Data for Environmental Modeling (D4EM):

Collaborative Design and Implementation of Data Retrieval and Processing Software for Environmental Modeling Using Open Source Technology

Emissions Inventories: Integration, Analysis, and Communications

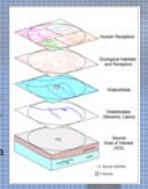
Raleigh, North Carolina May 14-17, 2007

Data for Environmental modeling (D4EM) is a comprehensive set of tools that obtains and processes data for models. This fully integrated, open source software was originally conceived to populate the geospatial data inputs required for multimedia modeling studies, such as those performed using the Multimedia, Multi-pathway, Multi-receptor Exposure and Risk Assessment (3MRA) modeling system. The D4EM is a collaborative effort led by EPA's Office of Research and Development (ORD) in Athens, Georgia, in conjunction with RTI International, AQUA TERRA Consultants, and Idaho State University.

Some of the data sets supported by D4EM are also used in constructing emission inventories. These include land use and land cover (LU/LC), water bodies and water networks, major roads, elevation, and political boundaries. The user interacts with data through a customized MapWindow™ GIS user interface for obtaining and manipulating data, validating data for completeness, and generating model-specific data files. The modular design makes D4EM extensible to new data sets as well as additional parameters from current data sources.

Design Elements:

- Grew out of common needs for modeling groups at US EPA to access, retrieve, process, and format data to support integrated environmental assessments
- Open source GIS platform; extendable through plug-in technology
- Open source software in .NET computing environment
- Open source user interface developed in JAVA
- Document overall process of locating, downloading, and processing data for a model
- Extendable interface for additional data processing functions

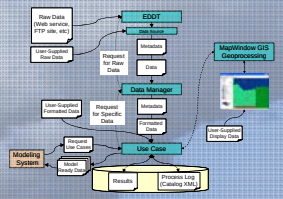


Conceptual Multimedia Model

Major Components:

- Use Case Manager to interface with modeling systems
- Environmental Data Download Tool (EDDT)
- Data Manager (DM)
- MapWindow ™ GIS
- Use Cases for gathering and manipulating data
- Project data store

Flow chart depicting interactions and data flow between D4EM components



Environment Data Download Tool (EDDT) Data Sources:

- NHDPlus
- Terra Server (Bounding Box)
  - DOQ
  - DRG
  - Urban
- NWIS (Bounding Box, HUC8, HUC12)
- NLCD (Bounding Box)
- BASINS (HUC8 except base maps)
  - Land Use/Land Cover
  - Urbanized Areas
  - Populated Place Locations
  - Reach File version 1 (RF1)
  - Elevation (DEM)
  - National Elevation Dataset (NED)
  - Major Roads
  - USGS HUC Boundaries
    - Accounting Units
    - Cataloging Units
  - Dam Sites
  - EPA Regional Boundaries
  - State/County Boundaries
  - Federal and Indian Lands
  - Legacy STORET
- Planned
  - STATSGO
  - Modernized STORET

EDDT Download Interface

Spatial Data Derivation:

Creation of modeling parameters based on spatial data.

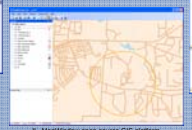
Calculation of surface water variables from NHDPlus data source. (i.e. Slope, area, centroid, stream order)

Calculation of sub-watershed surface areas delineating the in-flow and out-flow regions.

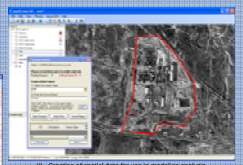
User Interface Design:

Use Case Manager → MapWindow GIS Application → Spatial Data Entry → Metadata Tracking → Data Review

I. Java-based Use Case manager for loading and organizing projects and use cases



II. MapWindow open source GIS platform



III. Creation of spatial data for use in modeling analysis

Shapefile metadata creation.

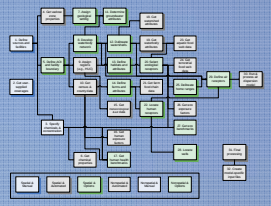
Process log (date, time, operation)

IV. XML files document shapefile creation and data manipulation.

V. Non-spatial form for data review.

Future Design Considerations:

I. Creation of new Use Cases previously identified by development team. Use case list and process flow are shown below.



II. Extend Use Cases to support data needs of more models.

III. Continue enhancing MapWindow GIS functionality.

IV. Enhance EDDT to include more data sources.

V. Extend data manager to add new data processing functions.

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