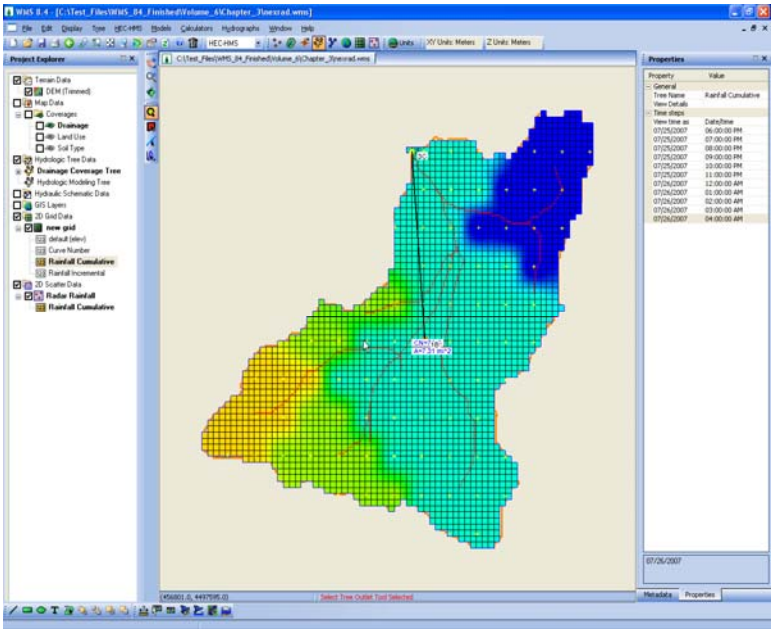
WMS

v. 8.4

WMS 8.4 Tutorial

Spatial Hydrologic Modeling – Using NEXRAD Rainfall Data in GSSHA

Learn how to setup a GSSHA model using distributed rainfall data



Objectives

Read an existing GSSHA model. Then modify this GSSHA model to use NEXRAD (distributed radar rainfall) data for the model's precipitation. Post-process the results and view the difference in results between using gage-based and distributed rainfall.

Prerequisite Tutorials

- Spatial Hydrologic Modeling – Developing a GSSHA Model using the Hydrologic Modeling Wizard

Required Components

- Data
- Drainage
- Map
- Hydrology
- 2D Grid
- GSSHA

Time

- 20-40 minutes

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1 Contents

2 Introduction

In this tutorial, you will see how NEXRAD rainfall data can be used in GSSHA. You will begin with an existing GSSHA project file. You will see how NEXRAD data can be processed for GSSHA and view the difference in results between using gage-based and distributed rainfall.

The data used for this tutorial can be downloaded from the WMS learning center of the Aquaveo web site and can be unzipped to a folder called ***spatial*** on your computer.

3 Open an Existing GSSHA Project

Open the WMS project file for Judy's Branch watershed in Illinois and use NEXRAD radar rainfall for the project.

1. In the *2D Grid Module*  select ***GSSHA | Open Project File…*** Browse and open the file ***\spatial\GSSHA\BasicGSSHA\FullModel.prj.***

2. Make sure that the coordinate system is correct. Select ***Edit | Current Coordinates…***

   Horizontal system: *UTM NAD 83 (US)*
   Zone: *16 (90 W - 84 W - Northern Hemisphere)*
   Units: *Meters*
   Vertical System: *NAVD 88(US)*
   Units: *Meters*

3. Click *OK.*

4. Right click on the GSSHA coverage and choose *Zoom to Layer.*

4 Importing NEXRAD Rainfall Data

NEXRAD rainfall datasets have already been downloaded for this watershed. For information on how to obtain your own radar rainfall datasets, see

http://www.xmswiki.com/index.php?title=GSDA:Obtaining_NEXRAD_Radar_Data_from_NCDC

1. In the *2D Grid Module*  select ***GSSHA | Precipitation***. Under *Rainfall event(s)* select *Nexrad Radar*.
2. Click on *Import Radar Data…* button which will open the Convert Grids dialog.
3. In the Convert Grids dialog that opens, make sure that the conversion option is set to *Arc/Info ASCII Grid* to *Incremental Distribution Rain gages*.
4. Click the *Add Files…* button and browse to ***\spatial\RawData\JudysBranch\NEXRAD***.
5. In the Open file browser, change the View Menu to *Details* (Figure 4-1).

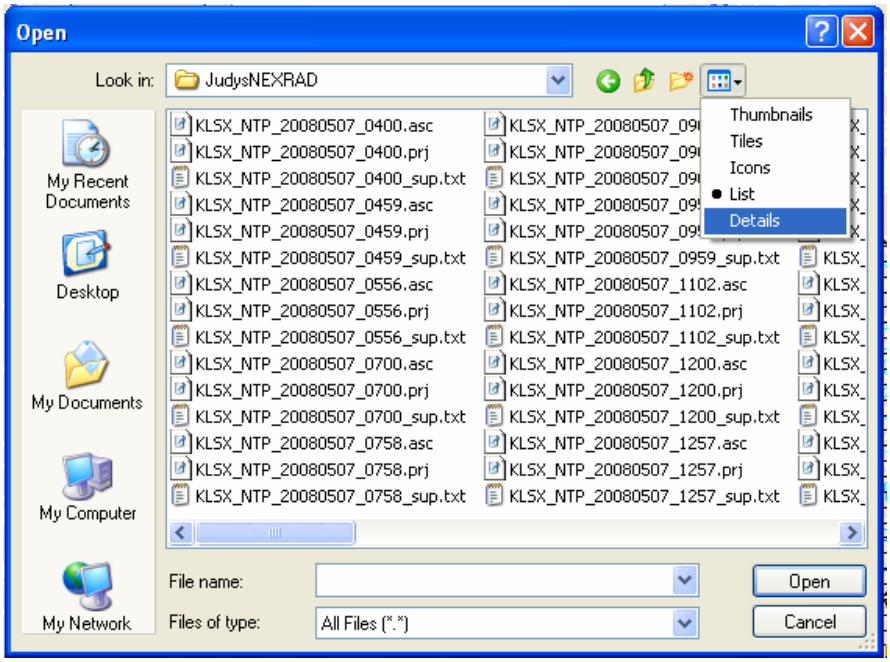


Figure 4-1: Change the view menu to Details

6. Click on the *Type* column heading to sort the files by Type.
7. Select the last time grid which is *KLSX_NTP_20080508_1657.asc*.

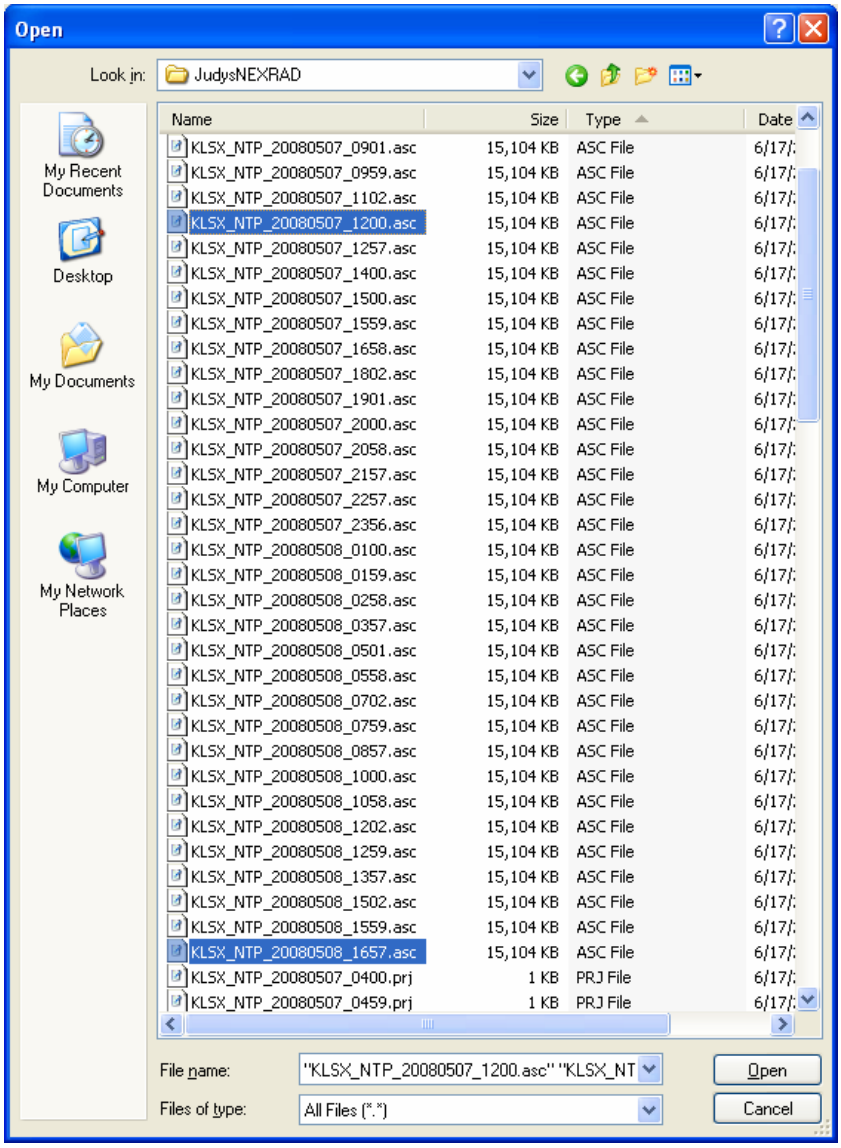


Figure 4-2: Select the last time grid first

8. Hold the *Shift* key and select the starting time grid which is *KLSX_NTP_20080507_1200.asc* (Figure 4-2). Click *Open.*
9. In the Convert Grids dialog, toggle on the option *Convert inches to millimeters* (if it is not already on).
10. Toggle on *Create 2D grid rainfall dataset* option. Make sure that the time interval is 1 hour (60 min).
11. Change the *Starting date* to 05/07/2008 and the *Starting time* to 12:00:00 PM (Figure 4-3).

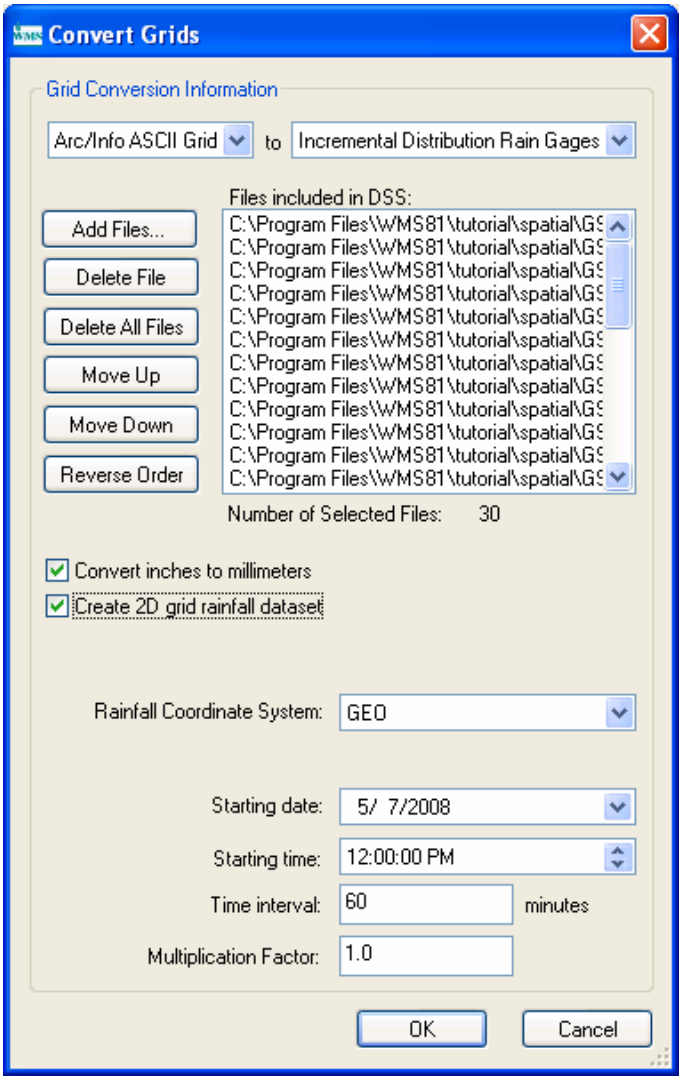


Figure 4-3: Set up the Convert Grids dialog as shown

12. Click *OK* to save the grid file. It will take some time to save the grid.
13. As soon as the saving process completes, a summary file will open up showing the date/time and rainfall depth (mm) at each time interval. Minimize this file; you will need it later on (Figure 4-4).

You should now see many gages covering the watershed and a network of polygons joining the gages. You should also notice a new Gridded Rainfall Gages coverage in the coverage tree.

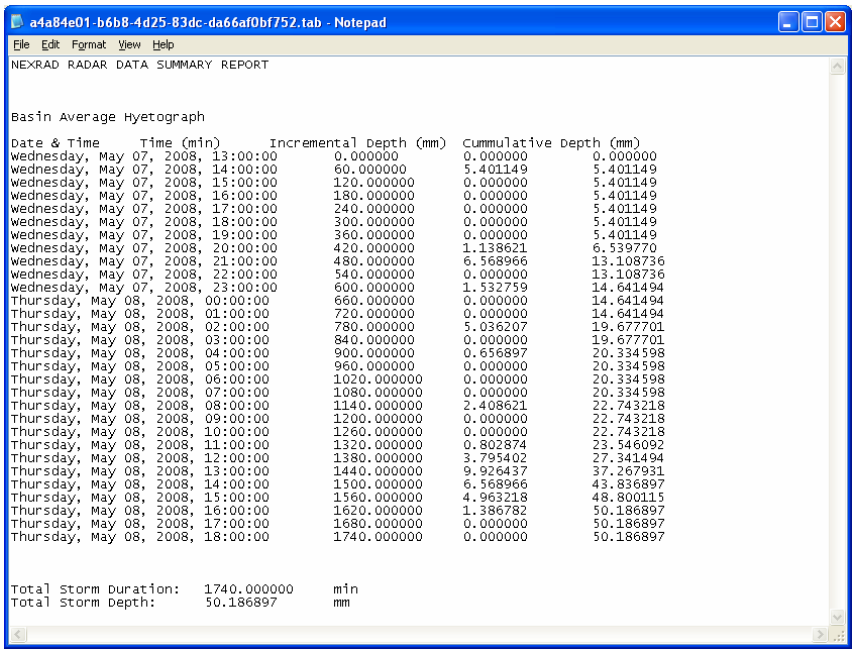


Figure 4-4: NEXRAD Radar Data Summary Report

14. In the GSSHA Precipitation dialog, toggle on the *Gridded Rainfall Gages* option and click *OK*.

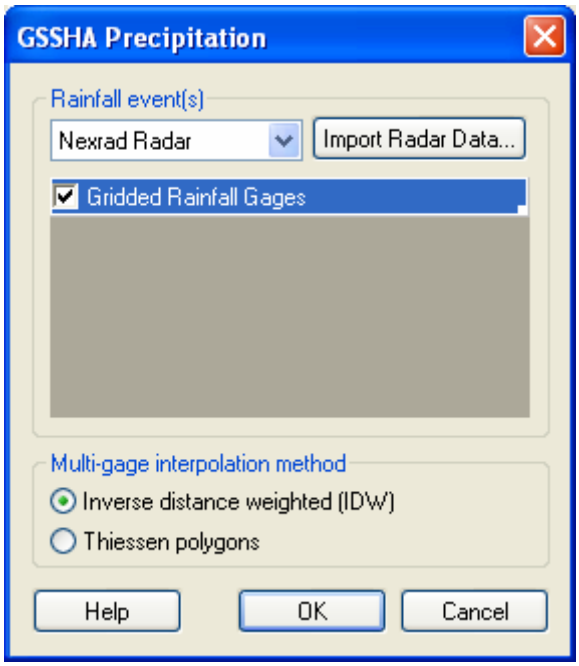


Figure 4-5: Toggle on the Gridded Rainfall Gages option

15. The WMS window should look similar to Figure 4-6.

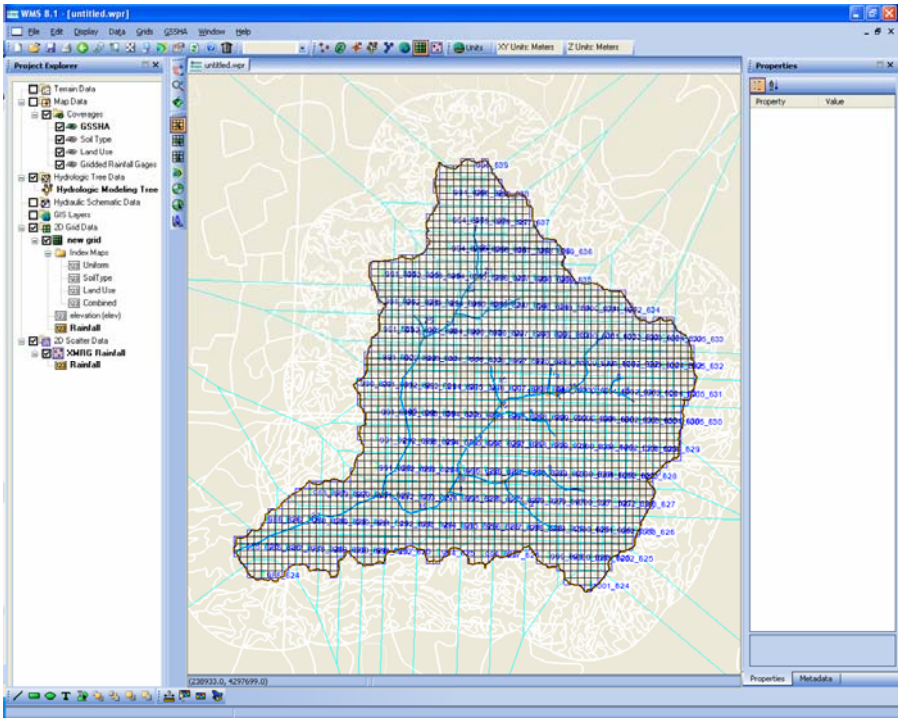


Figure 4-6: GSSHA project with gridded rain gages

5 Visualizing Meteorological Data

Before continuing, let us visualize the gridded rainfall data.

1. Toggle *off* the display of the Soil Type and Land Use coverages.
2. Right click on *Rainfall Cumulative* on the data tree under 2D Grid Data and select *Contour Options…*Select *Color Fill* for the *Contour Method.* Click *OK.*
3. With the down arrow key on your keyboard, step through the time steps in the properties window on the right sidebar to see how the precipitation varies.

There are two rainfall datasets, one is incremental and the other is cumulative. You may choose to view the incremental rainfall data set in the same way you viewed the cumulative data set. Whichever dataset is selected will be used to create the film loop.

4. In *2D Grid Module* select ***Data | Film Loop…*** Specify the folder where you want to have the animation saved, check off the option to *Export to KMZ (Google Earth)* and click *Next.*
5. Under the option to *Write to AVI file,* make sure *Rainfall Cumulative* is checked and that the option to write to a KMZ file is turned off for all datasets. Turn *off* the option to *Write the 2D Scattered Dataset to a KMZ File*.
6. Click *Next.*

7. Click *Finish*. WMS will now a few moments to create and save the animation file. The animation will start playing as soon as the saving process is complete.

Let us now continue working with the model.

6 Saving the Model

We have now imported the NEXRAD rainfall into GSSHA and copied the data into the Gridded Rainfall Gages coverage. Next we will save and run the model.

1. Select ***GSSHA | Save Project file…*** Save it as ***\spatial\GSSHA\NEXRAD\ nexrad.prj***.

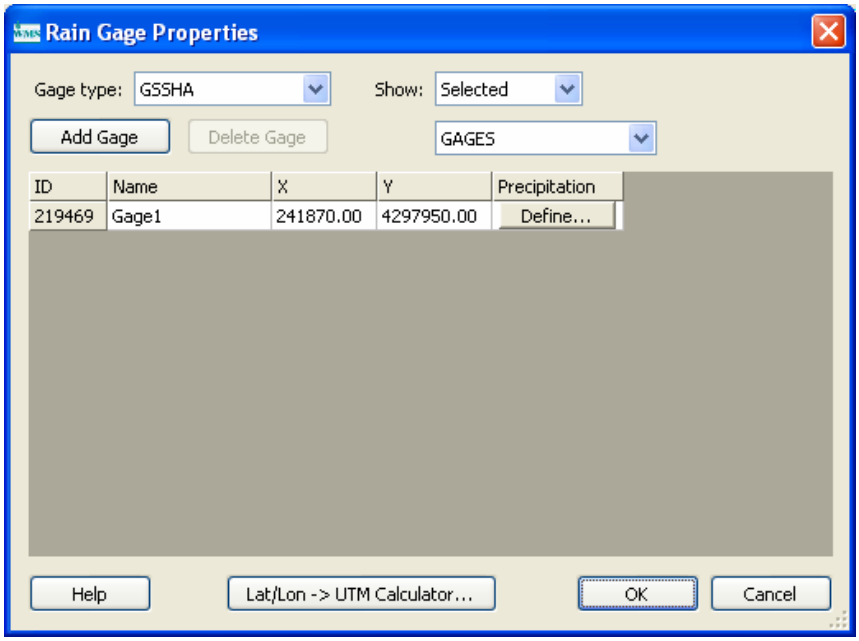
7 Running the Model

1. Select ***GSSHA | Run GSSHA….***
2. Toggle off the option to *Suppress screen printing*.
3. Click *OK*.
4. Once GSSHA has finished running, click *Close.*
5. In the Project Explorer, under 2D Grid Data, you should see a folder with the letter "S" on it. This represents the GSSHA solution files. Click on the dataset labeled *depth* to make it active.
6. Right click on the *depth* dataset and choose *Contour Options….*
7. Change the *Contour Method* to *Color Fill.*
8. Click on the first time step in the properties window and scroll through the depth dataset using the down arrow key to view the watershed response. If you wish to create a film loop of the watershed response, follow the steps outlined in section 5.
9. With the *Select Hydrographs* tool  selected, double-click on the hydrograph icon to view the runoff hydrograph at the watershed outlet.
10. Right click on the hydrograph plot and choose *View Values…* to view the runoff time series. Copy and paste the time series values to Excel in order to compare with the results from the next section.

8 Using Rainfall Hyetograph and Running the Model Again

1. Make sure you are in the *2D Grid* Module  .
2. Right click on Coverages in the Project Explorer and select *New Coverage.*
3. Change the type of the coverage to *Rain Gage* and click *OK* which will add coverage on the data tree under coverages.
4. Click on the Rain gage coverage and choose *Create Feature Point Tool*  . Click on the white area just outside your watershed boundary so that it will be easier to locate and make sure you are not too far away for the watershed. This will add a rain gage to the watershed. Next we will define the rainfall hyetograph data for this gage.

5. Choose *Select Feature Point/Node tool* and double click the gage that you just created.
6. In the Rain Gage properties dialog, make sure the *Gage Type* is set to *GSSHA* and click on the *Define…* button which will open the XY Series editor window.
7. In the XY Series Editor, toggle off the option *Show Dates.*



11. Open the summary file which we had previously minimized and copy the contents of the summary file to Excel.
12. Make sure that the incremental/cumulative depths are in millimeters (if not use conversion factor or 1 inch = 25.4mm to convert).
13. Copy and paste the columns labeled Time (minutes) and Incremental Depth to the XY series editor (Figure 8-1).

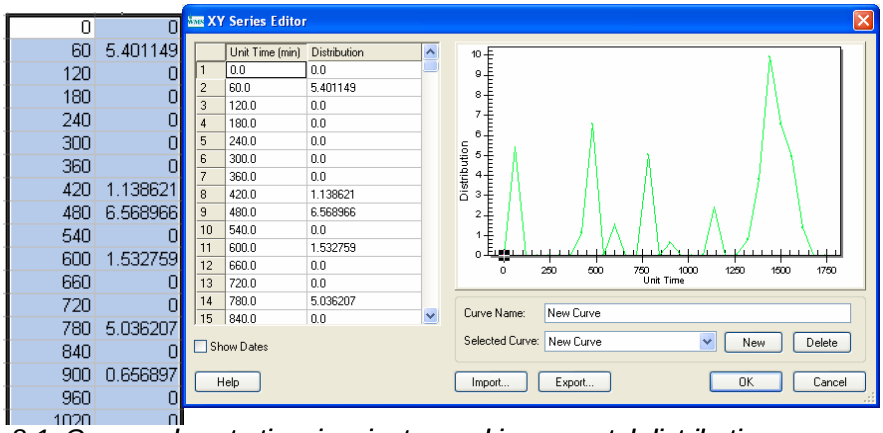


Figure 8-1: Copy and paste time in minutes and incremental distribution

14. Now check the option to *Show Dates.* Set the date to be 05/07/2008 and time to 12:00:00 PM. Click *Select*.
15. Click *OK*.
16. Click *OK* to close the Rain gage property dialog.
17. Switch to the *2D Grid Module*  and select ***GSSHA | Precipitation*** again.
18. Toggle off *Gridded Rainfall Gages* and select *Rain Gage.*
19. Click *OK.*
20. Select ***GSSHA | Save Project File…*** and save the project with a new name: ***\spatial\GSSHA\NEXRAD\nexrad2.prj.***
21. Run GSSHA ***(GSSHA | Run GSSHA…***).
22. View the results.
23. Open the hydrograph plot and view the hydrograph values using the ***View Values*** menu command. Copy the hydrograph ordinates to Excel and compare the distributed rainfall and single rainfall point hydrograph plots.

