

Atmospheric Cluster Sites (?)

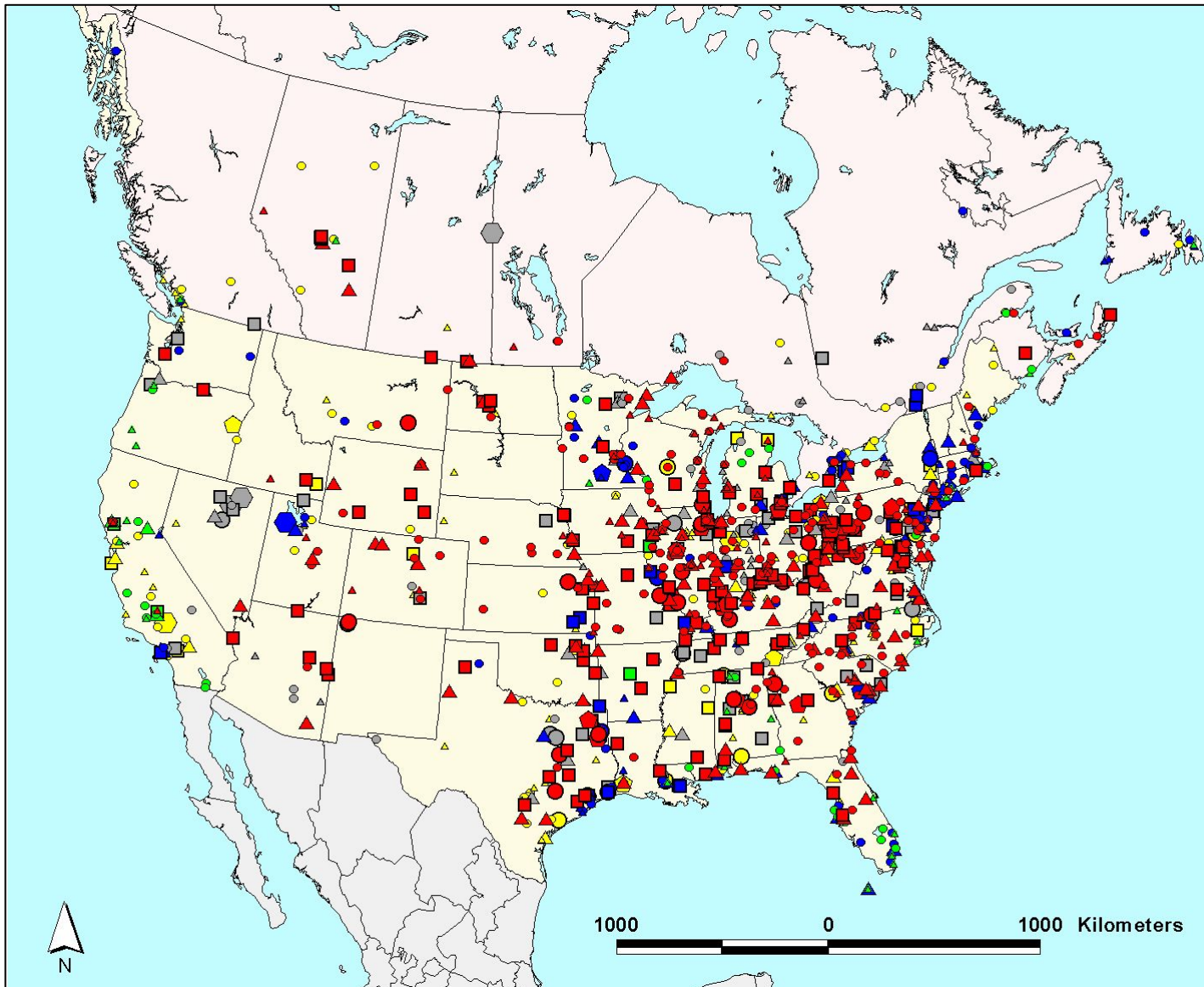
Mark Cohen
NOAA Air Resources Laboratory
1315 East West Highway,
R/ARL, Room 3316
Silver Spring, Maryland, 20910, USA
mark.cohen@noaa.gov

<http://www.arl.noaa.gov/ss/transport/cohen.html>



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Annapolis Maryland, May 5-7, 2008

2002 U.S. and Canadian Emissions of Total Mercury [Hg(0) + Hg(p) + RGM]



Large Point Sources of Mercury Emissions Based on the 2002 EPA NEI and 2002 Envr Canada NPRI*

size/shape of symbol denotes amount of mercury emitted (kg/yr)

△	5 - 10
○	10 - 50
△	50 - 100
□	100 - 300
○	300 - 500
⬠	500 - 1000
⬡	1000 - 3000

color of symbol denotes type of mercury source

■	coal-fired power plants
■	other fuel combustion
■	waste incineration
■	metallurgical
■	manufacturing & other

* Note – some large Canadian point sources may not be included due to secrecy agreements between industry and the Canadian government.

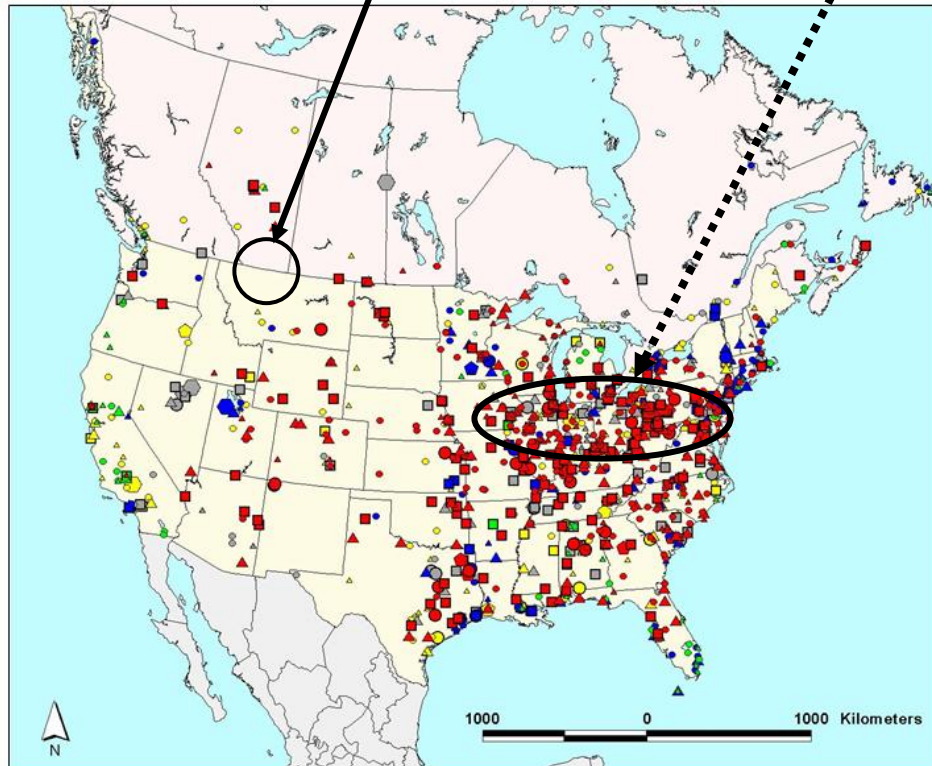
“remote”, far from strong emissions sources* –

- spatial gradients in atmospheric concentration & deposition may be relatively small
- in such a region, the need for “atmospheric cluster sites” may be relatively minimal

In regions with strong sources –

- there may be large spatial gradients around any given “intensive” site
- If want to characterize these gradients with measurements, then “atmospheric cluster sites” would appear to be necessary

2002 U.S. and Canadian Emissions of Total Mercury [Hg(*g*) + Hg(*p*) + RGM]



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**** In this example, have considered current anthropogenic sources... if there are strong “natural” or “re-emission” sources, then gradients may be present***

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Atmospheric Measurements at At Cluster Sites (?):

❑ **Wet deposition measurements (e.g., MDN sites)**

- relatively inexpensive (~\$15-20K/yr per cluster site)
- only represents part of the deposition
- also, wet deposition not as useful for model evaluation

❑ **To estimate dry deposition (or surface exchange) with *measurements*, need speciated ambient concentration measurements and meteorological measurements**

- relatively expensive (\$100-200K/yr per cluster site)
- with current technology, probably impractical to have a large number of routine “cluster sites” around an intensive site that can estimate dry deposition
- perhaps new techniques can be developed that are cheaper and easier, e.g., some sort of passive RGM sampler? Or some sort of inexpensive dry deposition measurement system (*but this is a lot more difficult to develop than you might think...*)

- ❑ It is difficult to apply the “cluster site” idea to the atmosphere.
- ❑ We can imagine taking periodic water, fish, soil and other related samples from a number of cluster sites in a region, *but we can't measure comparably fundamental key atmospheric parameters at a comparable number of sites*
- ❑ Basically, for the atmosphere, you really can't measure even the basic things you need to measure everywhere you need to measure them.
- ❑ The need for models to fill in the gaps between measurements is thus critical for the atmosphere – perhaps even more critical for the atmosphere than for other media...

In sum, for atmospheric “cluster sites”:

- ❑ A few strategically placed comprehensive atmospheric sites in a region may be preferable to a larger number of lesser sites...
 - In some cases, long-term deployments
 - In some cases, campaign-based (i.e., short-term) comprehensive measurement deployments in a region

- ❑ Atmospheric models are going to be needed – even to interpret the data regarding other indicators at cluster sites

- ❑ For the atmosphere, decisions about “intensive” and “cluster” sites should strongly consider the value of the measurements for developing, evaluating and improving atmospheric models

(included in Tab 4 of your binder)

Issues relating to ability to use data from the site for atmospheric model evaluation

- (a) Degree to which the **terrain is atmospherically "simple"** -- at least for initial sites -- so that uncertainties in meteorological data do not overwhelm models. For example, if there are sub-grid scale weather phenomena important to the Hg model that cannot be resolved practically by a meteorological model, then it will be difficult if not impossible to use the data at the site for model evaluation or improvement
- (b) Nature and extent of **existing efforts to simulate meteorology** in the local and regional environment, e.g., if some one is already running, say, MM5 on a fine grid in the region and is willing to collaborate and share data
- (c) Degree of **ability to characterize emissions sources in region** contemporaneously with the measurements. Since an atmospheric model relies on emissions inventories as an input, preferred sites are those where the local and regional sources are -- or can be -- well characterized. An example of this would be a site in the region of a coal-fired power plant that has elected to install a continuous, speciated mercury emissions monitor

Issues relating to ability to use data from the site for atmospheric model evaluation

... continued

- (d) Tendency to get **well defined "episodes"**, including source-related episodes. In general, good to have a wide range of concentrations of each atmospheric mercury form to evaluate the model against, as opposed to a site with relatively constant concentrations of atmospheric mercury
- (e) Relative tendency to get **"simple" plume impact episodes** -- e.g., from one single well defined source at a time -- as opposed to getting "complex" plume impact episodes from multiple, diverse sources.
- (f) **Not too close to sources** (e.g., less than 5-10 km and meteorological uncertainties may be too dominant). And, if too close to tall-stack source, plume will not even have hit the ground yet.
- (g) **Not too far from sources**. At distances greater than ~100 km or so, may be difficult to "see" a source, even if wind blowing directly from the source to the site.
- (h) Degree of **atmospherically relevant interfering activities** at site, e.g., amount / proximity of onroad or offroad traffic
- (i) **Ability to erect a stable tower**, e.g., at least 10 meters tall. Ability to erect or existence of taller tower for the possibility of making measurements aloft (e.g., 100 m tower).