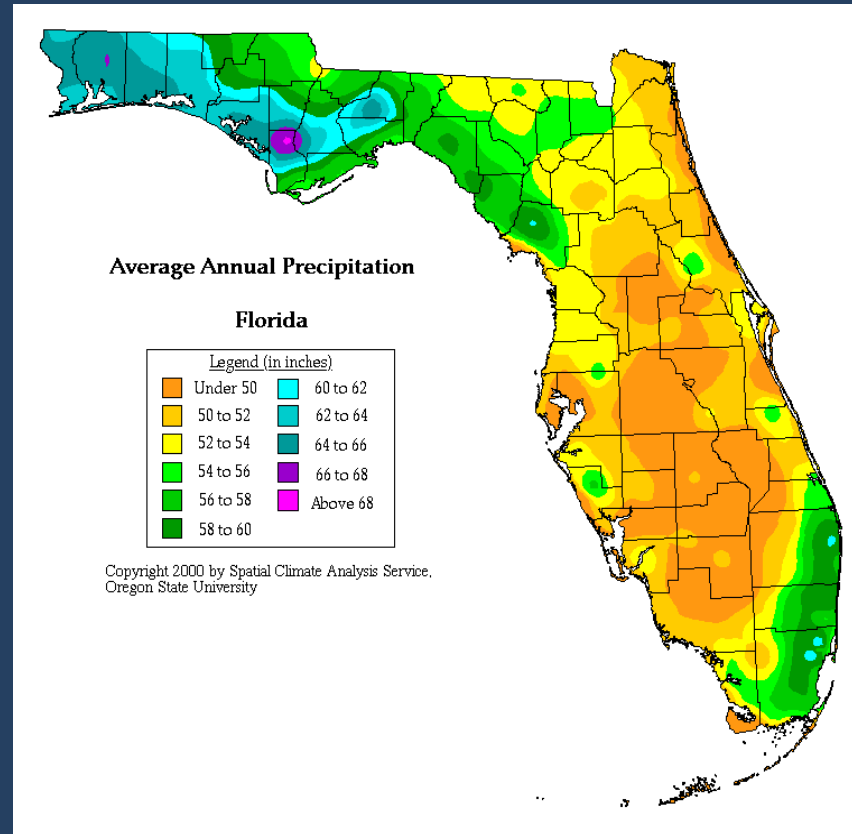


Florida Statewide Mercury TMDL Study

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Mercury TMDL Stakeholders Meeting
Tallahassee, Florida
January 4, 2011

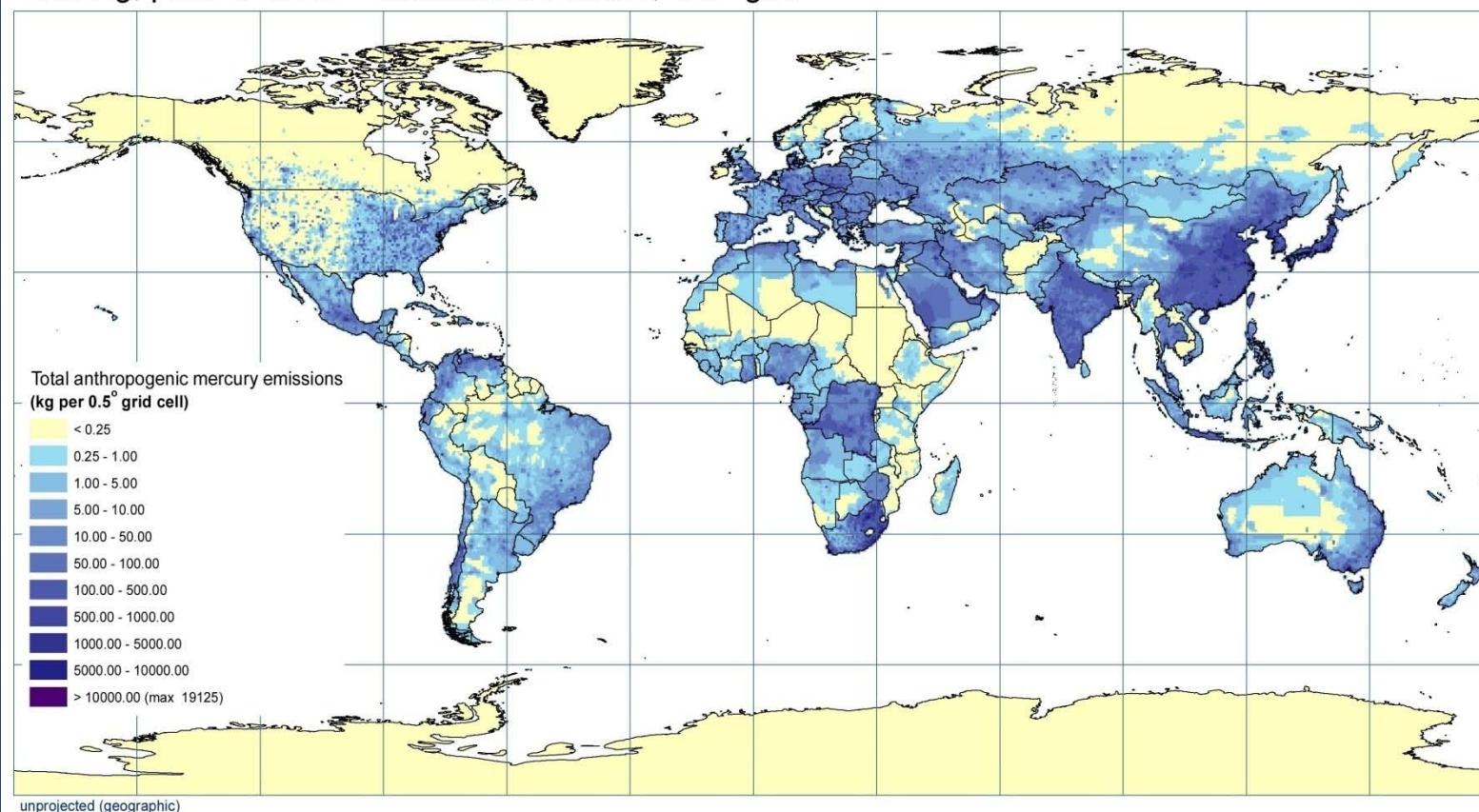
Spatial Distribution of Global Emissions of Mercury to Air

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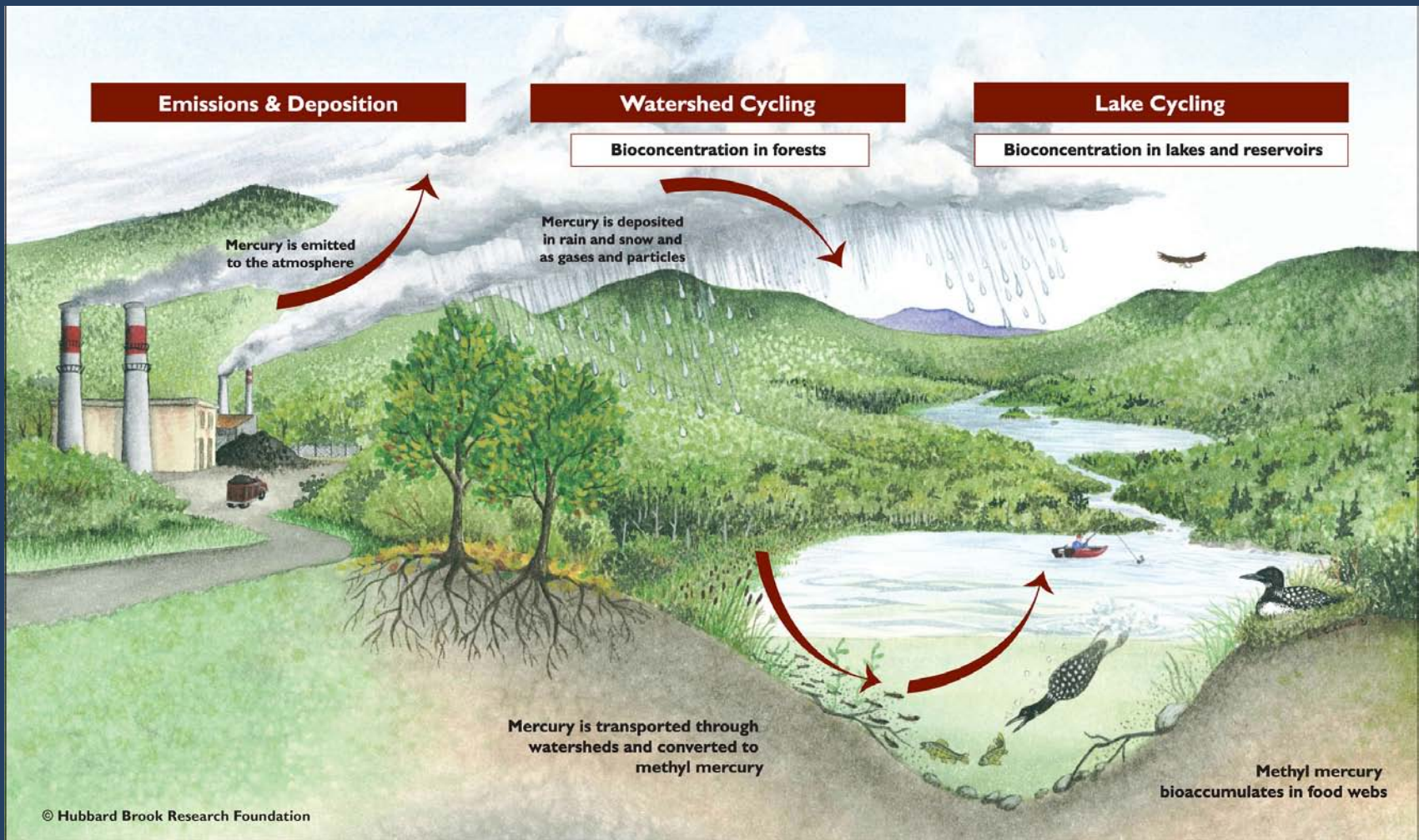
Spatially Distributed Inventories of Global Anthropogenic Emissions of Mercury to the Atmosphere, 2000

Total Hg, point sources + distributed sources, 0.5° grid



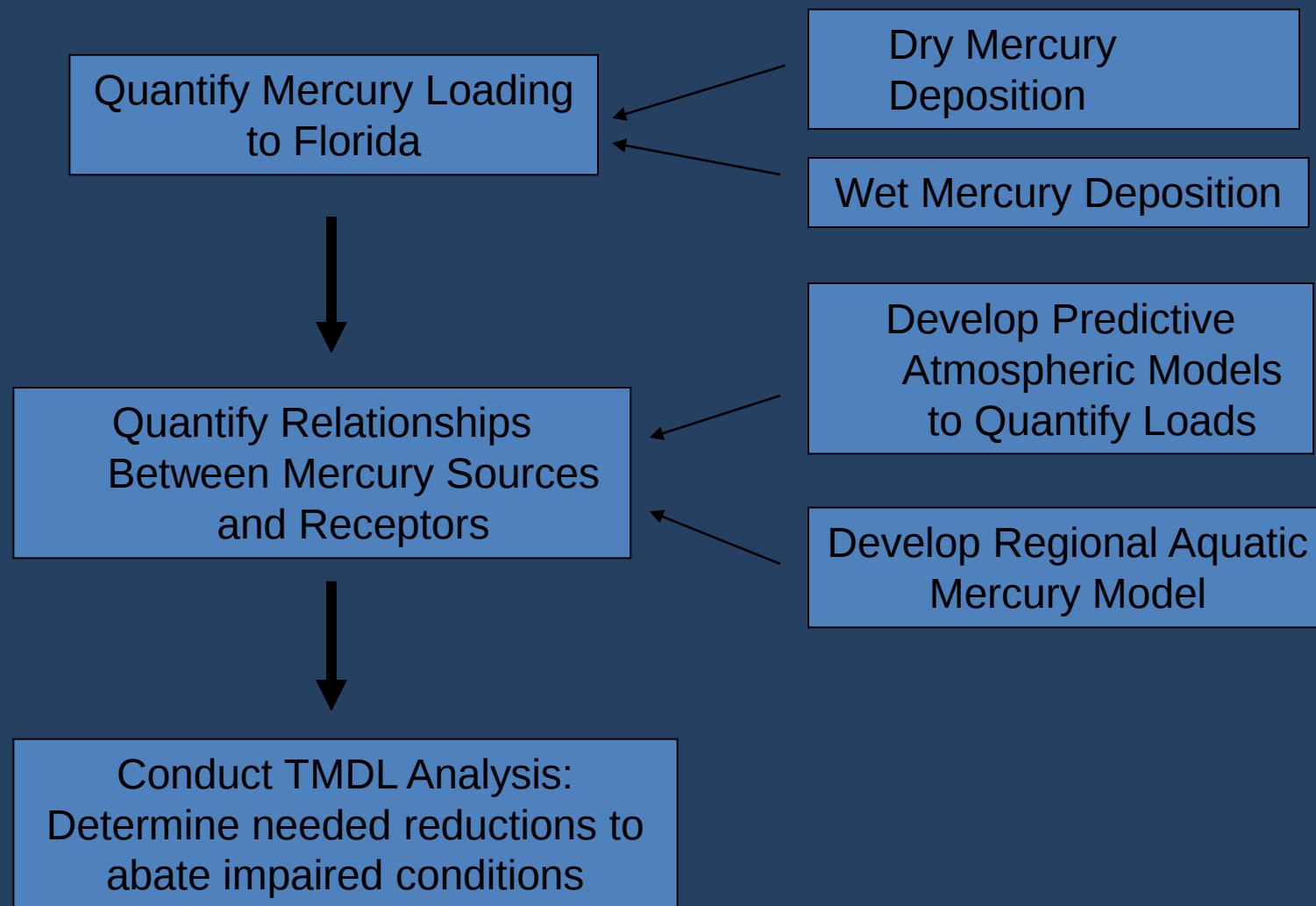
citation:
Pacyna, J., S. Wilson and F. Steenhuisen. 2005.
Spatially Distributed Inventories of Global Anthropogenic
Emissions of Mercury to the Atmosphere.
(www.amap.no/Resources/HgEmissions/HgInventoryMain.html)

Hg Emissions → Hg Deposition → Hg Exposure



Statewide Mercury TMDL Project for freshwater

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The Project Team

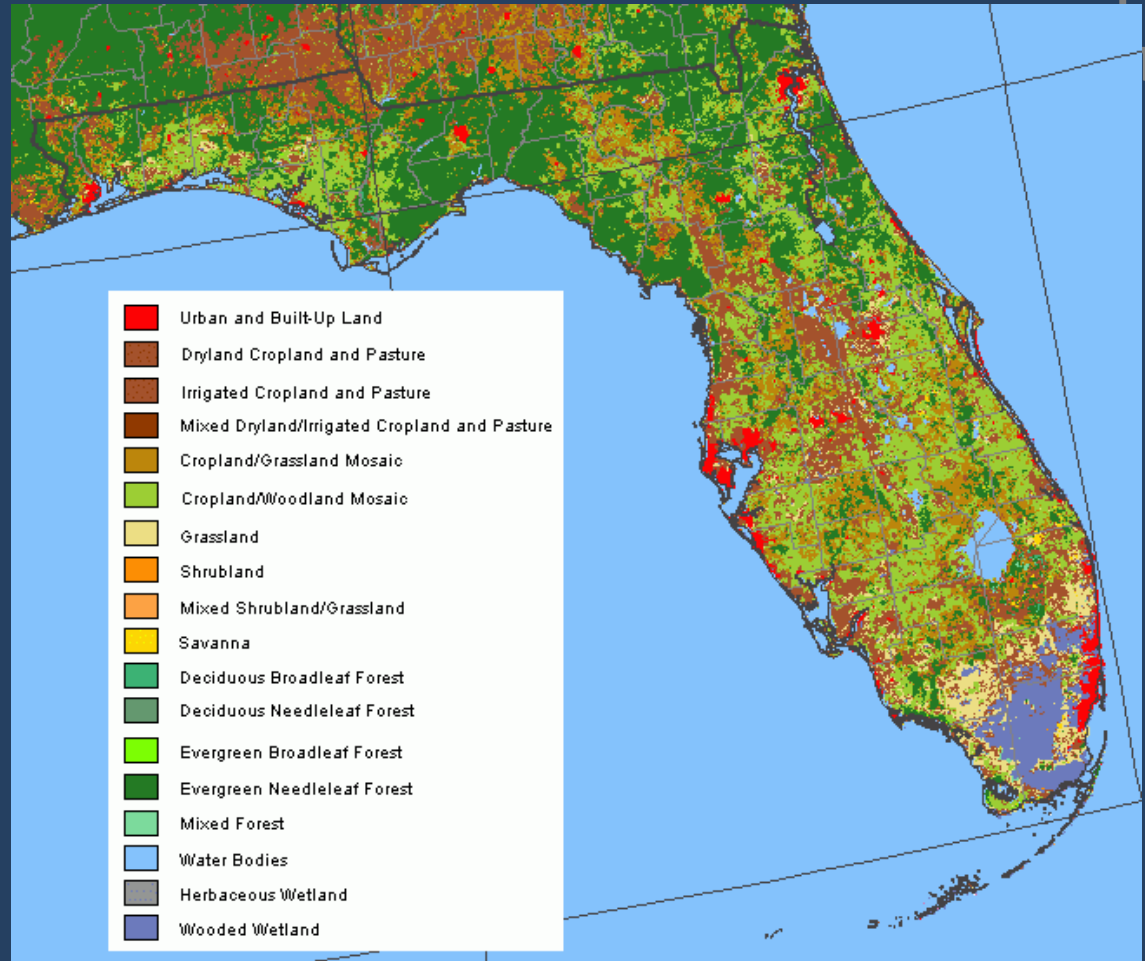
- FDEP
- University of Michigan
- Aqua Lux Lucis, Inc.
- Atmospheric Research & Analysis, Inc.
- Institute for Atmospheric Pollution of the National Research Council (IIA-CNR) of Italy
- Florida Fish and Wildlife Conservation Commission
- USEPA Office of Research and Development
National Exposure Research Laboratory
- USEPA Science and Ecosystem Support Division

The Project Team (continued)

- Southern Company Services, Inc.
- Orange County
- University of Central Florida
- Everglades National Park
- Broward County
- Hillsborough County
- City of Jacksonville

Major Mercury TMDL Project Components

- Atmospheric Monitoring
- Atmospheric Modeling
- Aquatic Monitoring
- Aquatic Modeling



Overview

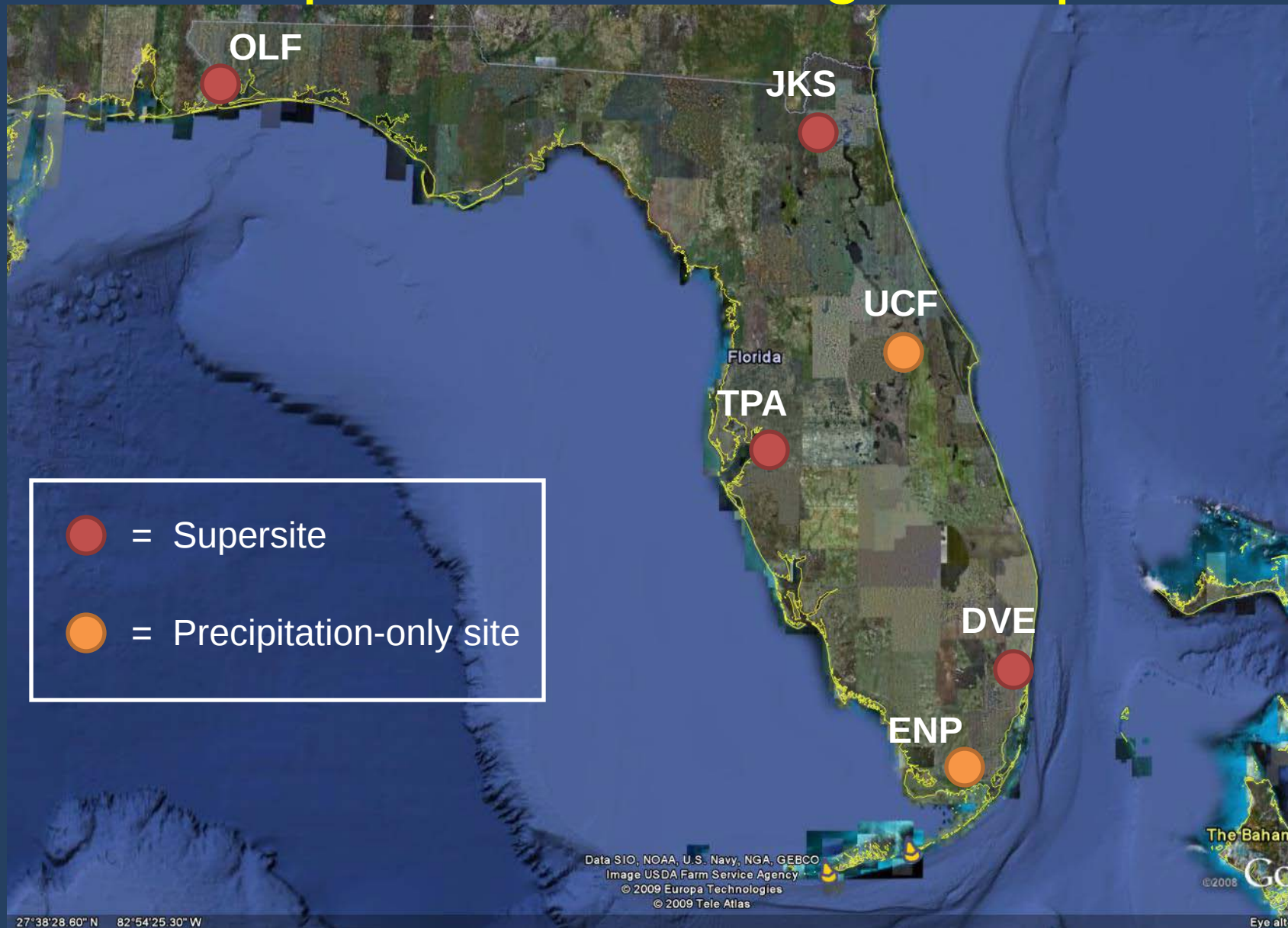
- Overall goals of the atmospheric monitoring effort:
 - Provide data to assess wet and dry loading estimates of mercury.
 - Provide data to assess source attribution for mercury.
 - Provide data to evaluate deterministic atmospheric models.

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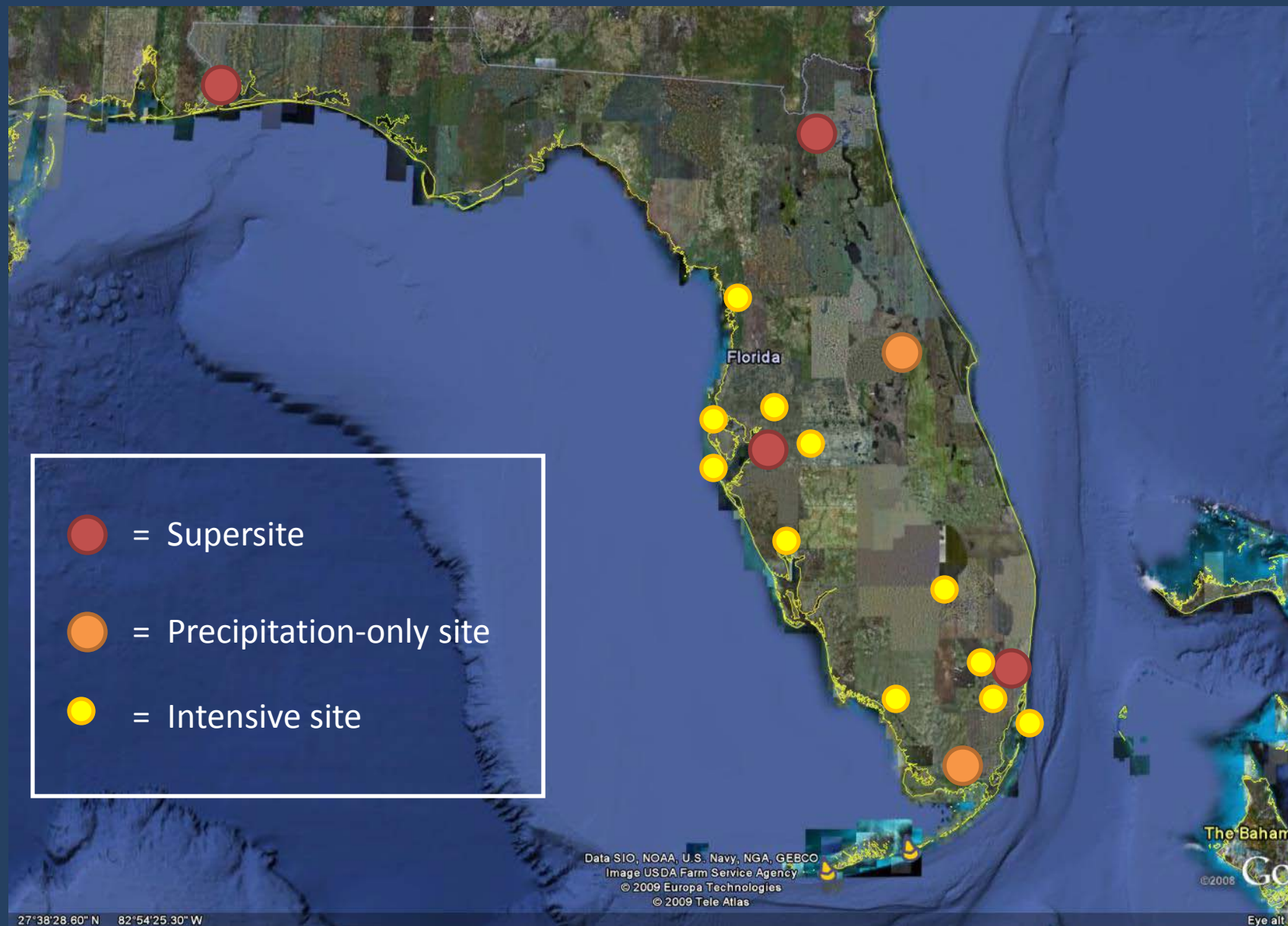
Atmospheric Monitoring at Supersites

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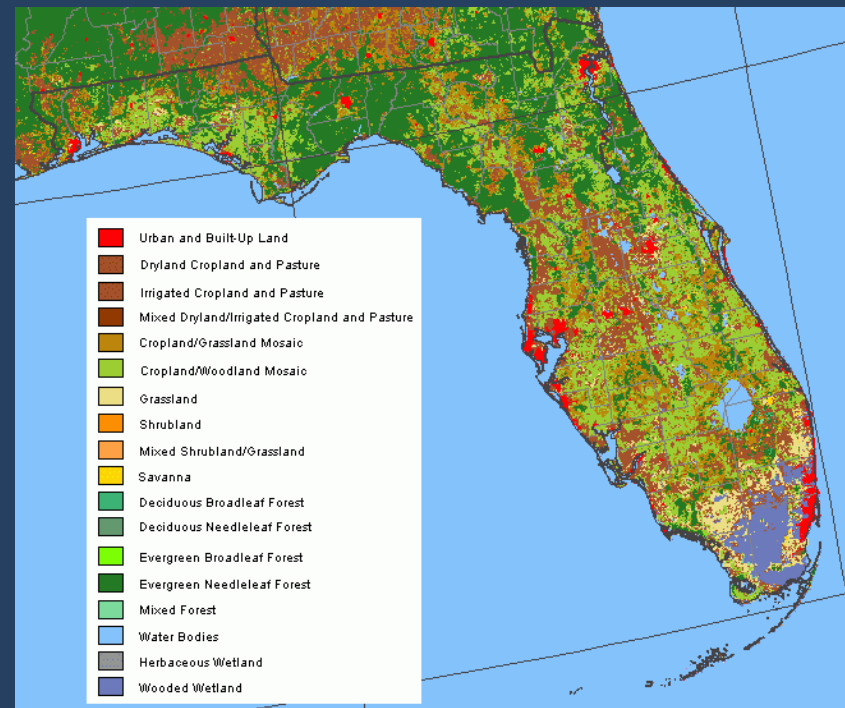
Intensive Deposition Monitoring (ex: 2009)

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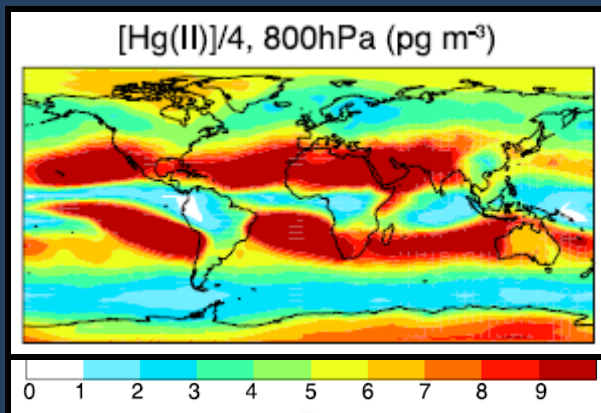


Overview

- Goals of the overall atmospheric modeling effort:
 - Provide wet and dry loading estimates of mercury and other species of interest.
 - Provide source attribution for mercury deposition to freshwater lakes and streams.

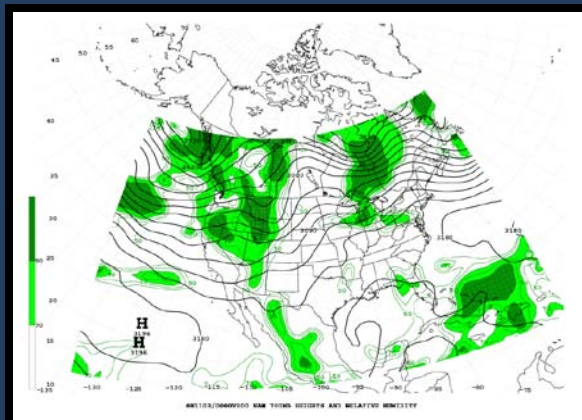


Global Chemical Model (ECHMERIT)



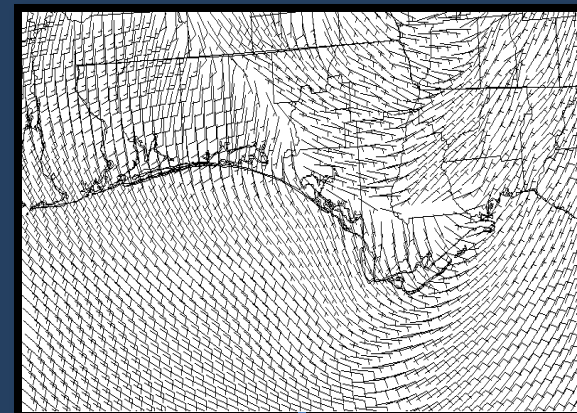
**Initial and
Boundary Conditions**

Regional Meteorological Model (WRF)

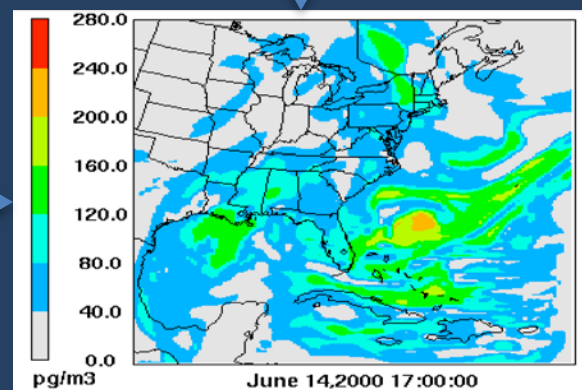


**Regional Thermodynamic
and Wind Fields**

Regional Meteorological Model (WRF Nested Domain)



**Local Thermodynamic
and Wind Fields**



**Regional Chemical Transport Model
(CMAQ)**

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Major Goals of Aquatic Component of TMDL Study

Predict the current distribution of Hg concentrations in a target species of fish (largemouth bass) throughout the state.

1. An inferential approach is necessary since it is not feasible to sample and determine directly the LMB Hg concentration in the more than 7,700 lakes and 77,500 km of streams and rivers in Florida.
2. The inferential approach assumes that LMB Hg concentrations across lakes and streams are dominated by biogeochemical variables other than mercury loading, while variations in fish tissue concentrations within a lake (all other factors held constant) are governed by changes in mercury loadings.

Major Goals of Aquatic Component of TMDL Study

Predict how the current distribution of Hg concentrations in LMB across the state will change in response to changes in atmospheric deposition of Hg.

1. Approach assumes that the long-term response of aquatic ecosystems to changes in atmospheric deposition of Hg is linear (more specifically, a 50% reduction in inputs will result in a long-term 50% reduction in fish tissue Hg).
2. Approach assumes that status of lakes and streams is currently in steady-state (equilibrium with atmospheric inputs of Hg).
3. Changes in atmospheric inputs will vary from one eco-region to the next as a function of the transfer relationship between receptor sites and local emission sources and the magnitude of local emission reductions. These relationships will be defined by the Atmospheric Monitoring and Modeling components of the TMDL Study.

Sampling Approach to Develop Aquatic Model to Infer Statewide Hg Distribution

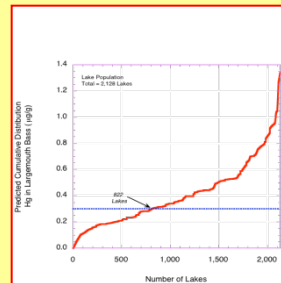
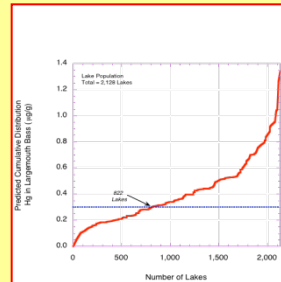
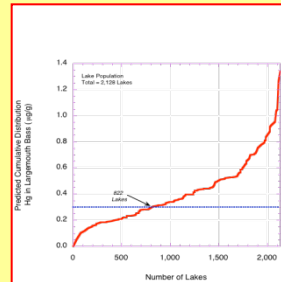
- Lake and stream sampling based on three variable by five concentration level sampling matrix, yielding 125 unique variable-level combinations.
- Total N sampled = 128 lakes and streams each.
- Prospective lakes and stream reaches will be selected from FDEP SMN.
- Concurrent water chemistry sampling for major ions, nutrients, and dissolved and total Hg and MeHg.
- 12 LMB will collected from each water body for Hg_{total} analysis.
- Statistical models will be constructed relating LMB Hg concentrations to water quality variables and atmospheric deposition.
- Model verification will be conducted using a *k-fold* approach.

Predicting Target Loading Rates

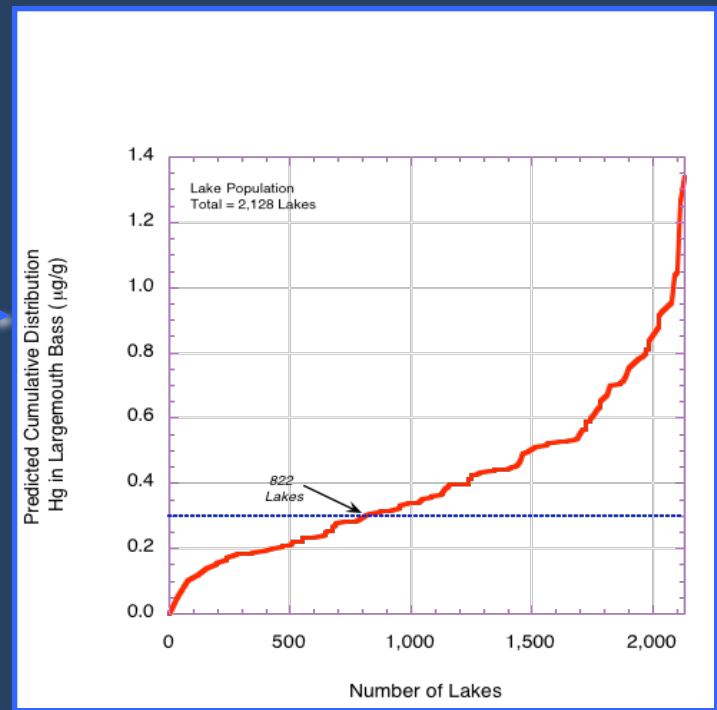
Sample lakes using
balanced bins
125 bins
 $N = 128$

Develop Empirical
Model

Apply model to
each TMDL Basin
using randomized,
stratified sampling



*Cdf*s for individual
eco-region



Cdf for entire State
of Florida