Integrated Modeling for Integrated Environmental Decision Making

Gary J. Foley

Co-Chair, International Air Quality Advisory Board

2003 - AN INTEGRATED ANALYSIS OF THE POTENTIAL EFFECTIVENESS OF MERCURY EMISSION REDUCTION STRATEGIES IN THE GREAT LAKES

- Using atmospheric transport & fate models, one can link the changes in emissions to the change in atmospheric deposition for selected persistent toxic substances, including mercury, identifying the sources and/or source regions that contribute the mercury deposited to each of the Great Lakes.

- Modeling the linkages among contributions of mercury from the atmosphere, tributaries, sediments and non-point source run-off to the uptake and/or the bioaccumulation in fish is a much more difficult problem.

- Because of this, this potential effectiveness of mercury control strategies are often evaluated solely in terms of changes in atmospheric deposition rather than mercury concentrations in fish tissue.

- However, given that the primary route of human exposure to mercury is through consumption of contaminated fish, characterizing the relationship between mercury emission reductions and changes in concentrations in fish is critical for understanding the effectiveness of current management strategies.

2003 - AN INTEGRATED ANALYSIS OF THE POTENTIAL EFFECTIVENESS OF MERCURY EMISSION REDUCTION STRATEGIES IN THE GREAT LAKES

- This study investigated some of the key areas of uncertainty in the relationships between mercury emissions, deposition and concentrations in the sediments, water, and fish of aquatic systems through the application of three sub-models to Lake Ontario.

- There are a number of uncertainties associated with this approach due to both missing process information and the lack of data for development and evaluation of these types of models.

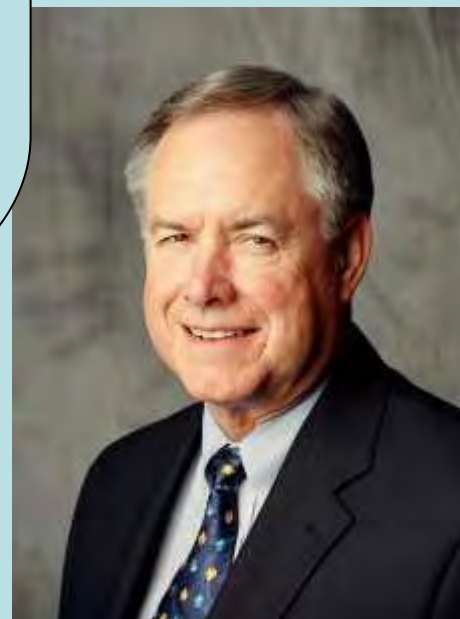
- Hence, the model application described in this paper is best used as a screening level analysis to explore the sensitivity of the model to different parameters and data sources. Using a range of values for missing or less certain information, key uncertainties are hypothesized and provide suggestions focus future research and modeling efforts.

- This is demonstrated using an application of mercury emission reductions from the 1996 coal fired utilities in the US and Canada and the predicted changes in fish uptake of mercury in Lake Ontario.

“The Agency can and should do better in delivering the integrated modeling needed to energize integrated decision-making.”

“Far more expansive, integrative thinking on the part of our best and brightest is the critical key to our success. Understanding how all of the components fit, how to optimize system performance and characterize resultant uncertainty is a tremendous challenge worthy of our concerted effort. “

“Our charge to participants in this workshop is to look to those who have been successful and those who have struggled in integrating models, to think about work in your specialty within the context of broader need, and to consider actively collaborating with your colleagues in teaming to better “connect the dots” in developing products that solve issues important to people and the environment.”



Ron Kriezenbeck

Deputy Regional Administrator, Region 10

Co-Chair, Council for Regulatory Environmental Modeling

"As resources diminish and emerging issues arise and multiply, we must focus on early coordination across all our programs to ensure that efforts are not duplicated and that models cannot only be easily integrated, but also used for multiple purposes."

"As our understanding of complex environmental problems evolve, and the models we construct to assist us with our regulatory decision making often expand in their complexity, scope and breadth to encompass these emerging issues and insights, **we must avoid the tendency to develop overly complex models that are not only resource intensive to run, but which can only be used by a select number of individuals**. "

Kathy Callahan
Deputy Regional Administrator, Region 2

"Building bridges among the different modeling communities is, in my view, essential for the future of environmental protection…we need all of this increased capability to see more clearly what we've always known in principle: that the environment is an interconnected system, and that what happens in one location can have repercussions far away."

"I hope that you will use this conference not just to **exchange ideas, but also to build the relationships that will promote even faster and more comprehensive collaboration** and advances in our ability to predict and to understand."

Stan Meiburg
National EPA-CDC Liaison
Former Deputy Regional Administrator, Region 4

Why is Integrated Modeling Needed?

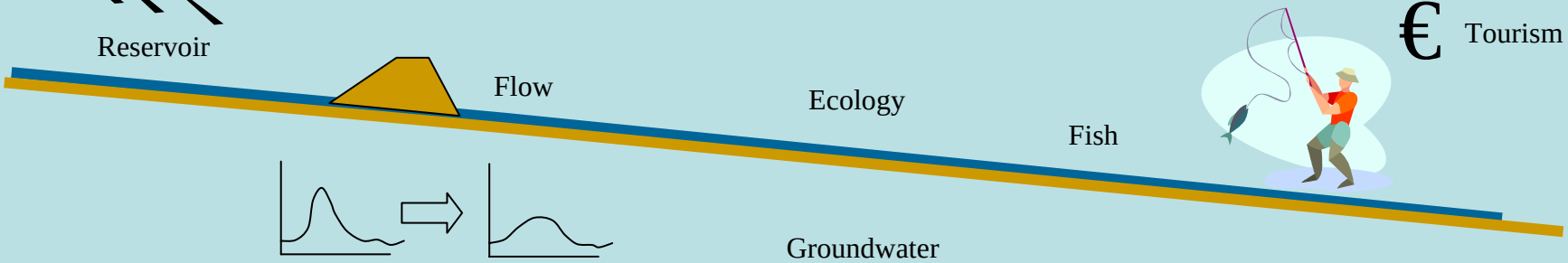
Competition for scarce resources

Need for integrated environmental management

Complexity leads to need for decision support

Need for whole catchment models

Need for model linking



What are the Challenges?

- Poor communication and collaboration across disciplines and programs (stove-piping).
- Institutional and statutory structure may not facilitate consideration of cross-media interactions.
- Organizations possess modeling capacity but need to focus on interfacing science and policy to build knowledge-brokering.
- Scientific and technical limitations:
  - incompatibility among models and frameworks;
  - lack of high quality data and meta-data; model and data quality issues;
  - lack of accepted and consistent standards for data, models, modeling systems, framework architectures;
  - current information management systems may hinder collaboration