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## National Data – Linking Models and Data in Regional Applications

Paul R. Hummel  
*AQUA TERRA Consultants, USA*

John L. Kittle, Jr.  
*AQUA TERRA Consultants, USA*

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# *National Data – Linking Models and Data in Regional Applications*

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Paul R. Hummel and John L Kittle, Jr.

***AQUA TERRA Consultants  
Decatur, GA***

***50 Years of Watershed Modeling:  
Past, Present and Future***

***Boulder, CO***

***September 24-26, 2012***



# *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

**Download Data**

Region to Download: Hydrologic Unit 02060006

**BASINS**

DEM Shape     GIRAS Land Use     NED     Census     303(d)  
 DEM Grid     Legacy STORET     NHD     Meteorologic

**National Hydrography Dataset Plus**

All     Catchments  
 Elevation Grid     Hydrography  
 Flow Direction Grid     Hydrologic Units  
 Flow Accumulation Grid     Streamgage Events

**Station Locations from US Geological Survey National Water Information System**

Daily Discharge     Water Quality     Measurements     Ground Water

**Data Values from US Geological Survey National Water Information System**

Station Locations must be selected on the map before data value download

**National Land Cover Data 2001**

Land Cover     Impervious     Canopy     1992 Land Cover

**EPA STORET Water Quality**

Stations     Results

Merge     Clip to Region       

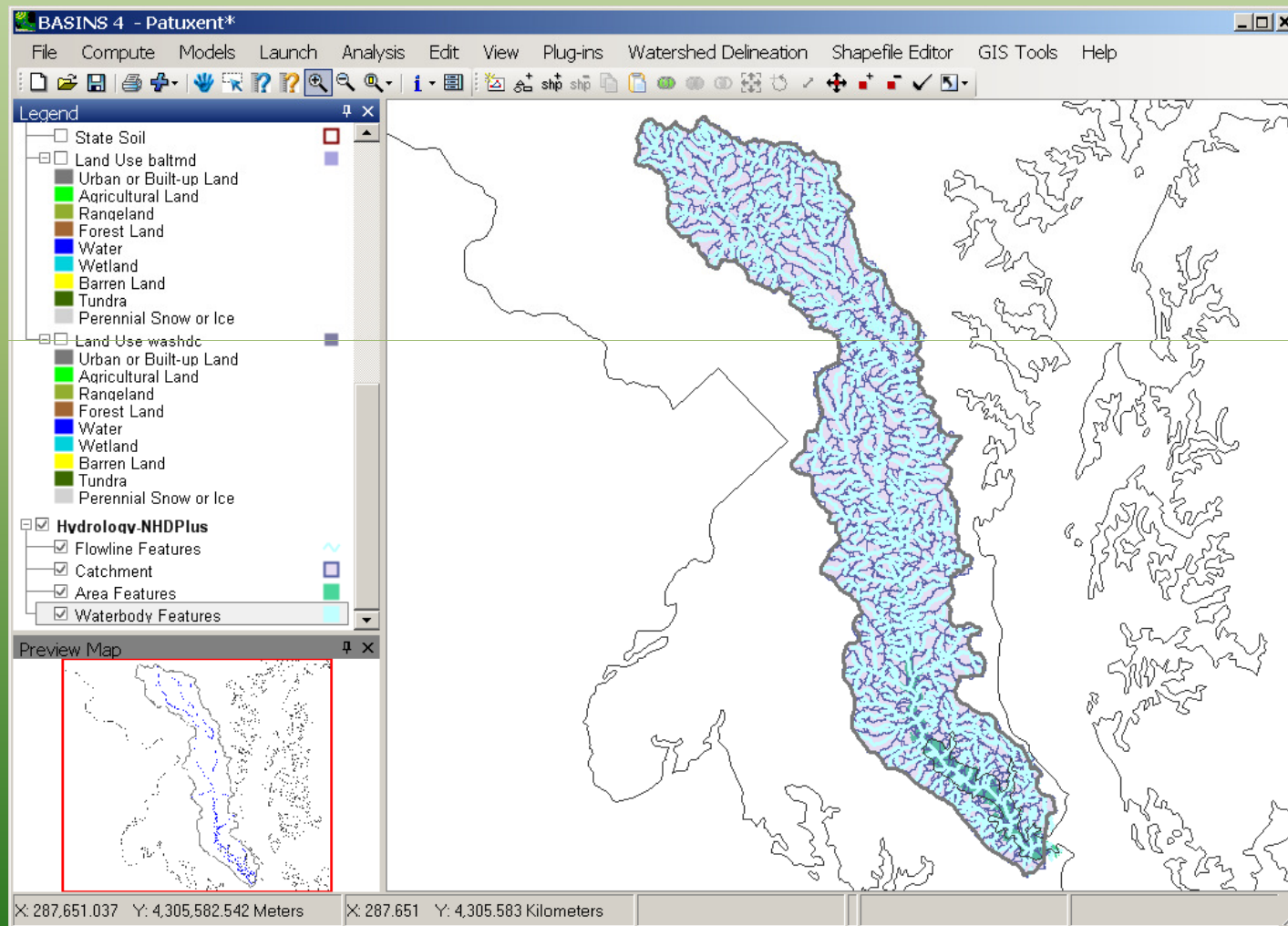
- Data sources discovered at run time
- Changes to a source's web hosting requires update to only that source's component, not entire system
- Access to most current data available
- Utilities to convert data to generic form usable by models



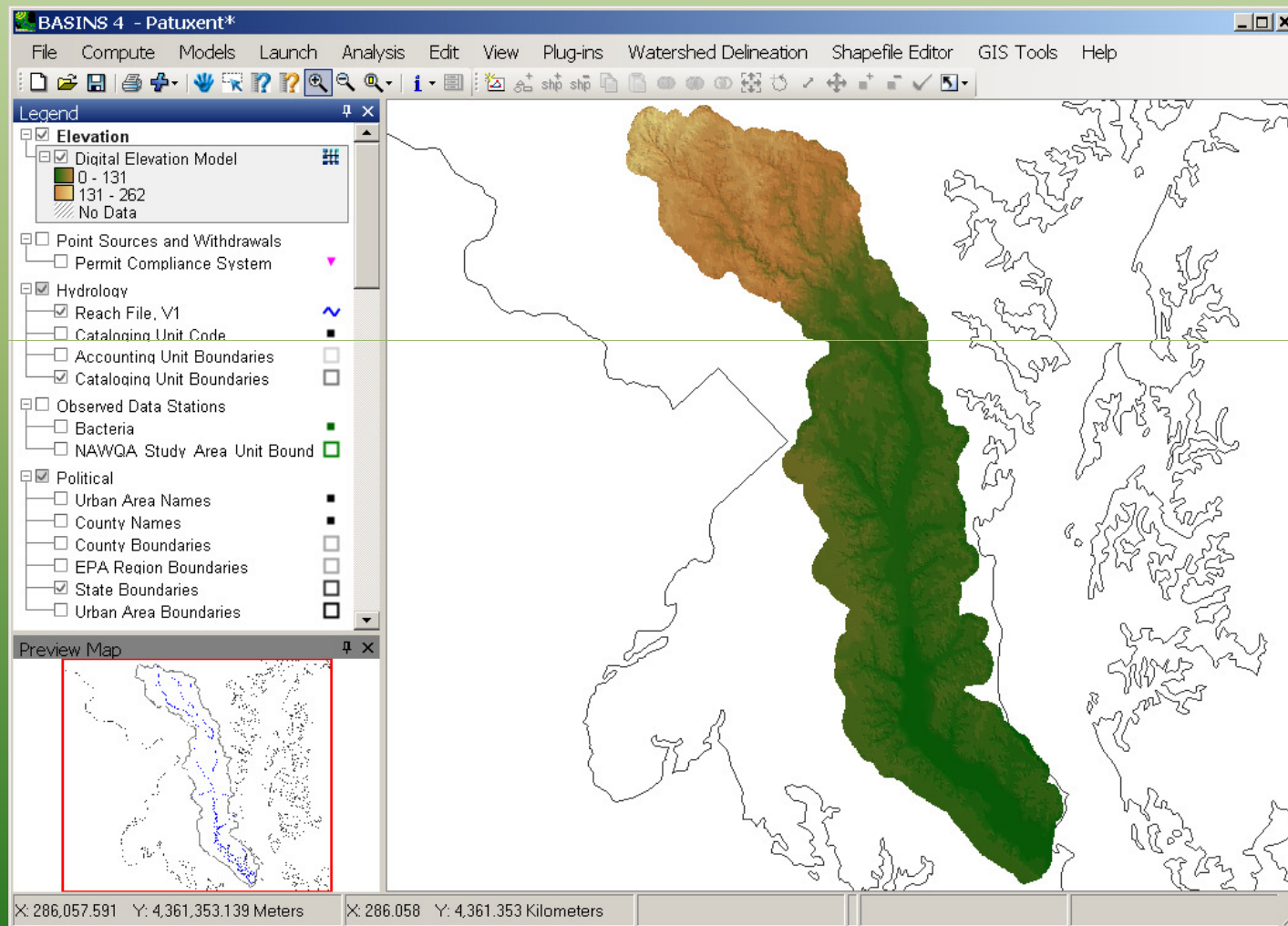
# *Archived Data Source Examples*

- **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)**

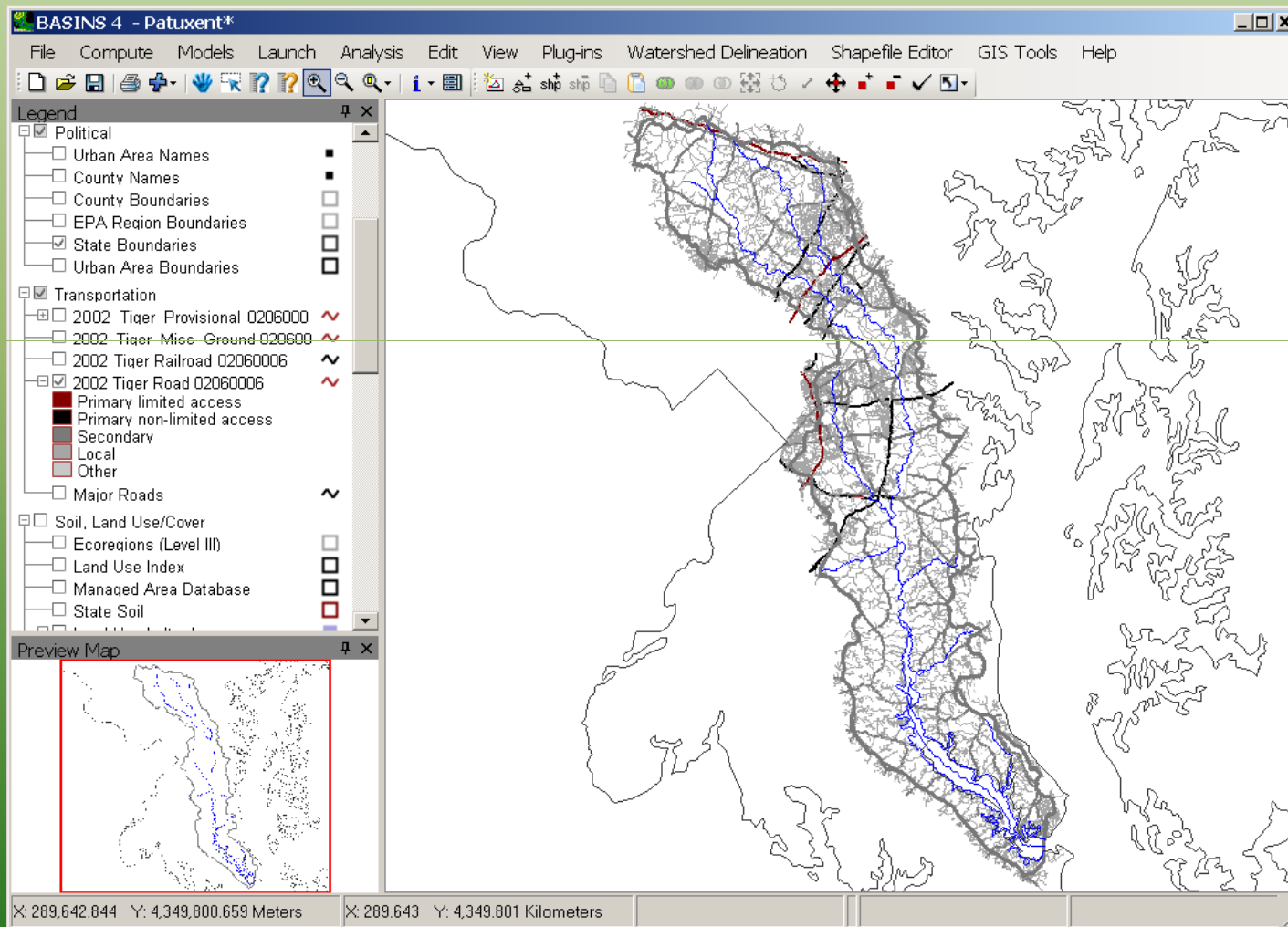
# Examples of Downloaded Data NHDPlus



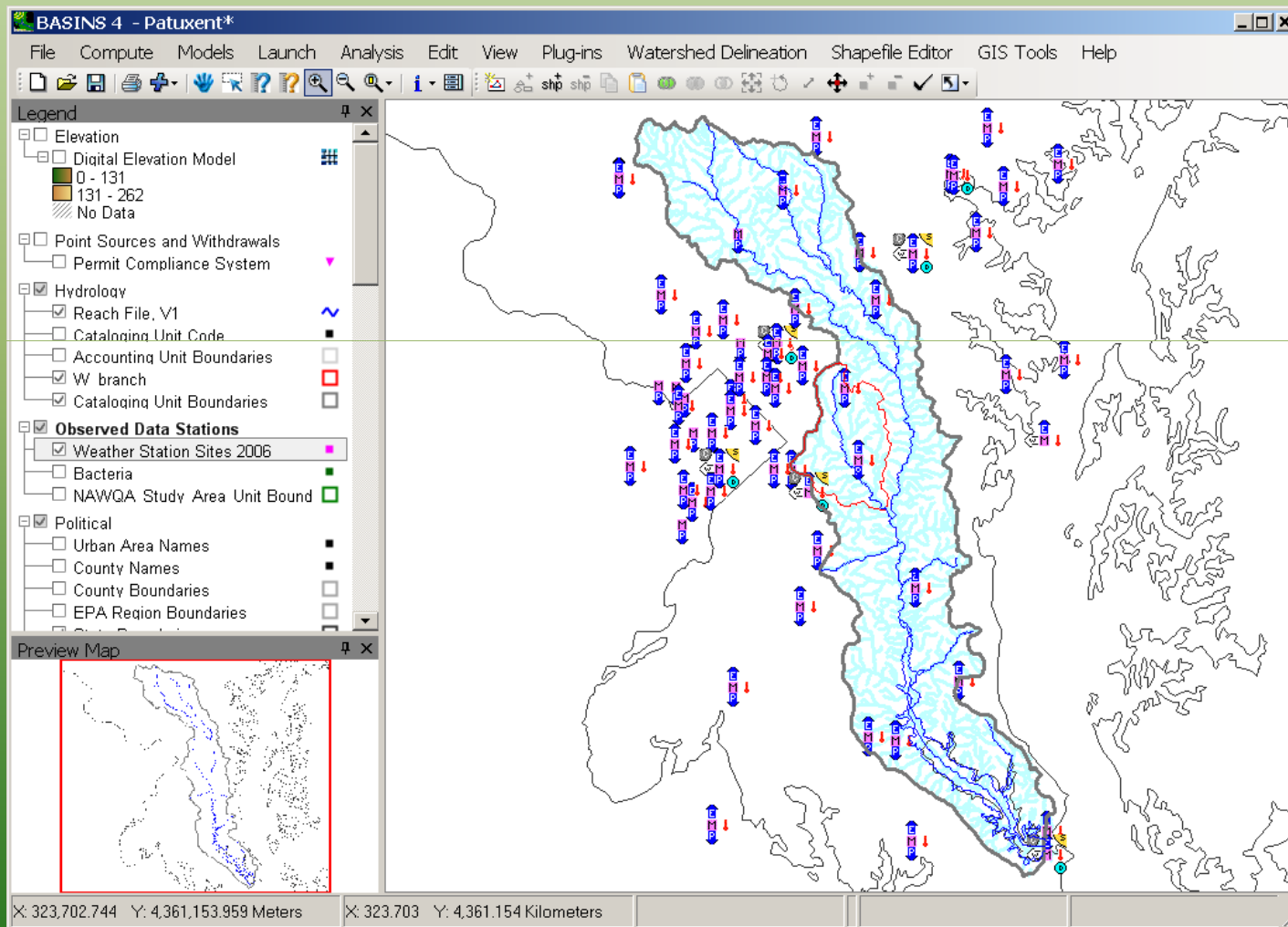
# Examples of Downloaded Data Elevation



# Examples of Downloaded Data Census Tiger



# Examples of Downloaded Data Met Stations



# Examples of Downloaded Data

## Soils Data

Stormwater Calculator

### Soil Type

The different Hydrologic Soil Groups surrounding the site are shown on the adjoining map.

- A - low runoff potential
- B - moderately low potential
- C - moderately high potential
- D - high runoff potential

Select a soil group for the site by clicking one of the buttons above or by clicking a corresponding soil group area on the map.

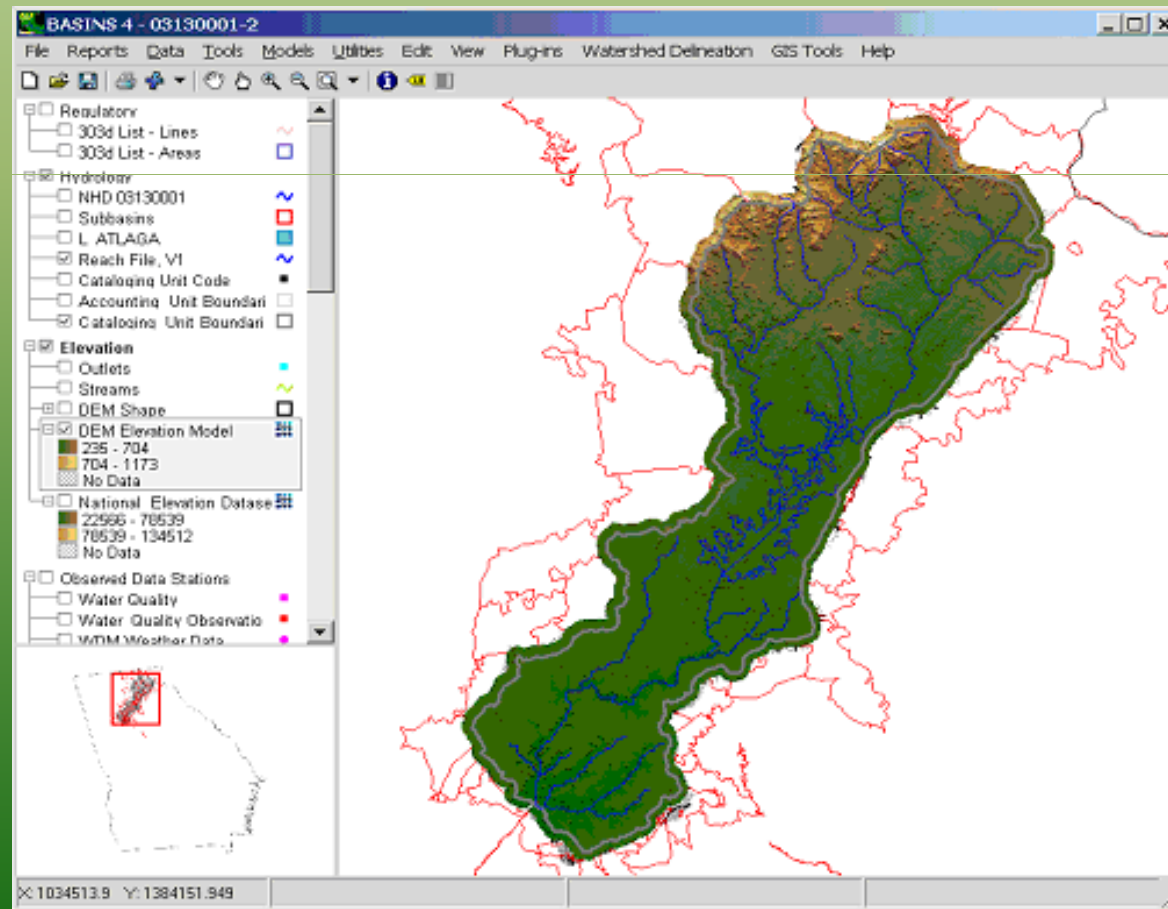
1000 feet 250 m

© 2011 Microsoft Corporation © AND © 2010 NAVTEQ

<- Back Next -> Finish

# *Data Visualization - Spatial*

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



# *Data Visualization - Temporal*

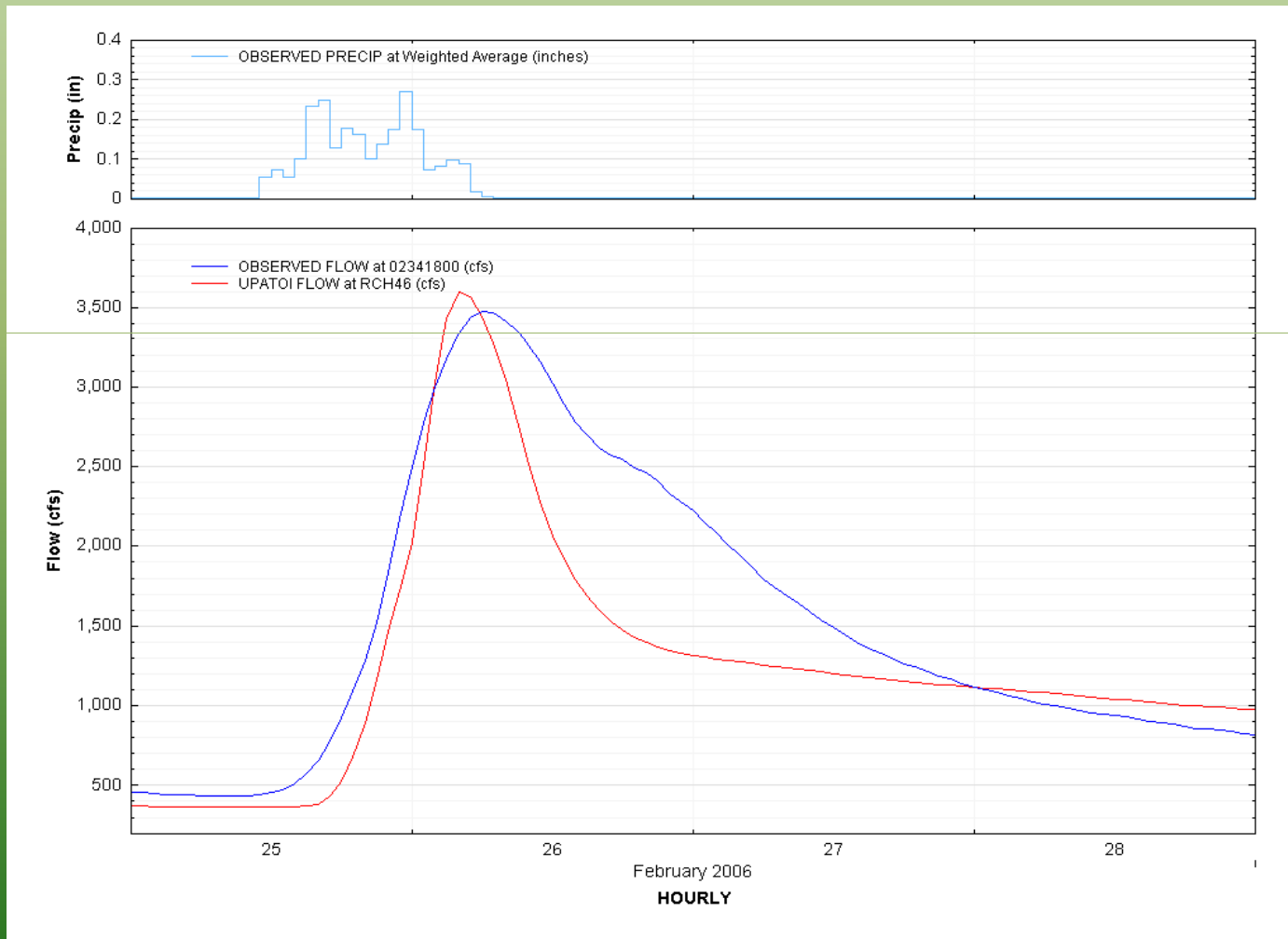
## Generic timeseries class

- Common format for all timeseries data
- Communication between models
- Robust suite of analysis tools



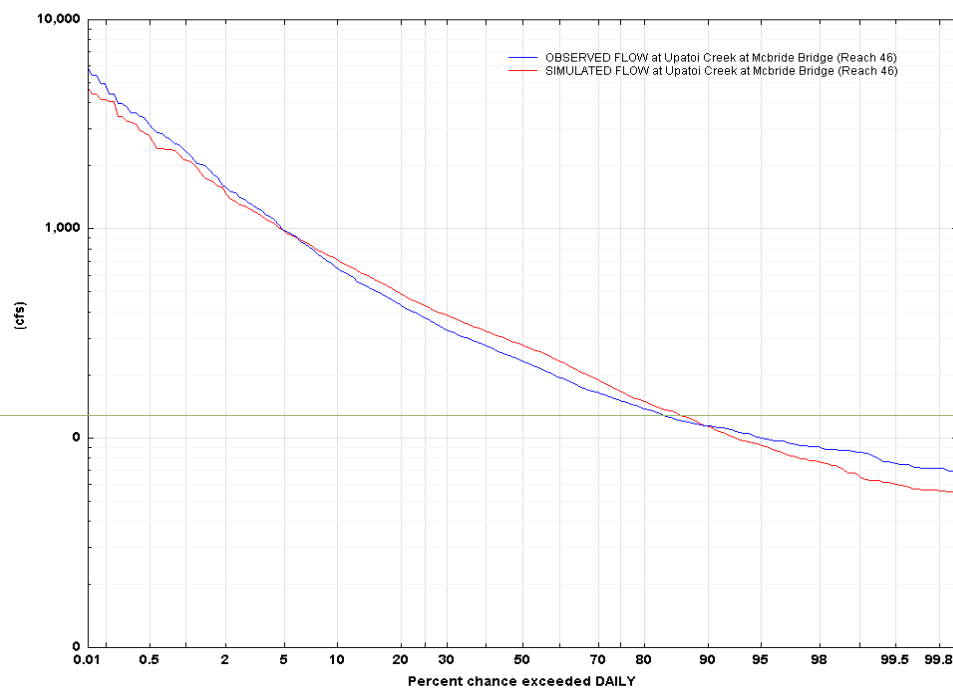
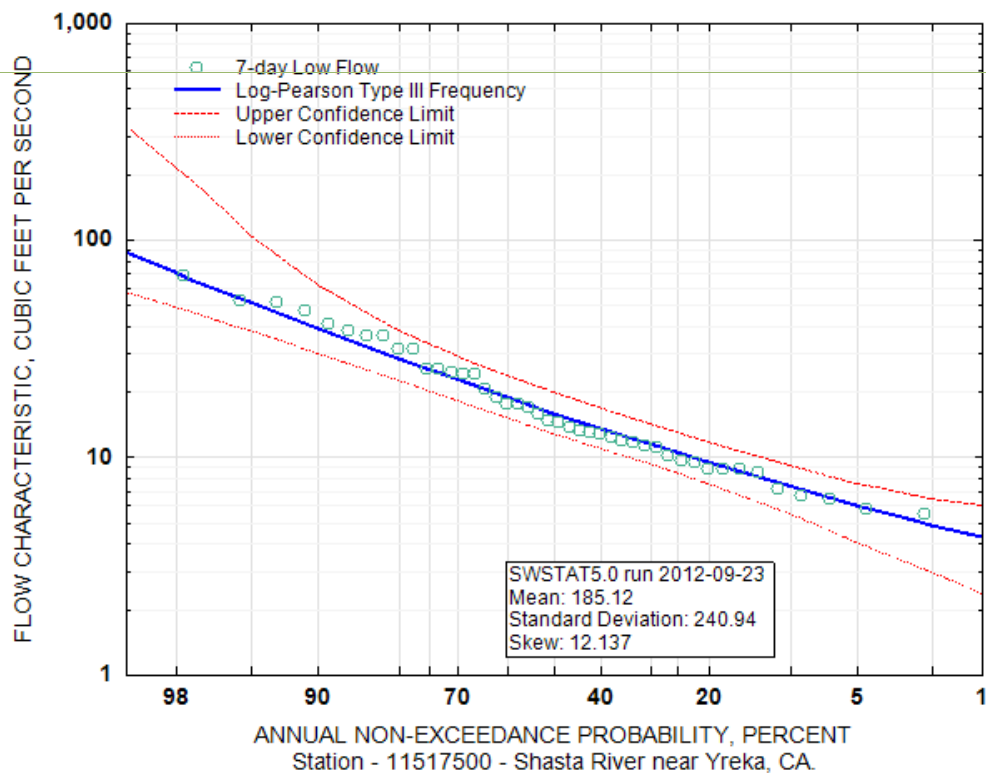
# Data Visualization/Analysis

## Listing and Plotting

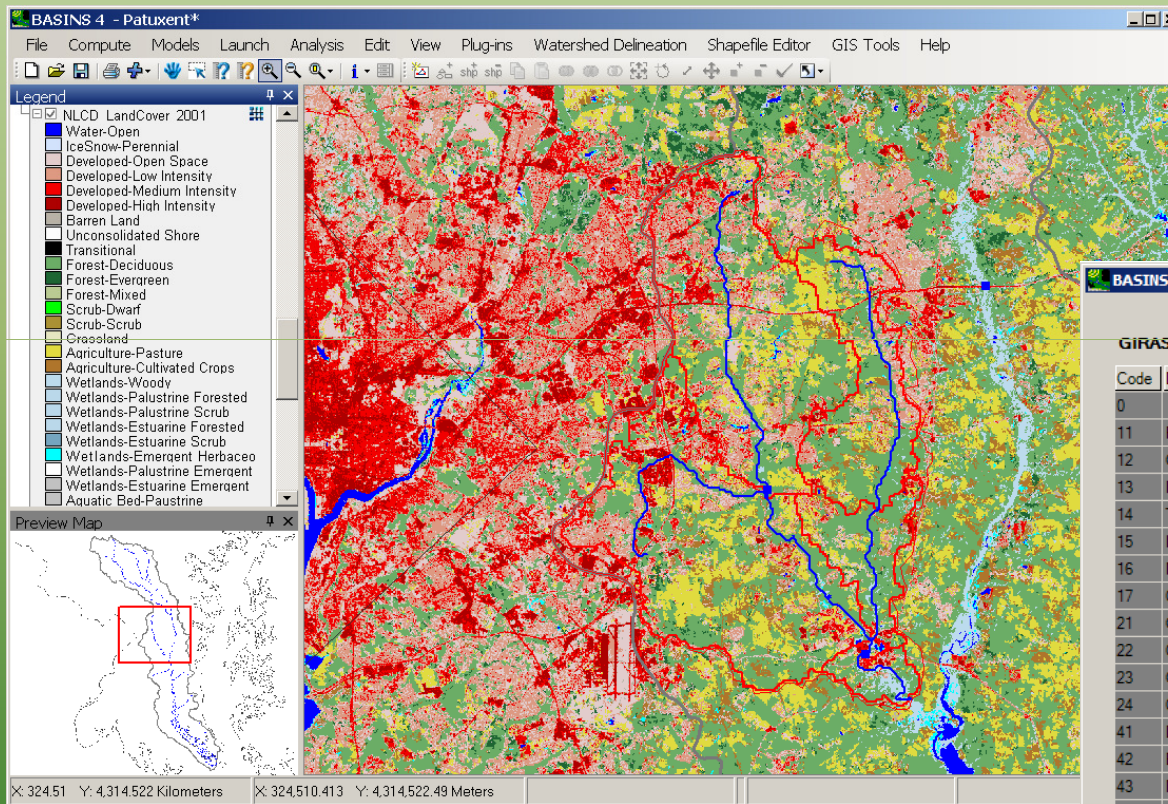


# Duration/Frequency Analysis

## USGS Surface Water Statistics



# Data Transformations – Spatial Downscaling/Upscaling



**BASINS LandUse Reclassification**

Normal  Advanced

GIRAS classes within layer Cataloging Unit Boundanes (grouped by giras.dbf)

Code	Description	Area Percent	Group	Impervious %	Multiplier	Subbasin
0		0.01			1	<all>
11	RESIDENTIAL	14.21	Urban or Built-up Land	50	1	<all>
12	COMMERCIAL AND SERVICES	2.49	Urban or Built-up Land	50	1	<all>
13	INDUSTRIAL	0.19	Urban or Built-up Land	50	1	<all>
14	TRANS. COMM, UTIL	0.77	Urban or Built-up Land	50	1	<all>
15	INDUST & COMMERC CMLXs	0.27	Urban or Built-up Land	50	1	<all>
16	MXD URBAN OR BUILT-UP	0.13	Urban or Built-up Land	50	1	<all>
17	OTHER URBAN OR BUILT-UP	0.64	Urban or Built-up Land	50	1	<all>
21	CROPLAND AND PASTURE	34.34	Agricultural Land	0	1	<all>
22	ORCH,GROV,VNYRD,NURS,ORN	0.11	Agricultural Land	0	1	<all>
23	CONFINED FEEDING OPS	0.01	Agricultural Land	0	1	<all>
24	OTHER AGRICULTURAL LAND	0.04	Agricultural Land	0	1	<all>
41	DECIDUOUS FOREST LAND	5.98	Forest Land	0	1	<all>
42	EVERGREEN FOREST LAND	0.57	Forest Land	0	1	<all>
43	MIXED FOREST LAND	30.42	Forest Land	0	1	<all>
51	STREAMS AND CANALS	5.12	Wetlands/Water	0	1	<all>
52	LAKES	0.02	Wetlands/Water	0	1	<all>
53	RESERVOIRS	0.3	Wetlands/Water	0	1	<all>

Buttons: Load Save Close Add Delete

# Data Transformations - Temporal

## Adjustments to precipitation with CAT

**Modify Existing Data**

Modification Name:

Existing Data to Modify:

How to Modify:

**Percent Change in Volume**

Single Change  Multiple changes within specified range

Minimum:  %

Maximum:  %

Increment:

**Events**

Vary values only in the following Events Change  % of volume

Exceeding threshold

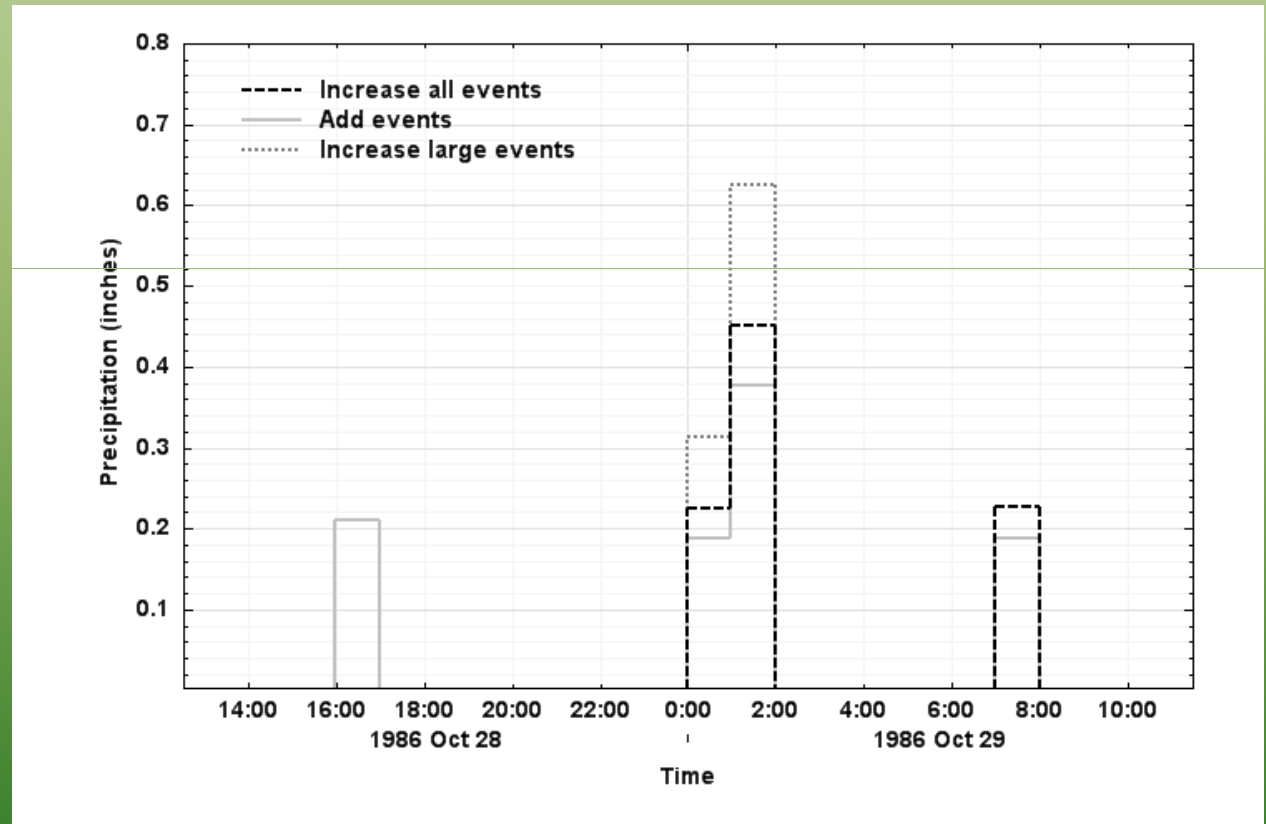
Allow gaps up to

Sum of values exceeding threshold

Total duration above

**Months/Years**

Vary only in selected



# *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?*