

The National Atmospheric Deposition Program (NADP):

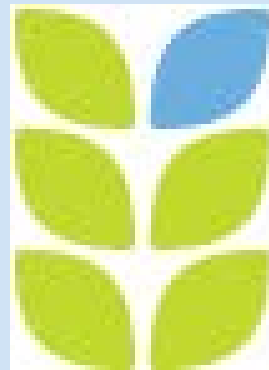
A Case Study

David A. Gay

NADP Program Office, University of Illinois, Champaign, IL USA
dgay@illinois.edu, +01.217.244.0462

A Cooperative Research Program (*Un. Of Illinois*)

- Measure wet deposition of pollutants
 - Three networks (NTN, AIRMoN, Mercury Deposition Network)
- Monitor the rate of pollution movement to the surface
 - Two networks (dry deposition est., AMoN, Atmospheric Mercury Network)
- North America
 - US, Canada, and some in Mexico
 - Also Taiwan, South America, Hawaii
- Owned and operated by our members
 - Decisions made by our members
 - Started in 1978, 37th year
- Over 500,000 precipitation chemistry samples





National Atmospheric Deposition Program

National Trends Network (NTN)

Atmospheric Integrated Research and Monitoring Network (AIRMoN)

Ammonia Monitoring Network (AMoN)

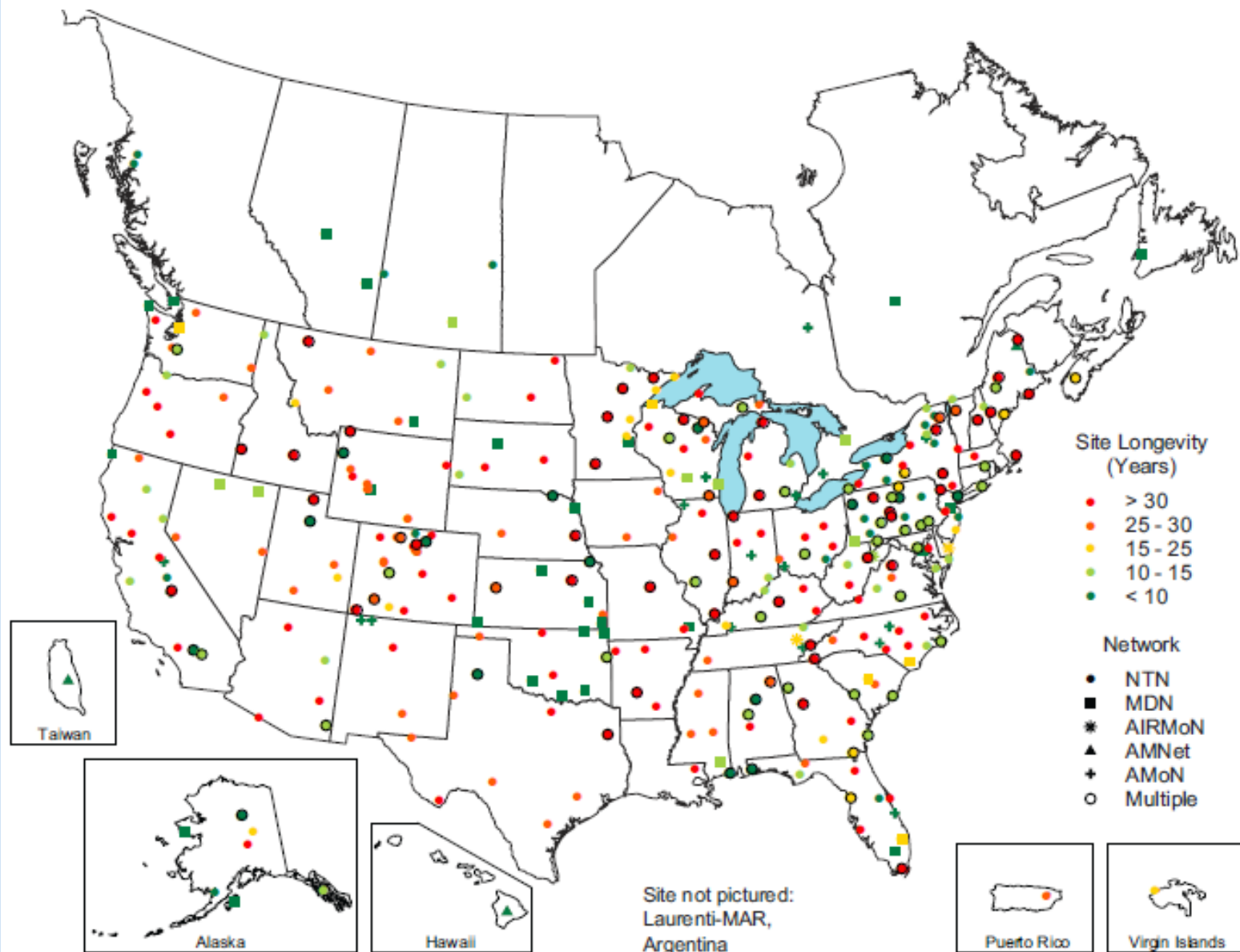
Mercury Deposition Network (MDN)
(wet deposition)

Atmospheric Mercury Network (AMNet)
(gaseous, dry dep.)

Trial Network
Mercury Litterfall Network

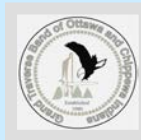


NADP - All Network Sites



The NADP Cooperators

(100+ total agencies)



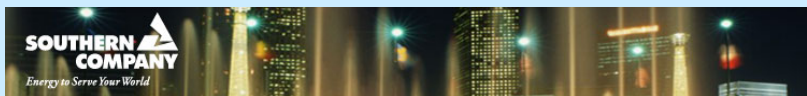
Universities



Other Organizations

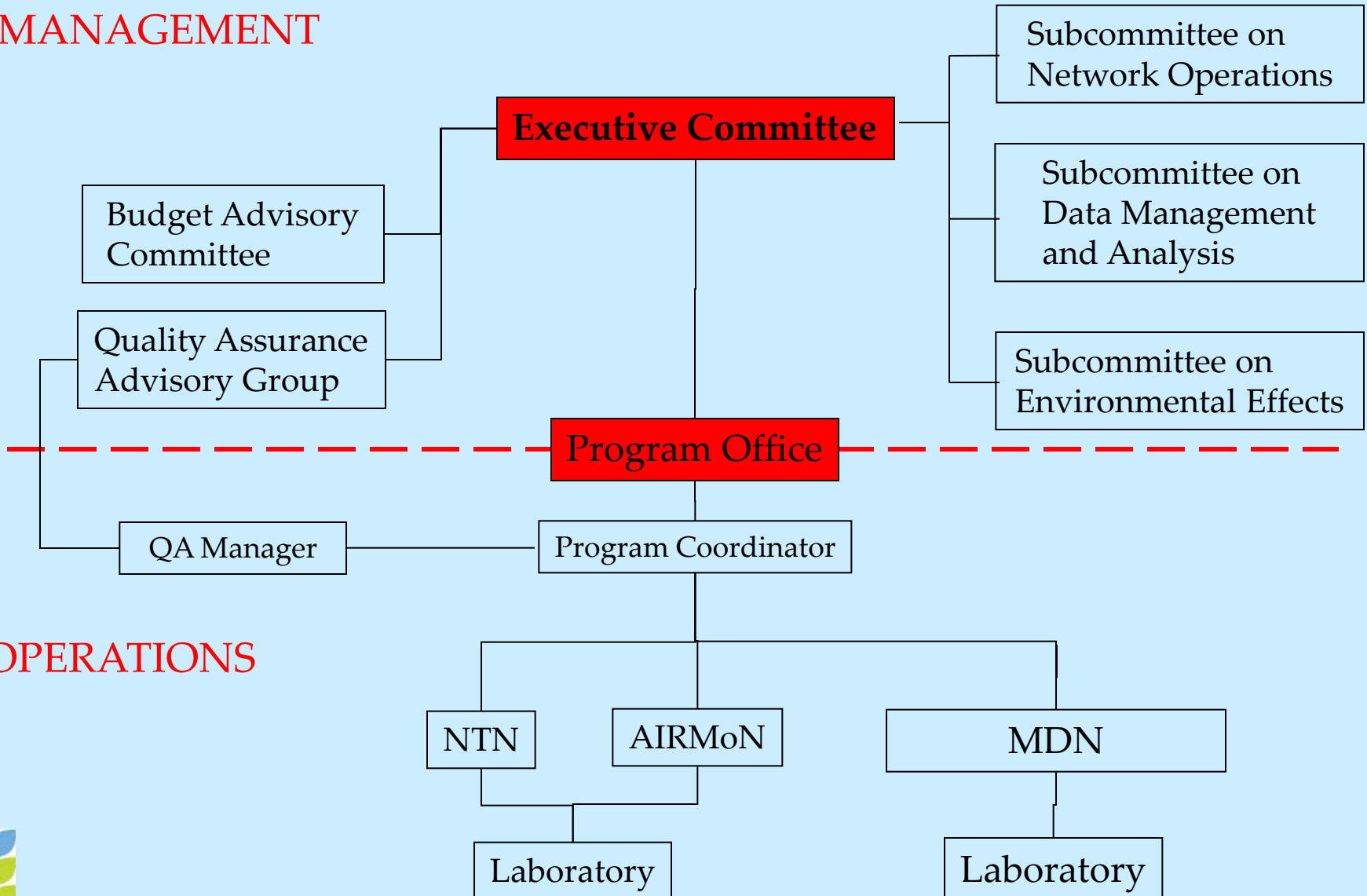


US States



Organization

MANAGEMENT



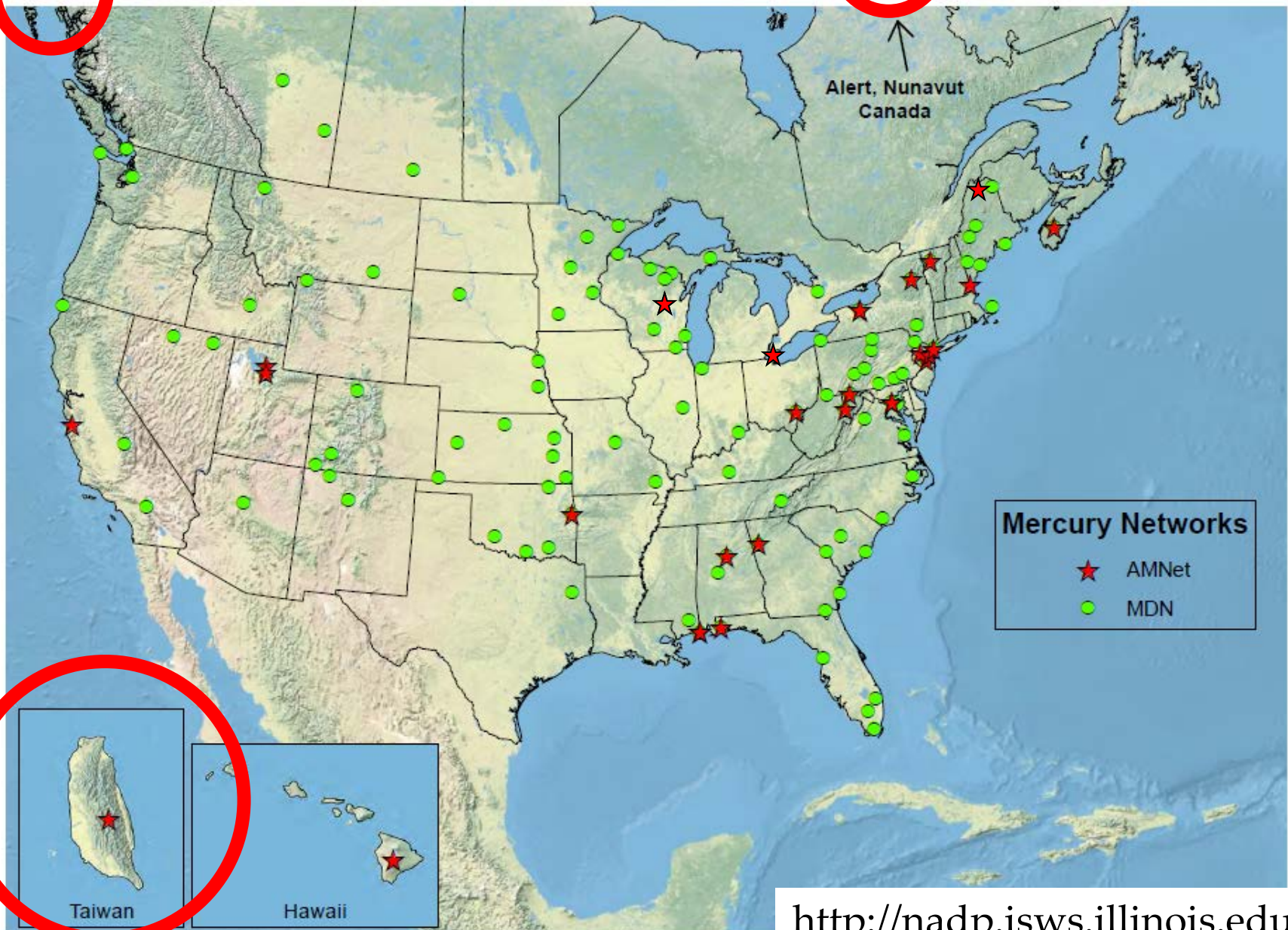
NADP's Goal

To *monitor* the chemistry of precipitation (rain and snow) and the atmosphere as consistently and as accurately as we can, for long periods *to determine changes over time* (trends).



NADP Measurement of Wet Deposition and Gaseous Concentrations

NADP's Mercury Networks



Mercury Deposition Network (MDN)



Collects one-week precipitation-only samples with MDN wet-dry collector



Measures precipitation with gage (2 options)



Analyses

Total Mercury

Methyl Mercury



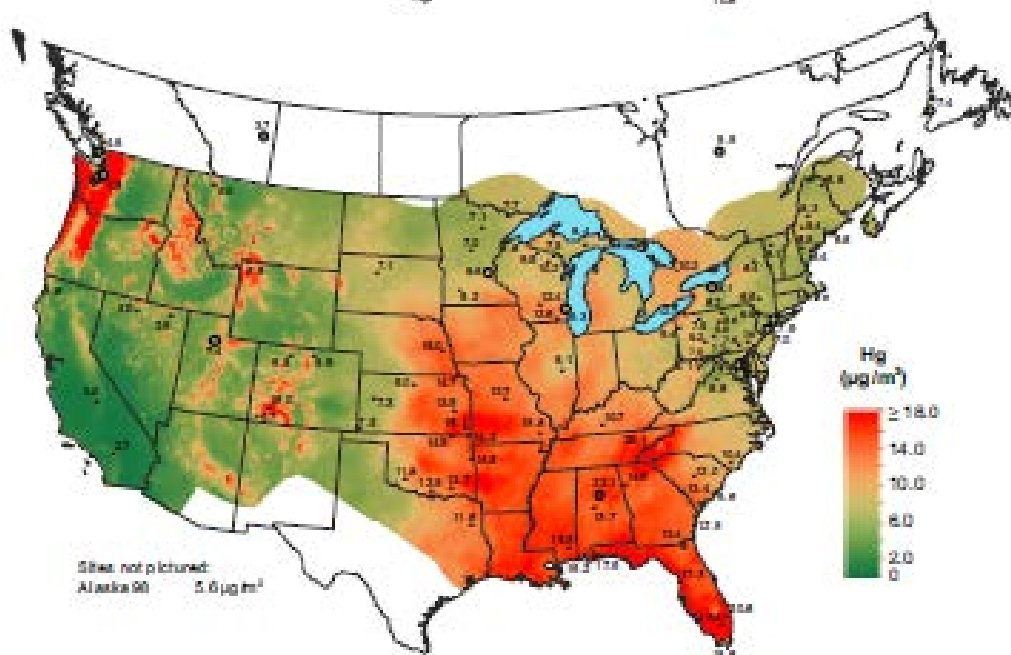
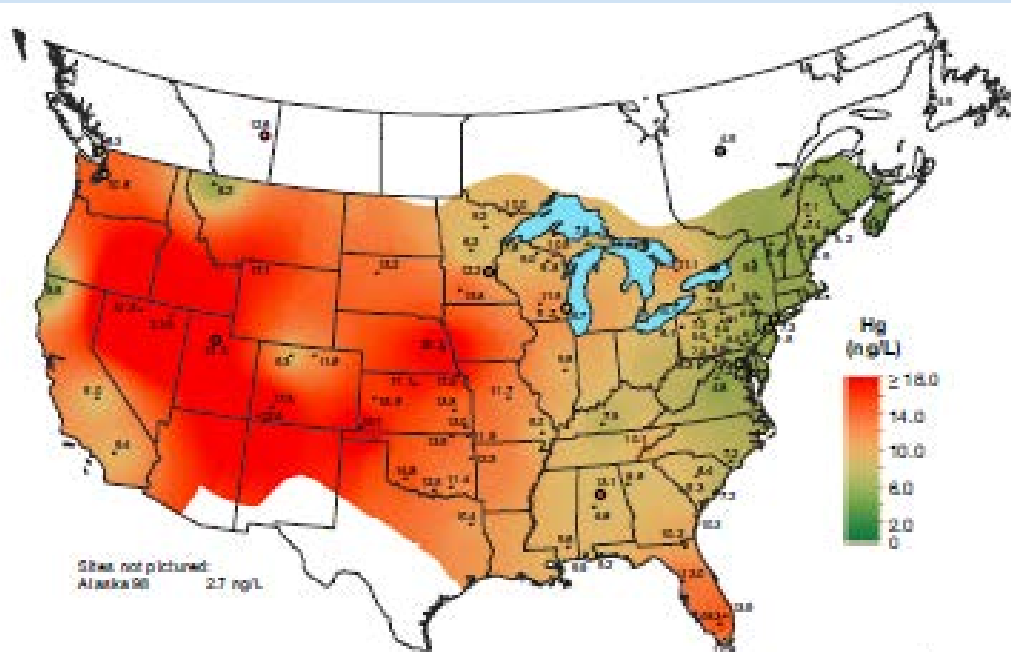
Optional “daily” mode



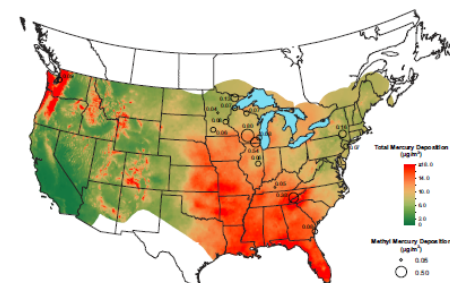
118 Sites







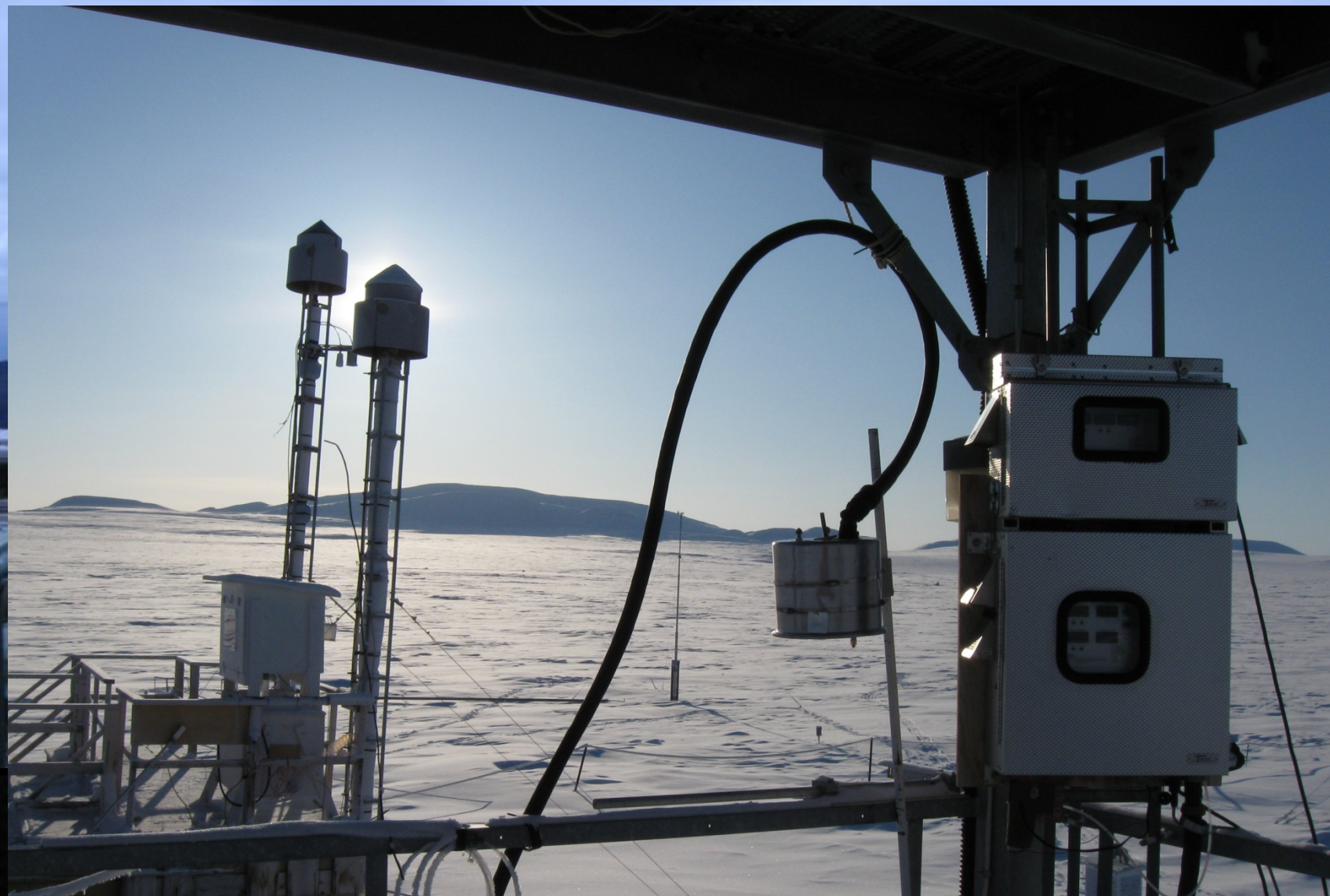
Total mercury concentration (top) and wet deposition (bottom), 2013.



AMNet Measurements

- Mercury fractions
 - GEM (hourly)
 - GOM (2 hourly)
 - PBM_{2.5} (2 hourly)
- Tekran System
 - 2537, 1130, 1135
- With wet deposition flux
 - Mercury Deposition Network
- Land cover variables
 - for estimates of dry deposition flux
- 24 Sites currently; 600,000 observations





Estimate Dry Deposition

- Weekly GOM, PBM, and GEM (downward/net)
- flux (F) = *air concentration* $\times$ *dry deposition velocity* (V_d)

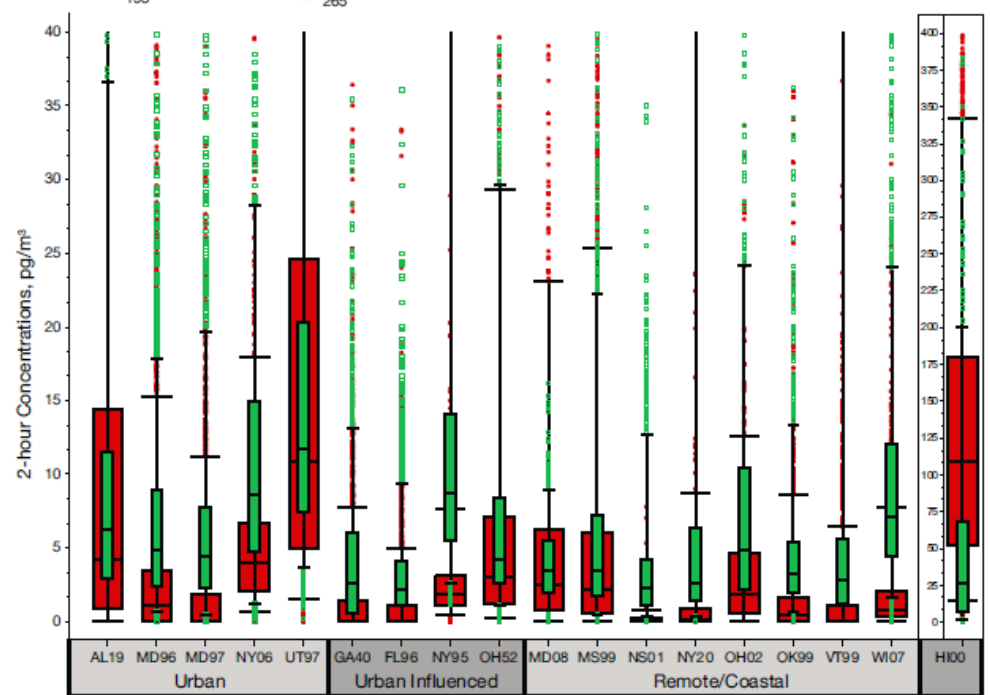
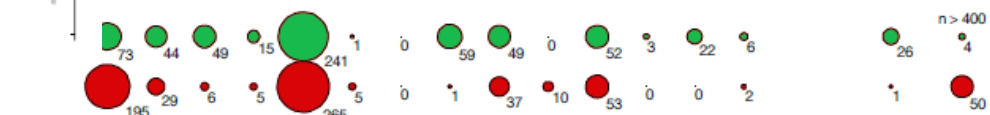
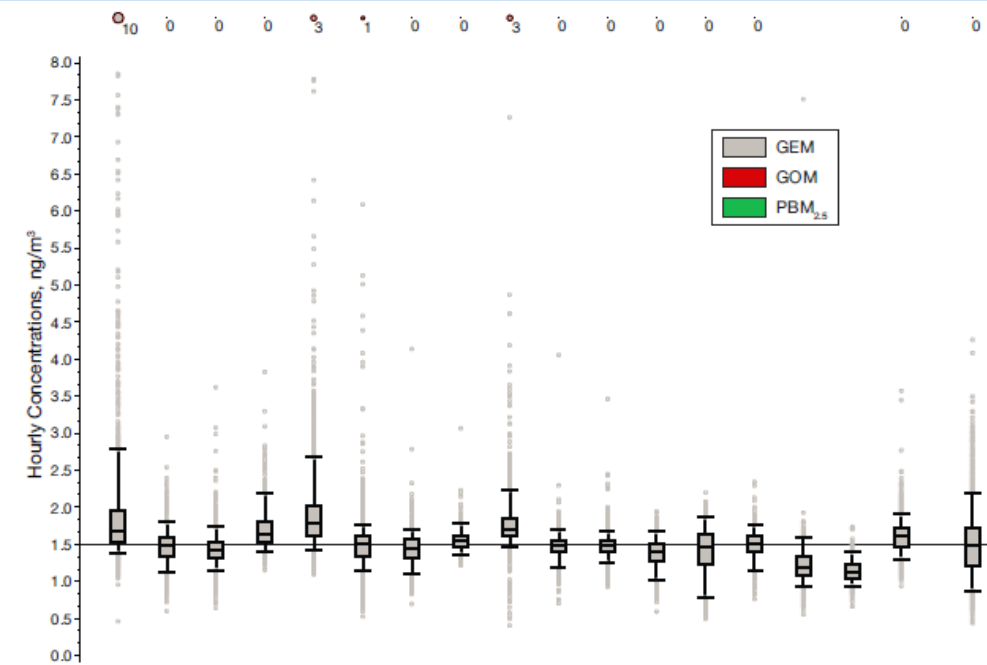
$$F = V_{\text{deposition}} * \text{Concentration}_{\text{air}}$$

where:

$$V_d = \frac{1}{R_a + R_b + R_c}$$

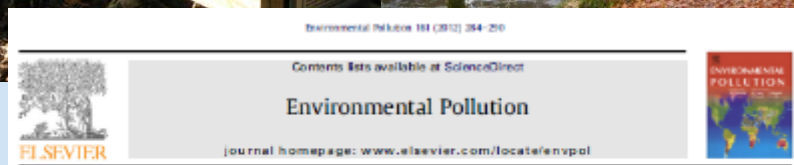
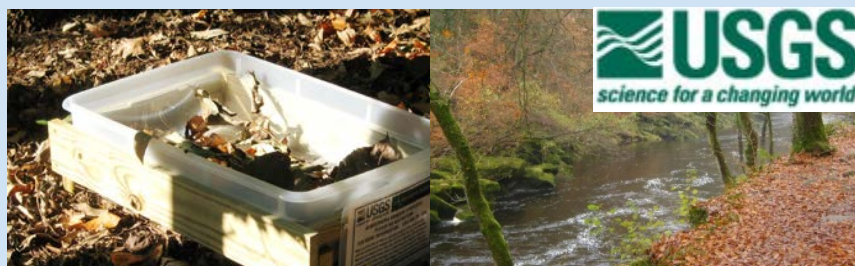
- R_a as aerodynamic resistance, R_b as quasi-laminar resistance, and R_c as canopy resistance





New NADP Trial Network: Mercury Litterfall

- Started in 2012
- In cooperation with USGS and USGS Mercury Research Lab
- 14 stations (w/MDN)
- Monthly observations (May to Nov)



Litterfall mercury dry deposition in the eastern USA

Martin R. Risch^{a,*}, John F. DeWold^b, David P. Krabbenhoft^b, Randall K. Kolka^c, Leiming Zhang^d

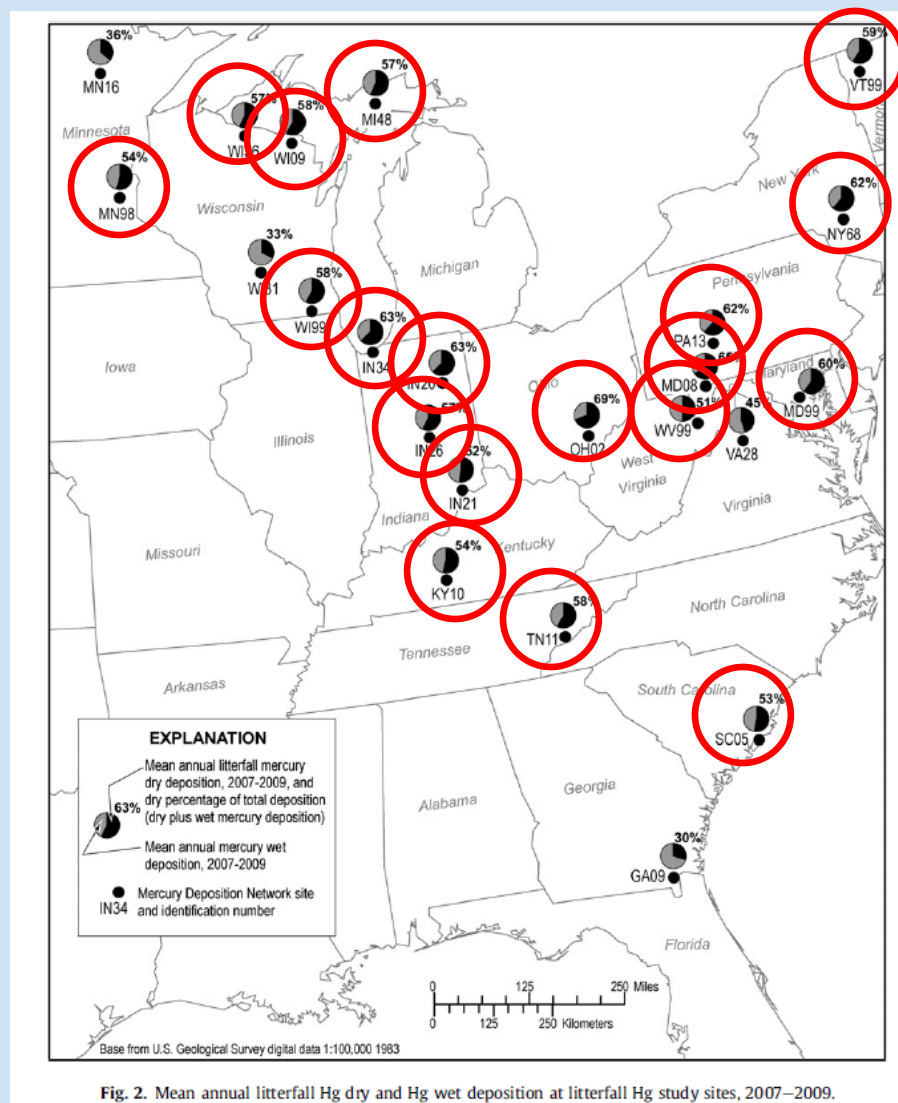


Fig. 2. Mean annual litterfall Hg dry and Hg wet deposition at litterfall Hg study sites, 2007–2009.

Advantages of the NADP “Method”

Strengths of the NADP Method

- Open & Collaborative Approach
 - Network based on cooperation of all parties
 - Based on common protocols
 - All working together
 - Common oversight
- Cost effective design to maximize monitoring dollars
- One laboratory for all samples
 - Consistency and oversight



NADP QA Overview

- ❑ Standard Operating Procedures
 - Field Operations, Data Management
 - Site Survey, Siting Criteria
 - Site pictures, information
- ❑ Scheduled blanks and spikes
 - Laboratory blanks
 - Field blanks
- ❑ 3rd Party QA Program (USGS & EPA)
 - Blind spike samples, Inter-lab comparison
 - Site Audits
- ❑ Independent QA director
- ❑ Site setup and Support
- ❑ AMNet: Automated QA of data records

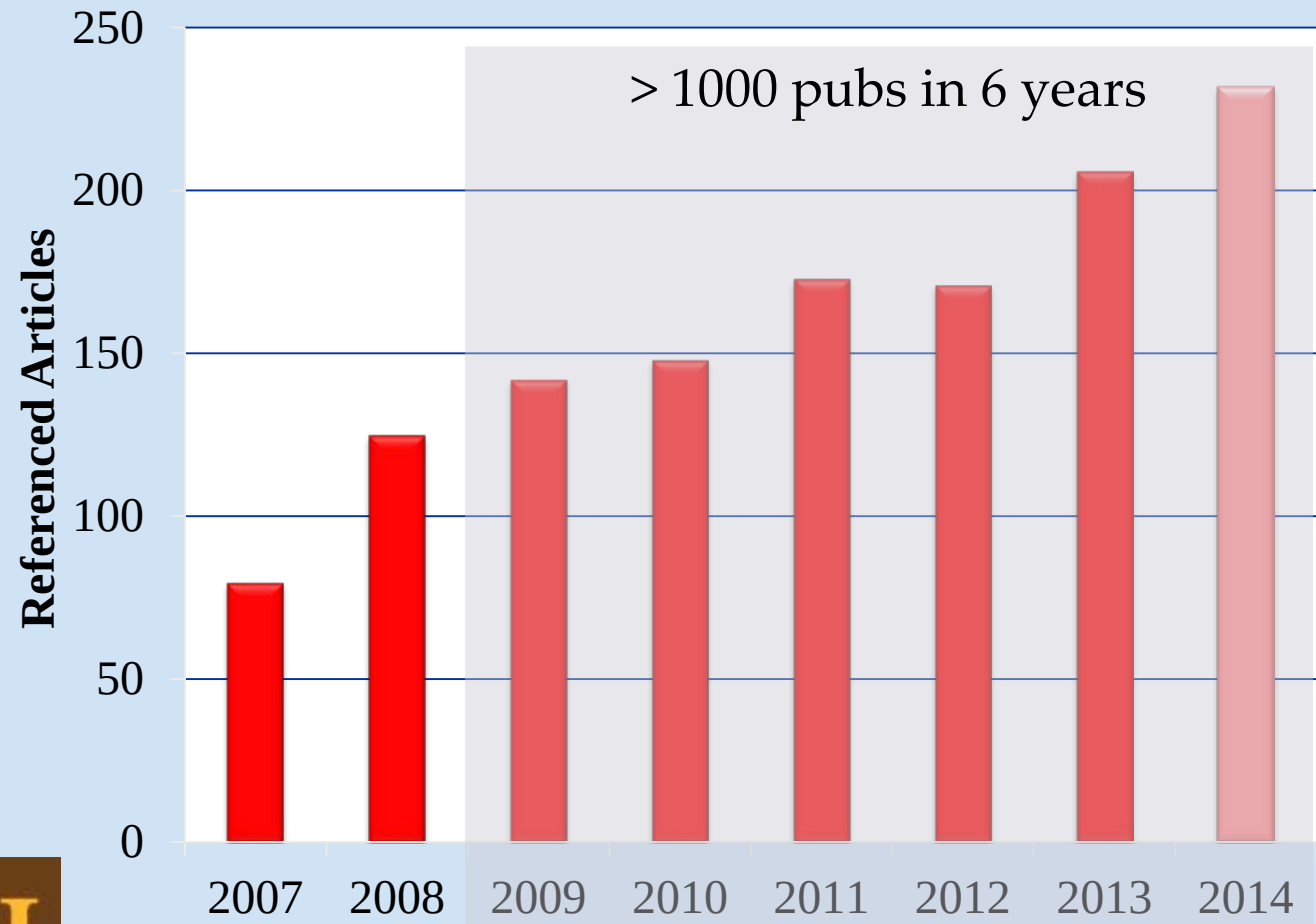


Keys to our Success

1. Consistent operating methods across sites and time
2. Good operators
3. Sharing of data
 - open access, reliability, its use keeps us relevant)
4. Diversified Funding
5. Open and transparent Governance
6. Commitment to long term monitoring
 - federal agencies
 - state agencies
 - other



The Real Value of NADP Data: Scientific Research



All data, all maps, all information

free of charge

<http://nadp.isws.illinois.edu>

National Atmospheric Deposition Program/MDN

Weekly Mercury Concentrations and Depositions

SiteID	Date On	Date Off	RGPPT	SVOL	SUBPPT	HgConc	HgDep	Sample Type	QR	Notes	YrMonth	DateMod
			mm	ml	mm	ng/L	ng/m ²					
MT05	10/28/2003 16:24	11/04/2003 16:16	20.32	190.30	20.32	3.66	74.53	W	B	mz	200310	11/22/2004
MT05	11/04/2003 16:17	11/11/2003 19:00	13.34	200.40	13.34	--	--	W	C	mzu	200311	11/22/2004
MT05	11/11/2003 19:01	11/18/2003 21:05	18.80	245.80	18.80	--	--	W	C	zhu	200311	11/22/2004
MT05	11/18/2003 21:10	11/25/2003 15:57	30.73	228.00	30.73	--	--	W	C	dmzu	200311	11/22/2004
MT05	11/25/2003 16:10	12/02/2003 20:50	47.50	623.70	47.50	--	--	W	C	zhu	200311	11/22/2004
MT05	12/02/2003 21:10	12/09/2003 20:13	12.95	185.30	12.95	--	--	W	C	dmzu	200312	11/22/2004
MT05	12/09/2003 21:00	12/16/2003 18:50	24.89	163.40	24.89	1.14	28.57	W	B	mz	200312	11/22/2004
MT05	12/16/2003 19:06	12/23/2003 18:05	3.56	31.70	3.56	8.34	29.67	W	B	mz	200312	11/22/2004
MT05	12/23/2003 18:10	12/30/2003 17:35	12.95	89.10	12.95	1.48	19.22	W	B	m	200312	11/22/2004
MT05	12/30/2003 17:39	01/13/2004 20:29	11.18	120.10	11.18	3.64	40.71	W	B	ez	200401	11/22/2004
MT05	01/13/2004 21:15	01/20/2004 16:52	5.08	51.20	5.08	2.09	10.65	W	B	mz	200401	11/22/2004

