# Hydrologic Engineering Center

HEC–HMS

Version 3.0
New Features
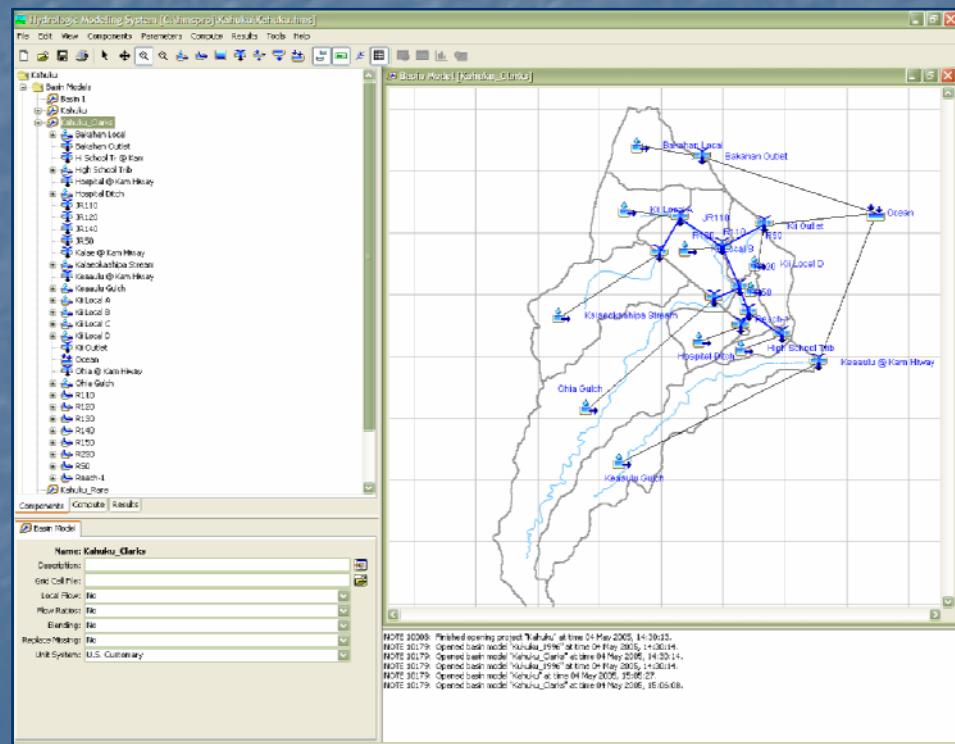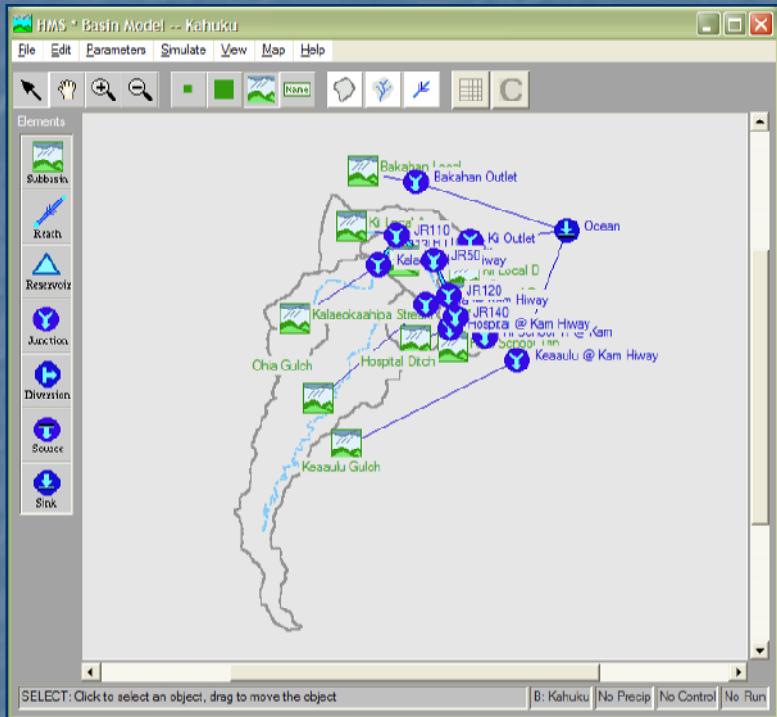
US Army Corps of Engineers
Hydrologic Engineering Center

2005 Tri-Services Infrastructure Conference, St. Louis

Topics

- HEC-HMS
  - Version 3.0
  - Concepts
  - Data Components
  - Simulation
  - Results

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HEC-HMS Version 3.0

- **Initial Release**
  - New User Interface - JAVA
  - Snow Accumulation and Melt
  - Depth-Area Storm Event Analysis
  - Evapotranspiration
- **Under Development**
  - Interior Flooding Capabilities
  - Land Surface Wash-off

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New User Interface - JAVA

- **Finished Java Conversion**
  - Converted Entire Existing Engine with Data Model and Simulation Components from C++, Galaxy to Java
  - Scraped Old Interface in Favor of New Design
    - Easy to Learn
    - More Flexible for Configuring Data and Viewing Results
    - Faster to Use Because it Anticipates User Needs
    - Similar in Layout to Other Engineering Software
  - New Interface Design Complete
- **Beta Testing in Progress**
  - Approximately 60 testers
  - Several International
  - Testing Complete August 26th

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HMS Provides

- Tool kit of options
  - Basin Parameters
  - Parameter estimation (optimization)
- Graphical user interface
  - Select-and-add icons
  - Graphical and tabular displays
- Multiple operating system support
  - Windows, UNIX

HMS Version 3.0

Watershed Explorer

Basin Map

Component Editor

Message Pane
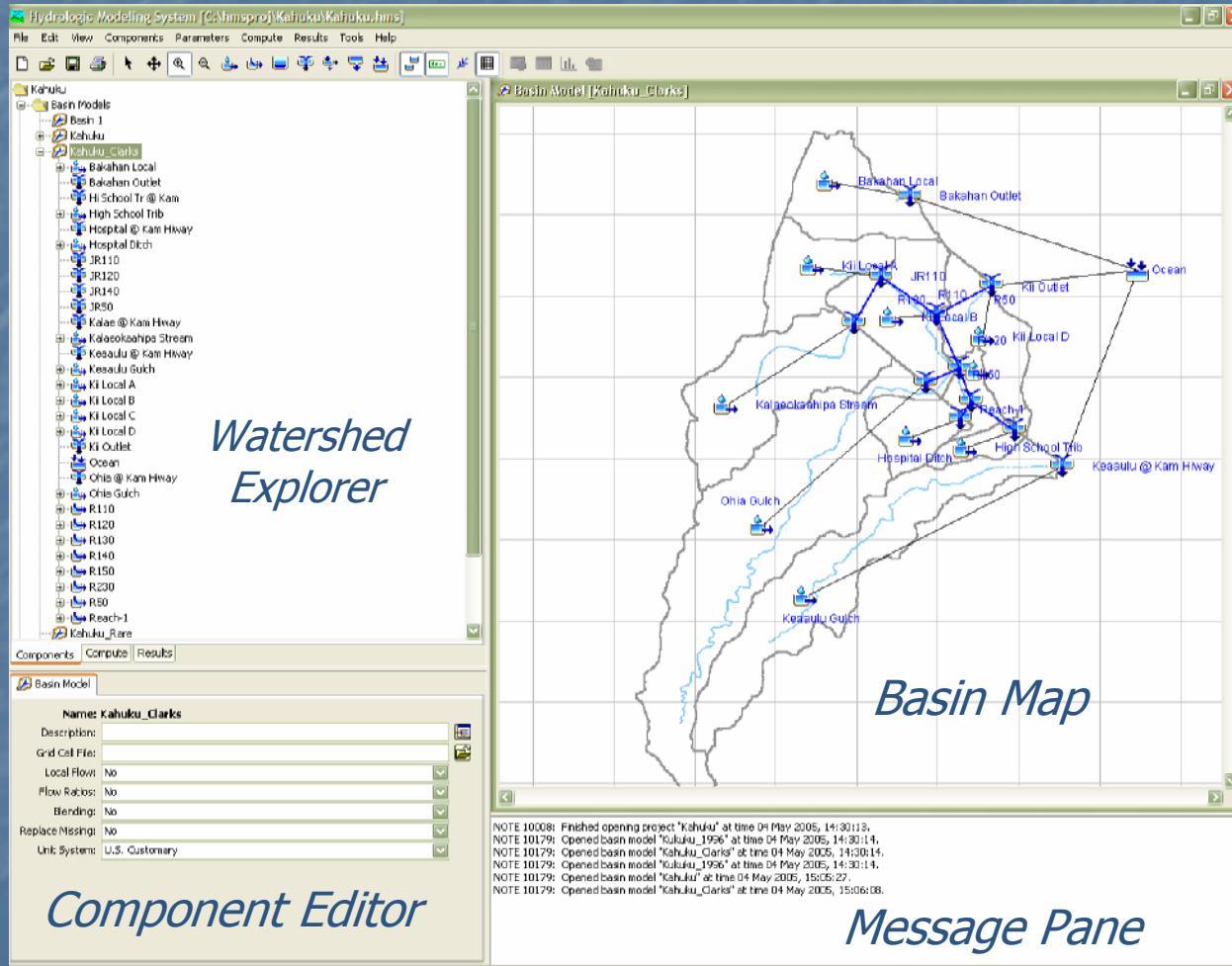
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Watershed Explorer

- List All Project Components
- Expand Multiple Components
- List All Elements
- Icon Shows Element Type
- Direct Access to Methods
- Selected Element Highlighted on Map
- Right Click Menu
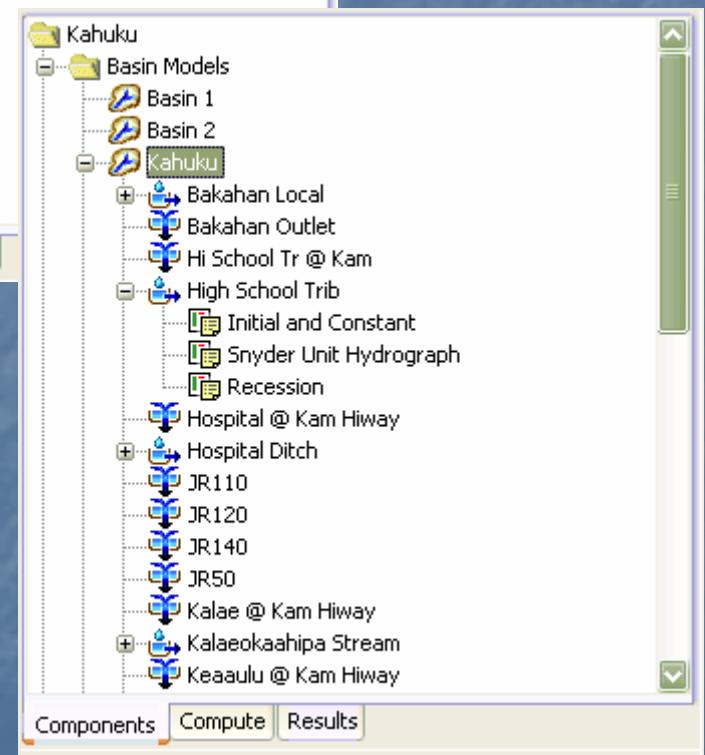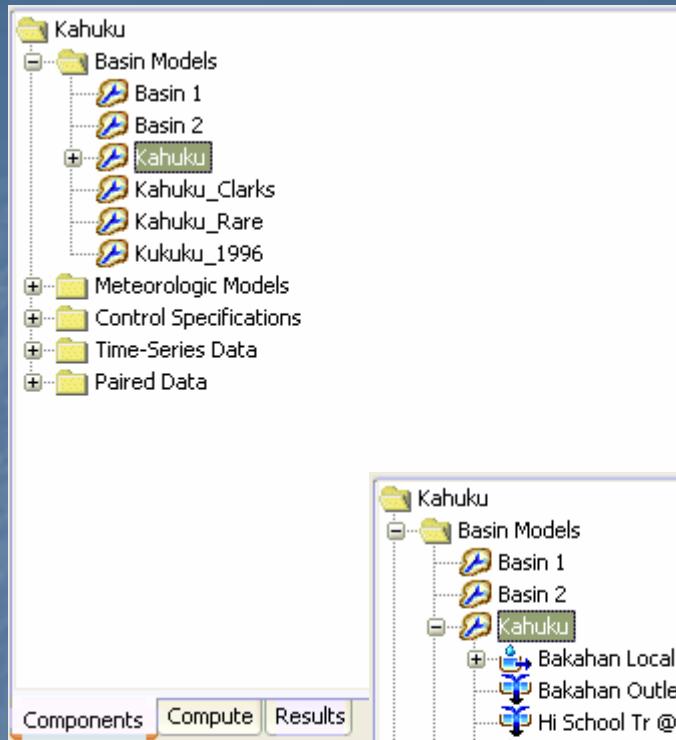
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Basin Map

- Georeferenced
- Shows all elements
- Make any Element Active
- Zoom In and Out
- Right Click Menu
- View Results
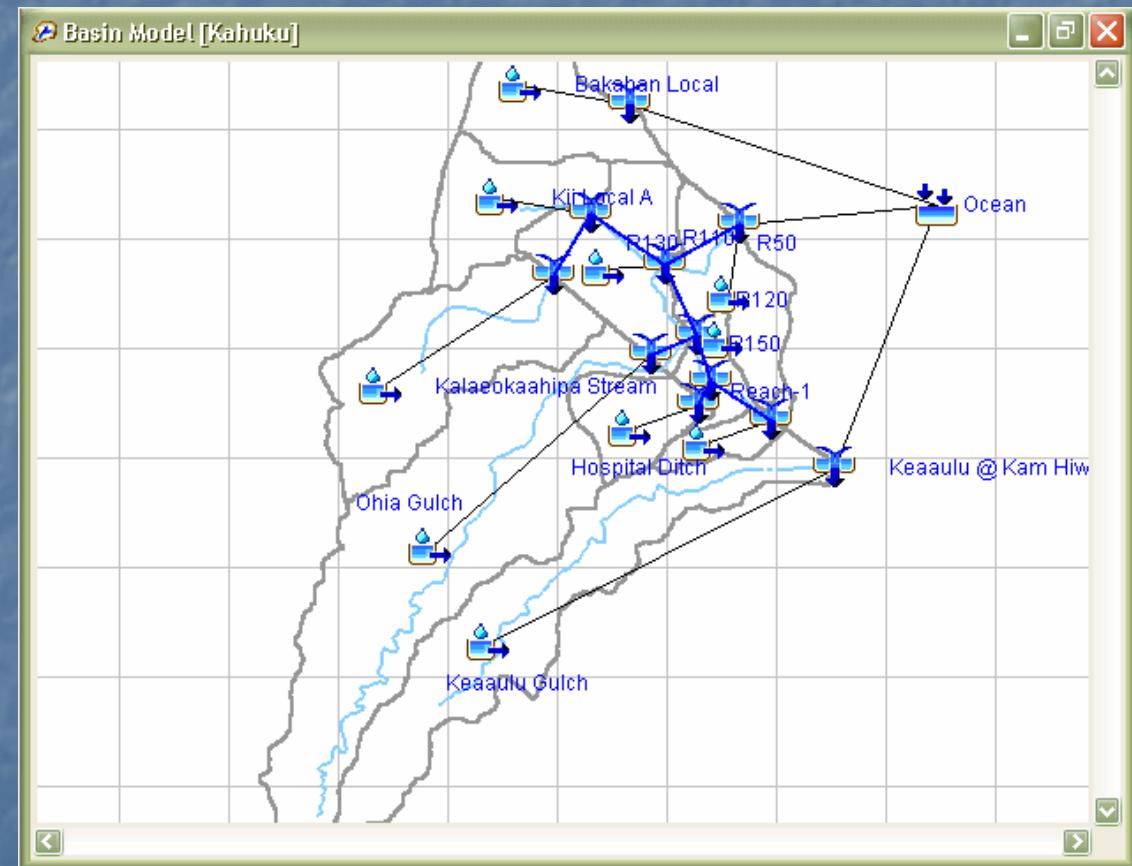
Component Editor

- Editors for all Elements
- Automatically Reflects Selected Element
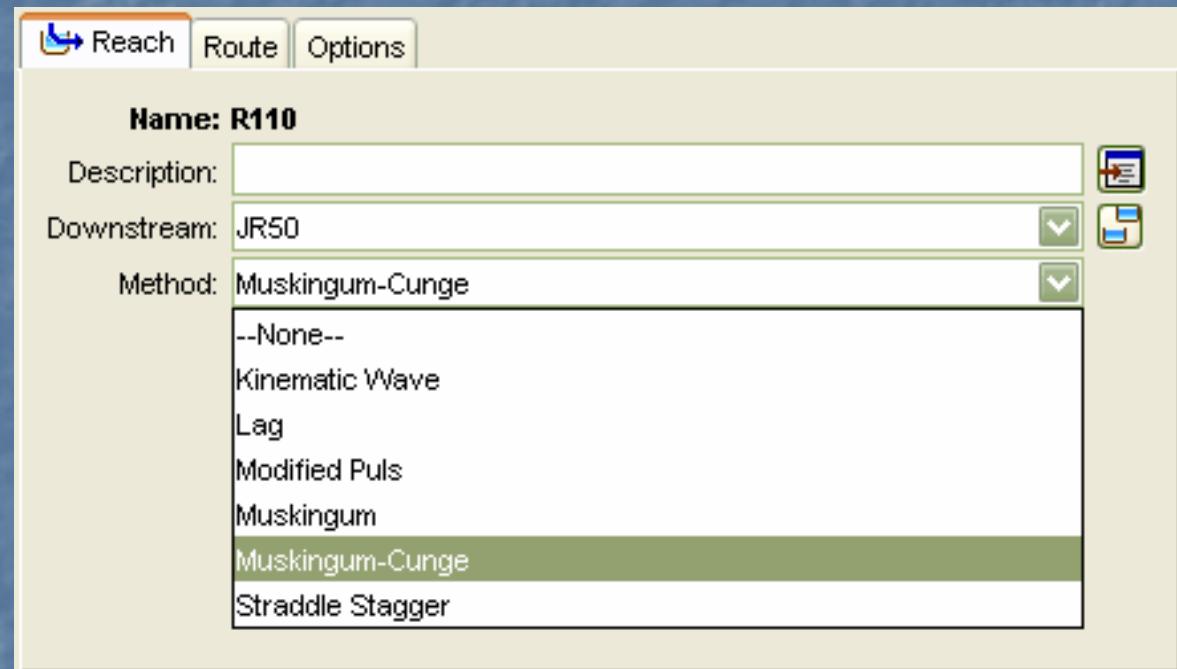
Message Pane

- Instant Feedback
- Lists errors
- Tracks Current Execution

NOTE 10008: Finished opening project "Kahuku" at time 06 May 2005, 19:41:36.
NOTE 10179: Opened basin model "Kukuku_1996" at time 06 May 2005, 19:41:36.
NOTE 10179: Opened basin model "Kahuku_Clarks" at time 06 May 2005, 19:41:36.
NOTE 10179: Opened basin model "Kukuku_1996" at time 06 May 2005, 19:41:36.
NOTE 10179: Opened basin model "Kahuku" at time 06 May 2005, 19:43:16.

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HEC-HMS Project

- Container for components
  - Basin model
  - Gage and paired data
  - Gridded data
  - Meteorologic model
  - Control specifications
- Analysis methods
  - Simulation
  - Parameter estimation (optimization)
  - Depth-Area

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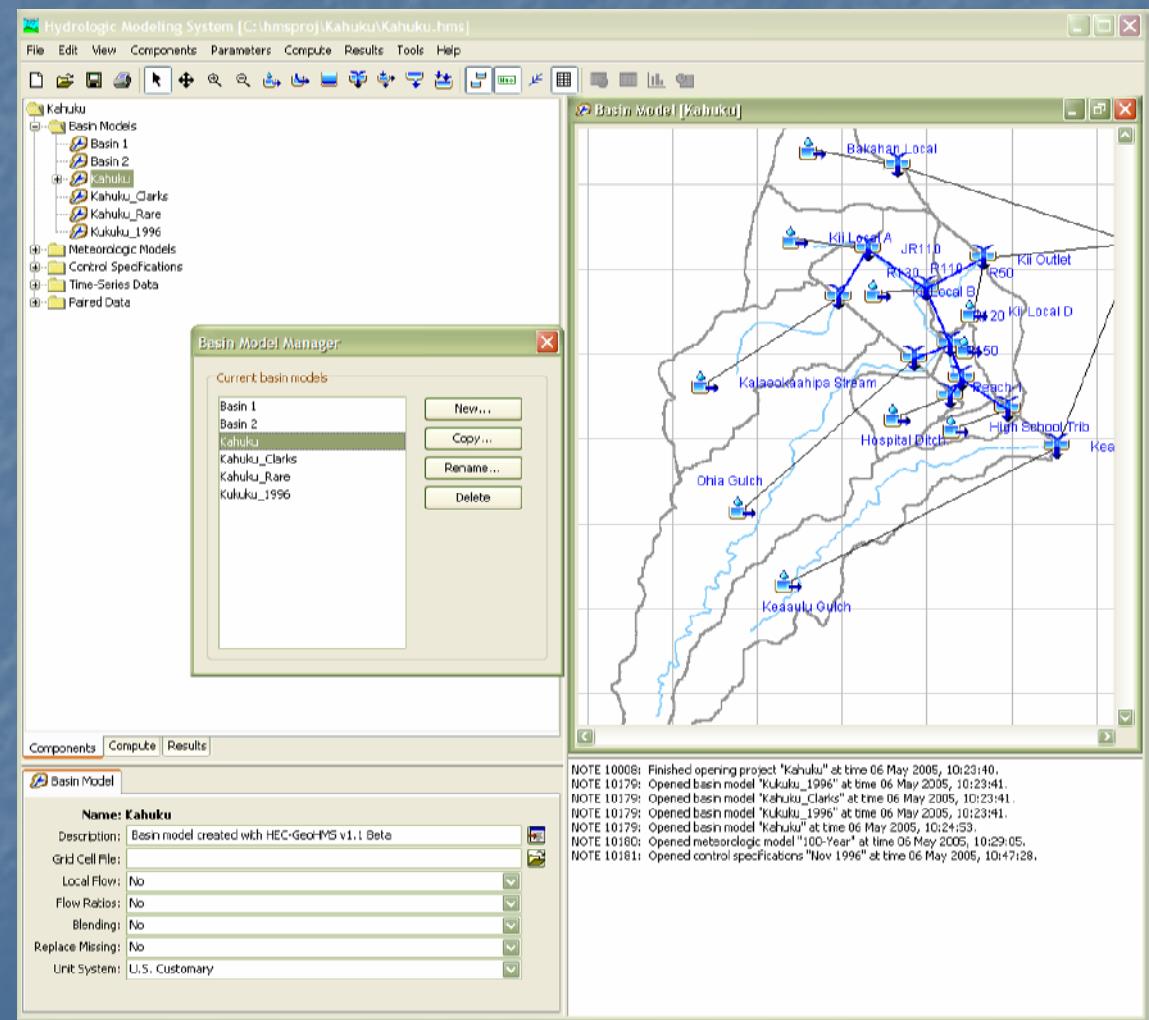
HEC-HMS Project Components
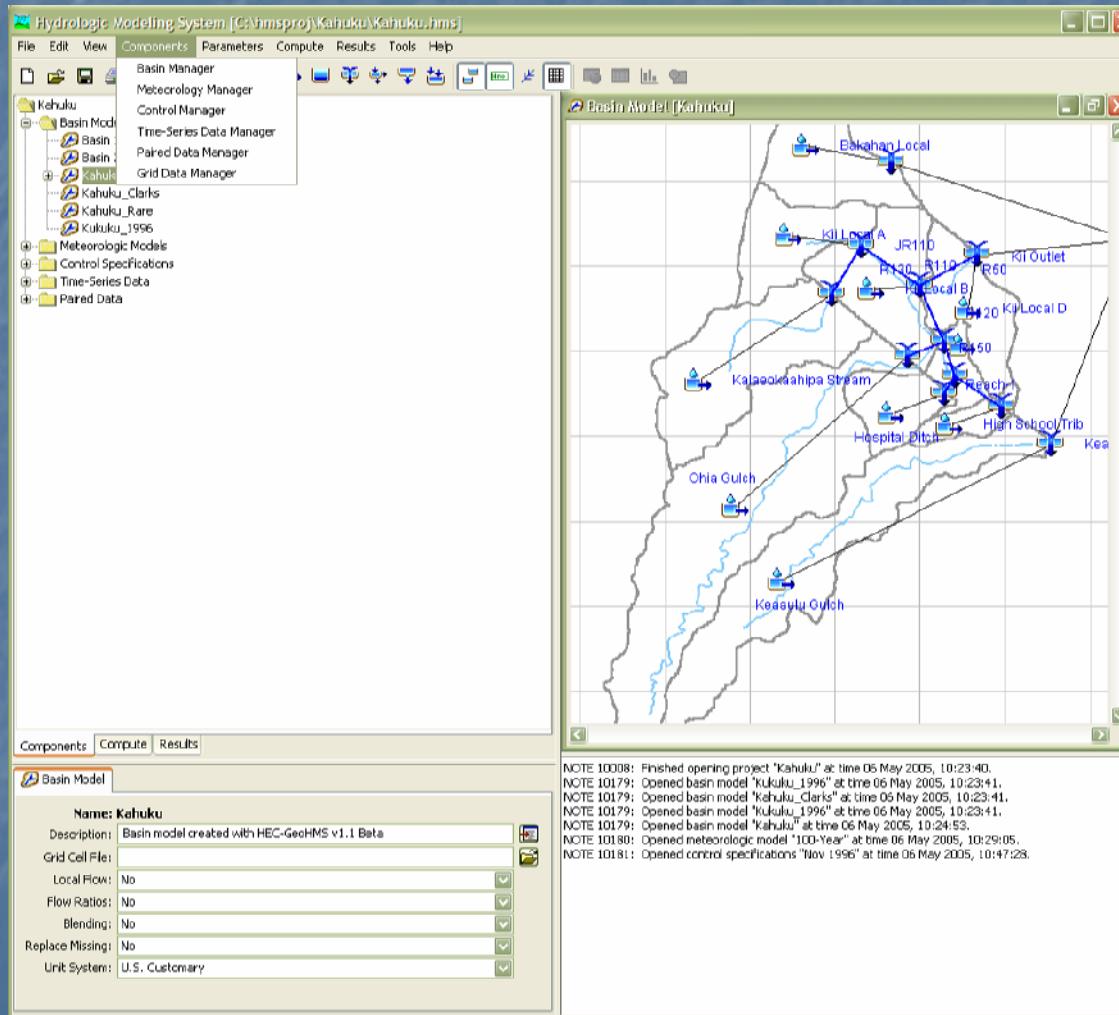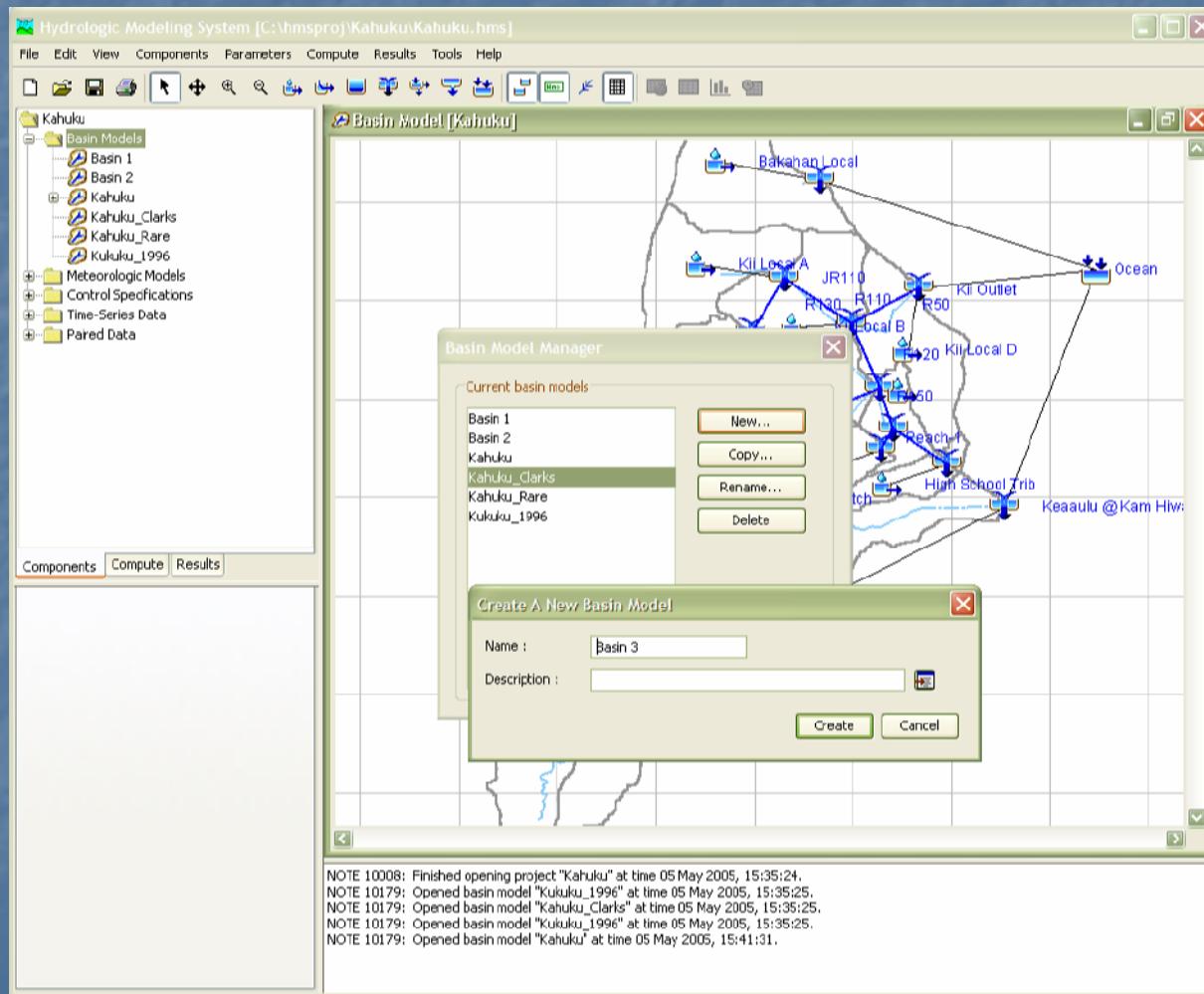
Basin Models

Basin Model Types

- **Area Averaged**
  - Parameters apply to entire subbasin
- **Gridded (GeoHMS)**
  - ModClark Transform
  - Gridded Precip
    - HRAP, SHG
  - Grid Cell File
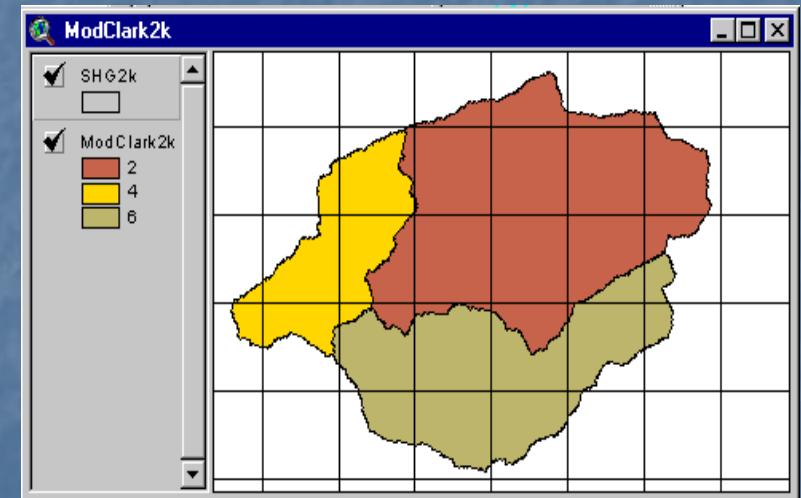
Basin Model Elements

- Subbasin - *Watershed Catchments*
- Reach - *Rivers and Streams*
- Reservoir - *Dams and Lakes*
- Junction - *Confluence*
- Diversion - *Bifurcations and Withdrawals*
- Source - *Springs and other Model Sinks*
- Sink - *Outlets and Terminal Lakes*

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Subbasin Element Loss Parameter

- **Loss Methods**
  - Initial and Constant
  - Deficit and Constant
  - Evapotranspiration
  - Green and Ampt
  - Gridded Deficit Constant
  - Gridded SCS Curve Number
  - Gridded SMA
  - SCS Curve Number
  - Soil Moisture Accounting
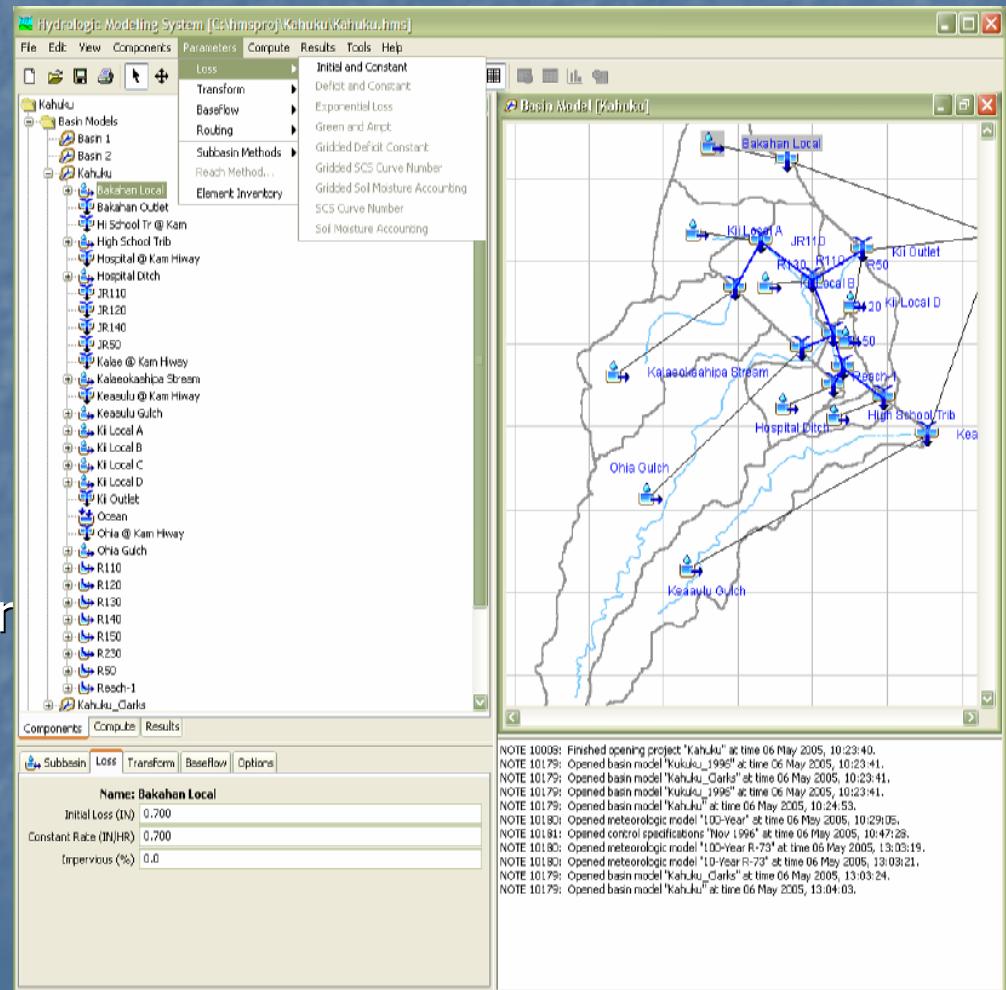
Subbasin Element

■ Editor

Subbasin Element Transform Parameter

- **Transform Methods**
  - Clark UH
  - Kinematic wave
  - ModClark
  - Snyder UH
  - SCS UH
  - User-specified S-graph
  - User-specified UH

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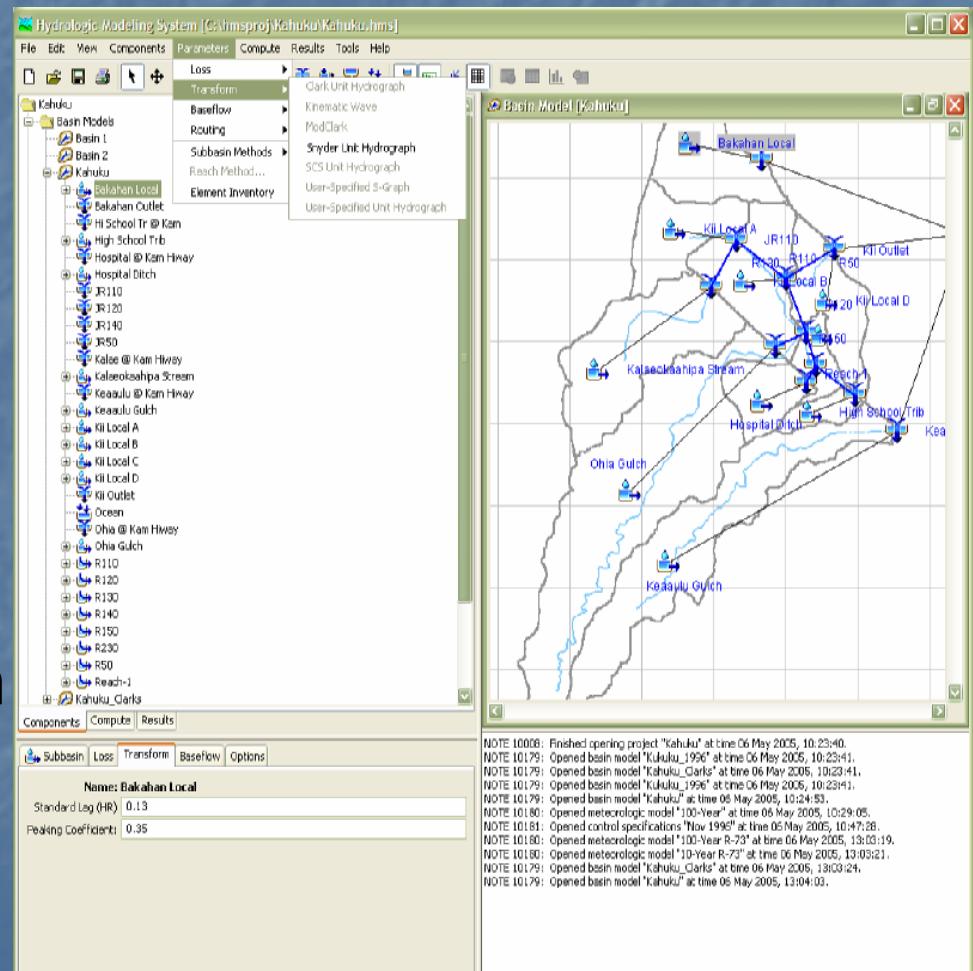
Subbasin Element Baseflow Parameter

- **Baseflow Methods**
  - Bounded Recession
  - Constant monthly
  - Linear reservoir
  - Recession
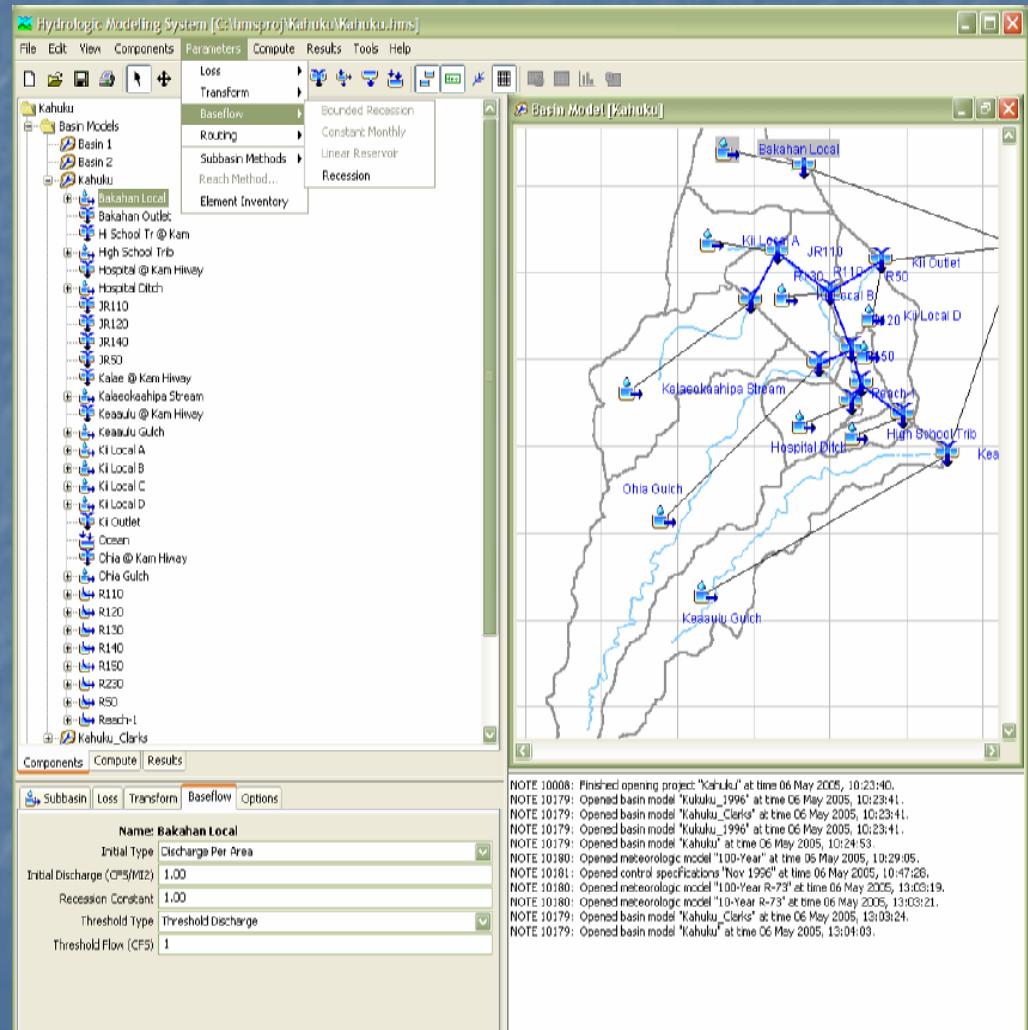
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Reach Parameters

- **Routing Methods**
  - Kinematic Wave
  - Lag
  - Modified Puls
  - Muskingum
  - Muskingum-Cunge
  - Straddle-Stagger
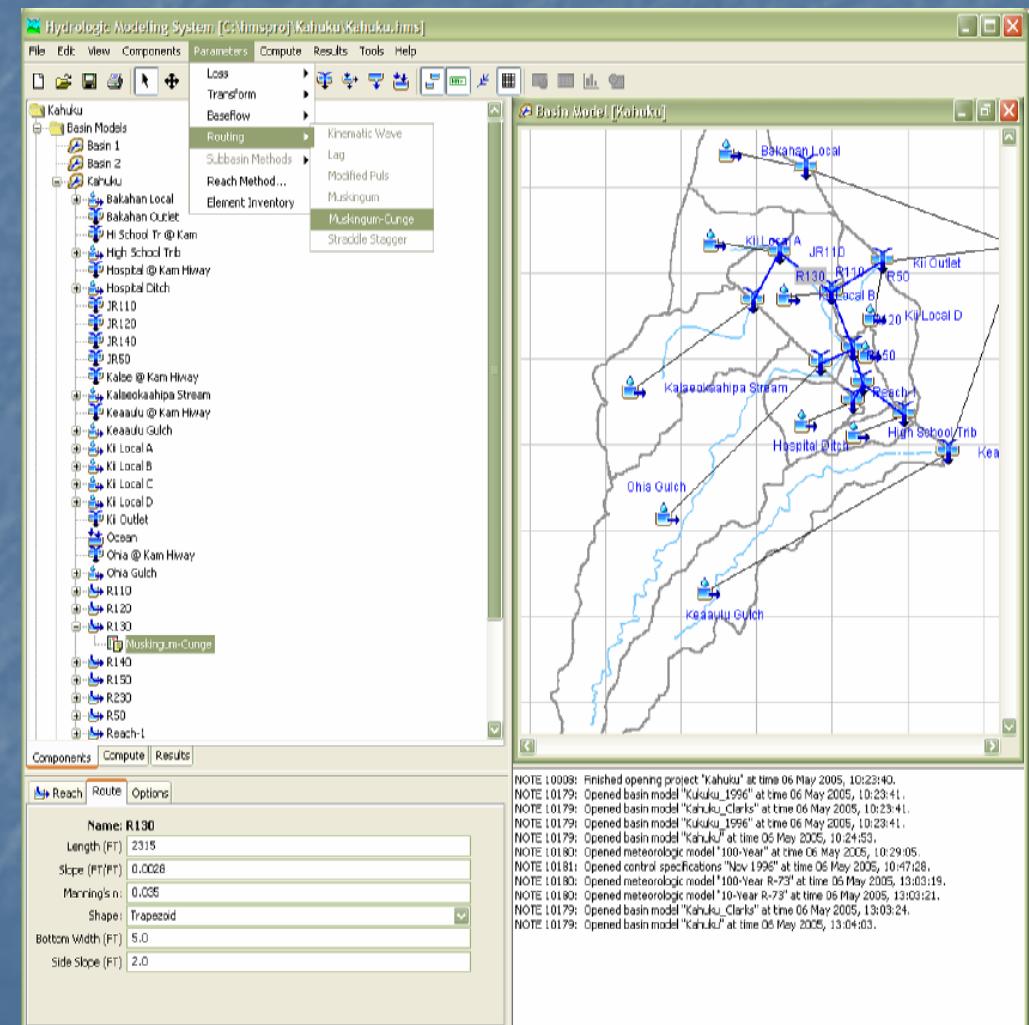
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Reservoir Parameters

- **Reservoir Methods**
  - Simplified Routing
    - Storage-Outflow
    - Elevation-Storage-Outflow
    - Elevation-Area-Outflow
  - Detailed Routing
    - Elevation- Storage
    - Elevation-Area
      - Outlet
      - Spillway
      - Overflow
      - Dam Failure
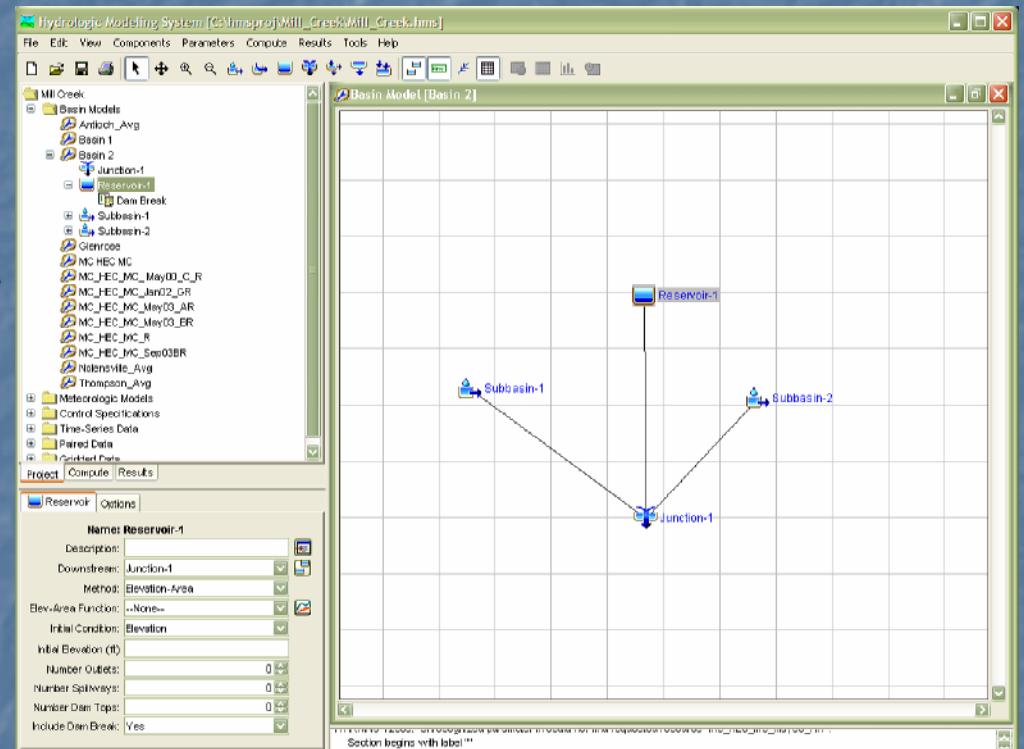
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Additional Elements

- **Junction**
- **Diversion**
- **Source**
- **Sink**
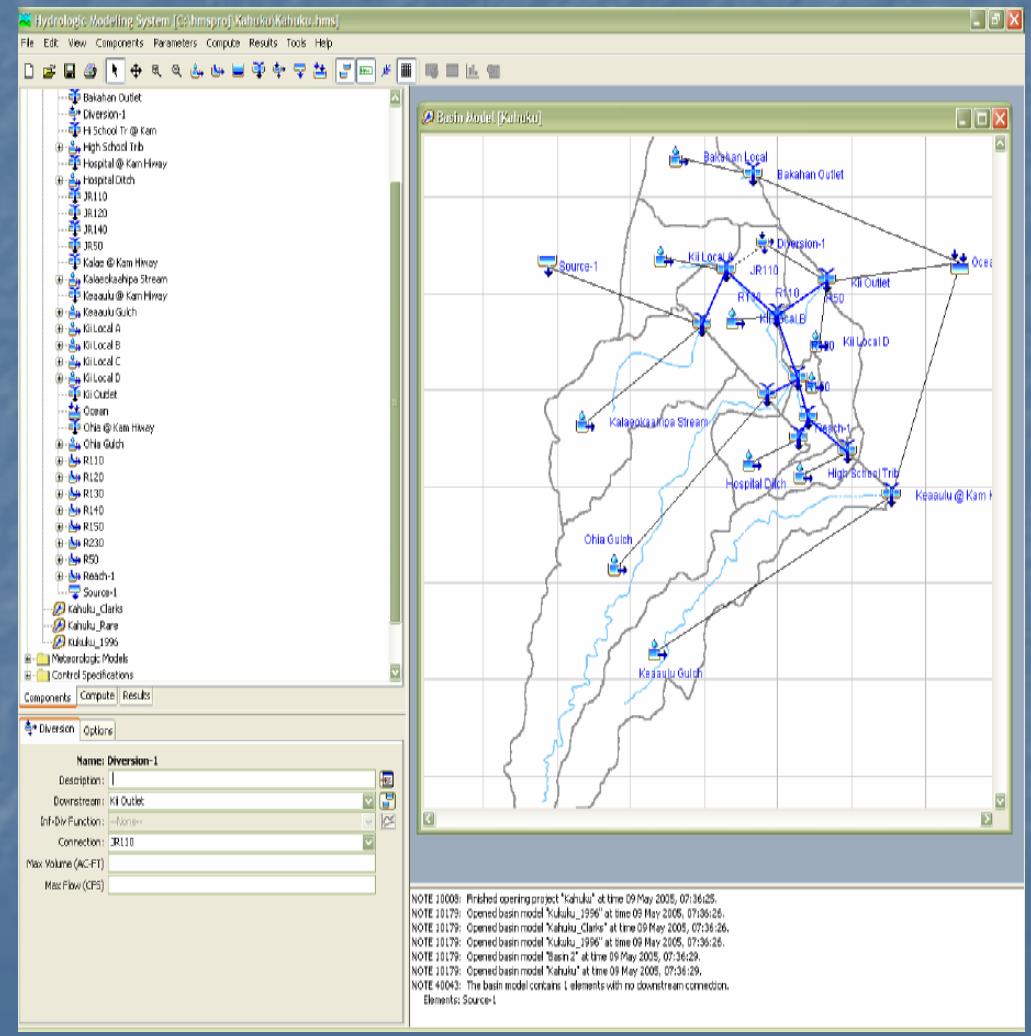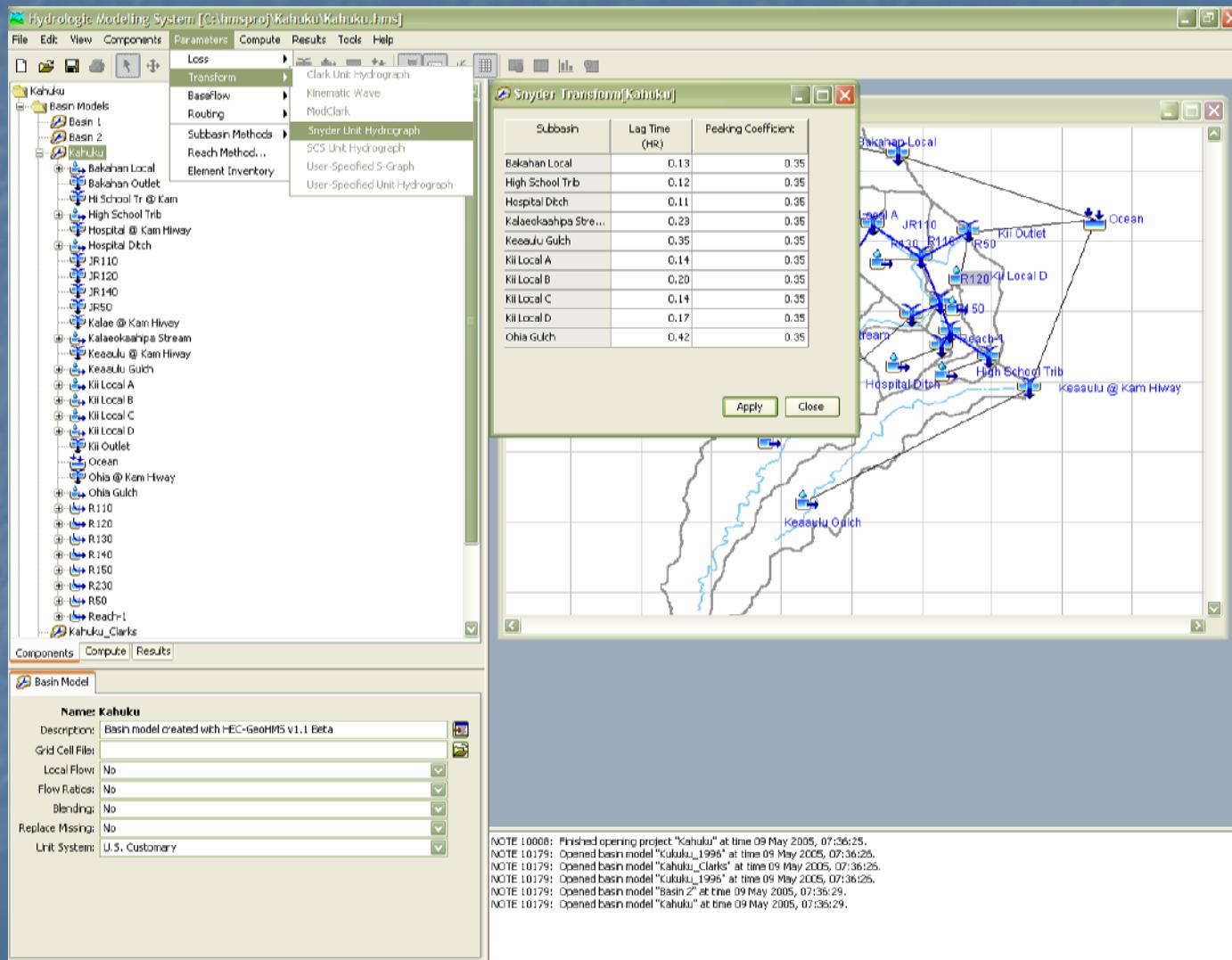
Global Editors

Global Editors
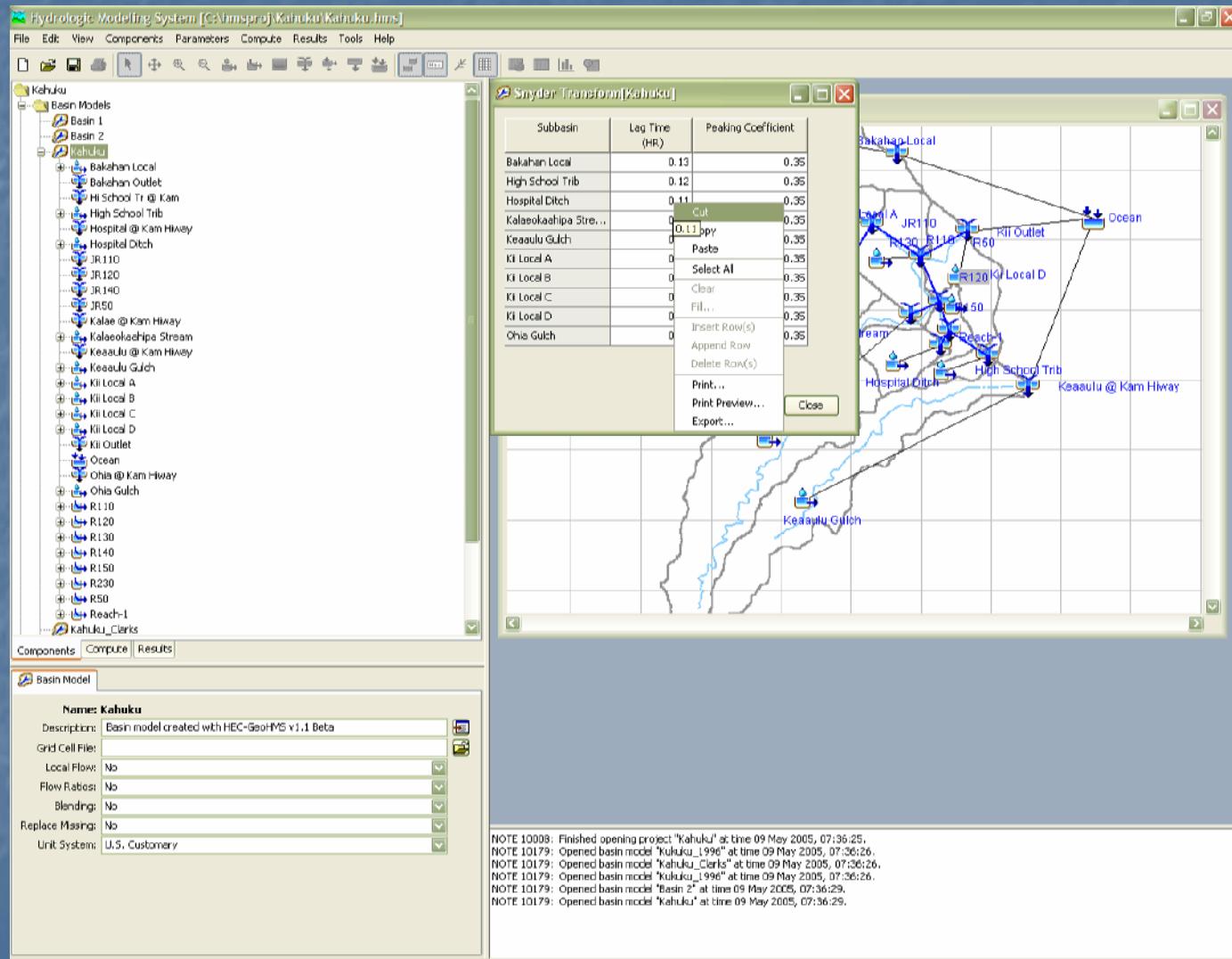
Meteorological Models
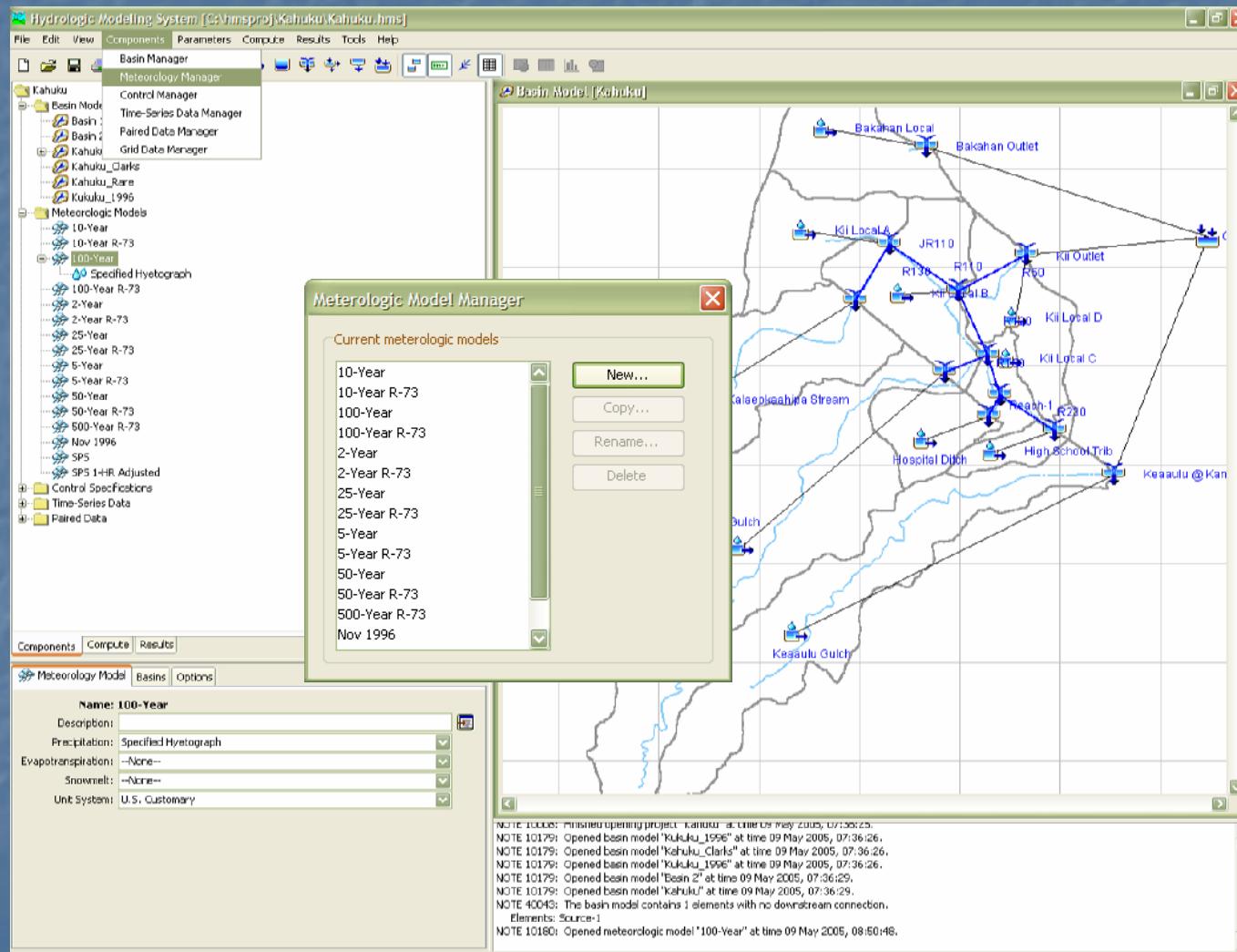
Met Model Choices

- **Precipitation**
  - Frequency storm
  - Gridded precipitation
  - Inverse-distance gage weighting
  - Standard project storm
  - User hyetograph
  - User-specified gage weighting

Met Model Editor

- **Reflects Model Type**

Met Model Editor

- **Evapotranspiration**
  - Priestly-Taylor
    - Crop Coefficient
    - Solar Radiation
    - Temperature
  - Gridded P-T
  - Monthly Average
    - Pan Coeff.
    - Rate

Met Model Editor

- **Snowmelt**
  - **Temperature Index**
  - **Gridded Temp Index**

Control Specifications

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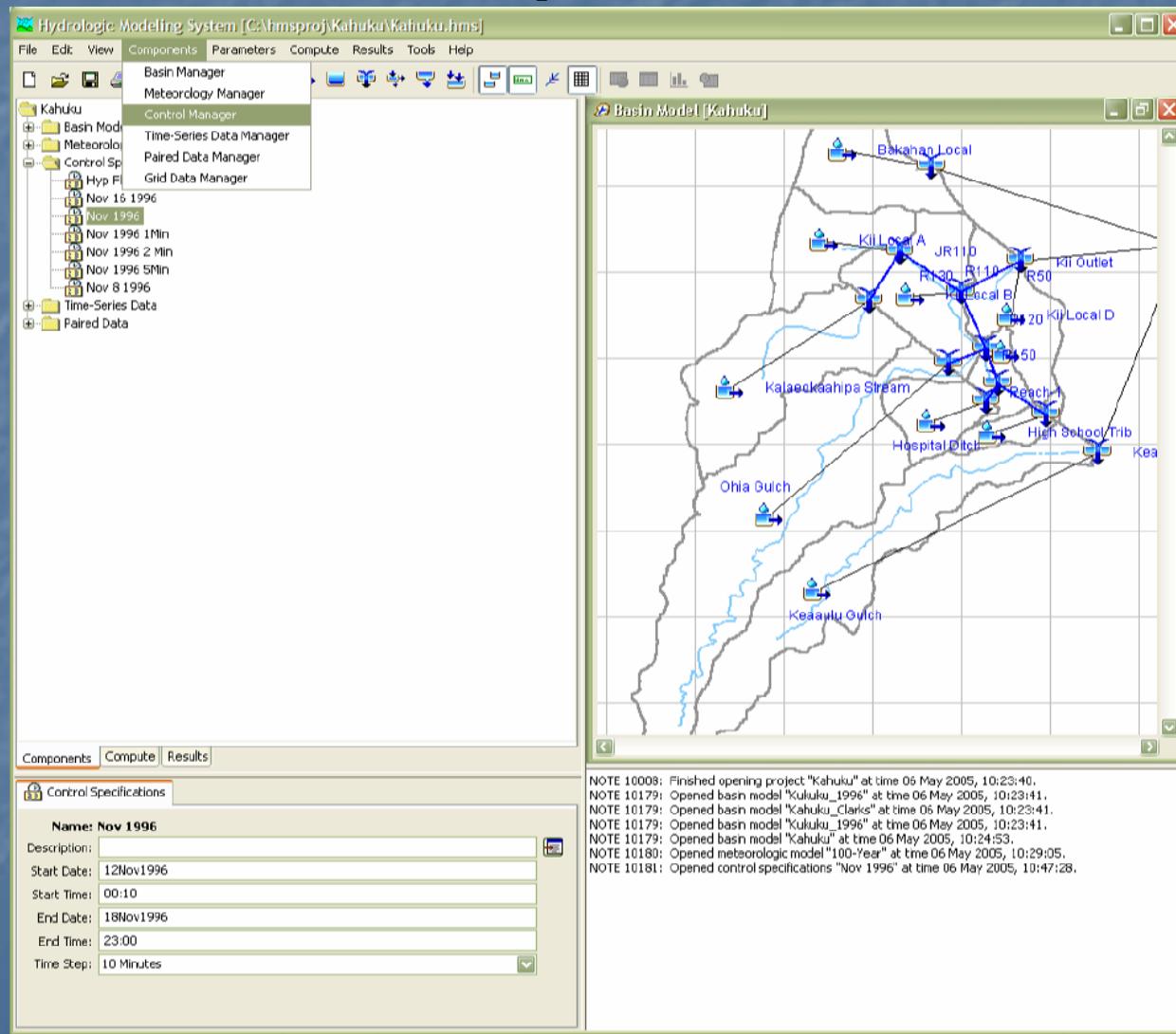
Time Series Data

- **Types**
  - Precipitation
  - Discharge
  - Temperature
  - Solar radiation
  - Crop Coefficient

Paired Data

- Types
    - Storage-Outflow
    - Elevation Storage
    - Elevation-Area
    - Elevation-Discharge
    - Inflow-Diversion
    - Cross Sections
    - Unit Hydrograph
    - S-Graph
    - ATI Meltrate
    - ATI Coldrate
    - Groundmelt Patterns
    - Evaporation Patterns
    - Meltrate patterns
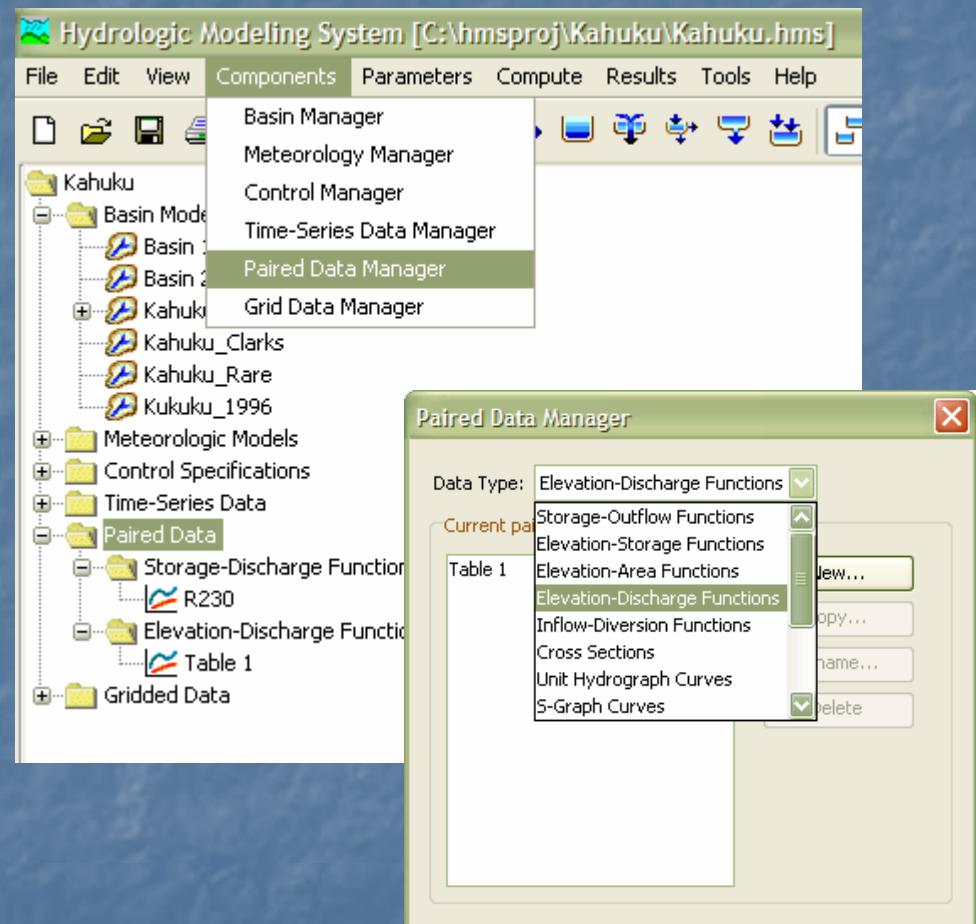
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Gridded Data

- Types
  - Precipitation
  - Temperature
  - Solar radiation
  - Crop Coefficient
  - Storage Capacity
  - Percolation
  - Storage Coefficient
  - Moisture Deficit
  - Impervious Area
  - SCS Curve Number
  - Elevation
  - Cold Content
  - Cold Content ATI
  - Meltrate ATI
  - Liquid Water Content
  - Snow Water Equivalent
- Data Source always DSS
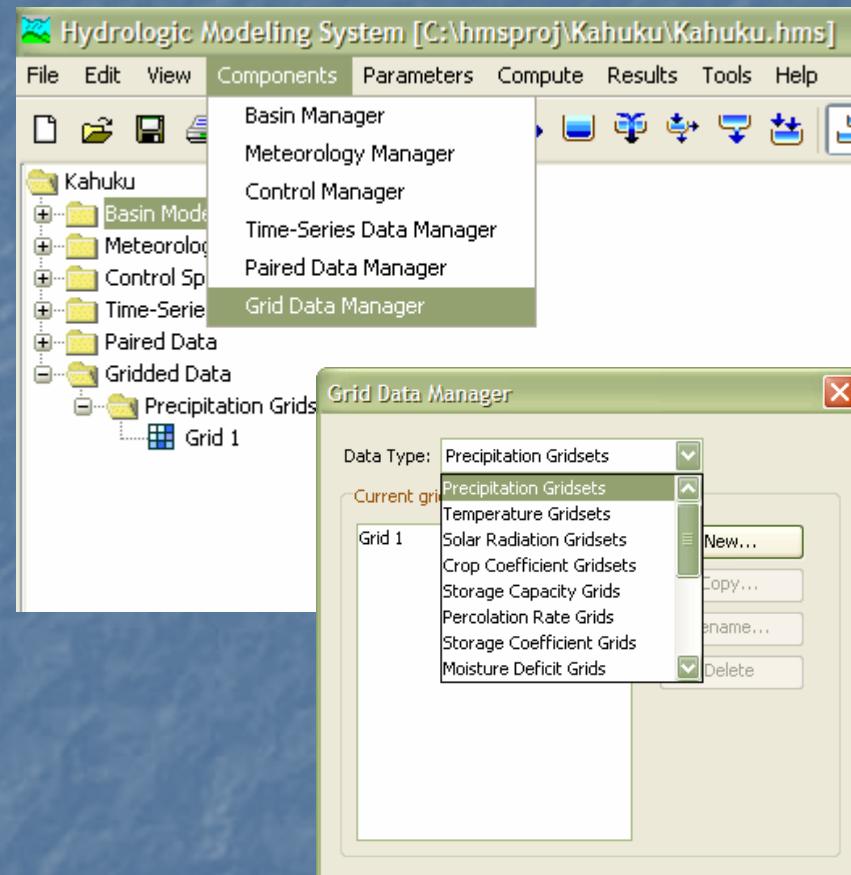
Model Computations

- Simulation
- Optimization
- Depth-Area Analysis

Simulation

Optimization

- Observed Data
- Existing Simulation

Depth-Area Analysis

- **Based on Existing Simulation**
- **Frequency Storm Met Model**

Depth-Area Analysis

- Frequency Storm Application Basis for Many Planning Studies

- Multiple Evaluation Locations Almost Always Necessary

- New Tool Provides Semi-Automated Analysis at Multiple Evaluation Locations

- Will Reduce Errors from Improperly Applied Storms

- Reduce Time to Evaluate Multiple Locations

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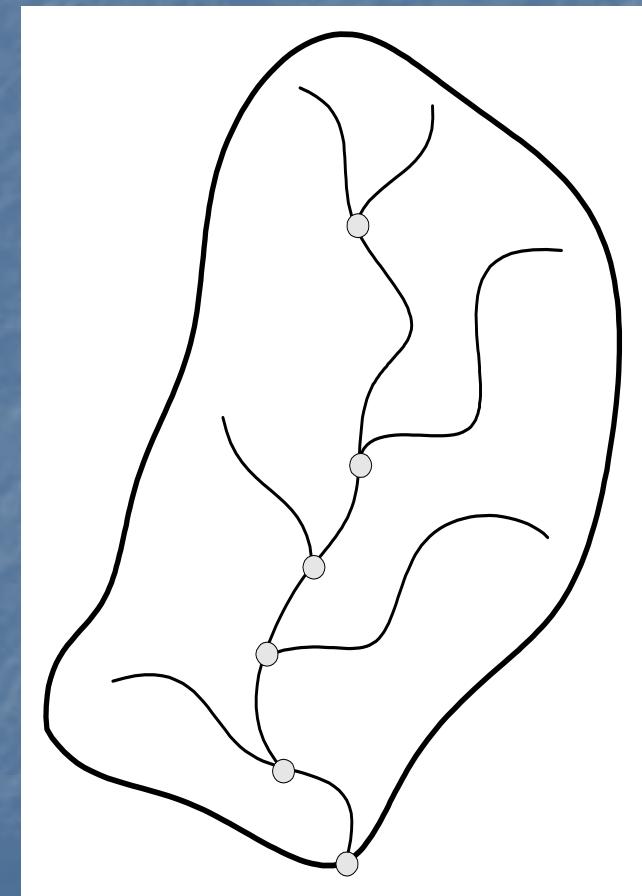
Simulation Results – Basin Map

- Based on Last Compute
  - For Selected Element
    - Graph
    - Summary Table
    - Time Series table
  - Preset Graphs, Tables
    - Based on Element

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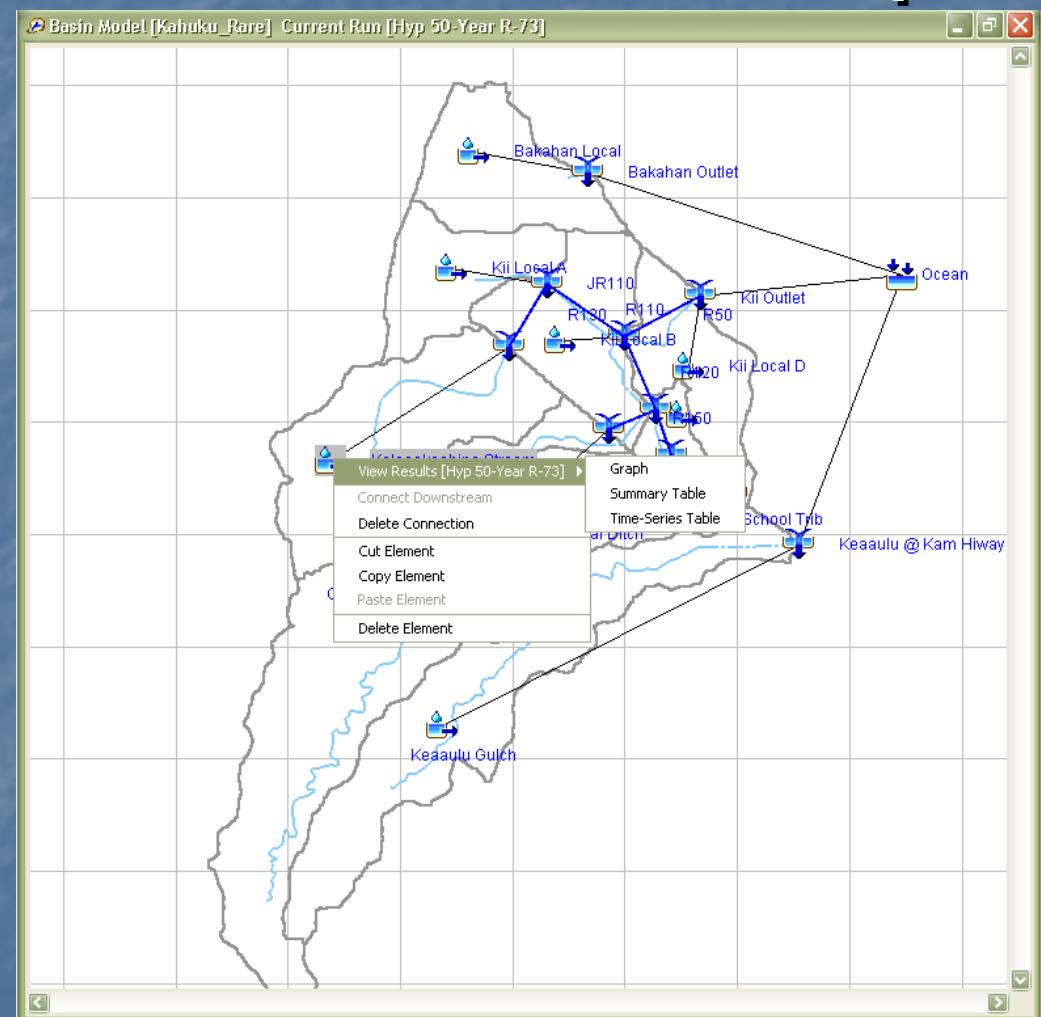
Simulation Results – Results Tree

- **Valid Results Enabled**
- **Compare Multiple Runs**
- **Plot in Preview Window**
- **Expand to Large Plot**
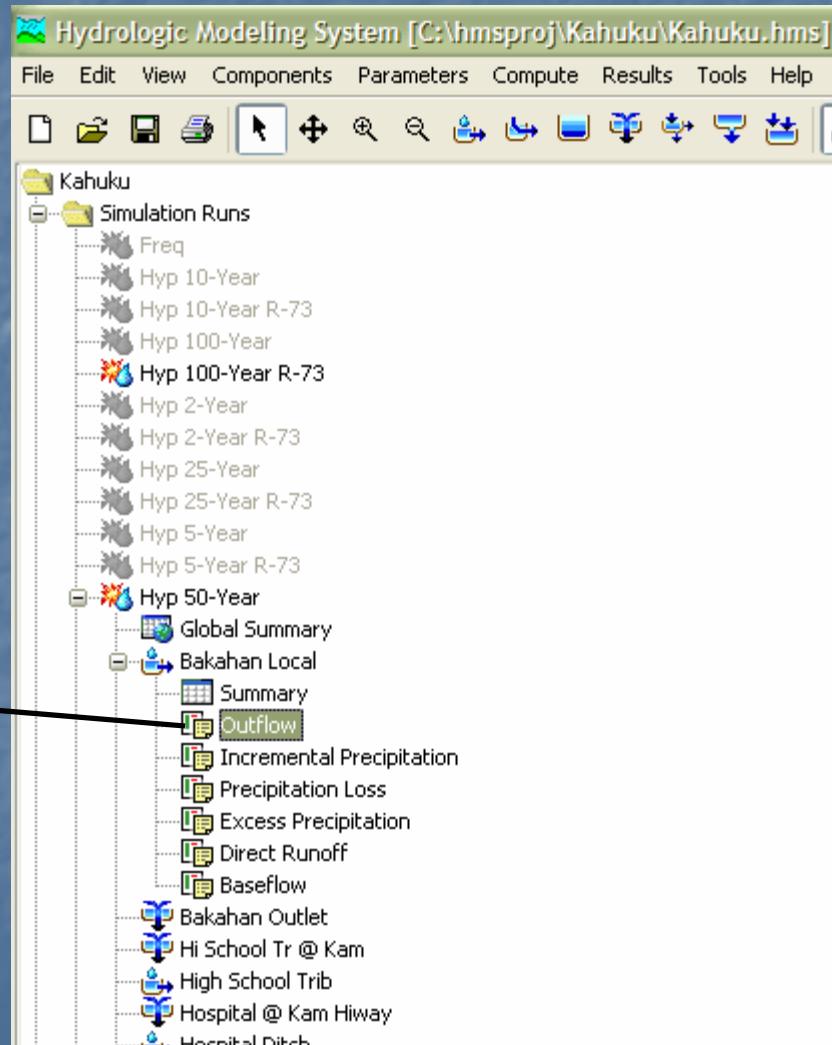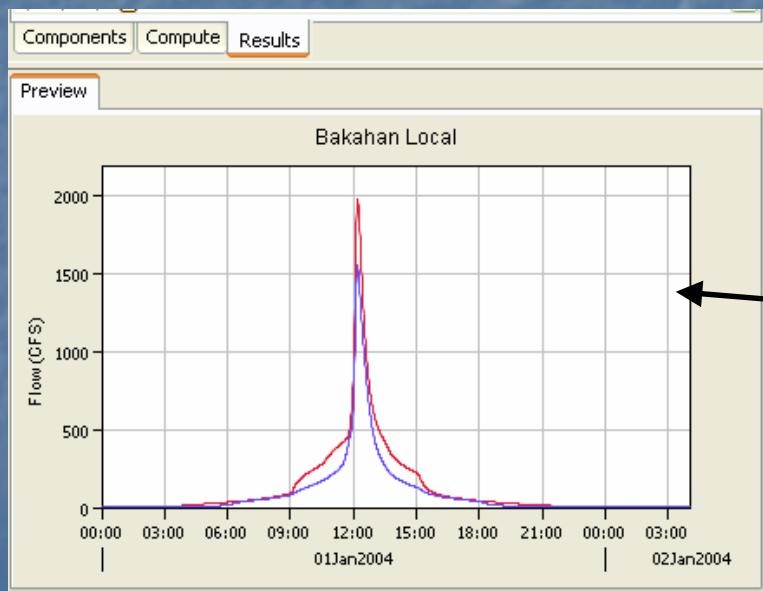
HEC-HMS Web Access

- Download HEC-HMS from HEC Website
  - http://www.hec.usace.army.mil/
- Beta Version HMS 3.0
  - Released and in test phase
- 2003 Statistics
  - 37,000 Downloads
  - 93 Countries

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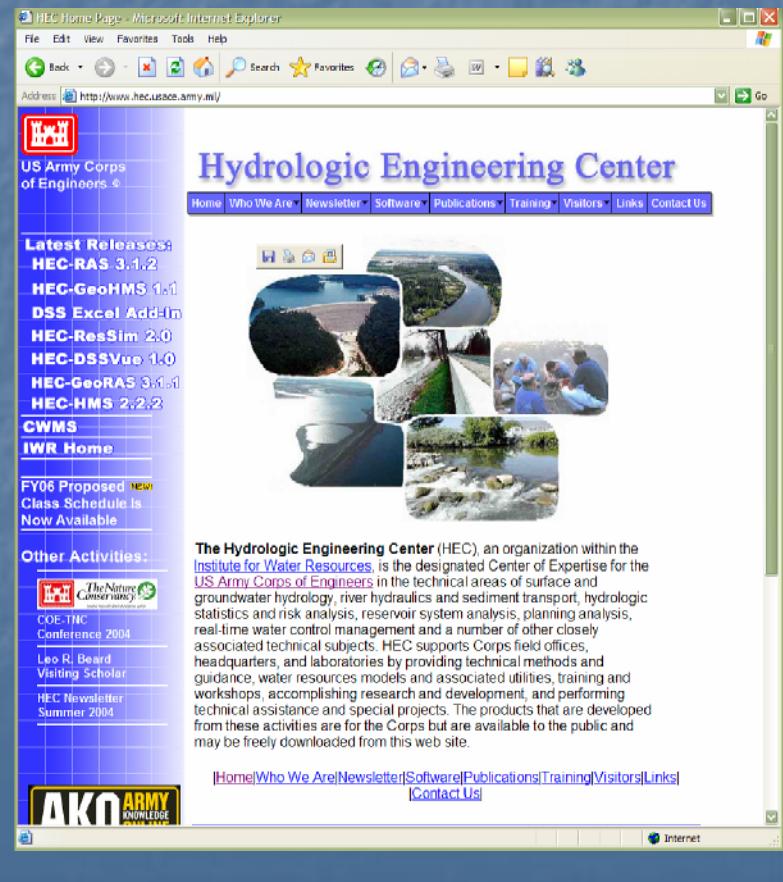
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