A Quick Look at Current Air Quality Modelling Being Undertaken by AESRD in the Context of Cumulative Effects Management

AESRD CMO Workshop 2013

March 13 - 14, 2013

Edmonton, Alberta

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Alberta Government

Outline

- **Regulatory air quality modelling**
- **Non-regulatory air quality modelling**
- **Integration of air quality modelling in a CEMS context**

Regulatory Modelling

Why?

"…a description of potential positive and negative environmental, social, economic and cultural impacts of the proposed activity, including cumulative, regional, temporal and spatial considerations."

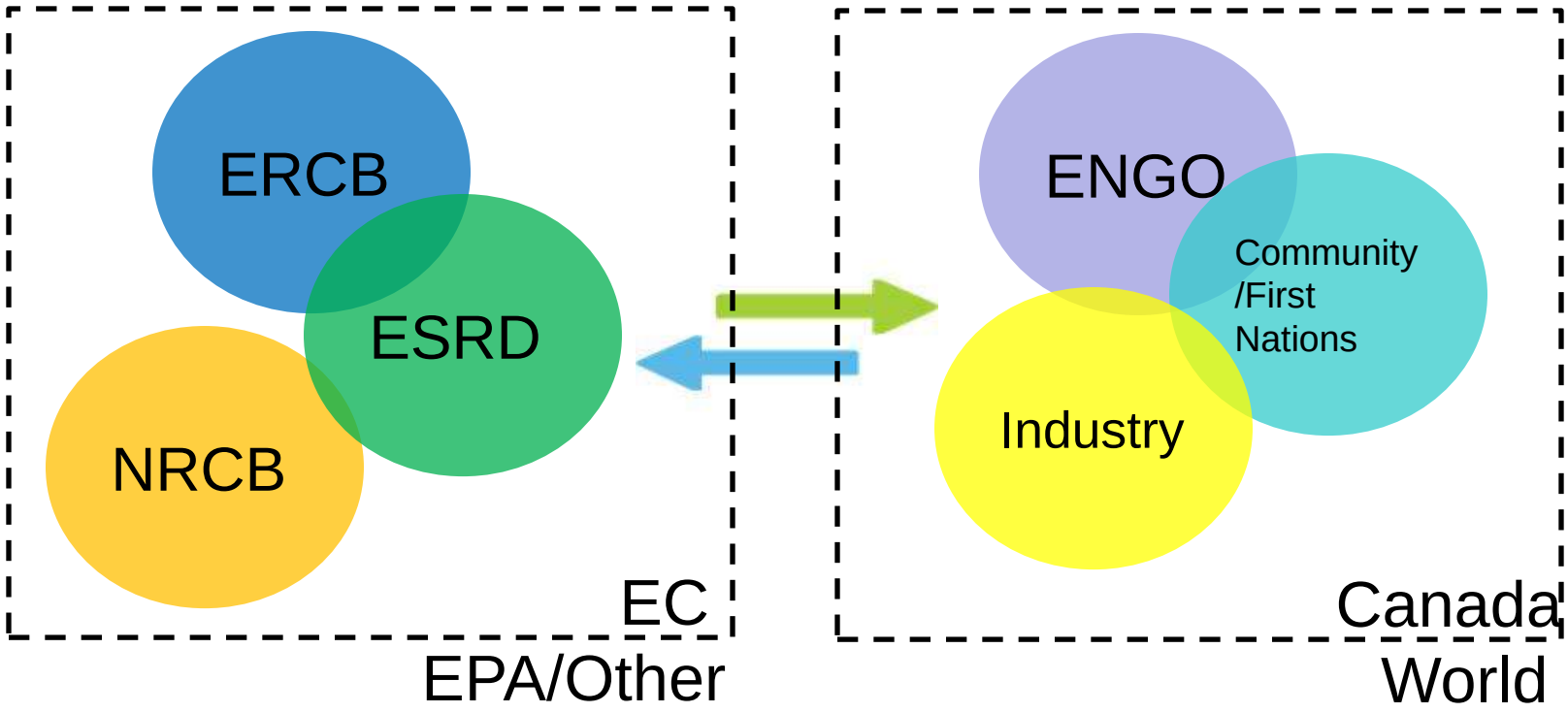
» **Alberta Environment Protection and Enhancement Act s.47(d)**

Regulatory Modelling

Who?

- **Regulators**

Non-Regulators



Regulatory Modelling

When?

- EIAs
- Permitting
- Special regulatory applications
    - Evaluating new AAAQOs
    - Evaluating new data sets

Regulatory Modelling

What?

- Perform modelling according to ESRD's Air Quality Modelling Guideline
- For non-routine flaring perform modelling according to ERCB's Non-Routine Flaring Guideline
    - Emission sources/values
    - Background levels
    - Meteorology
    - Models/Model settings
    - Objectives

Non-Regulatory Modelling

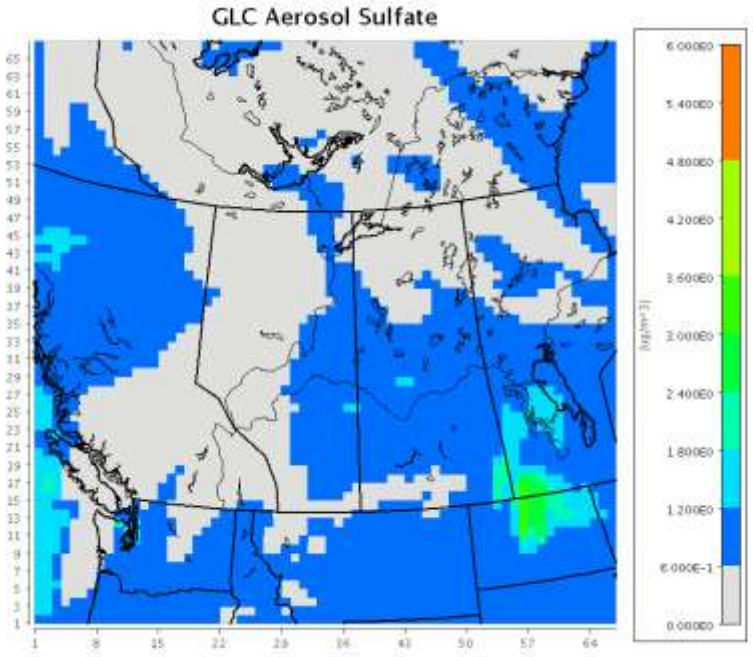
What?

- Not currently tied to an EIA or permitting exercise
- May be tied directly into CEMS:
  - Frameworks
  - Regional/international initiatives
- Emergency response

Non-Regulatory Modelling

Frameworks

- Acid Deposition Framework
  - Provincial/Western Canadian in scale
  - Non-regulatory data sets and models

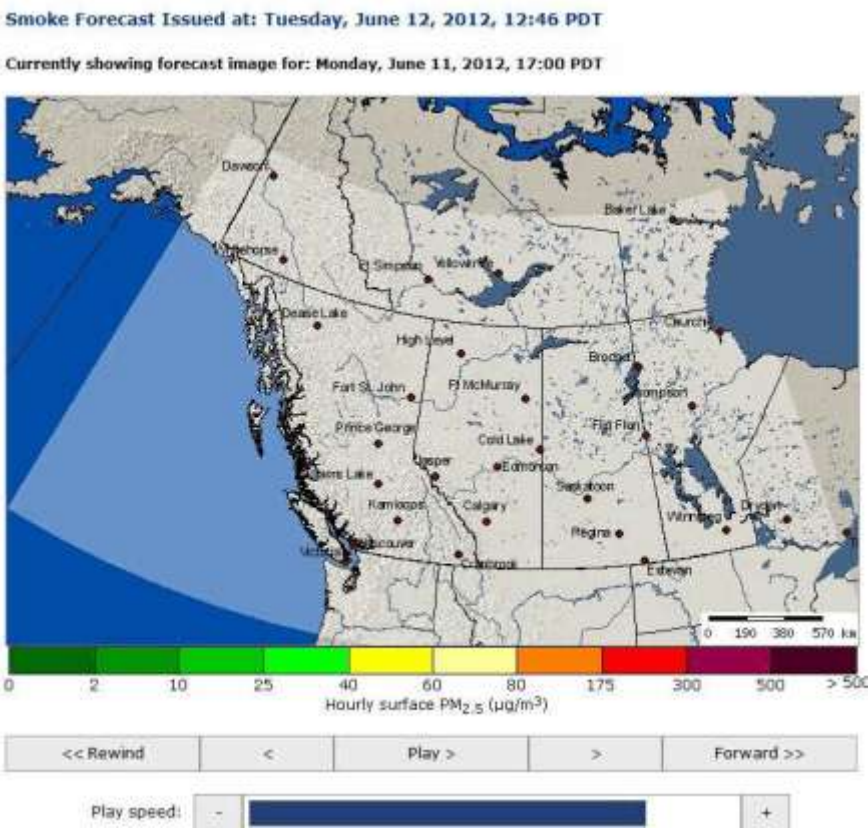


Non-Regulatory Modelling

Regional/International Initiatives

- **BlueSky**
  - **Provincial/Western Canadian in scale**
  - **Non-regulatory data sets and models**
  - **Multi-purpose**
    - Health
    - Emergency response
    - Prescribed burns

http://www.bcairquality.ca/bluesky/



Non-Regulatory Modelling

Emergency Release/Evacuation

- EAMAS
  - Developed for LARP region by ASERT (Martin Bundred)
  - Non-regulatory data
  - Information for first responders

Outline

- ✓ Regulatory air quality modelling
- ✓ Non-regulatory air quality modelling

- Integration of air quality modelling in a CEMS context

Integration

What's CEMS?

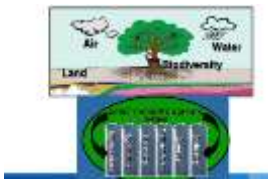
- **Manage activities that affect the environment, economy and society in a particular place**

	Current Approach	What is Needed
Environmental media	Single (one by one)	Air, land, water and biodiversity together
Spatial context	Project/local	Multiple scales
Scope	Regulated activities	Regulated and unregulated activities
Approach	Reactive	Proactive
Results	Mitigated impacts	Defined results
System organization	Fragmented	Connected
Responsibility/participation	Agency-by-agency	Collective action
Performance measurement	As required	Essential, more comprehensive

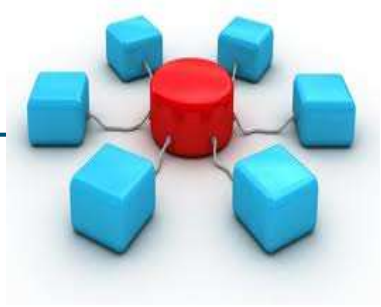
What's the renewed ESRD clean air strategy?

"… resource management decisions are integrated to minimize cumulative environmental effects."

- Air quality management is *integrated* with land, water and biodiversity management to be certain that ecosystems are sustained.



Integration



What needs?

- Local to global scale, across – nesting, coupling, or model integration
- Implications of different spatial (and temporal) resolutions
- Different environmental compartments

→ support for complex and cumulative problems

Integration

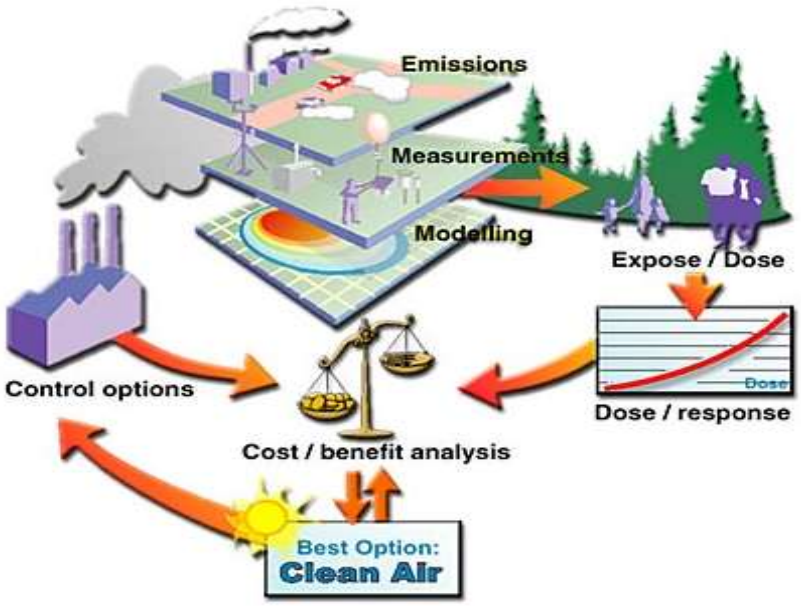
What's Model Integration?

- *Model integration* means? "Different things to different people"
- Two basic models for application integration
  - Integral (Deep) modelling: to build the model as a whole; produces a single new model that combines two or more given models

  - Assemblage (Functional) approaches: to assemble already built or extant models; leaves the given models as they were

Integration

Air Integrated Models (Non-regulatory)



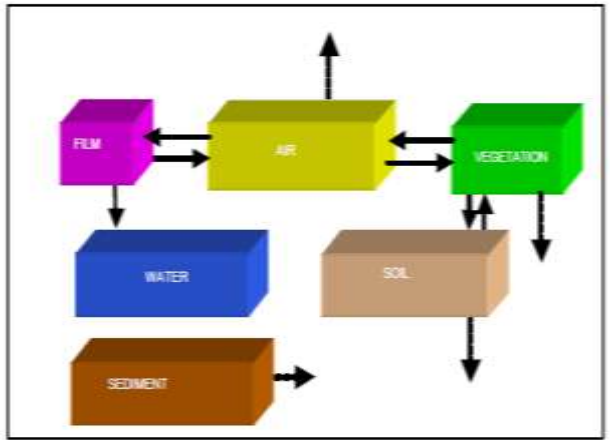
AirQUIS (Integrated air quality management system)

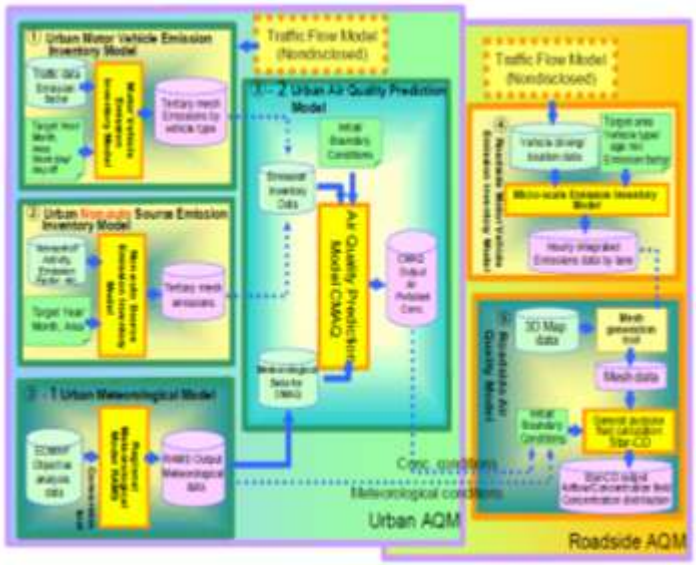
- An atmospheric transport model that produces atmospheric deposition fields for nutrients and other constituents
  - Community Multi-Scale Air Quality modelling system (US EPA)
  - GEM-MACH (EC)
  - AirQUIS (Norway)

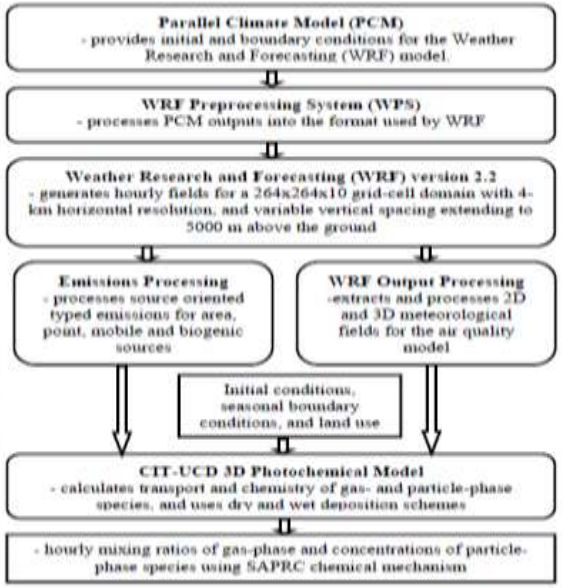
Integration

Air Integrated Models (Multi-media/scale/topic Applications)

- Climate/Air quality
- Multi-media (Air/Water/Soil/Sediment/ Vegetation)
- Multi-scale (Regional/local)







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Integration

2nd Generation Integrated Modeling System

- Air Integrated Models (Human Health & Risk Applications)
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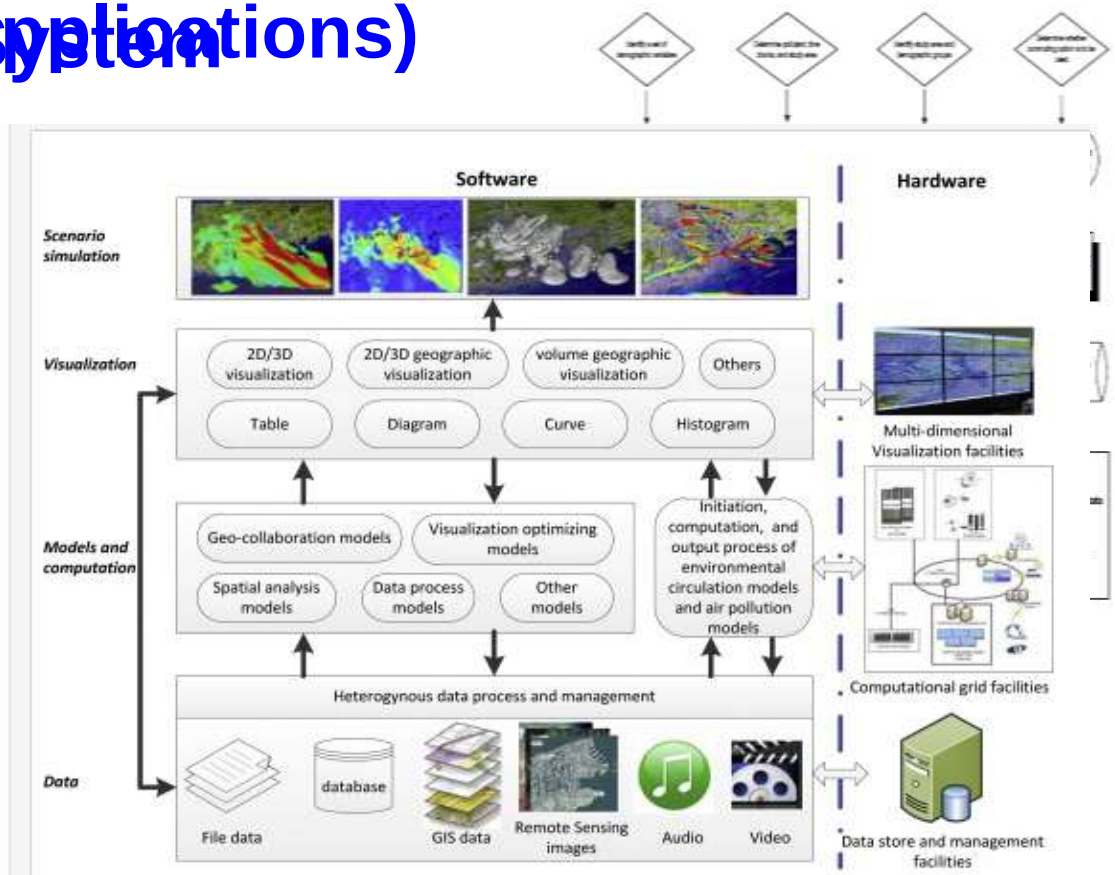
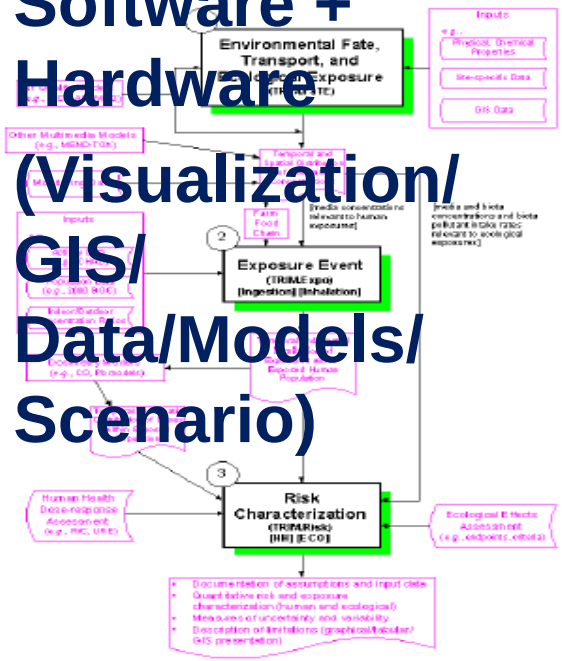
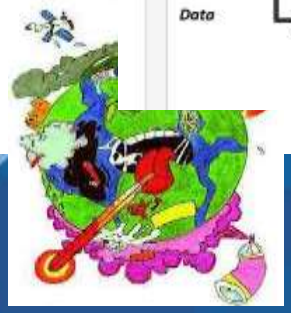


Software + Hardware (Visualization/ GIS/ Data/Models/ Scenario)

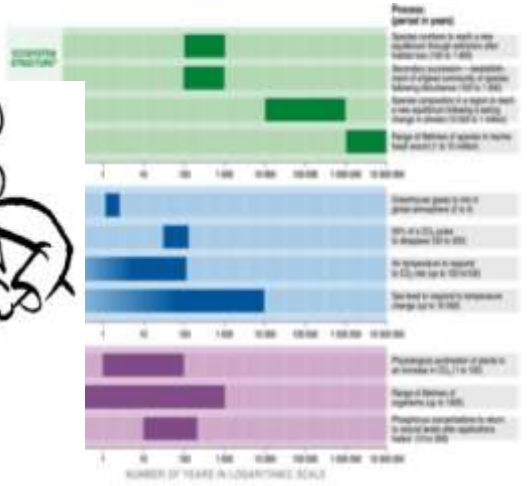




Integration

Common Issues

Temporal Dynamics



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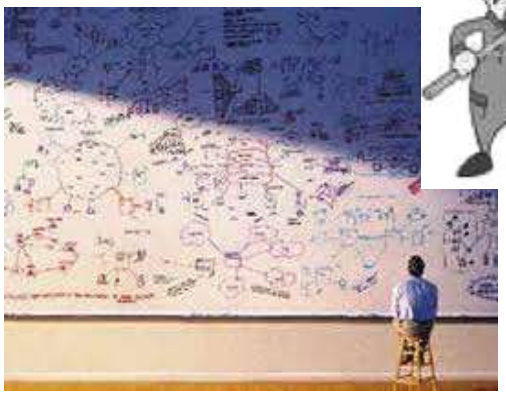
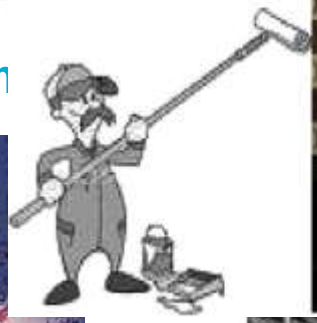
Overwhelming com





nfusion of tongues

Ref.: Voinov, A. et al., Environmental Modelling & Software 39 (2013) 149-158.

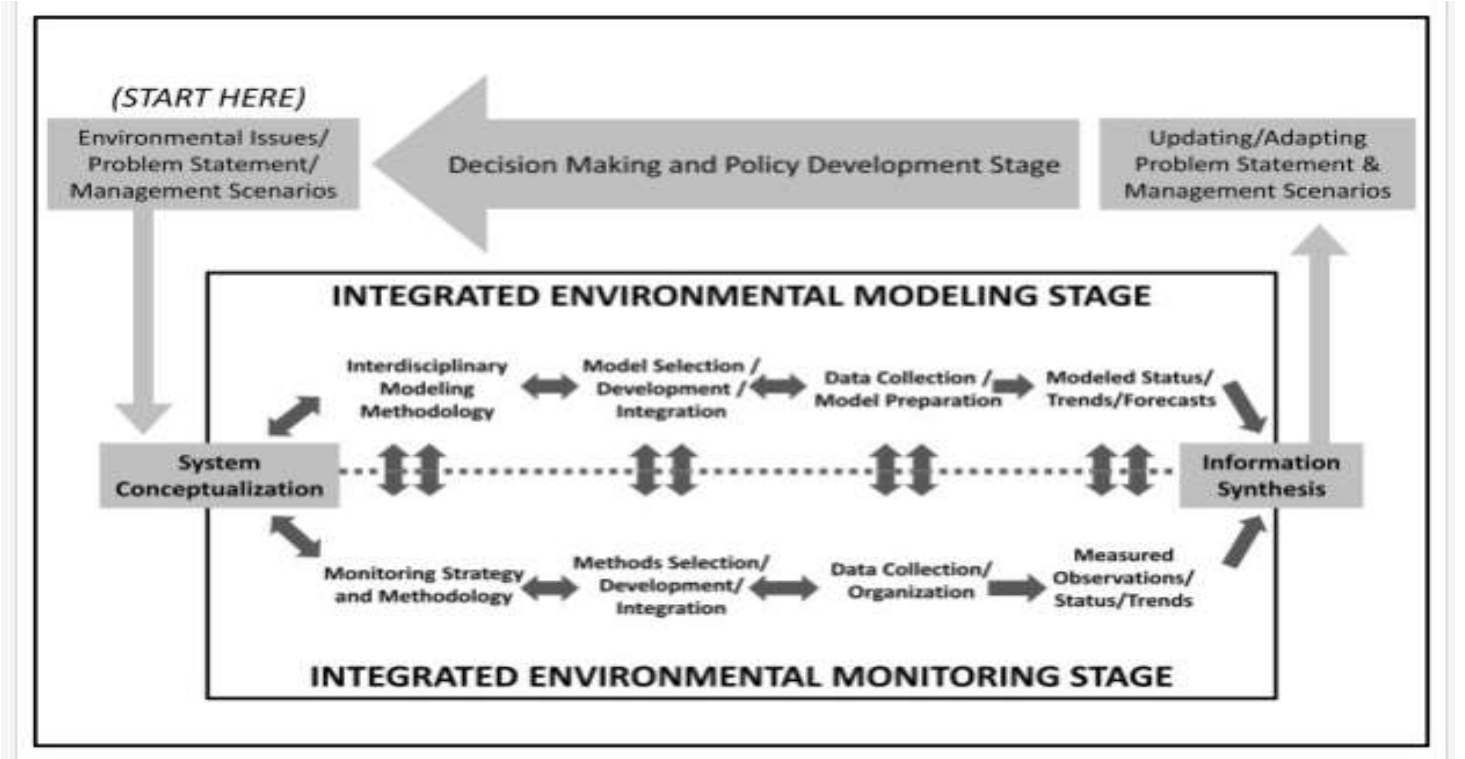
Integration

Supporting for CEMS or Decision Making

- Applied for **policy decision support** have achieved a substantial level of **maturity**
- A **growing understanding of the complexity** of the systems modelled, applying systems theory and control theory in model design and development, as well as carefully choosing the level of ambition and precision required
- **Decision makers** are often **expecting an accurate** representation of reality in models and results that pinpoint individual options or deliver an exact number
  - This is not a trivial problem to overcome, but improvements in **communication between model developers and users** can significantly reduce this problem

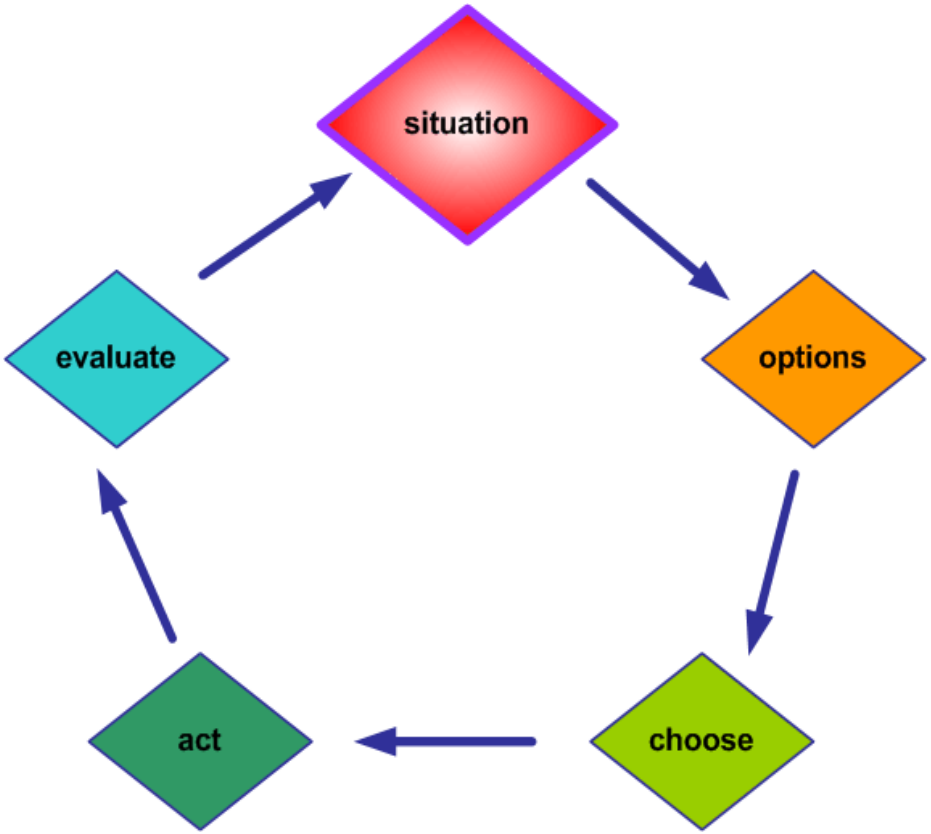
Integration

Decision Process (example)



Ref. Laniak G. et al, Environment Modelling & Software, 39, (2013) 3–23.

Closing …



- **Outcomes based**
- **Place based**
- **Performance management based**
- **Collaborative implications**