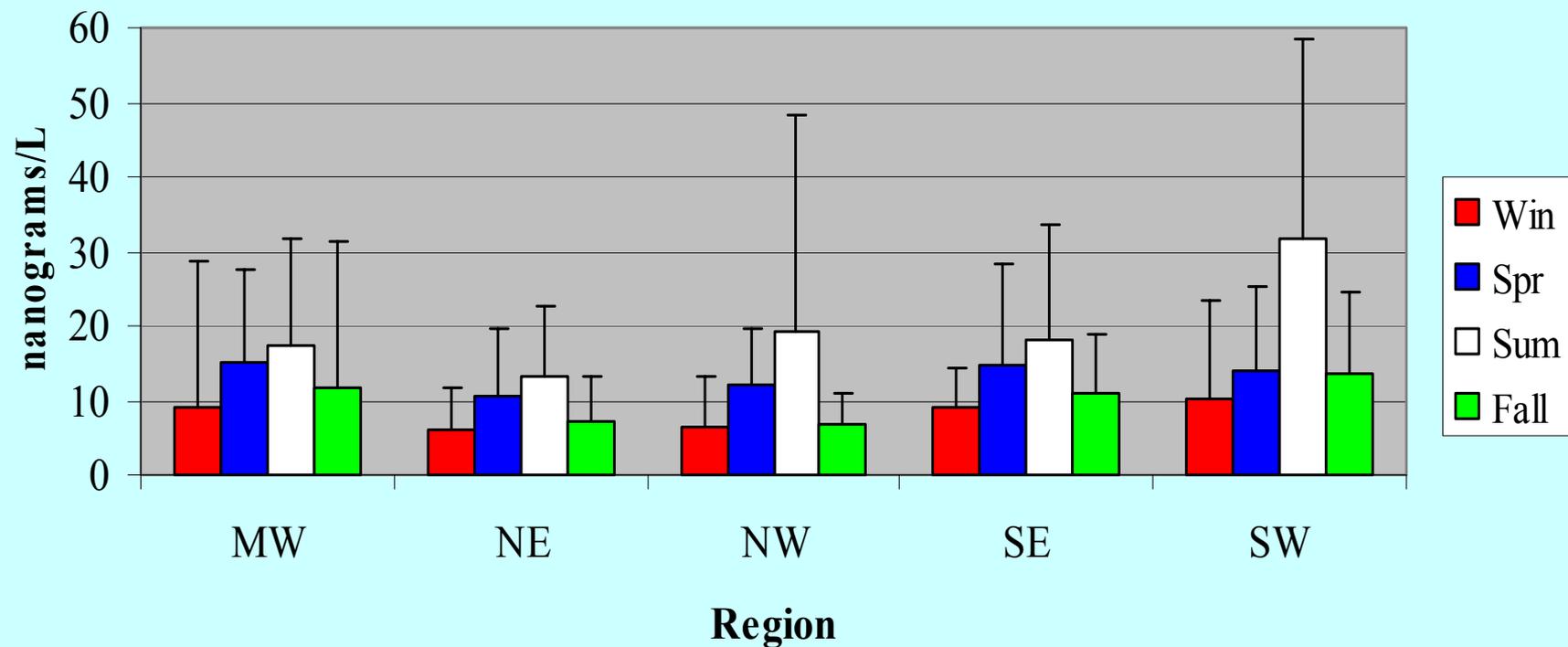
- Dual orifice precipitation sampler
- Recording rain gage
- Consistent sampling protocols
- Central laboratory
- Internal and external QA/QC



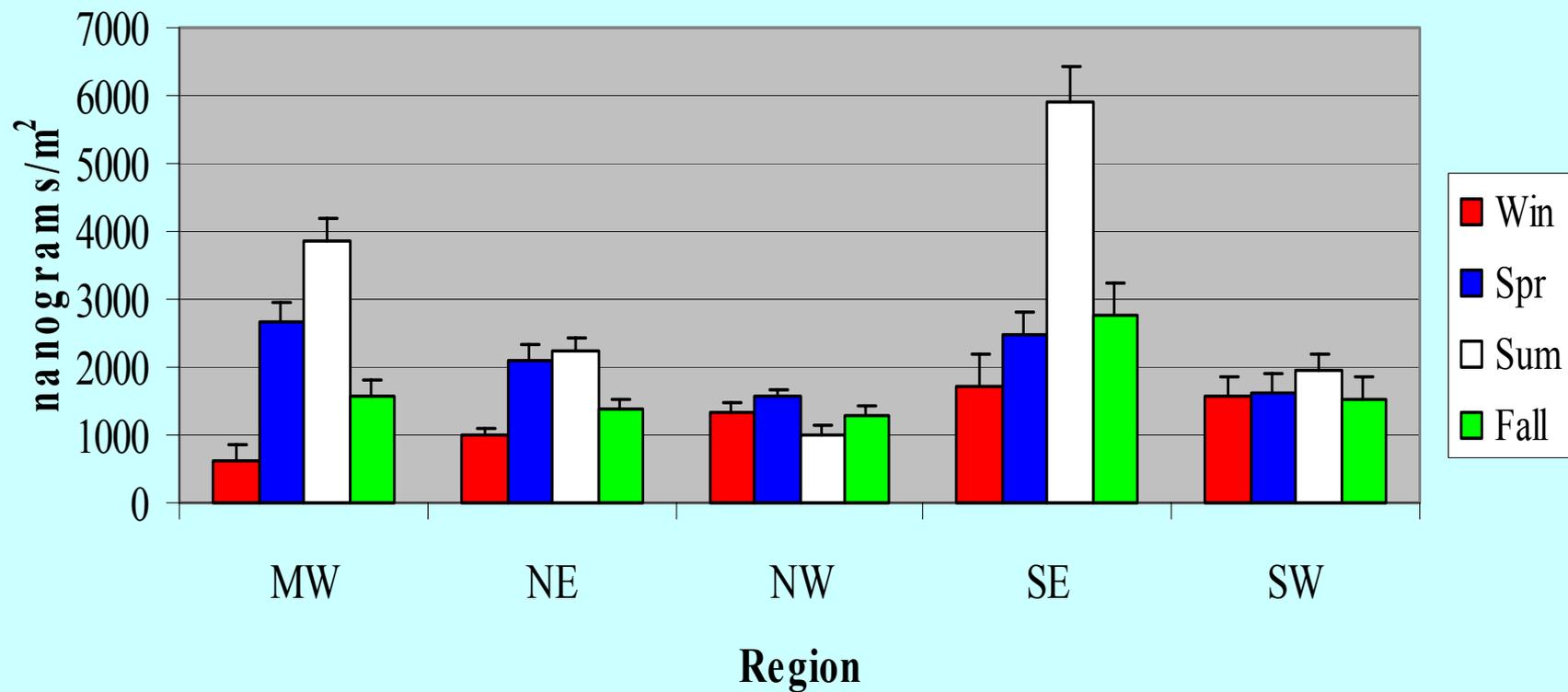
National Atmospheric Deposition Program Mercury Deposition Network



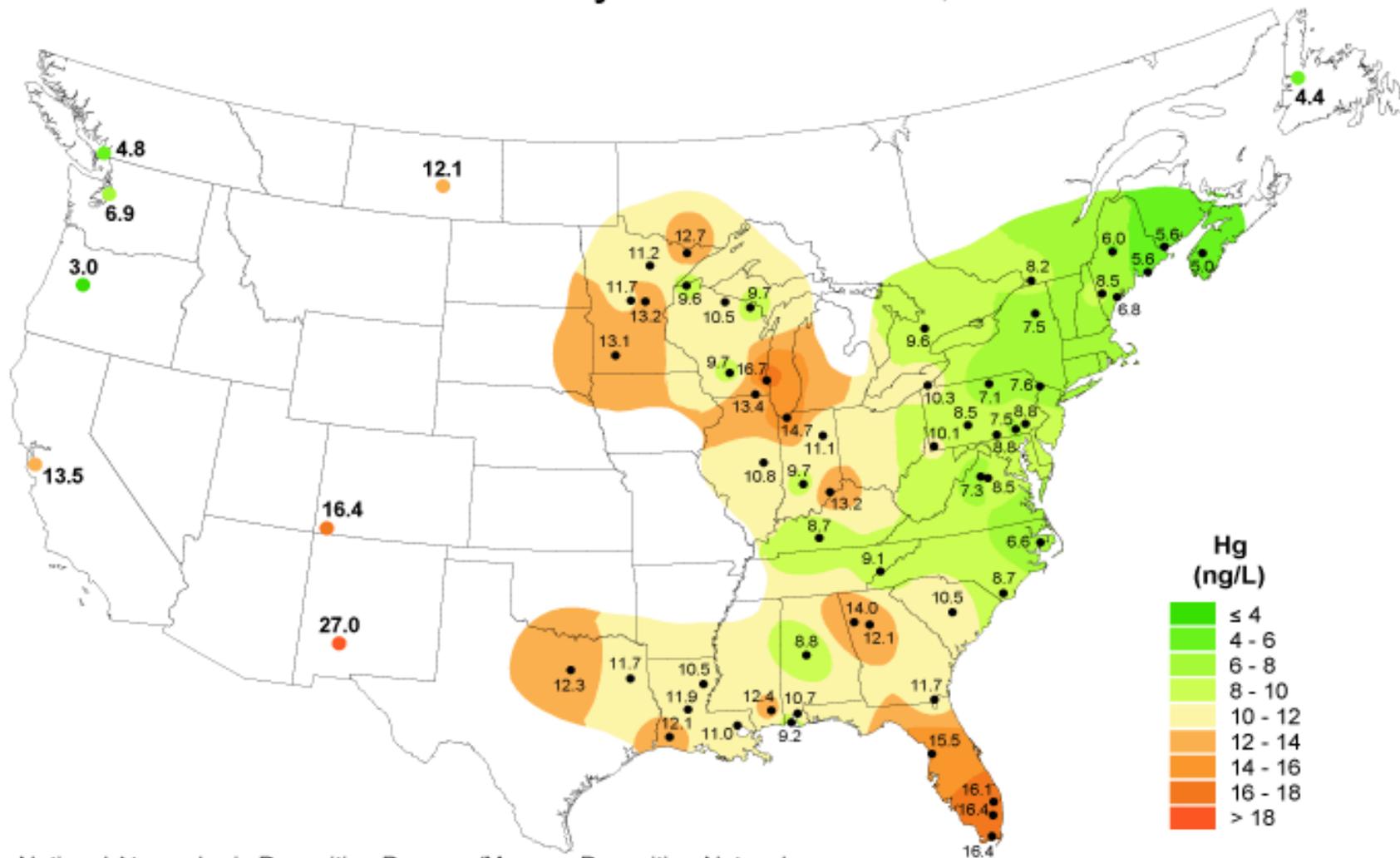
Seasonal Concentrations, By Region



Seasonal Deposition, By Region

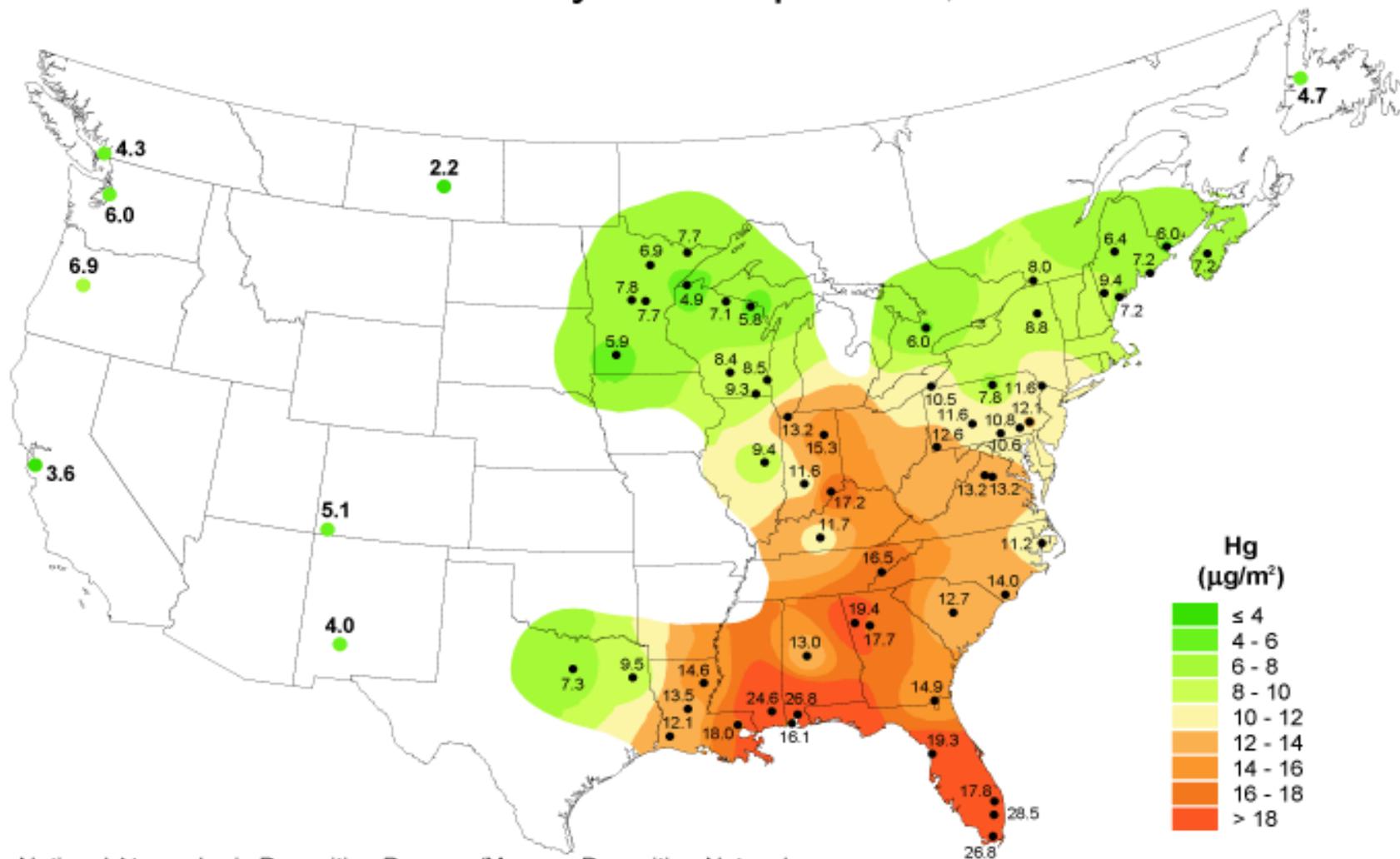


Total Mercury Concentration, 2003



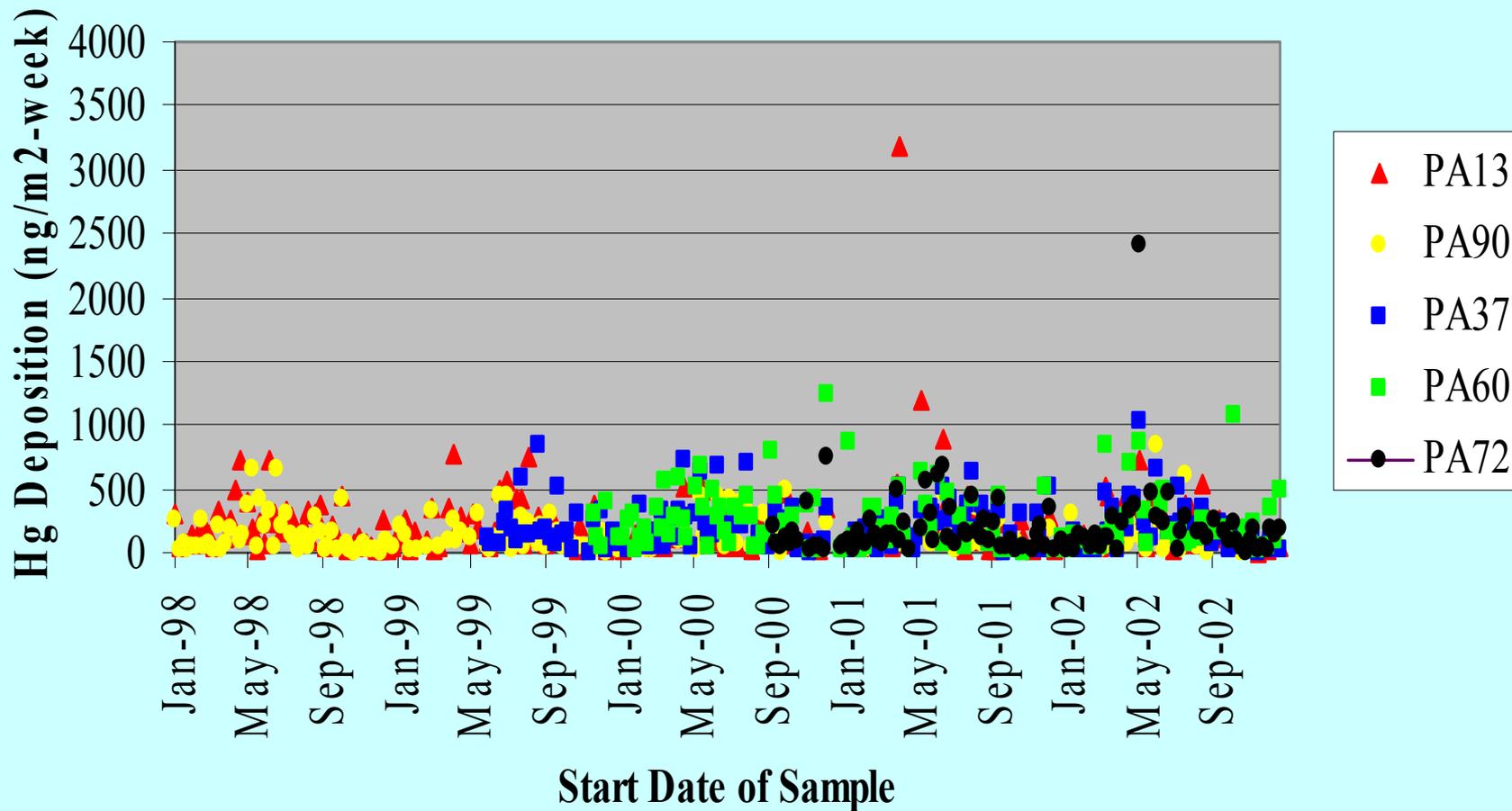
National Atmospheric Deposition Program/Mercury Deposition Network

Total Mercury Wet Deposition, 2003

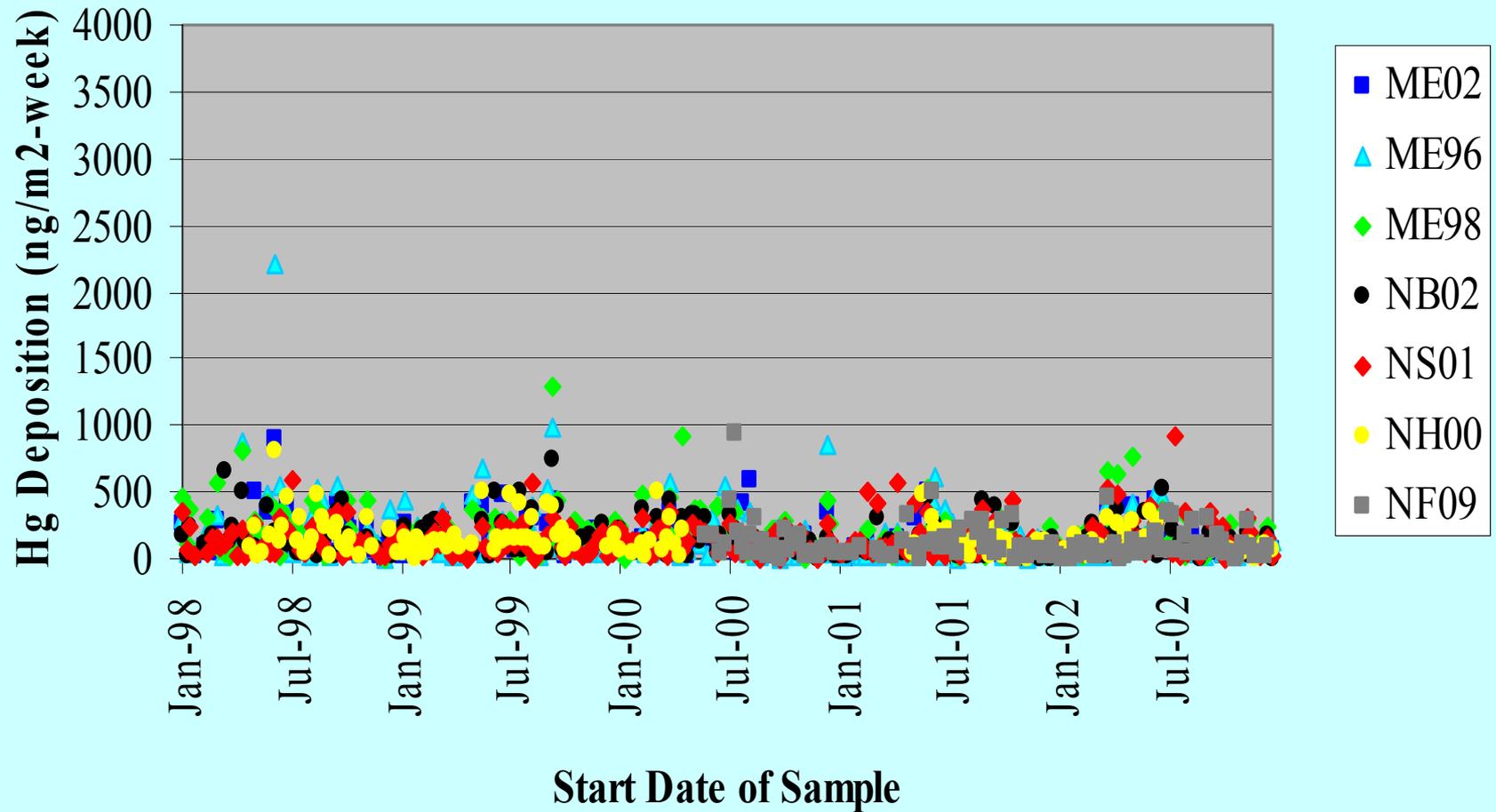


National Atmospheric Deposition Program/Mercury Deposition Network

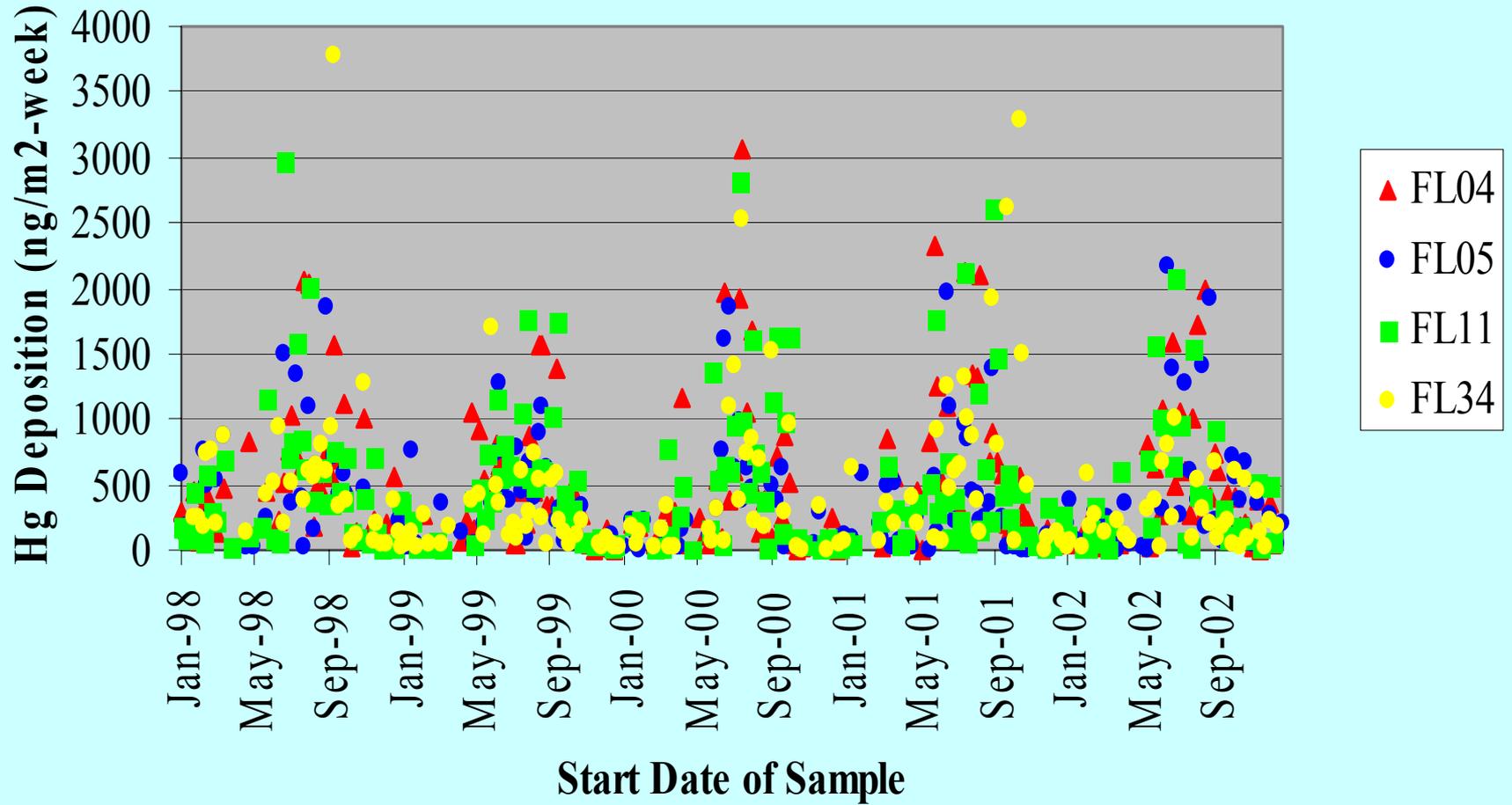
Weekly Deposition For Pennsylvania



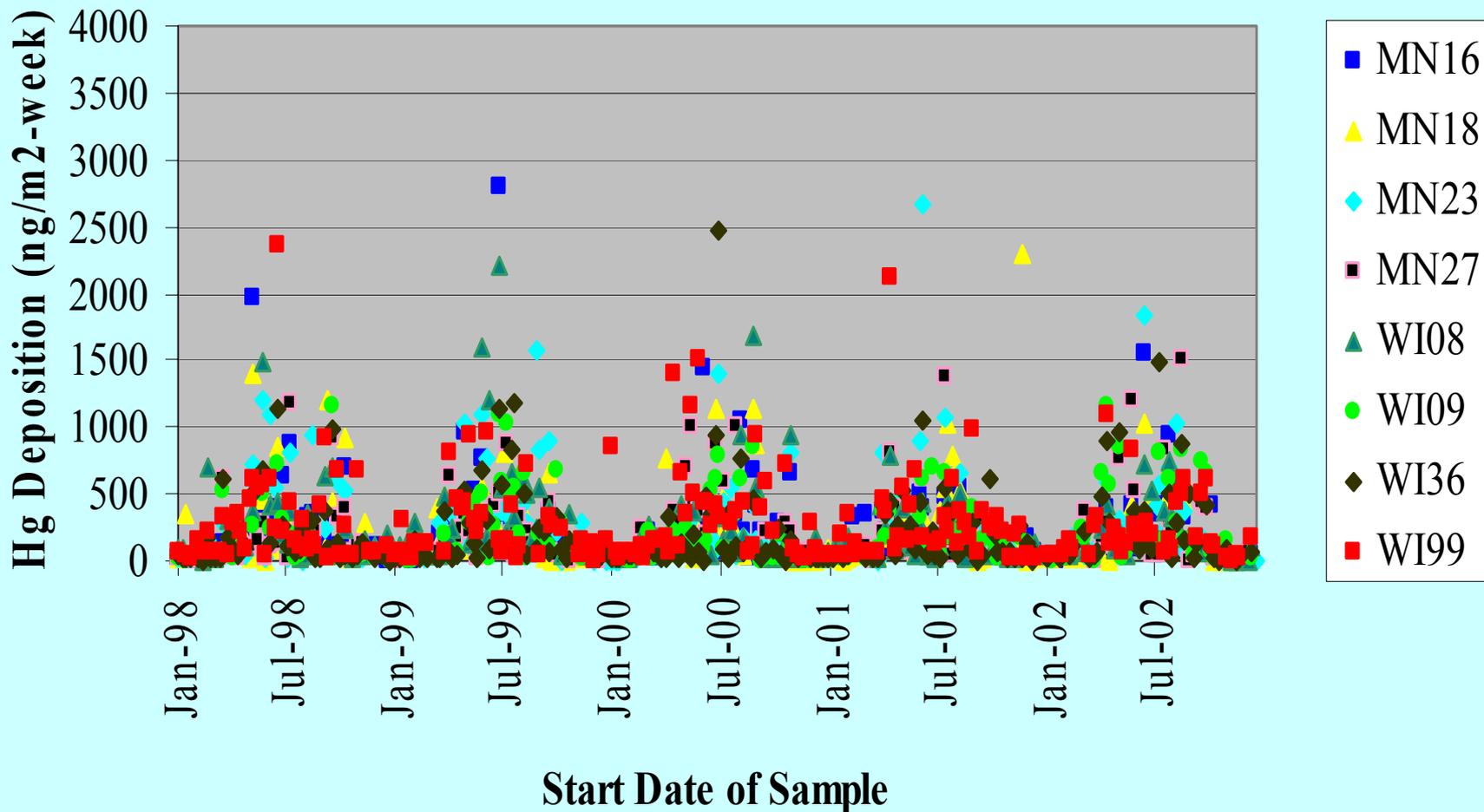
Weekly Deposition For Maine and Atlantic Provinces



Weekly Deposition For Florida



Weekly Deposition For Minnesota and Wisconsin



Seasonal Mann-Kendall Test

- ◆ Initial step - parametric modeling of precipitation versus concentration
- ◆ Nonparametric test for trend
- ◆ Detects monotonic trends
- ◆ Accommodates missing data and non-normal distributions
- ◆ Removes effects of seasonality without explicitly modeling it

Estimating the Trend Magnitude

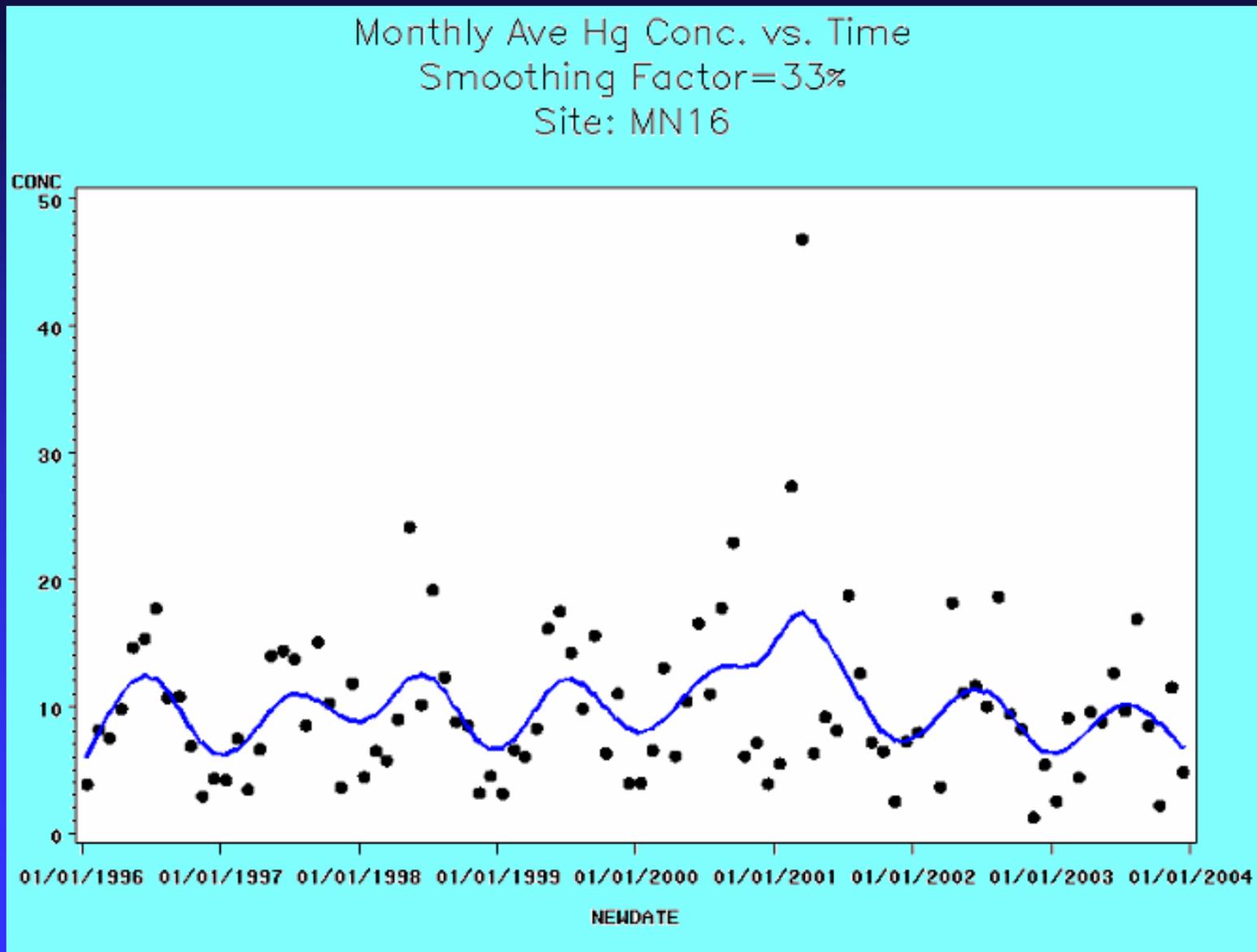
■ Sen slope estimator

- ◆ Median slope of all like-month, pairwise comparisons expressed as an annual trend

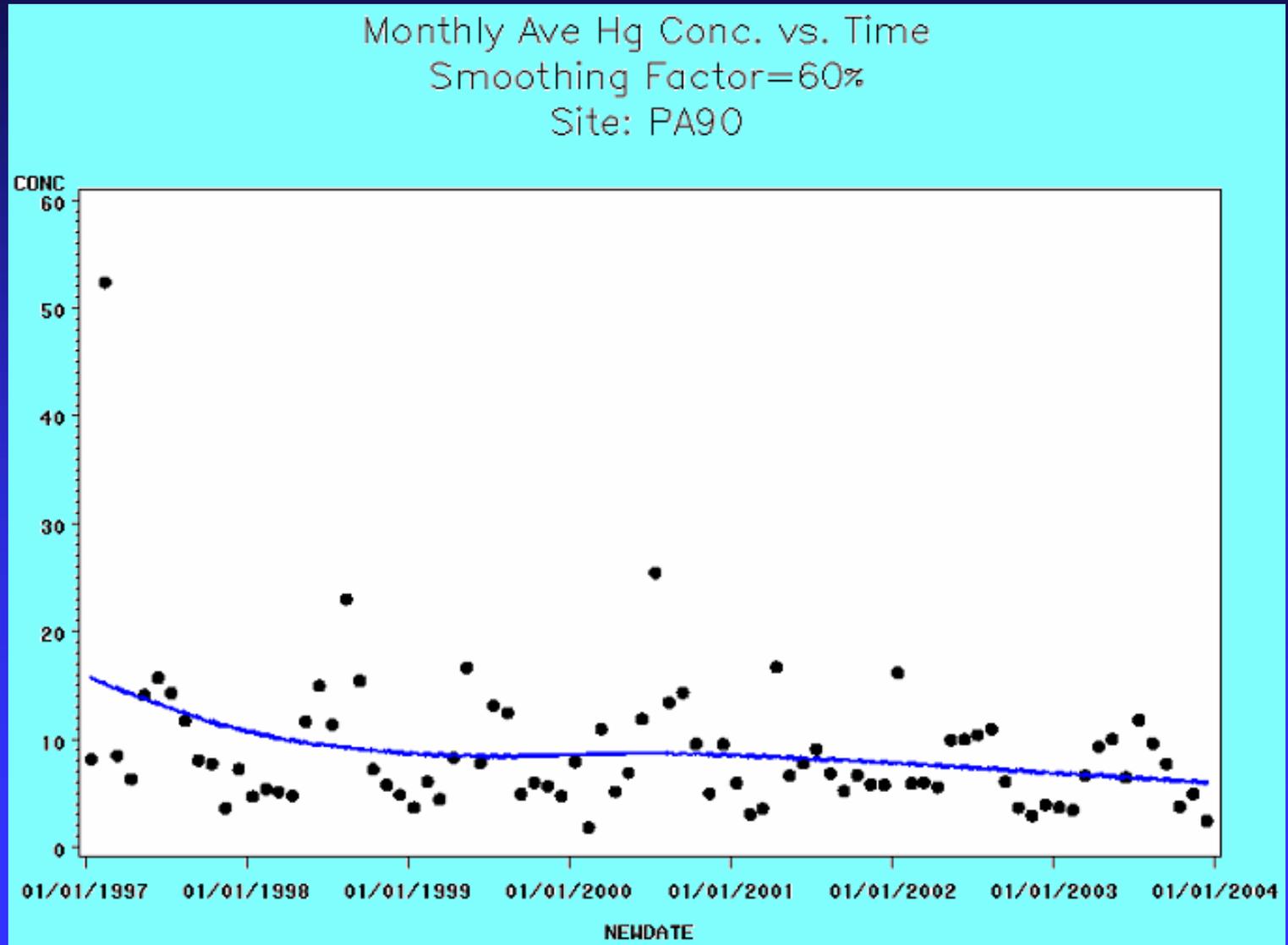
■ Period of record trend

- ◆ (Sen slope estimator * years of record)/average concentration in the first three years of the analysis

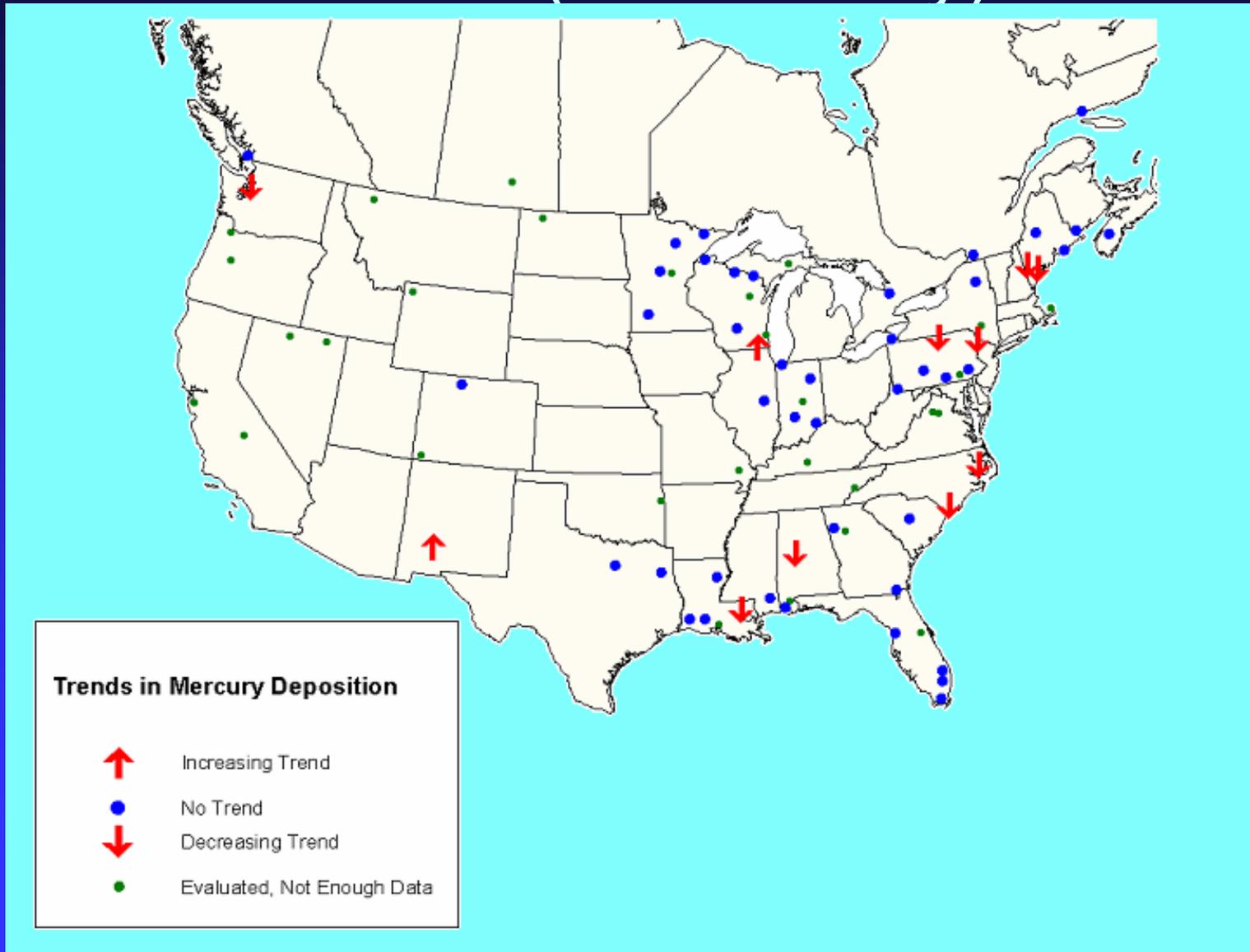
No trend with seasonality shown



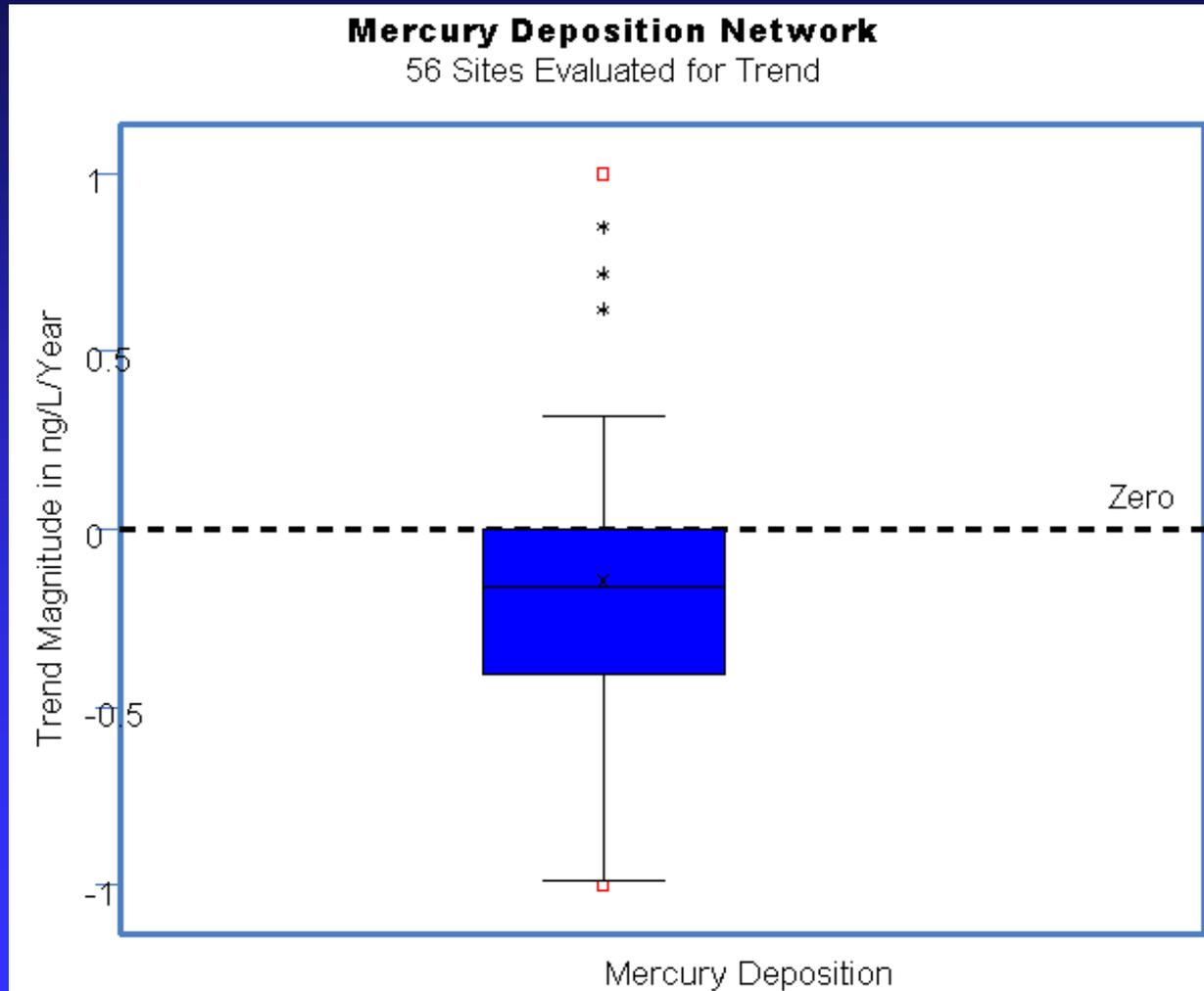
Site with significant negative trend



Trends in Wet Mercury Deposition 1996-2003 (Preliminary)



Boxplot of MDN Trend Slopes



Summary – NADP/MDN Concentration Trends 1996-2003

Number of sites evaluated	56
Median trend slope of 53 sites	-0.17 ng/L/yr
# Sites with positive slope	13
#Sites with negative slope	41
#Sites with zero slope	2
# Sites with significant positive trend slope at $\alpha=.05$	2
Sites with significant negative trend slope at $\alpha=.05$	9



Future Directions for MDN

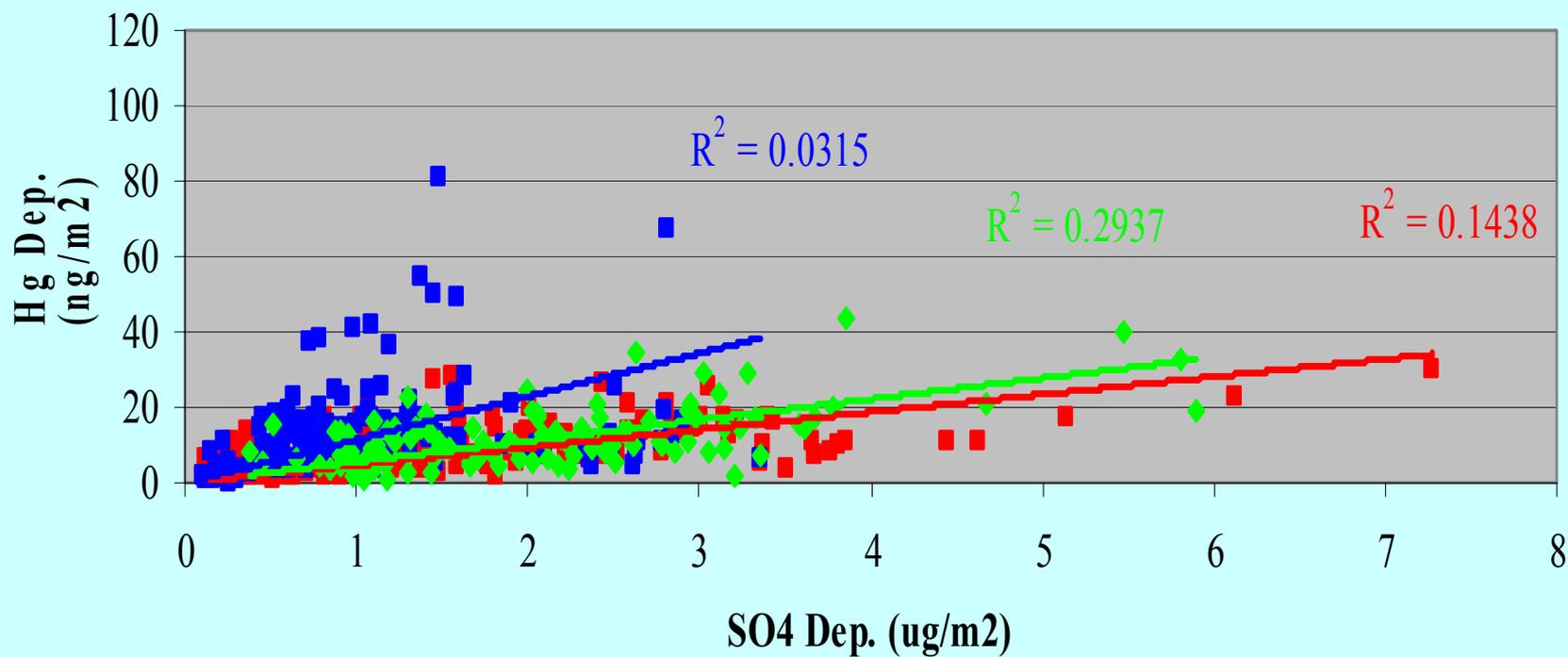
- Expand network coverage, especially in the Western U.S.
- Enhance data and graphical products
- Develop and deploy a next-generation wet deposition sampler for deposition of mercury and additional trace metals

How to Obtain the NADP Data

- <http://nadp.sws.uiuc.edu/mdn/>
- **Or Google: Mercury Deposition Network**
 - ◆ Up to date NADP-MDN site information
 - ◆ All NADP-MDN data
 - ◆ U.S. maps of mercury concentration and deposition patterns
 - ◆ Contact and meeting information

Sulfate vs Mercury, By Station

■ ME02 ■ MN23 ◆ IL11 — ME02 linear fit — MN23 linear fit — IL11 linear fit



Weekly Mercury Deposition and Sulfate at Bondville IL

● IL11 (SO4) ● IL11 — 5 per. Mov. Avg. (IL11) — 5 per. Mov. Avg. (IL11 (SO4))

