BMEGUI: Software for Geostatistical Estimation of Superfund Chemical Contaminants in Stream Water

25th Annual Meeting of the Superfund Research
Raleigh, NC

Prahlad Jat, Yasuyuki Akita, and Marc L. Serre
University of North Carolina,
Chapel Hill, NC

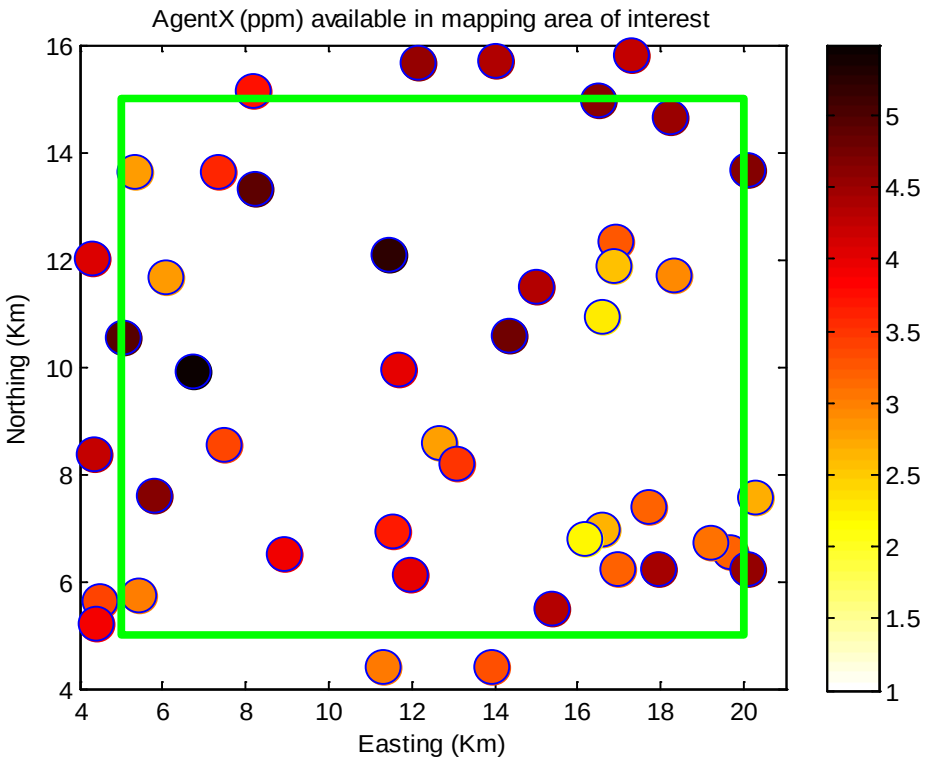
BME: Bayesian Maximum Entropy

BMElib – A powerful MATLAB numerical toolbox of Modern Spatiotemporal Geostatistics implementing the BME theory

BME allows processing a wide variety of knowledge bases

Rigorously processes hard and soft data

AgentX (ppm) Observations



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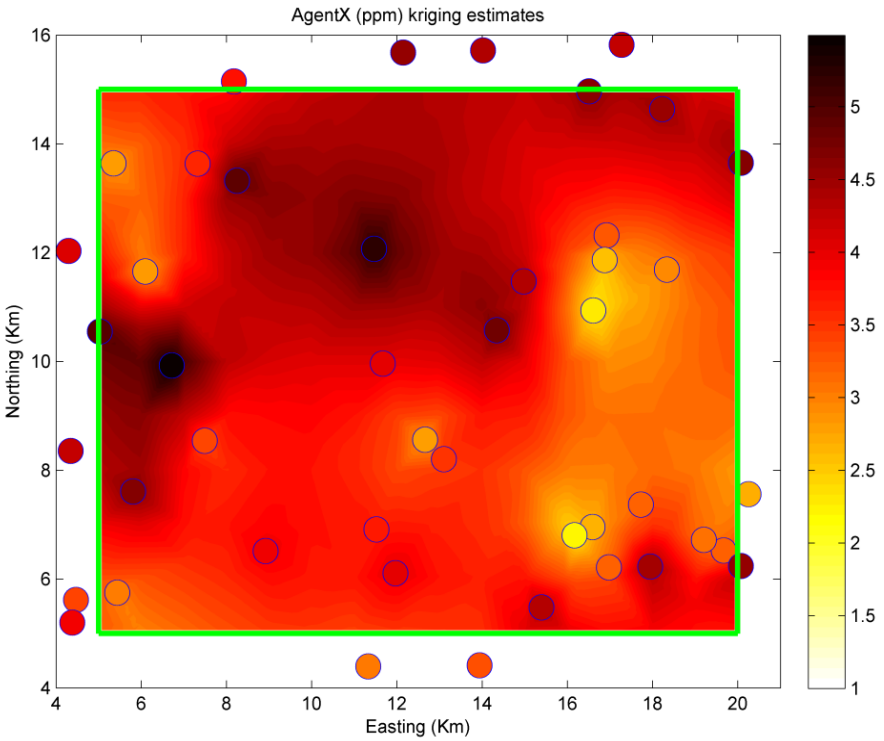
BME estimation (agentX, ppm)



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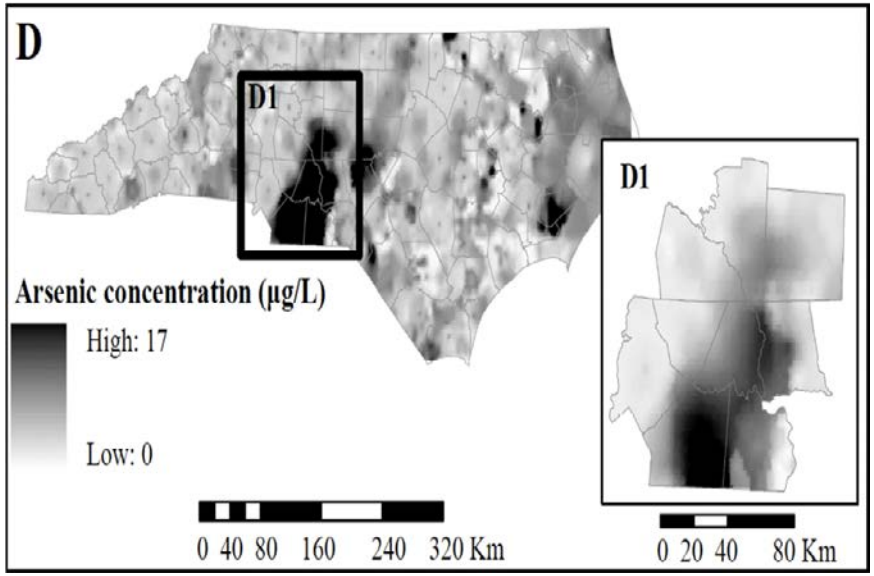
BME estimation of arsenic (ug/L)



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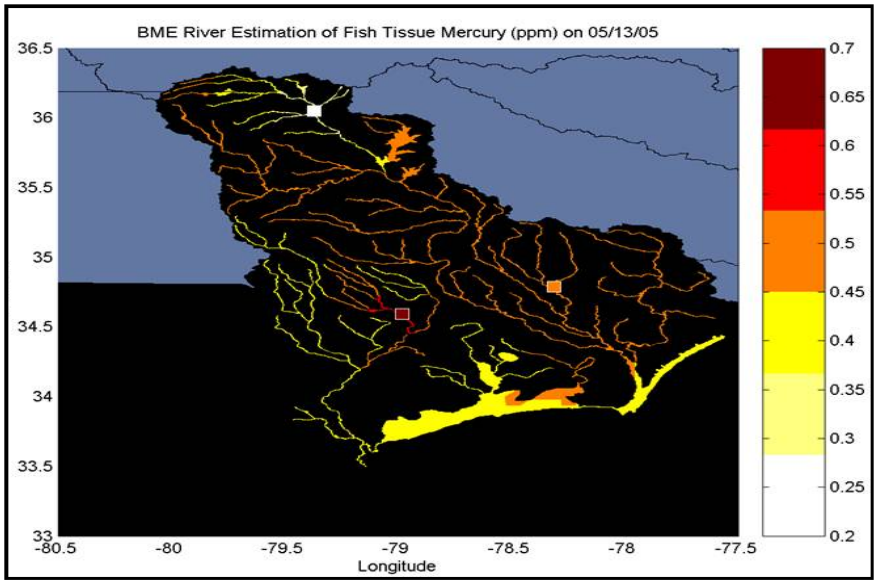
BME estimation of fish tissue mercury (ppm)



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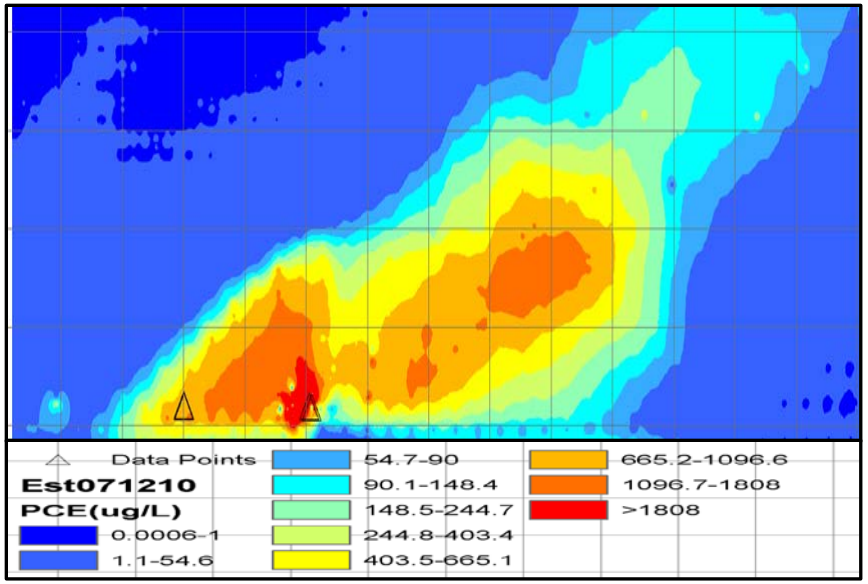
BME estimation of PCE (ug/L) at Billings, MT



BMEGUI: Bayesian Maximum Entropy Graphical User Interface

- ❑ Enhance and facilitates easy access to computationally intensive space/time BME analysis
- ❑ Provides the flexibility demanded by the specialist and the simplicity needed by the novice
- ❑ No programming skill needed
- ❑ ArcGIS compactable output

1. Read Data File
2. Check Data Distribution
3. Exploratory Data Analysis
4. Mean Trend Analysis
5. Covariance Analysis
6. BME Analysis

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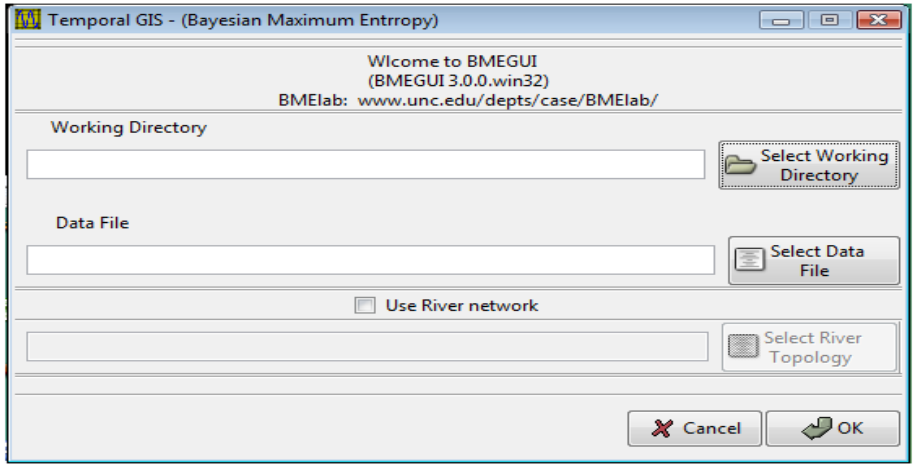

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Longitude	Latitude	Time (year)	PAHs (ug/kg)	Station ID
-97.202	40.145	1990	137	12526
-96.799	40.417	1991	112	12527
-96.395	40.688	1992	522	12528
-95.992	40.96	1993	234	12529
-95.588	41.231	1994	349	12530
-95.185	41.503	1995	57	12531
-94.781	41.775	1996	69	12532
-94.378	42.046	1997	156	12533

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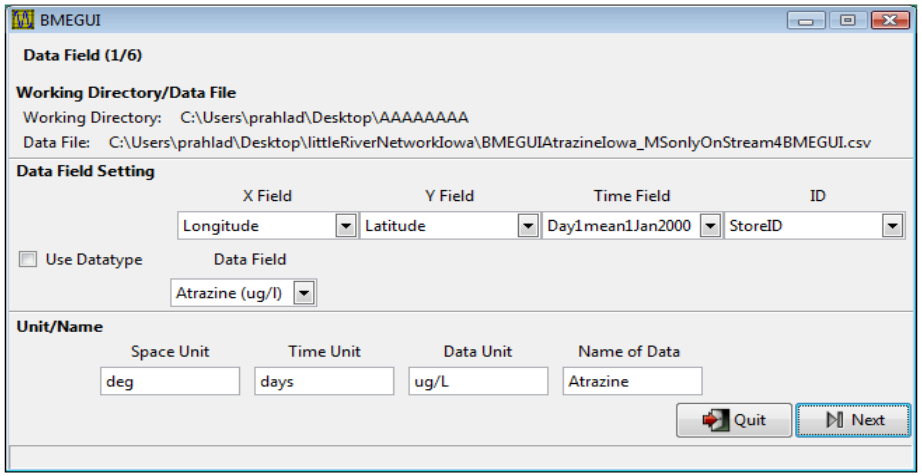

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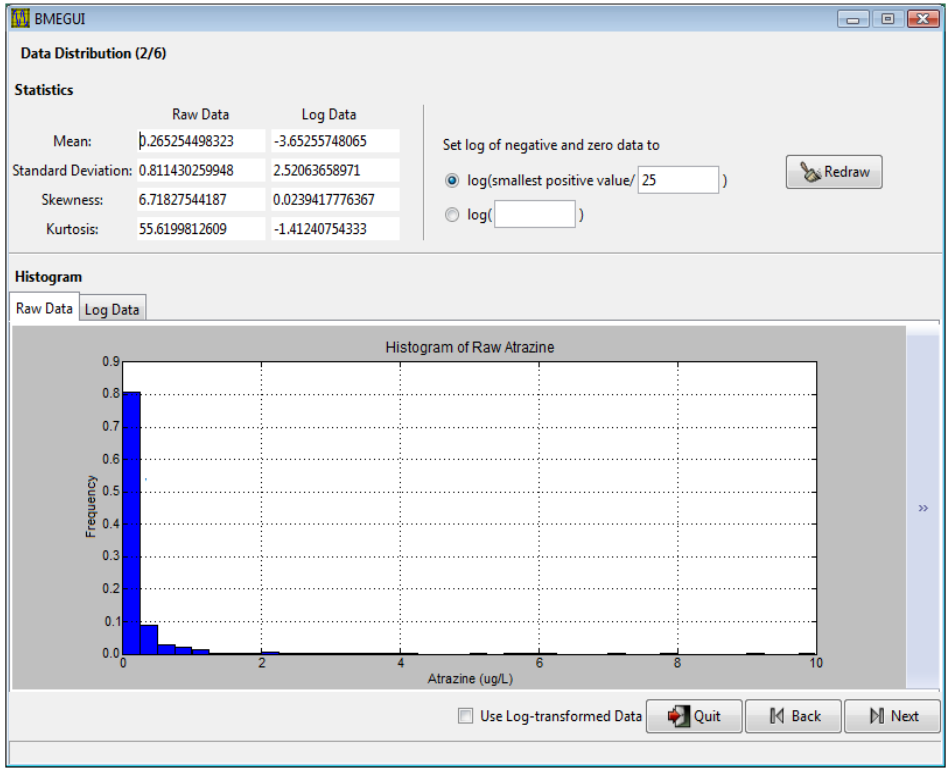

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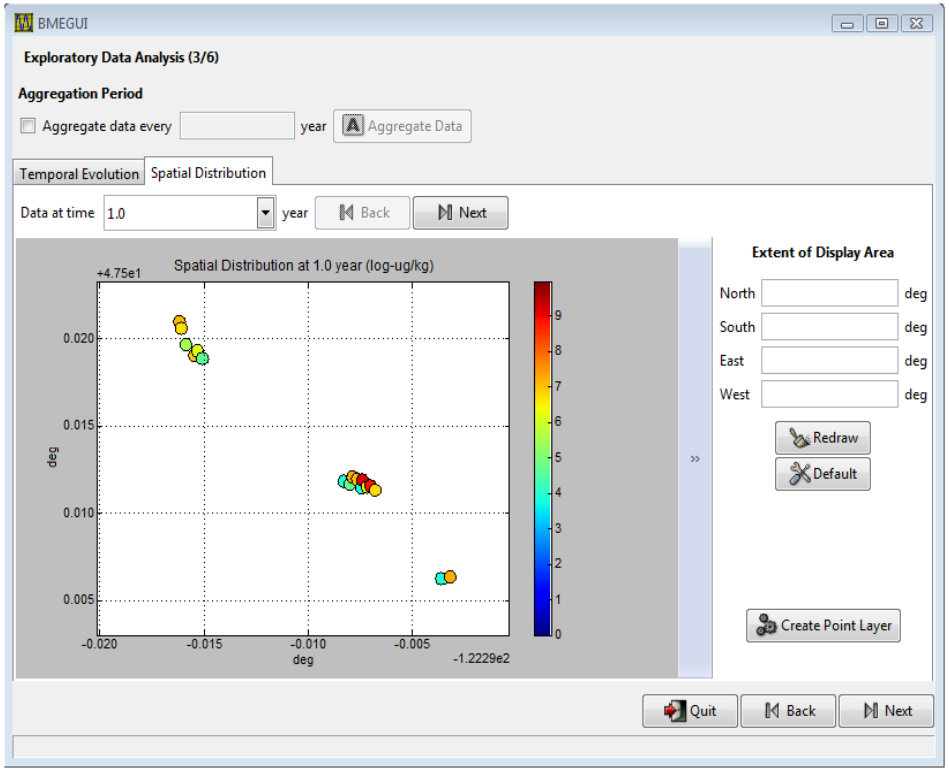

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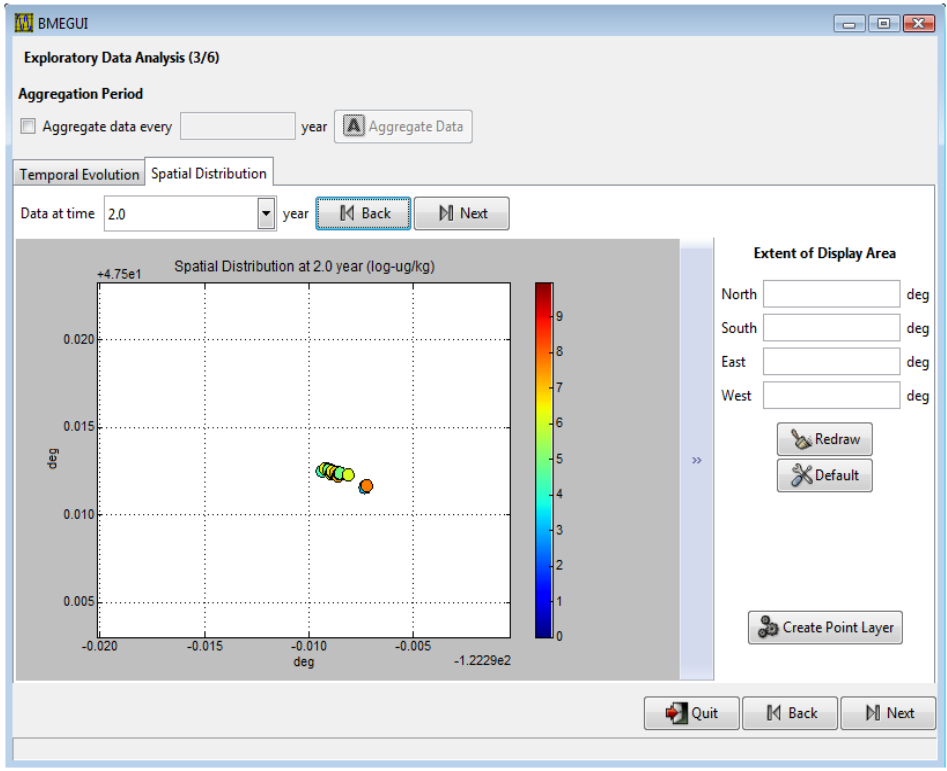

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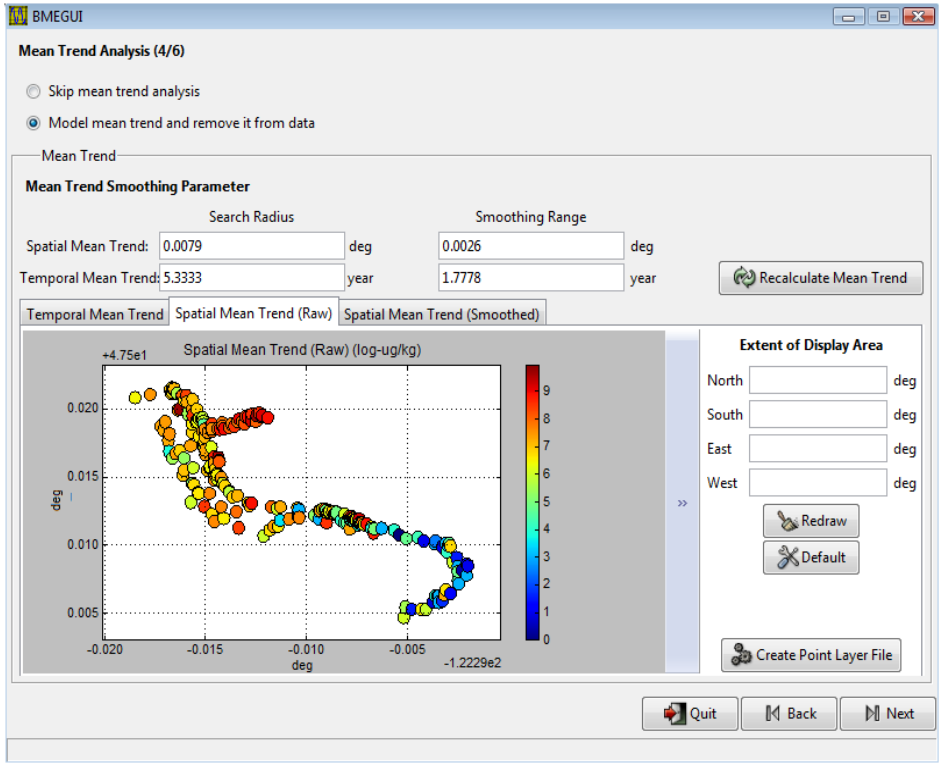

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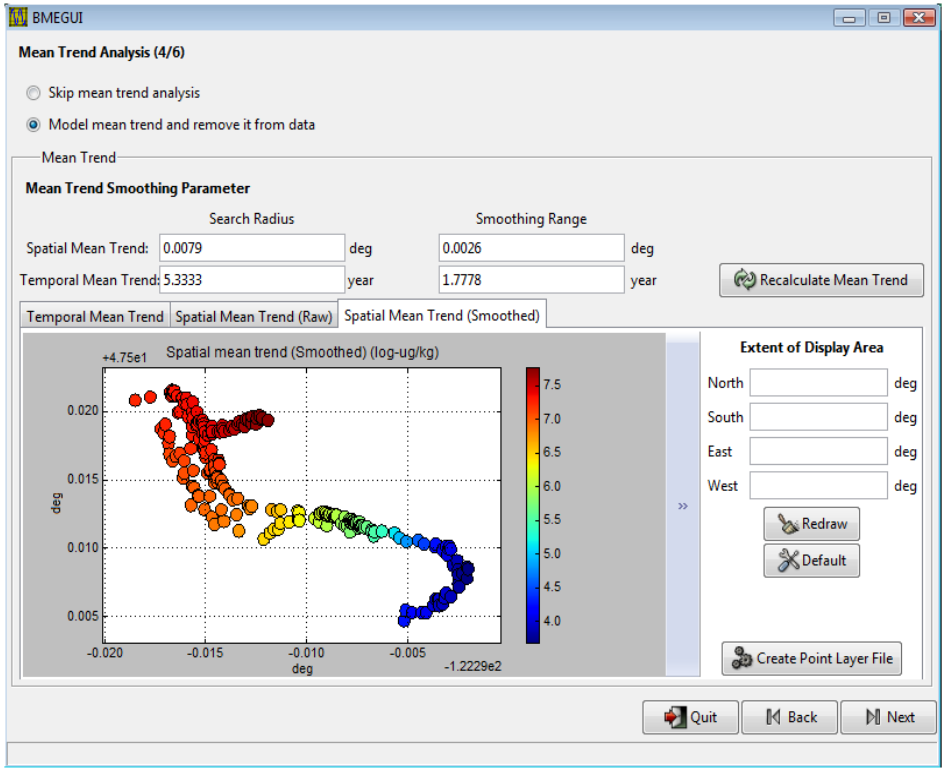

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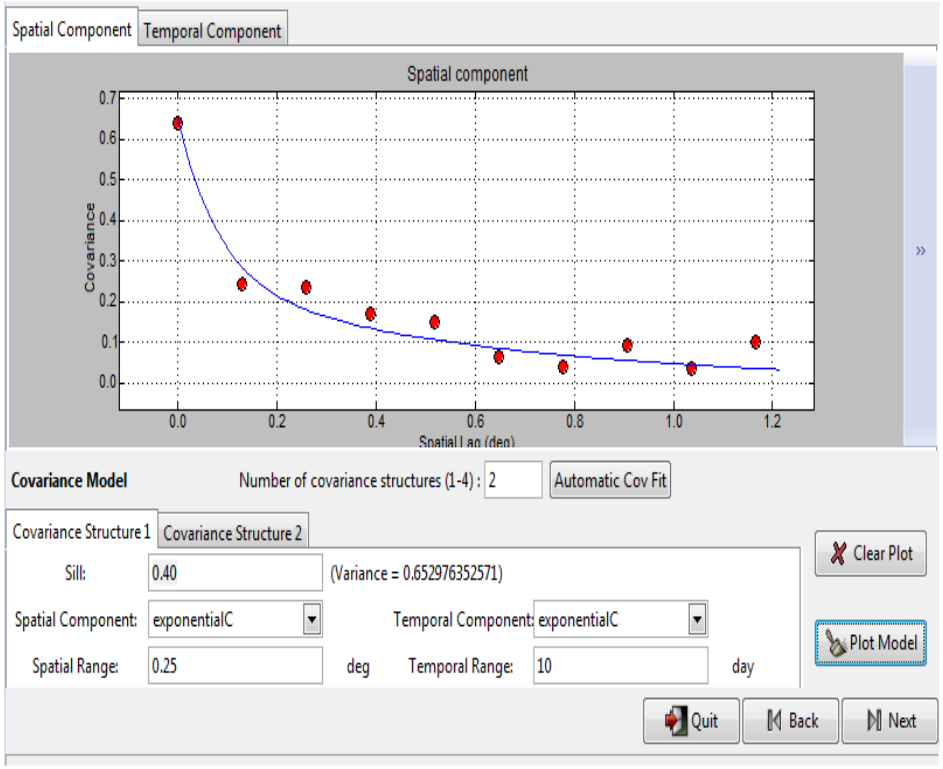

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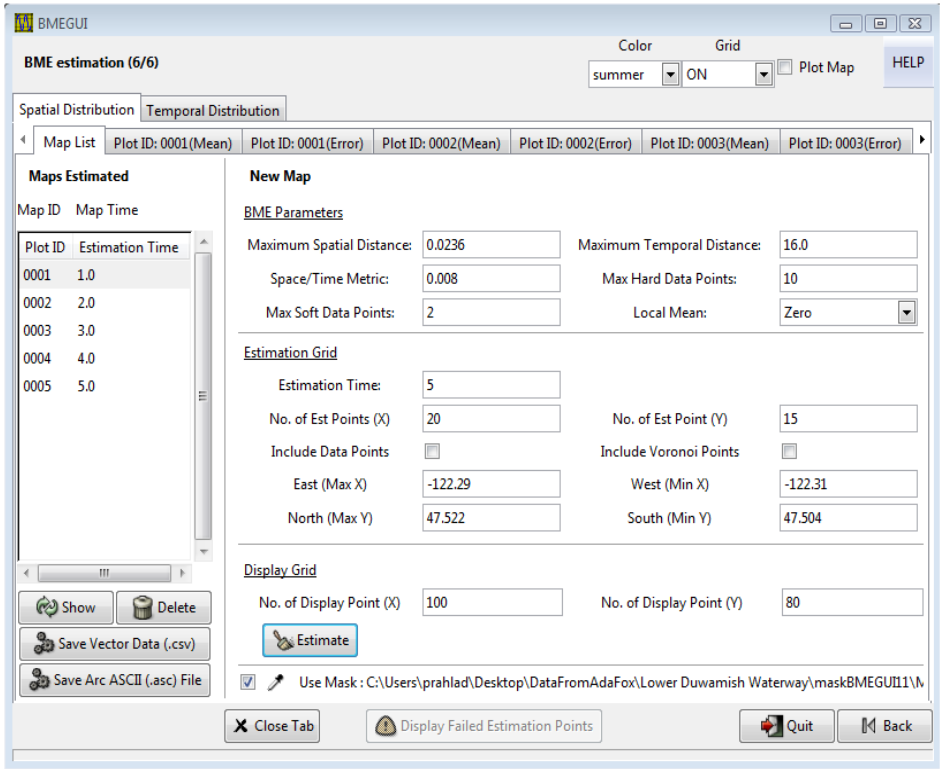
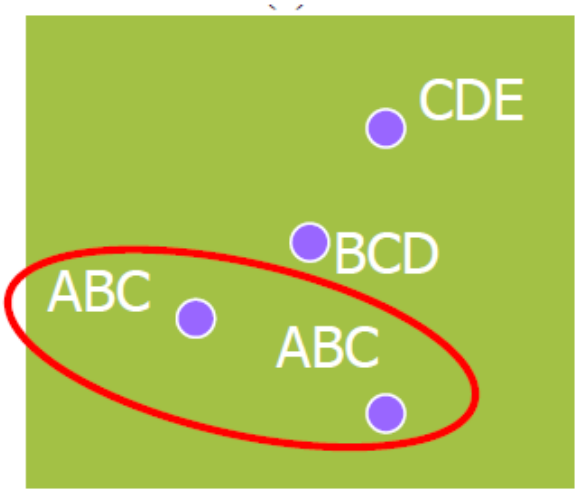


BMEGUI: automatic detection and correction of data errors

Type 1 Error: The same station ID is assigned to different locations



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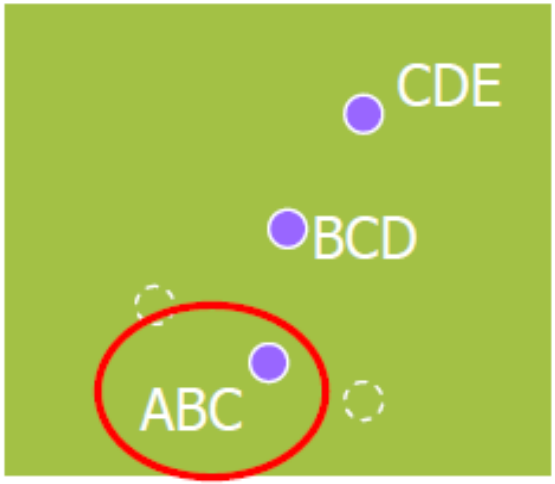
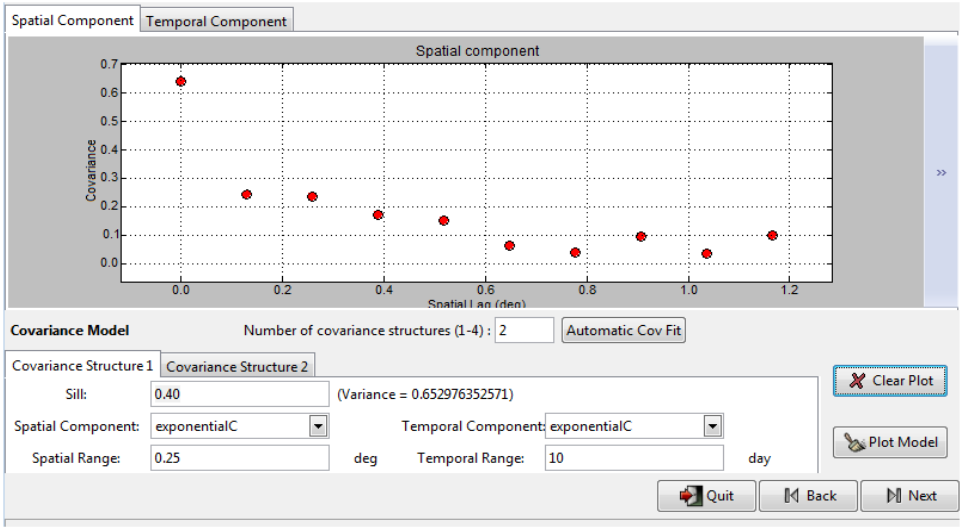


BMEGUI: Automatic Covariance Fitting

Automatic Covariance Fitting: Automatically fits a covariance model to experimental covariance values



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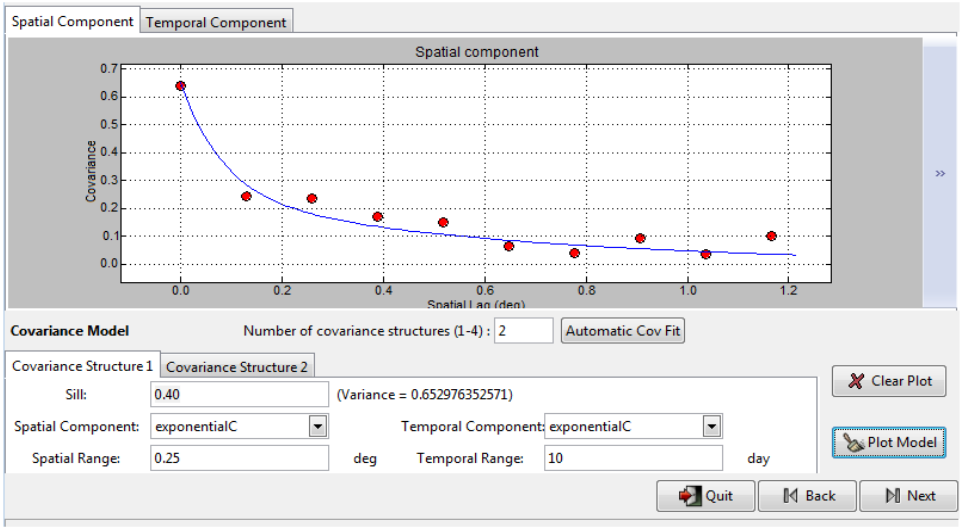
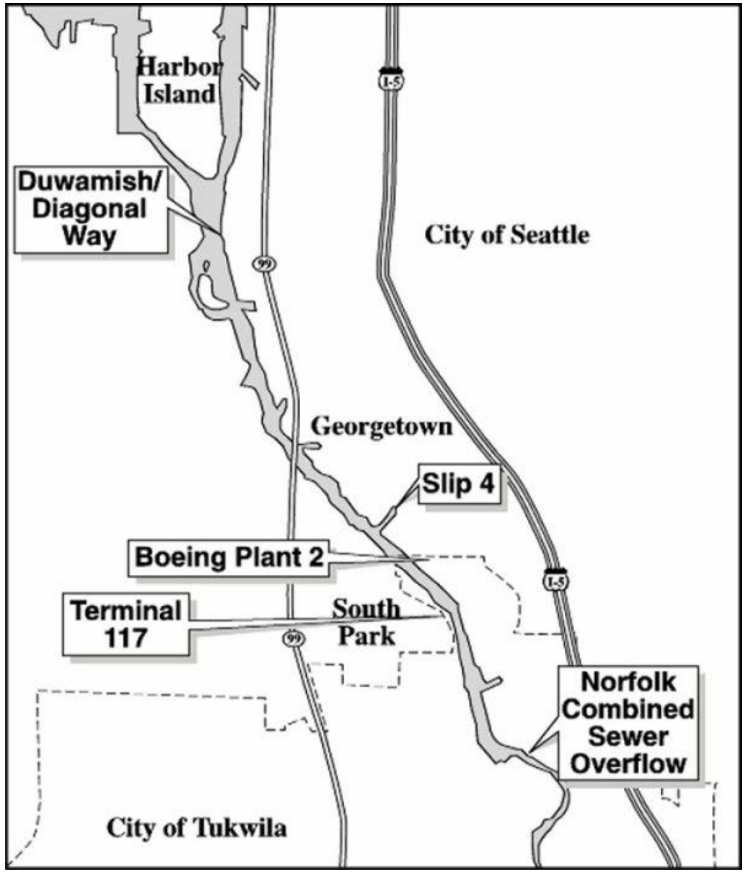


Site: Lower Duwamish Water Way (EPA Region10, Federal Superfund Site), King County, WA

Medium: Sand

Contaminants: PCBs, PAHs, and Metals

Obs. Period: 1994 -2007



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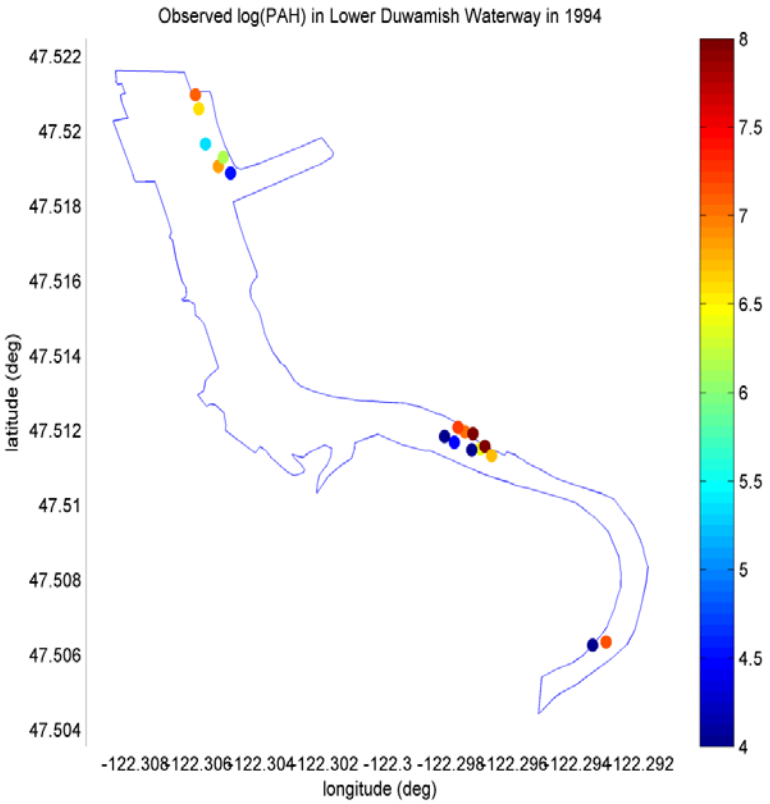

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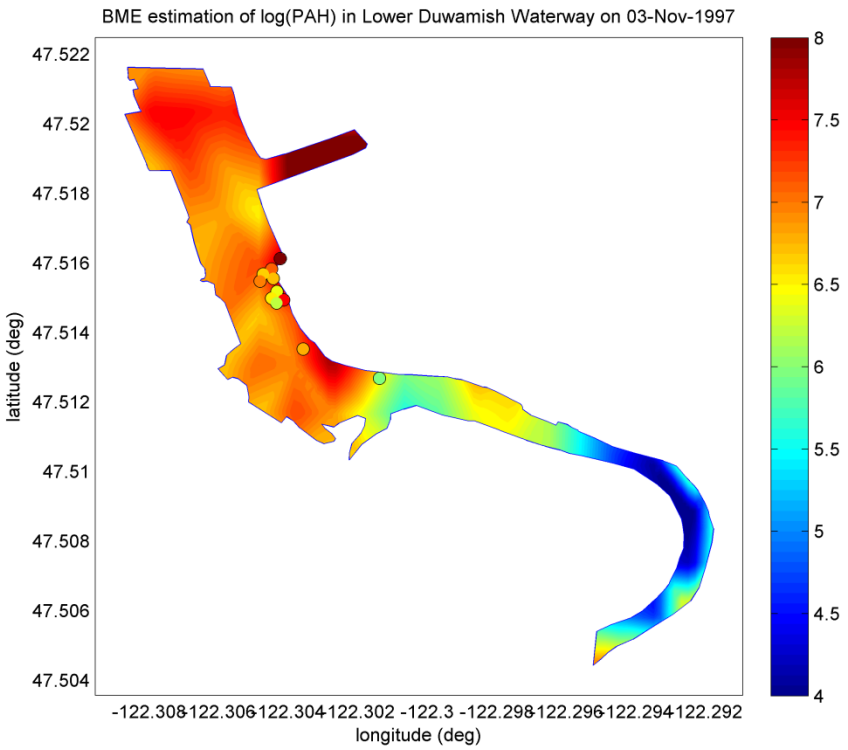

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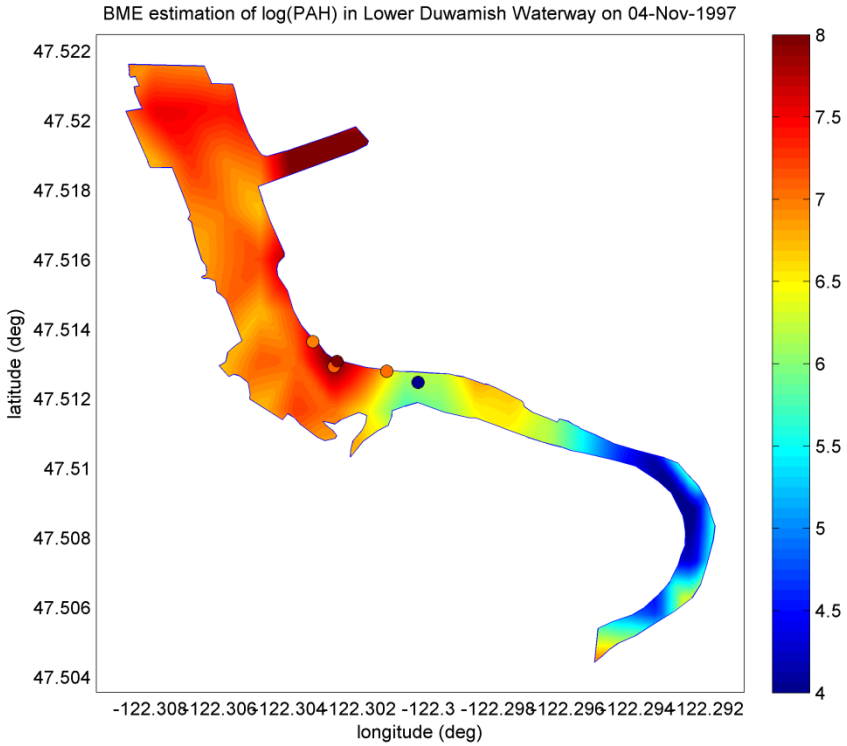

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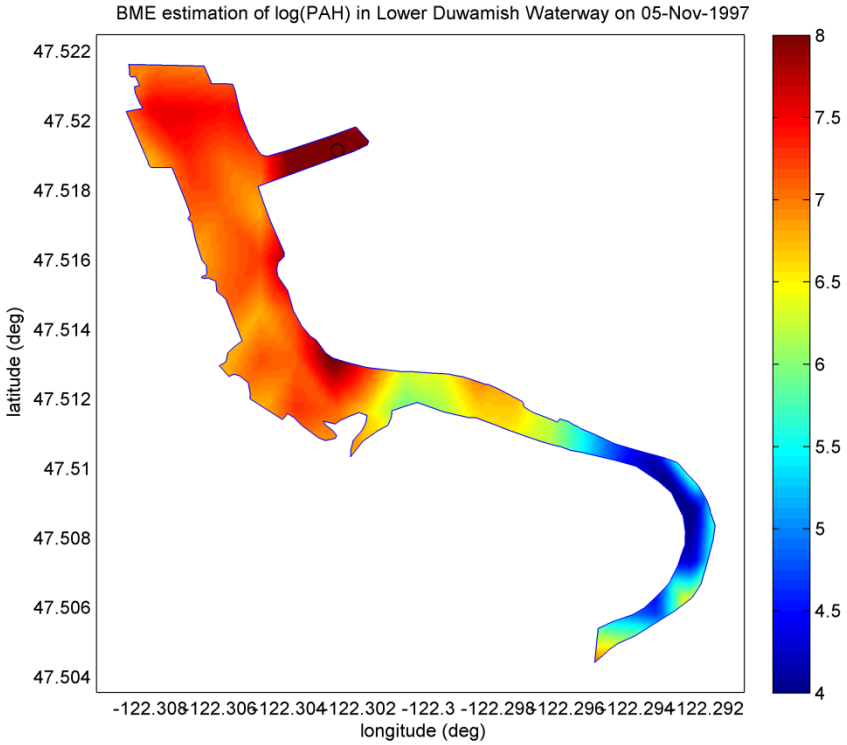

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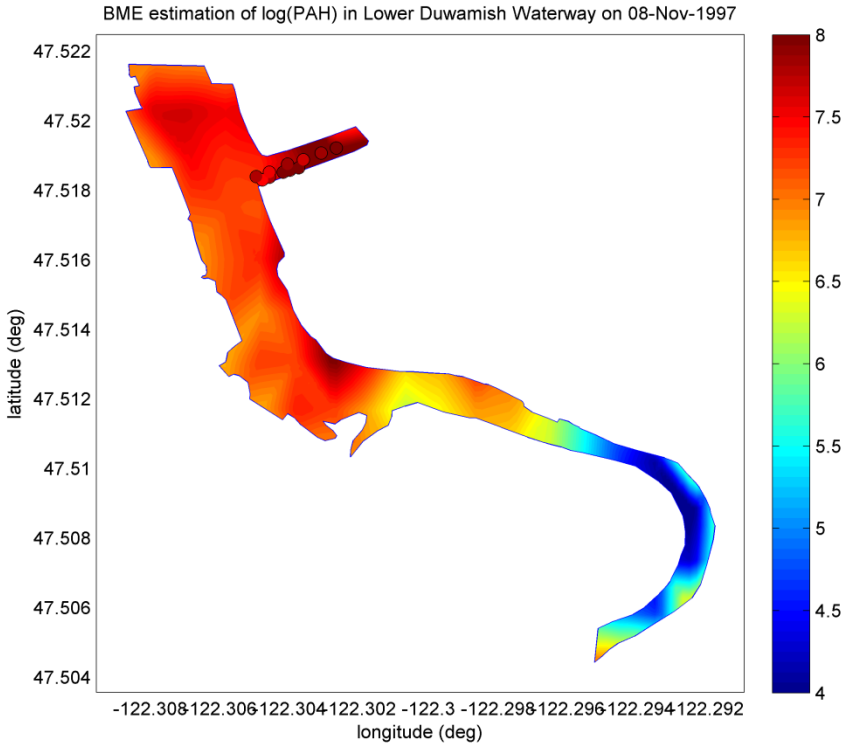

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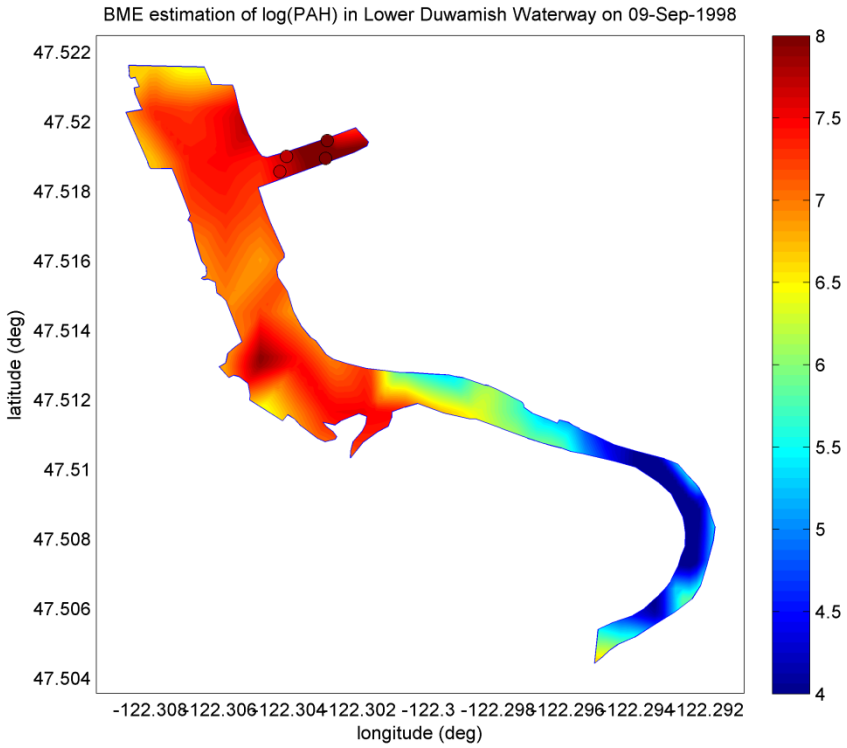

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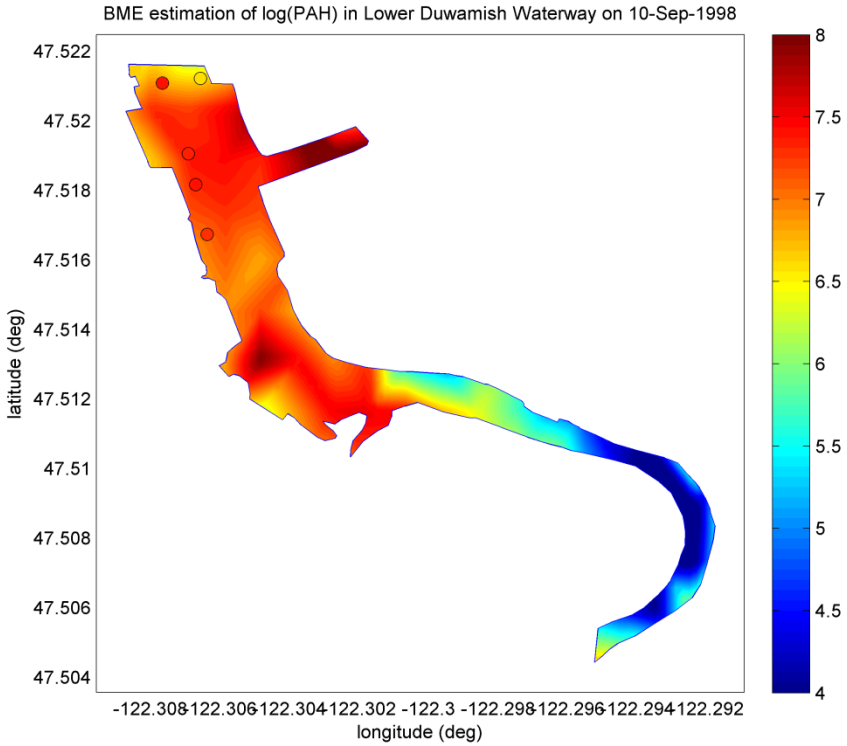

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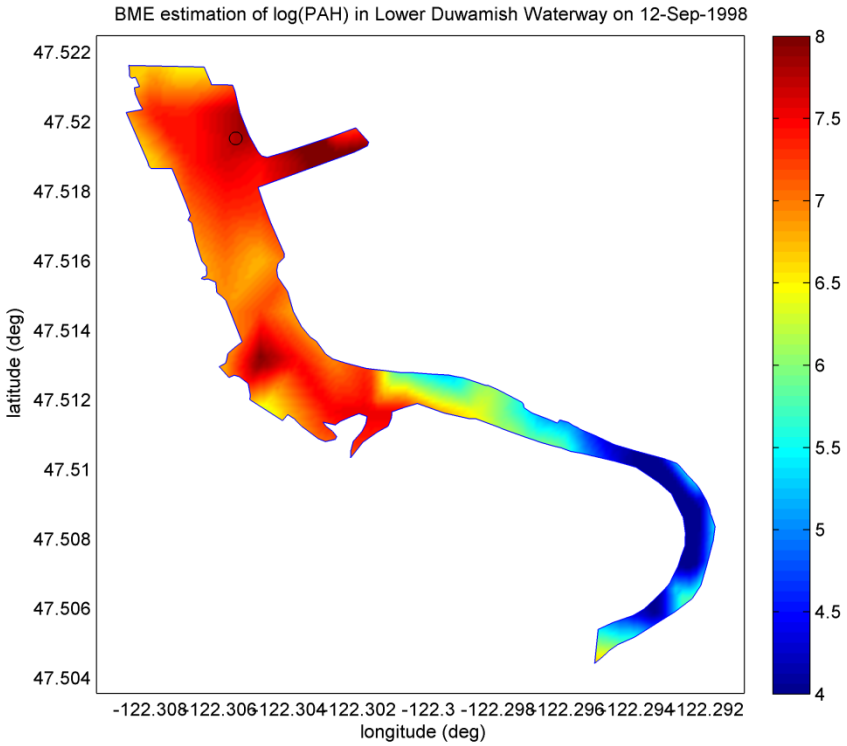

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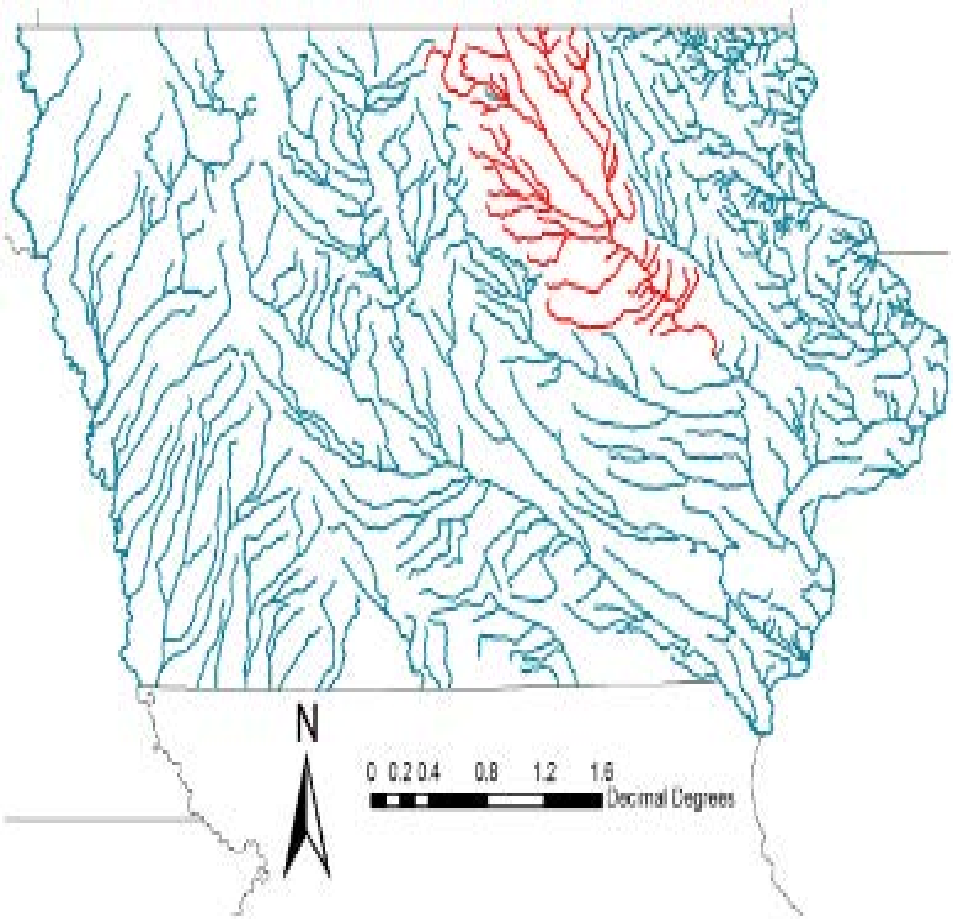
Site: NE Iowa State, Major Rivers .

Medium: Surface Water

Contaminants: Atrazine

Obs. Period: 2000-2010



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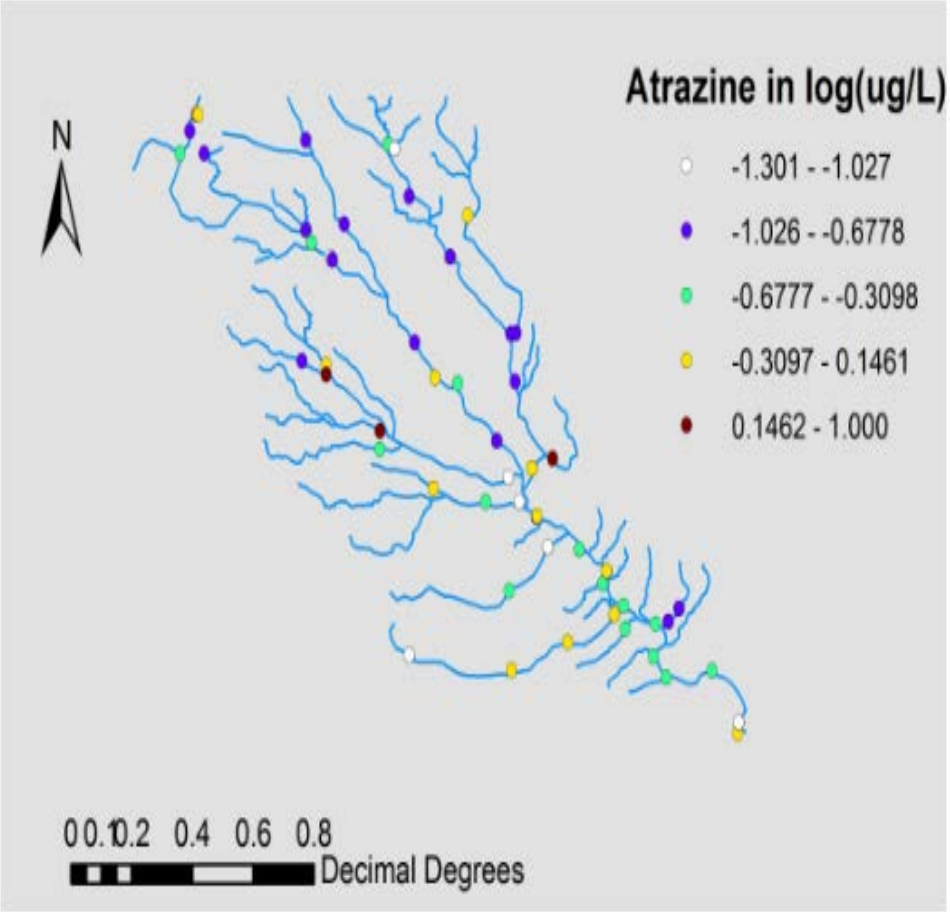

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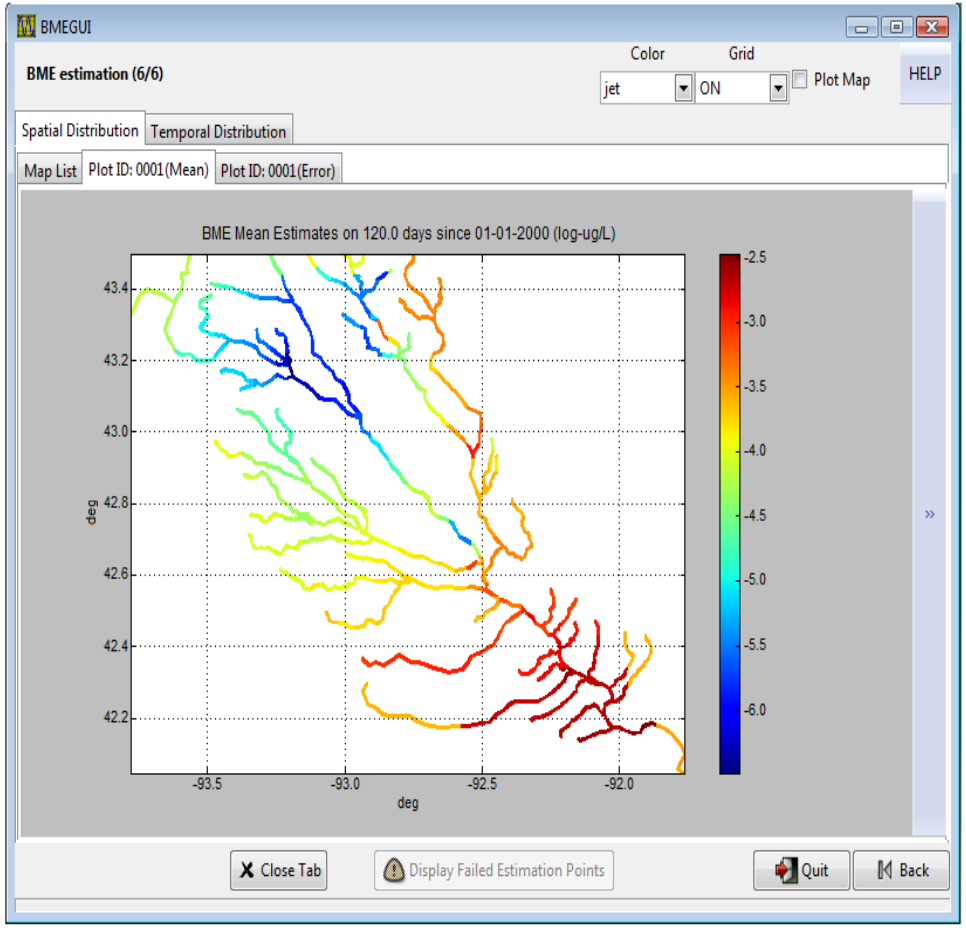

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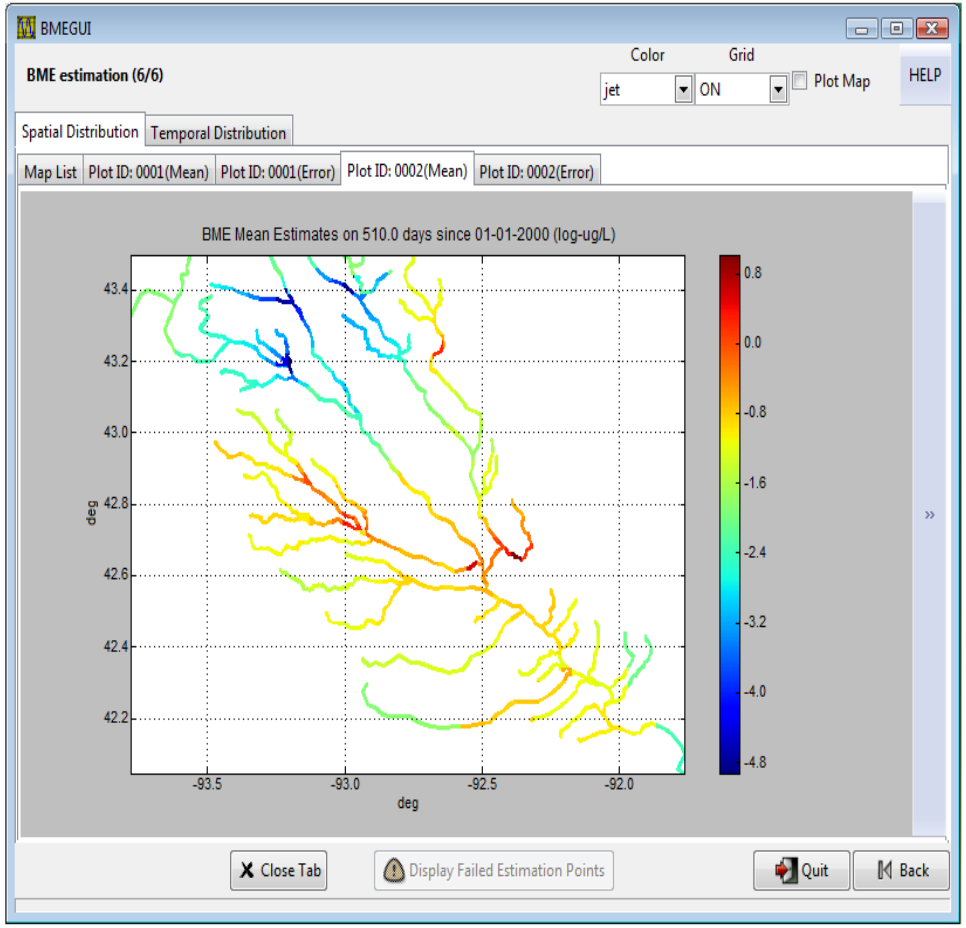

Agencies Using BMEGUI

- **New Jersey Dept. of Environmental Protection (NJDEP)**
  Using BMEGUI for superfund contaminants
- **EPA, Office of Superfund Remediation and Tech. Innov.**
  Using BMEGUI for PCE mapping at Billings (MT) Superfund Site
- **NC Dept. of Environmental & Natural Resources (DENR)**
  Working with Superfund Section, Aquifer Protection.
- **NC Dept. of Human Health & Services.**
  Arsenic in North Carolina: Public Health Implications (Sanders et. al., 2011).

Thanks

http://www.unc.edu/~jat

http://www.unc.edu/depts/case/BMElab/BMElabPeople/yasuyukiAkita/YasuyukiAkita_BMElab.htm

http://www.unc.edu/~mserre

BMEGUI: Research Translation Core

- Maintenance, technical development and debugging
- Improving user friendliness (Air, soft data types, automatic covariance fitting)
- Developing new features (riverBME, priority index)
- Training and application superfund sites