National Data – Linking Models and Data in Regional Applications

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50 Years of Watershed Modeling: Past, Present and Future

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Regional Application Characteristics

- Multiple Stakeholders
- Variety of Analytical Needs
- Local copy of project data

Goal: develop tools that are dynamic and flexible to meet the challenges inherent in these characteristics
Open Source Software Infrastructure

- Facilitates Collaboration
- No need to purchase expensive proprietary software
- Source code for all components available to end users
- Provides greater stability and transparency
- Open framework readily allows for inclusion of additional data/models/tools
Software Infrastructure Keys

- Component based
- Clearly defined components with API
- Allows flexibility to model builders
- Easily re-used and extended
Watershed Modeling Data Management Issues

- Accessing breadth/scale of needed data
- Processing, analyzing, and archiving the volume of data produced by models
- Connecting models
Watershed Modeling Data Access Components

- Downloading of archived sources
- Storage in generic formats
- Spatial/Temporal visualization and analysis
- Disaggregation/Aggregation
- Downscaling/Upscaling
- Model wrappers
Accessing Archived Data Sources

• Data sources discovered at run time
• Changes to a source’s web hosting requires update to only that source’s component, not entire system
• Access to most current data available
• Utilities to convert data to generic form usable by models
Archived Data Source Examples

- USGS National Water Information System (NWIS)
- USDA Geospatial Data Gateway and Soils Data Mart
- EPA STORET and BASINS
- NASA Global/North American Land Data Assimilation System (GLDAS/NLDAS)
Examples of Downloaded Data
NHDPlus
Examples of Downloaded Data
Elevation
Examples of Downloaded Data
Census Tiger
Examples of Downloaded Data
Met Stations
Examples of Downloaded Data
Soils Data
Data Visualization - Spatial

- MapWindow Open source GIS
- International user community
- Extensible through plug-in architecture
Data Visualization - Temporal

Generic timeseries class

• Common format for all timeseries data
• Communication between models
• Robust suite of analysis tools
Data Visualization/Analysis
Listing and Plotting
Duration/Frequency Analysis

USGS Surface Water Statistics

Graph showing the annual non-exceedance probability for flow characteristics. The graph includes data for 7-day low flow, Log-Pearson Type III frequency, upper confidence limit, and lower confidence limit. The text box at the bottom provides the details for the data set:

- Station: 11517500 - Shasta River near Yreka, CA
- Mean: 185.12
- Standard Deviation: 240.94
- Skew: 12.137
Data Transformations – Spatial
Downscaling/Upscaling
Data Transformations - Temporal

Adjustments to precipitation with CAT
**Model Wrappers**

- Plug-in allows the user to select and transfer data to the model
  - Models are “loosely coupled”
  - No change to model code
- Use native input/output formats
- Establish relationships with model developers
- Core models continue to be maintained by the corresponding model’s development team
Model Linkage

- Increasing demand for connecting models to meet complex issues
- Common data format and framework enable connectivity
- Well-defined components readily extensible to meet connection needs
Project Archiving

- Allows for review and further model refinement
- Provides reproducible “track record”
- Enables full model transfer among users
Future Directions

• USGS GWToolbox
• HIMALA-BASINS for International Centre for Integrated Mountain Development
• Expansion of Data for Environmental Modeling (D4EM)
• Re-engineer HSPF
Summary

• Regional watershed modeling often requires a broad array of dynamic and flexible tools
• Open source approach enables collaboration within the watershed modeling community
• Well-defined components are essential to collaborative efforts

• Questions?