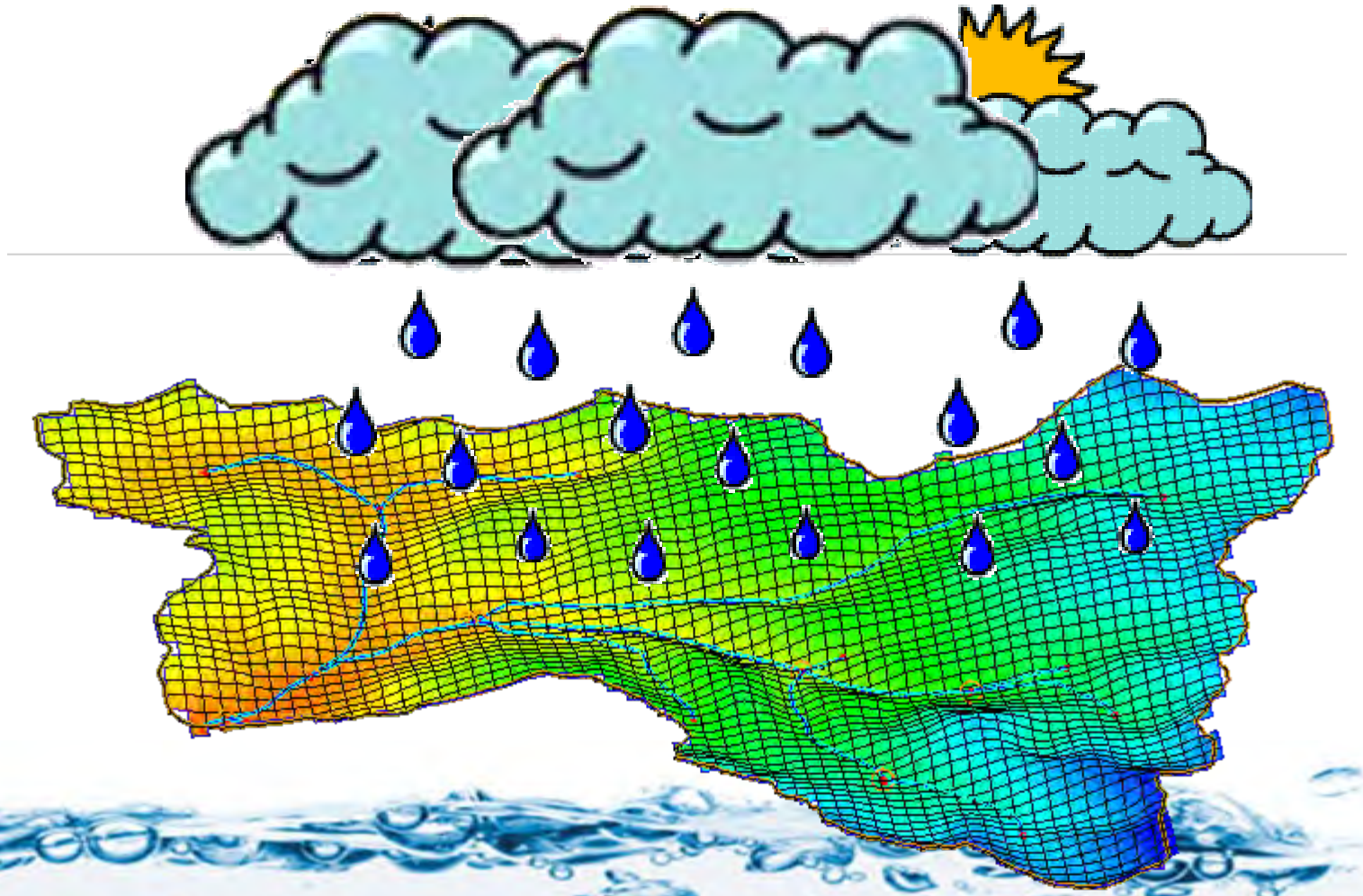
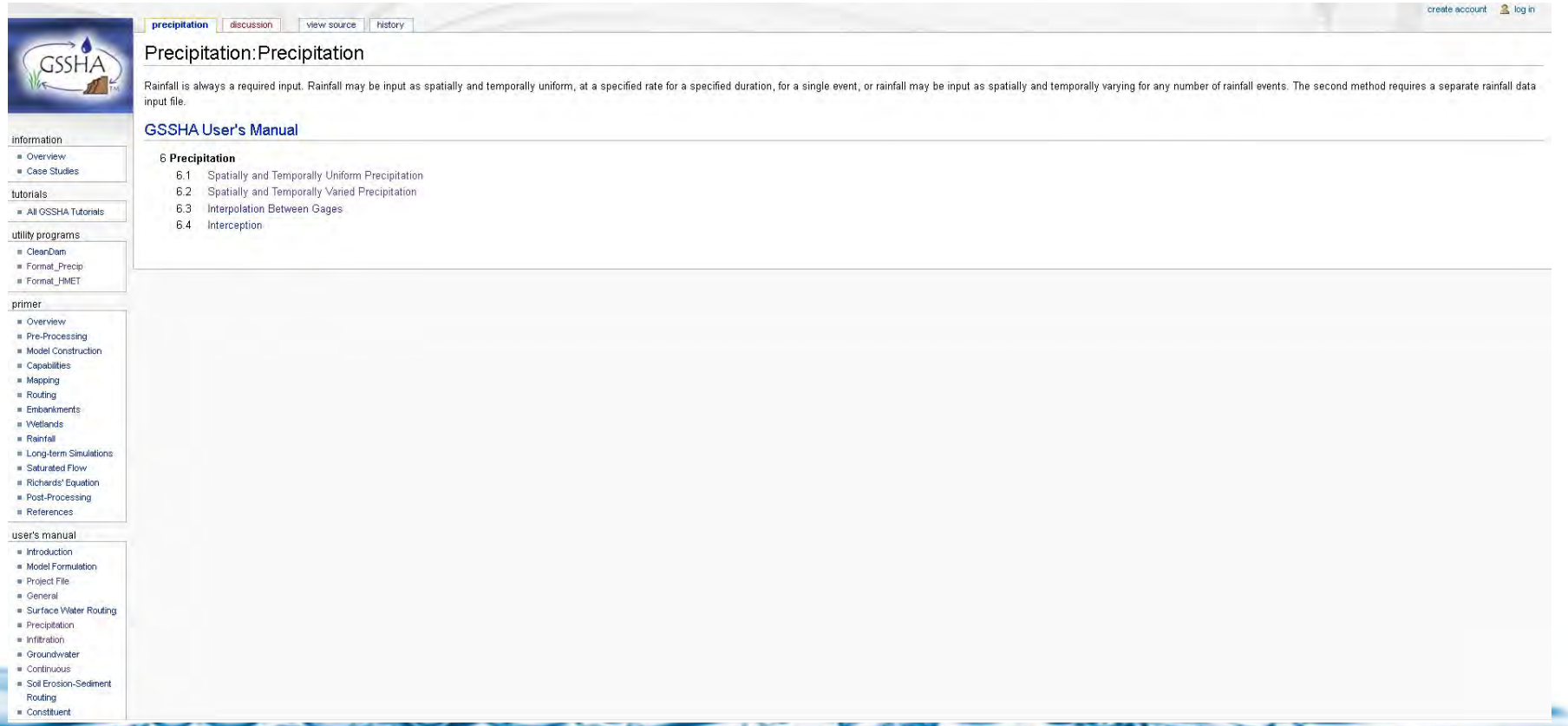
Rainfall methods in GSSHA



Precipitation Types

- Uniform rainfall
- Spatially uniform, temporally varying
- Spatially and temporally varying



Uniform Rainfall

- Specify uniform precipitation under global parameters
  - start time
    - year
    - month
    - day
    - hour
    - min
  - rate (mm/hr)
  - duration (min)

Spatially Uniform Temporally Varying Rainfall

- Specified in WMS as a single gage rainfall
- Time series data is entered as X and Y data
- Uniform time spacing is specified by the user
- Time series data can be imported or exported
- Useful for simulating "standard" storm events

Spatially and Temporally Varying Precipitation

- File built external to WMS
- Specify gage locations and rainfall rate with non-uniform time spacing
- Multiple formats for entering rainfall

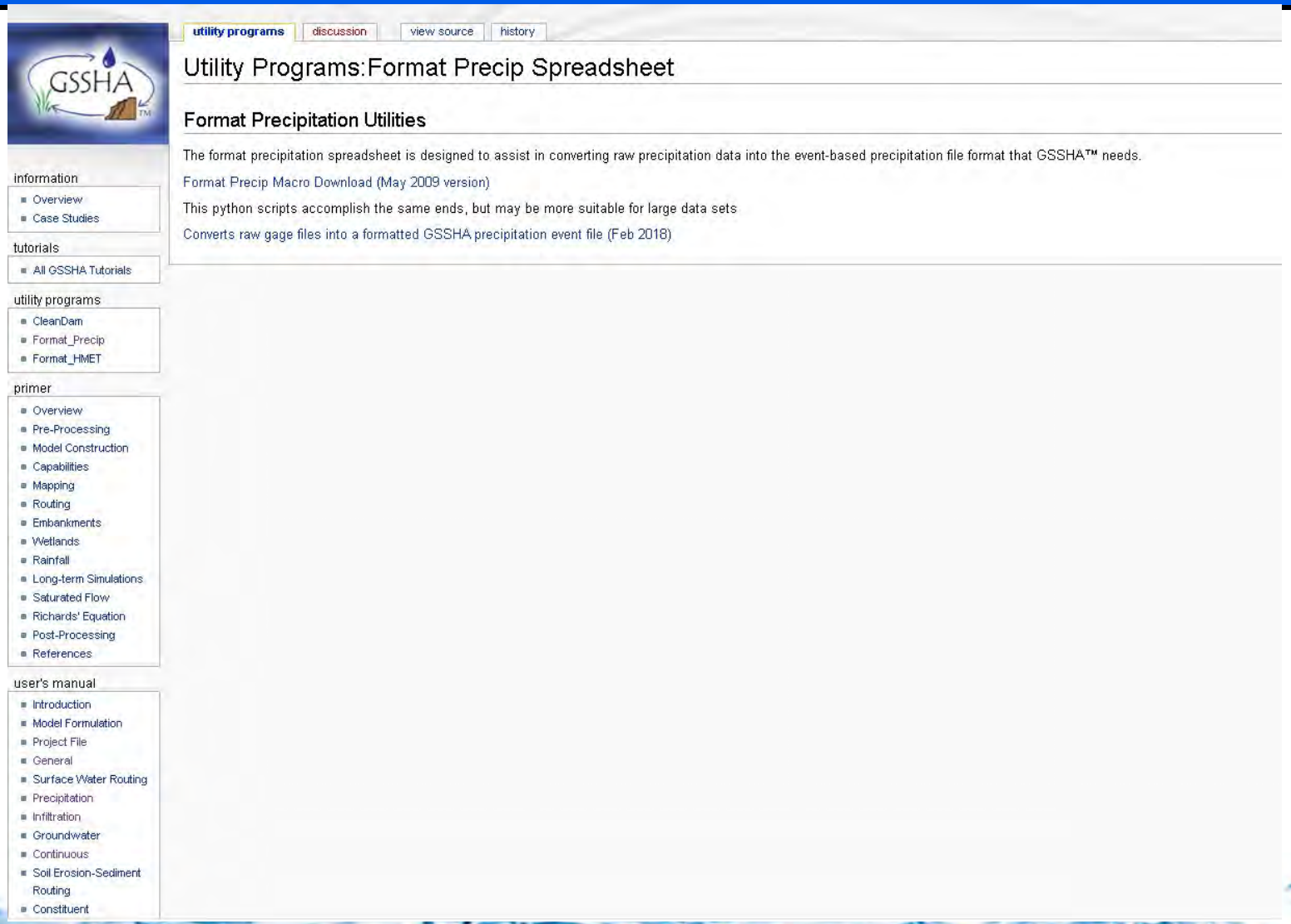
Gage Data Input File

- Card based input file
  - EVENT - Storm ID
  - NRPDS - # of time distributions in the event
  - NRGAG - # of gages for event
  - COORD – rain gage coordinate
    - One for each gage (NRGAG)
  - Rainfall source card
    - GAGES – accumulation (mm) at end of period
    - RADAR – rates (mm/hr) at the end of the sampling period
    - RATES – rates (mm/hr) at the beginning of the sampling period
    - One for each time period (NRPDS)

Example Gage Input File

- EVENT "Event of 30 June 1995- rainfall stops on July 1st"
- NRPDS 5
- NRGAG 3
- COORD 205150.0 4750212.0 "center of radar pixel #1"
- COORD 205045.0 4750104.0 "center of radar pixel #2"
- COORD 205320.0 4751173.0 "center of radar pixel #3"
- RADAR 1995 06 30 22 56 0.00 0.00 0.00
- RADAR 1995 06 30 23 18 10.75 2.25 5.80
- RADAR 1995 06 30 23 39 21.16 1.80 41.50
- RADAR 1995 06 30 23 57 12.13 20.90 20.70
- RADAR 1995 07 01 00 09 11.71 16.50 2.30

Rainfall File Conversion



utility programs | discussion | view source | history

Utility Programs:Format Precip Spreadsheet

Format Precipitation Utilities

The format precipitation spreadsheet is designed to assist in converting raw precipitation data into the event-based precipitation file format that GSSHA™ needs.

Format Precip Macro Download (May 2009 version)

This python scripts accomplish the same ends, but may be more suitable for large data sets

Converts raw gage files into a formatted GSSHA precipitation event file (Feb 2018)

information
- Overview
- Case Studies

tutorials
- All GSSHA Tutorials

utility programs
- CleanDam
- Format_Precip
- Format_HMET

primer
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- Mapping
- Routing
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- Wetlands
- Rainfall
- Long-term Simulations
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user's manual
- Introduction
- Model Formulation
- Project File
- General
- Surface Water Routing
- Precipitation
- Infiltration
- Groundwater
- Continuous
- Soil Erosion-Sediment Routing
- Constituent

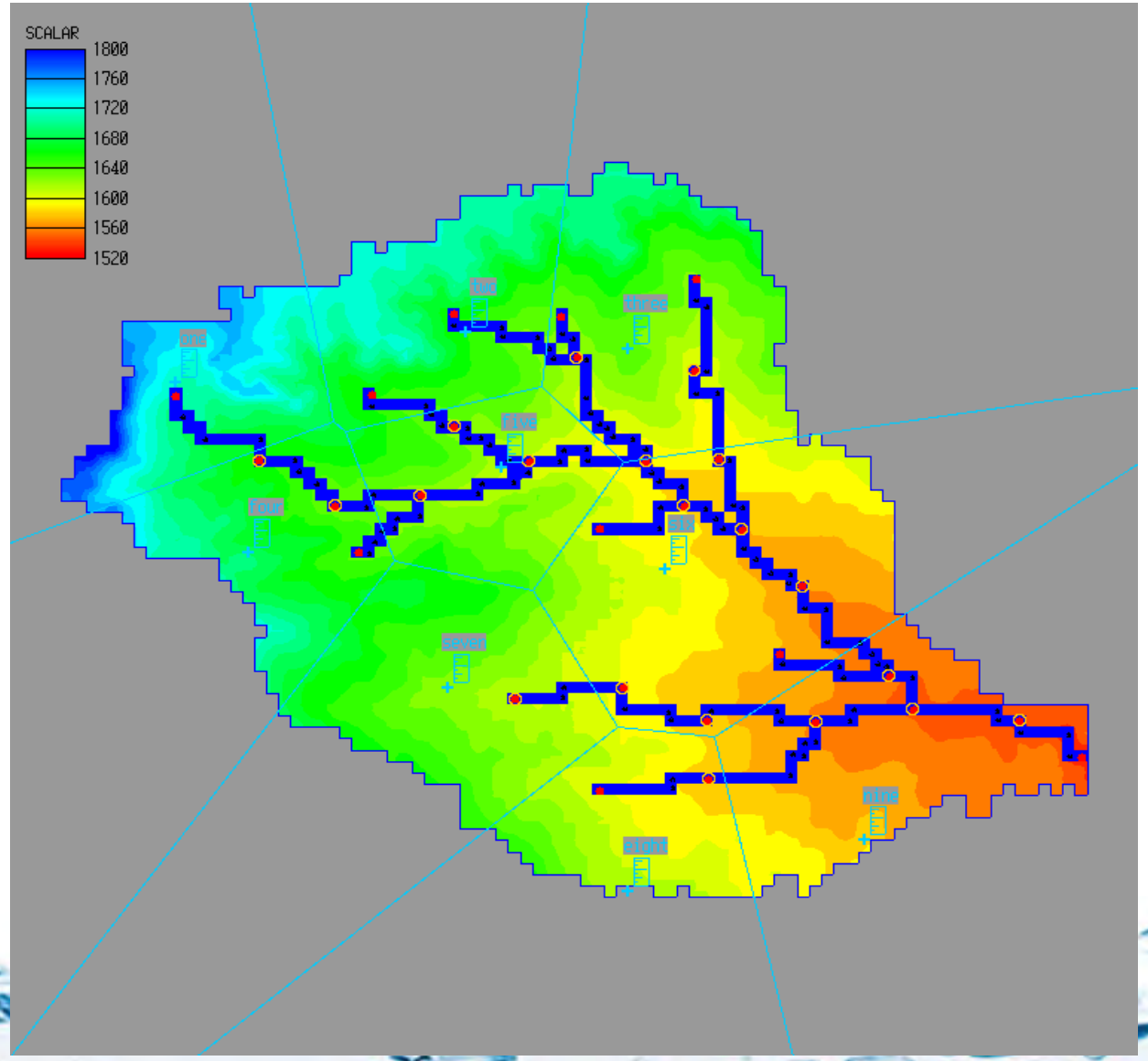
Guide for Rain Gage Selection

- GSSHA is very sensitive to rainfall input. Poor input data will result in poor model solutions.
- For best results multiple rain gages should be located inside the watershed.
- For convective storms, research indicates very poor correlation between gages more than 50 km apart.
- Include NEARBY gages outside the watershed.
- Input the finest temporal resolution possible.
  - If one gage has finer resolution than others use the data from that gage and repeat the data form the other gages.

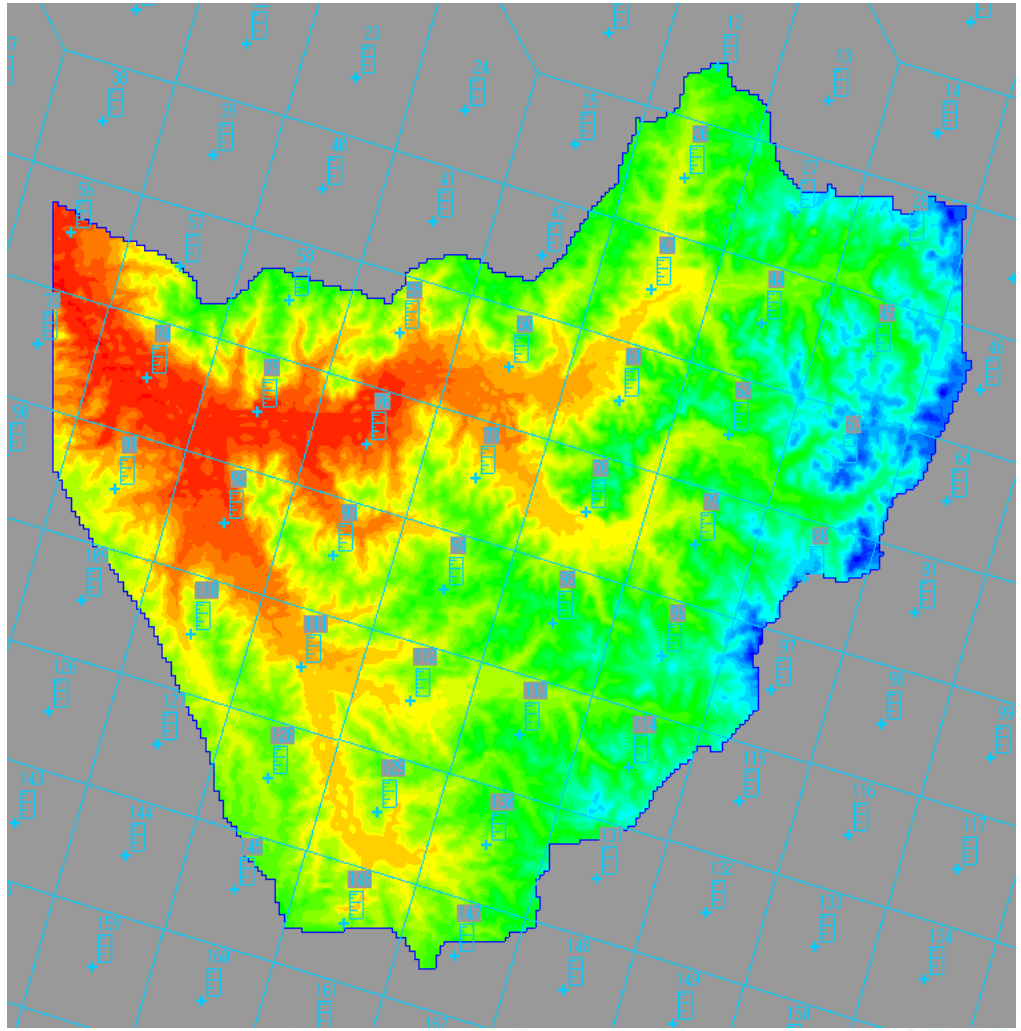
Spatial Distribution

- Thiessen polygon
- Inverse distance squared weighted
- Thiessen polygons can be used to represent radar rainfall.

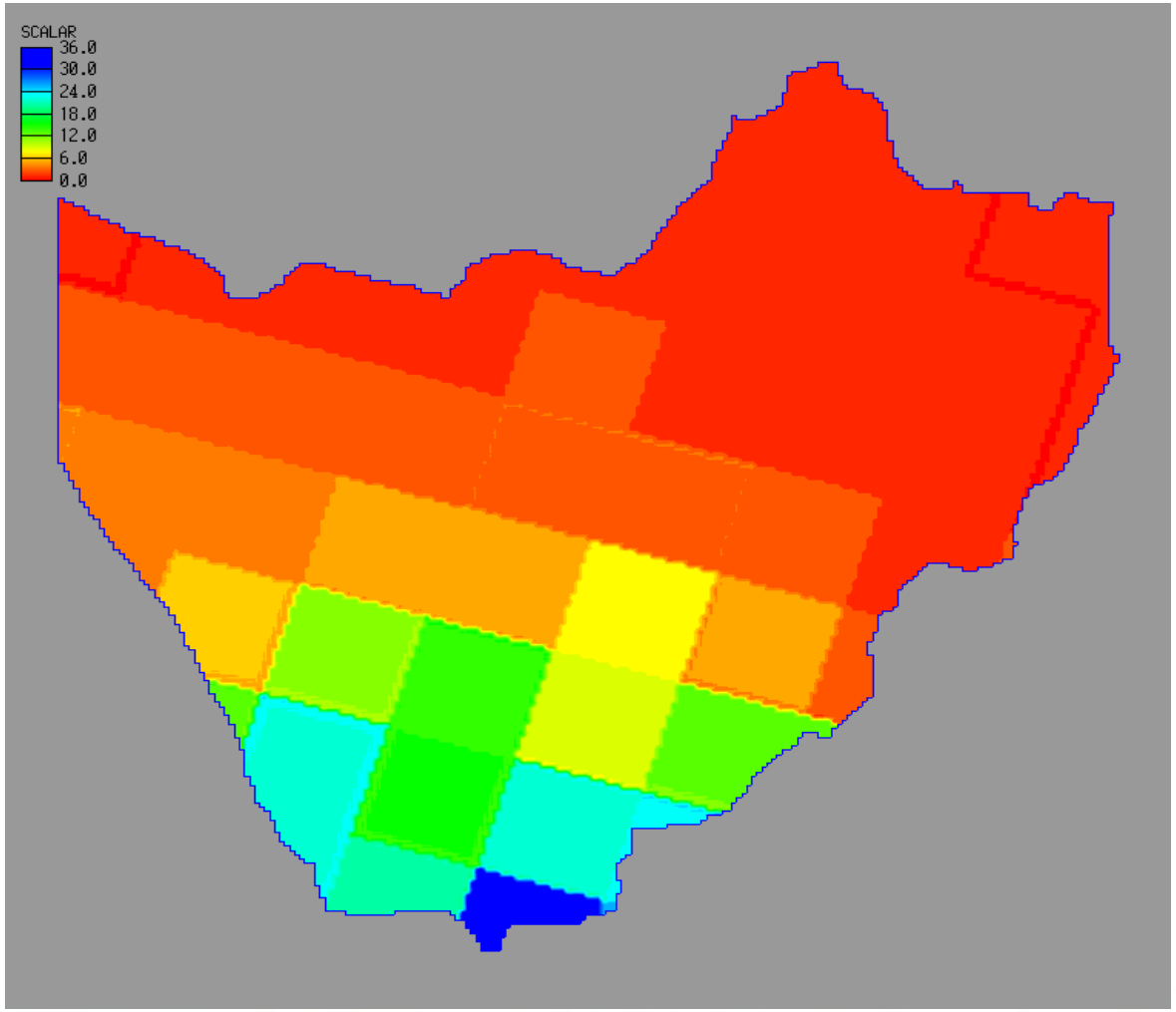
Rain Gages with Thiessen Polygons



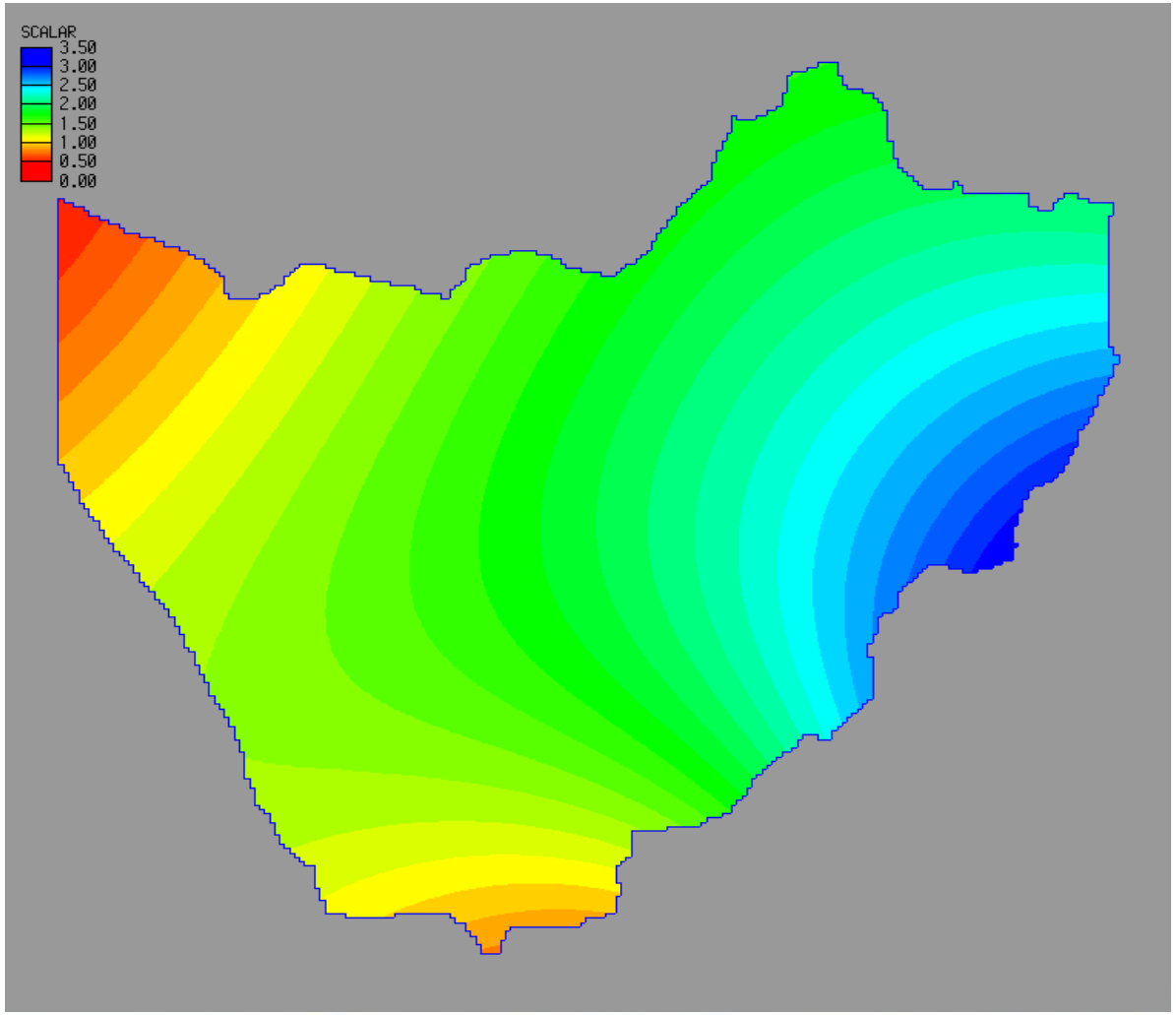
NEXRAD Radar Distributed with Thiessen Polygons



Snapshot of Rainfall Intensity



Inverse Distance Weighted Rainfall



Plant Interception

- Rainfall is intercepted by vegetation before reaching the land surface.
- Two parameter interception model
  - Initial volume of rainfall
  - Fraction retained of rainfall falling after satisfying initial storage

Inputs for Interception

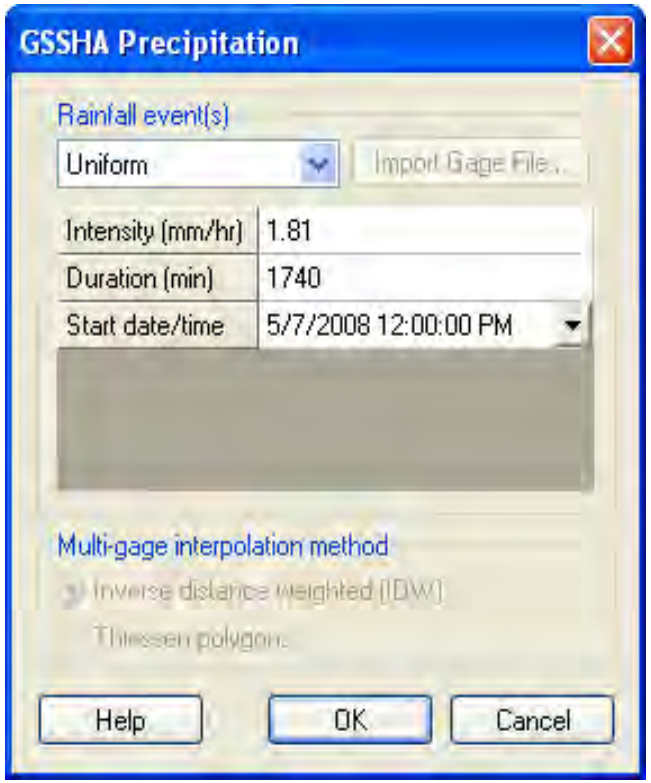
- Index map and mapping table
- Index map derived from vegetation coverage
- Mapping table contains values of
  - Initial storage volume (mm)
  - Fraction retained after satisfying initial storage

Applications

- Uniform rainfall most useful for initial model set up and trouble shooting
- Real watershed simulations are conducted with multiple gage, temporally varying rainfall
- Radar rainfall estimates can be useful when good gage data are not available
- Currently exploring the use of satellite data for remote regions

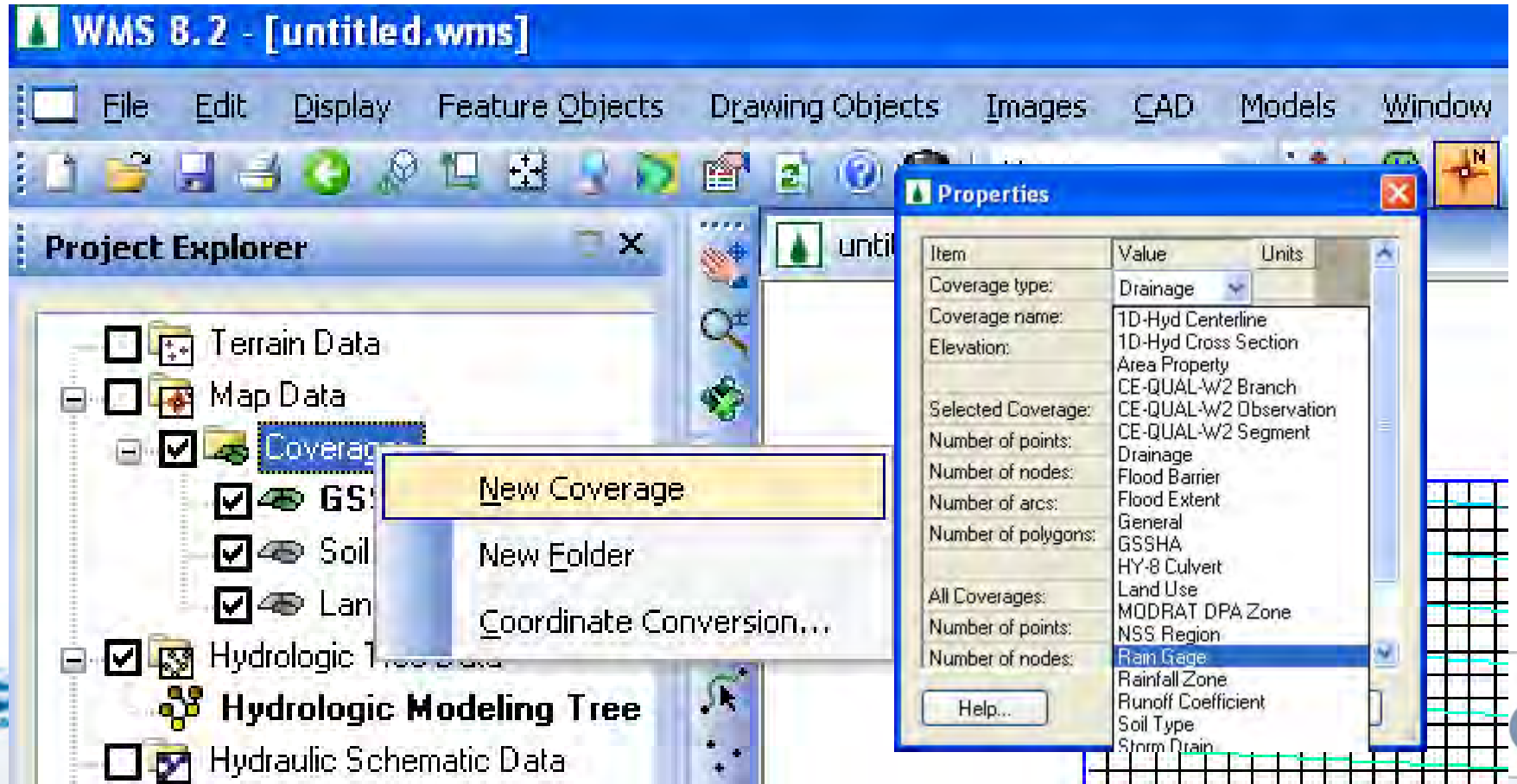
Uniform Precipitation

- The rainfall depth is uniformly distributed over time and is assumed to have same intensity all over the watershed
- Intensity: mm/hr
- Duration: min



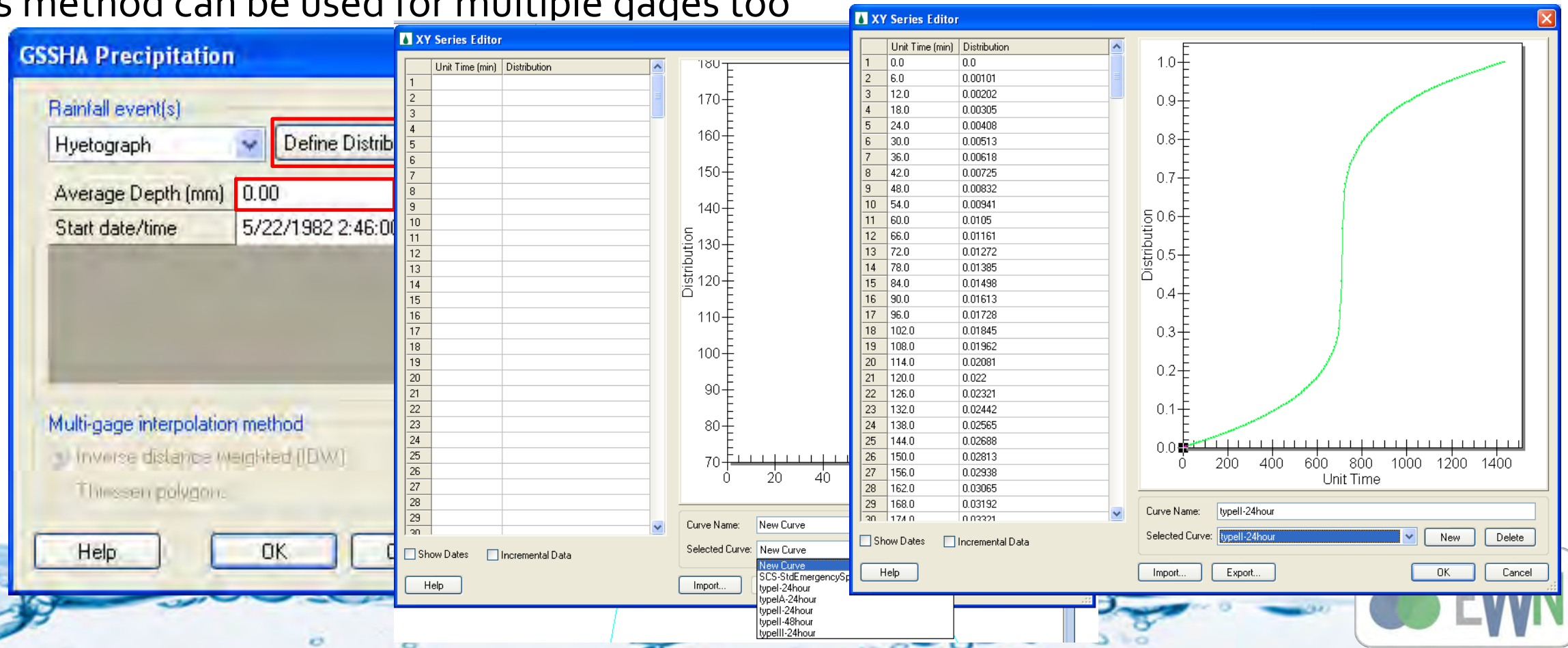
Using Gages

- Multiple gages can be used but each gage must have the same temporal distribution of rainfall
- Rain gage coverage is created



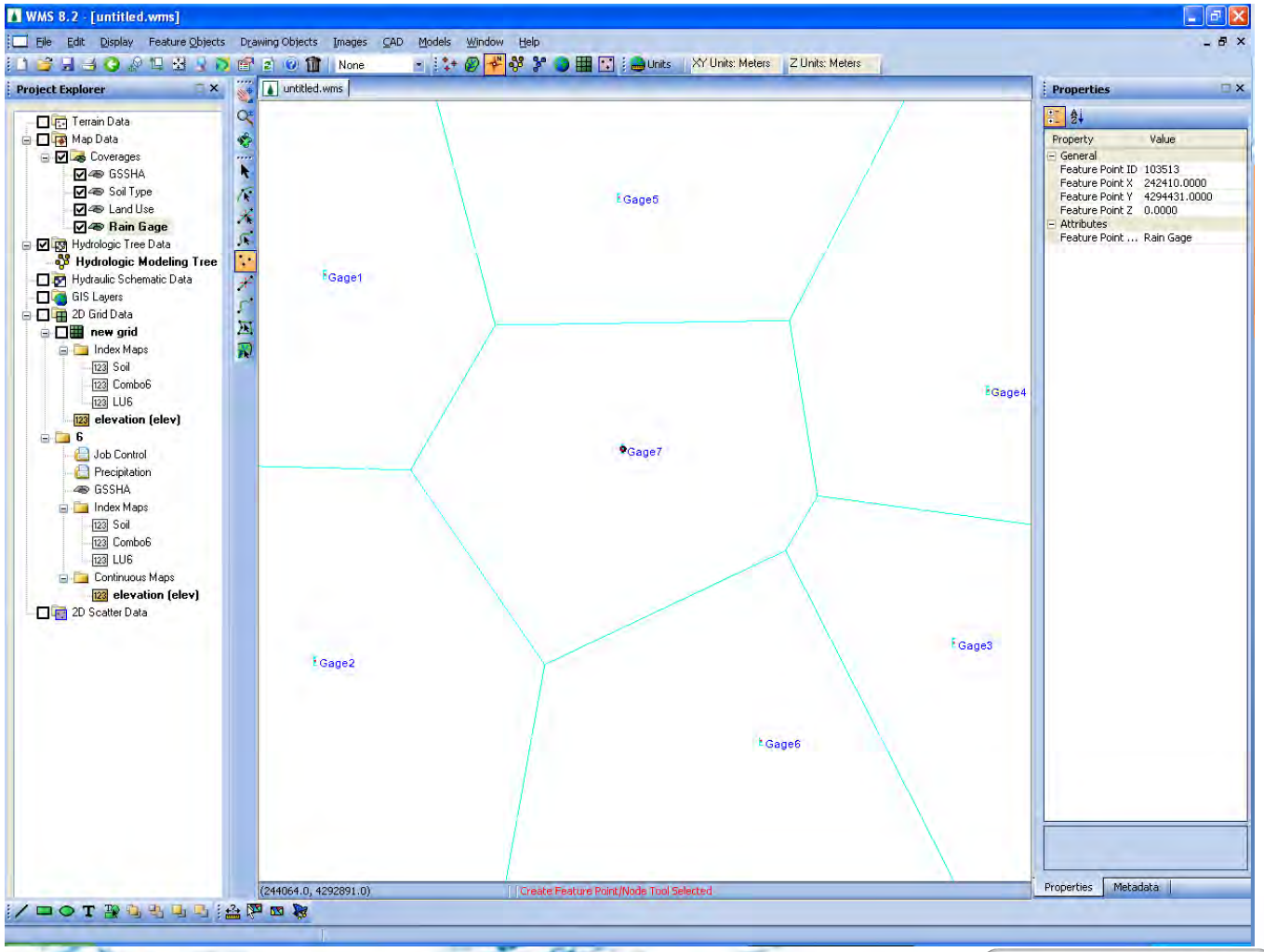
Using Hyetograph

- This option is useful if the normalized temporal distribution is available (eg NRCS storms)
- The distribution is defined in the XY series editor and total storm depth(mm) is defined.
- This method can be used for multiple gages too



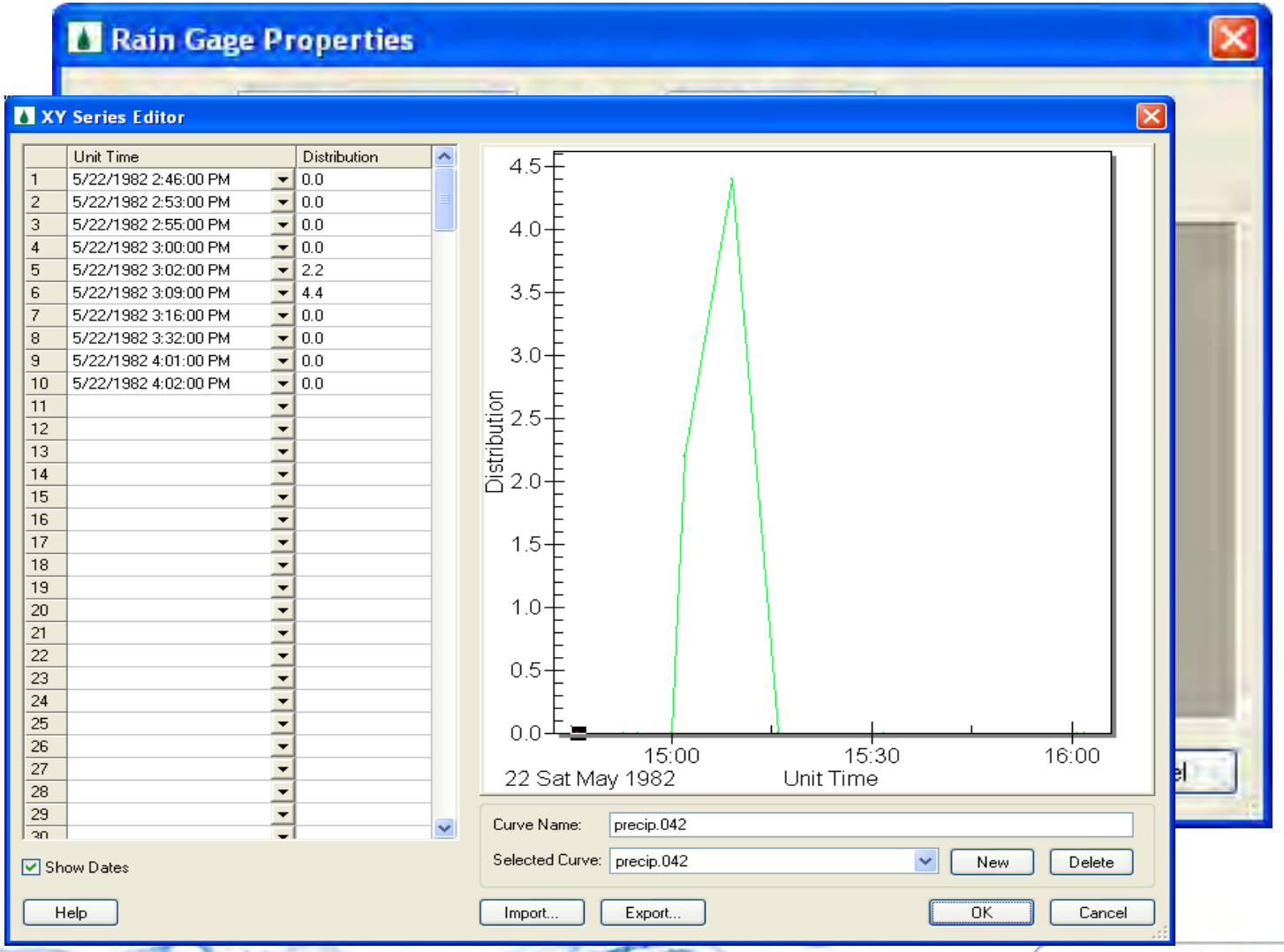
Using Gages

- The gages are created in the rain gage coverage
- WMS will automatically generate Thiessen polygons as the gages are created



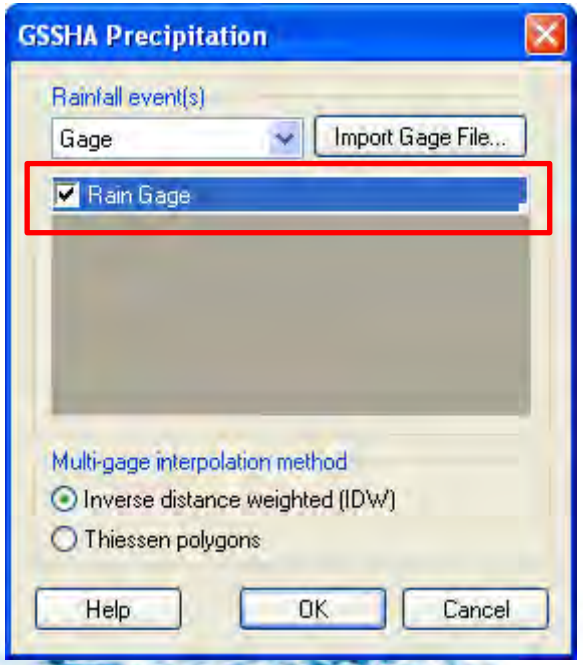
Using Gages

- The temporal distribution of the rainfall (rate/depth) in each gage is defined by double clicking each gage under rain gage coverage
- The depth should be incremental millimeters
- Cumulative millimeters can be used but the values should be normalized and multiplied by the total storm depth



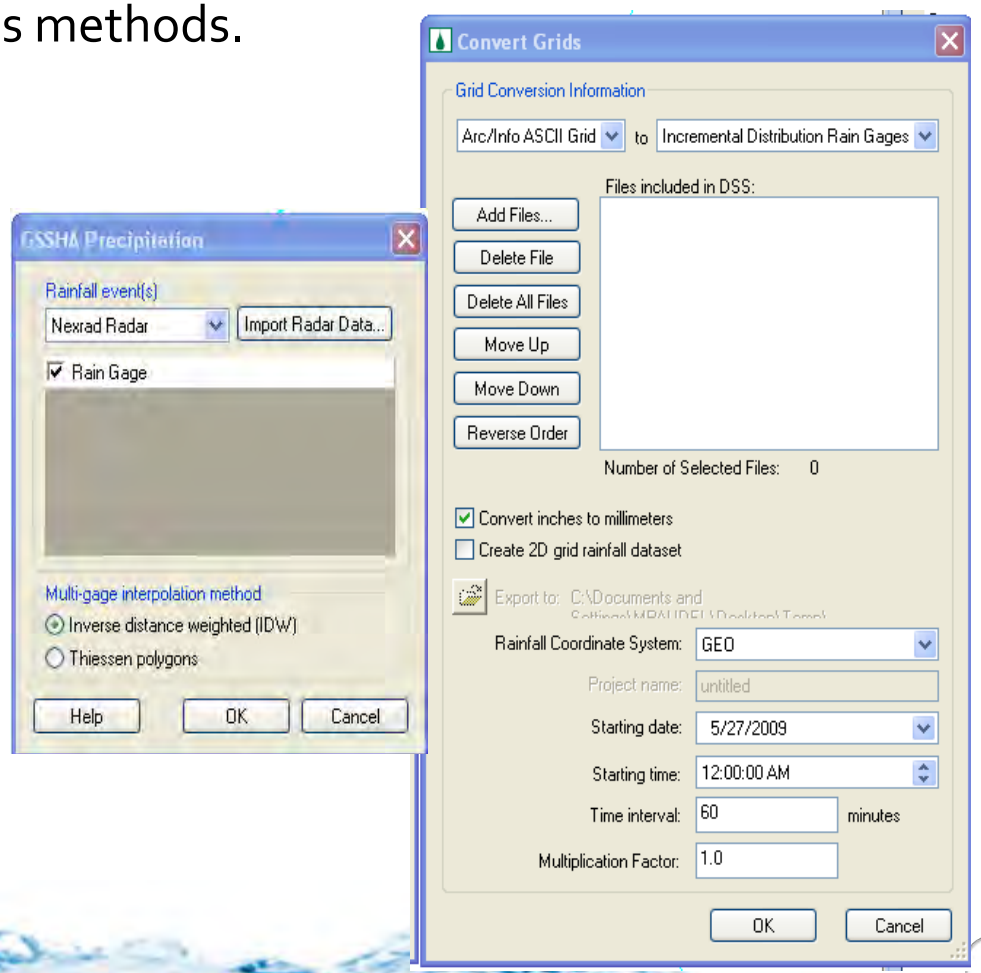
Using Gages

- Once all the gages are defined, we need to go back to GSSHA | Precipitation and select "Rain Gage" coverage to be used to get the gage information

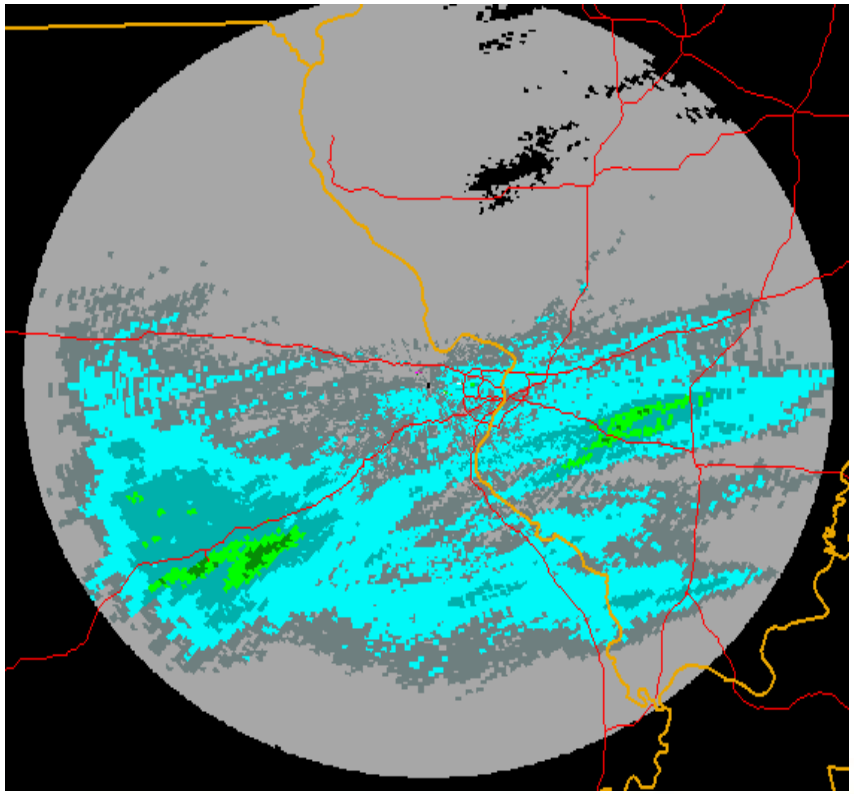


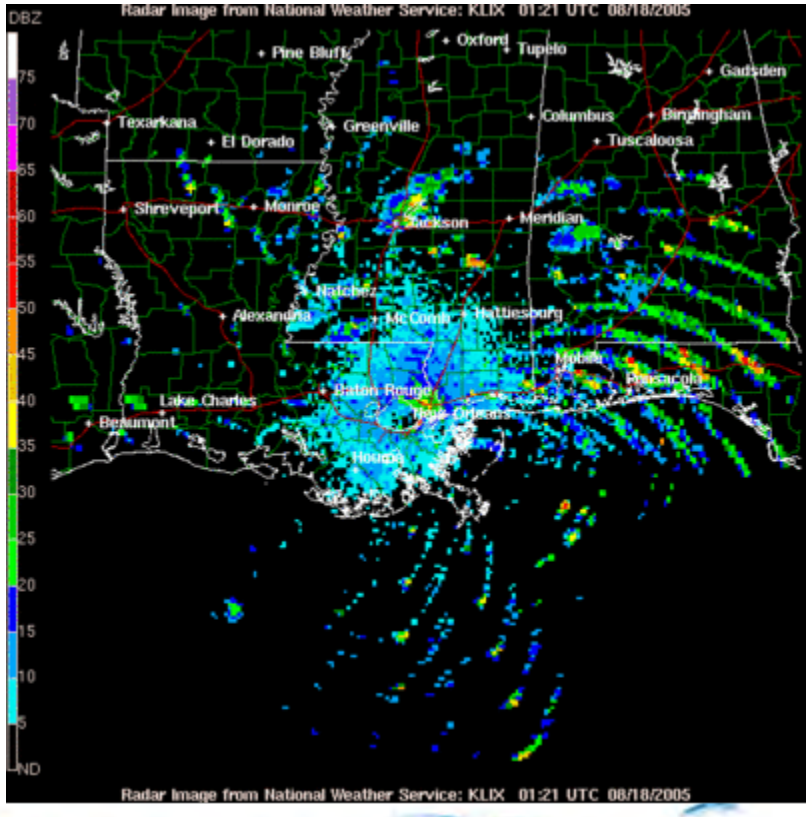
Using NEXRAD Radar data

- NEXRAD radar data is used to define the spatially and temporally varying rainfall
- It involves more computation compared to previous methods.
- This will be discussed in more detail next.



NEXRAD Radar Rainfall



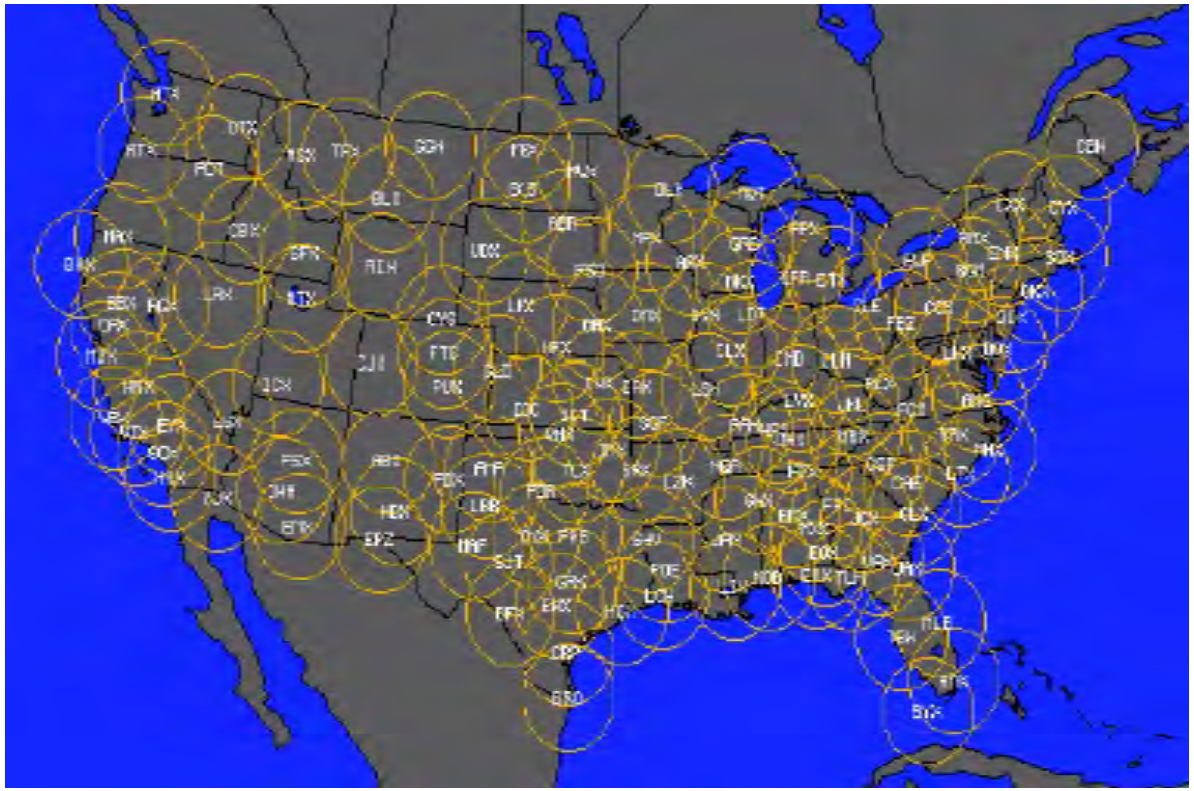


What is NEXRAD

- Developed by National Weather Service
- NEXt generation RADar (WSR-88D weather radar)
- NERAD senses the rainfall by transmitting a radio signal and measuring the reflection from falling rain drops
- Data available with 2Km*2Km grid

Coverage

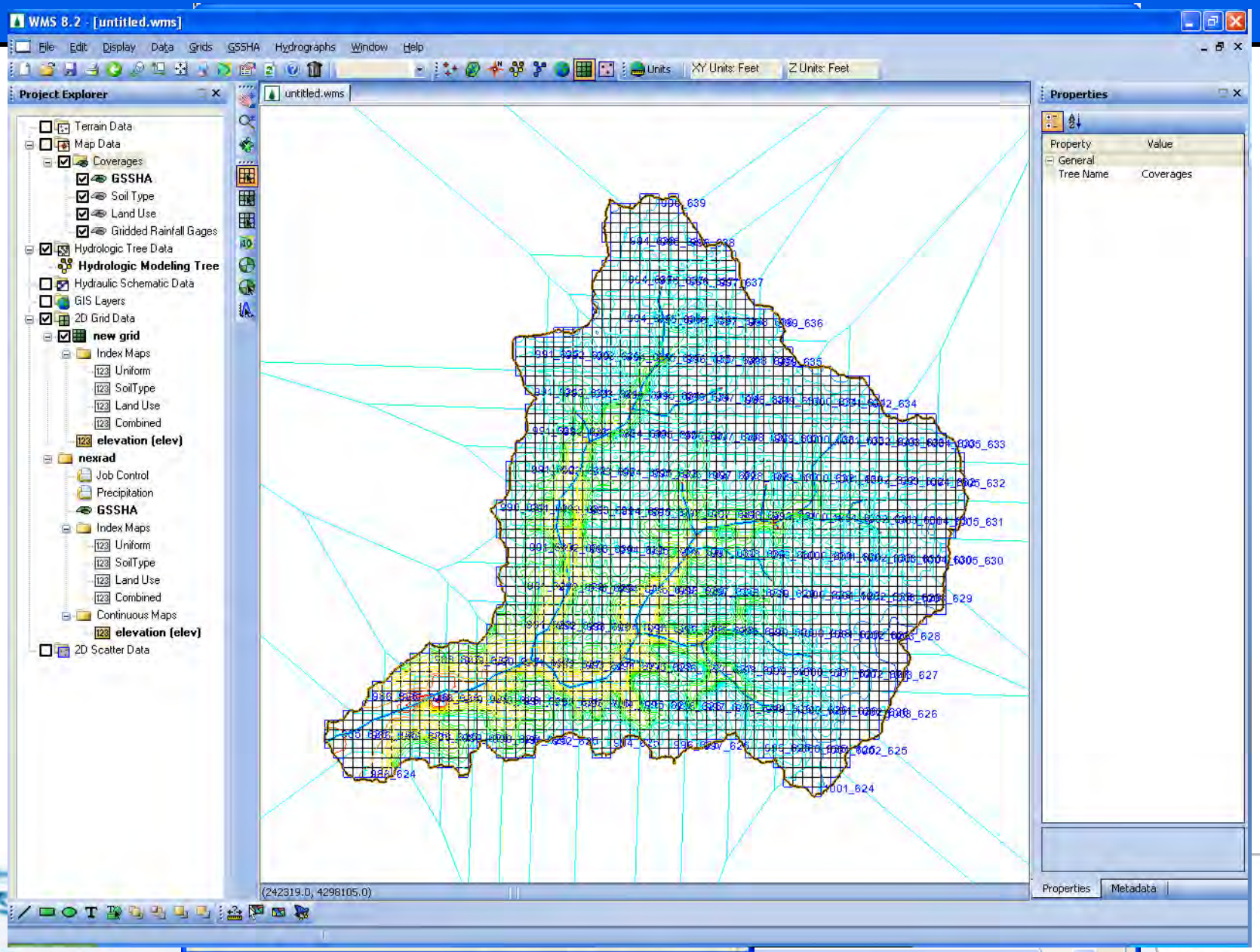
- Available for entire United States



Benefits

- When near the watershed NEXRAD data are typically of good quality and compare well with ground based gages.
- Provides superior spatial distribution of rainfall
- Can be used in GSSHA using WMS interface that processes the data and saves in the format accepted by GSSHA

Processing


WMS 8.2 - [untitled.wms]
File Edit Display Data Grids GSSHA Hydrographs Window Help
Units XY Units: Feet Z Units: Feet
Project Explorer
Terrain Data
Map Data
Coverages
GSSHA
Soil Type
Land Use
Gridded Rainfall Gages
Hydrologic Tree Data
Hydrologic Modeling Tree
Hydraulic Schematic Data
GIS Layers
2D Grid Data
new grid
Index Maps
Uniform
SoilType
Land Use
Combined
elevation (elev)
nexrad
Job Control
Precipitation
GSSHA
Index Maps
Uniform
SoilType
Land Use
Combined
Continuous Maps
elevation (elev)
2D Scatter Data
untitled.wms
Properties
Property Value
General
Tree Name Coverages
(242319.0, 4298105.0)
Properties Metadata

Additional Methods

- Satellite and remote sensed rainfall products
- PRISM – rainfall method from Oregon State University.
- Forecast - FIRO Project at Scripps at UC San Diego, CW3E
  - https://cw3e.ucsd.edu/