

Workshop 8 – IF-THEN-ELSE RULES AND SCRIPTING (Solution)

Introduction

This workshop will demonstrate building conditional rule structures (if-then-else blocks), creating static scripts, and creating state variable scripts in HEC-ResSim. Pre-written scripts will be utilized to demonstrate the process of scripting rather than the details of the scripting language.

Problem Statement

The goal of this workshop is to:

- Create a static script that plots Crazy Mountain inflow and outflow for the active alternative, as well as historical statistics (25th and 50th percentile historical inflows) for the same time window.
- Create an alternative that utilizes an if-then-else block to restrict the releases from Crazy Mountain Lake Reservoir based on comparisons of current inflow with historical statistics.
- Create an alternative that utilizes a state variable to restrict the releases from Crazy Mountain Lake Reservoir based on comparisons of current inflow with historical statistics.

To simplify the data entry aspects of the exercise, the following are in the shared folder of your watershed directory:

- Historical inflows to Crazy Mountain. These have been placed in the ventura.dss file with the following pathnames:
 - //CRAZY MOUNTAIN/FLOW-RES IN-P25//1HOUR//
 - //CRAZY MOUNTAIN/FLOW-RES IN-P50//1HOUR//
- “Custom Plot.txt”. This file contains the script code for the static script.
- “State Variable.py”. This file contains the script code for the state variable.

Tasks

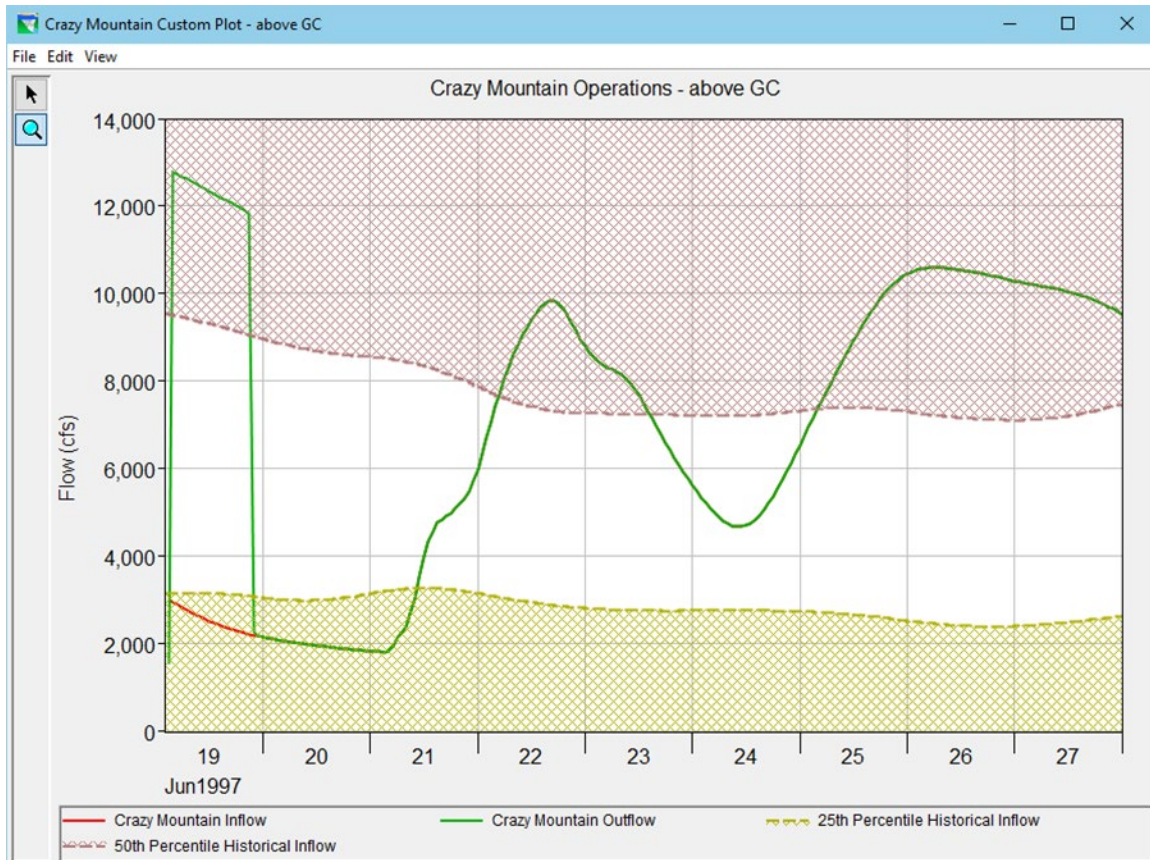
1. Open the workshop watershed **WS8_Start** and switch to the Simulation module, if necessary.
2. Open the **Sim 01 19Jun1997** simulation and compute the **above GC**.
 - Open the default plot for the Crazy Mountain reservoir and verify that basic guide curve operations are being followed.
3. Create a Static Script to Create a Custom Plot.
 - Launch the **Script Editor** by selecting **Tools→Script Editor** from the ResSim menu bar.

- Select the appropriate folder in the tree pane for the script to be accessible (visible) only from the Simulation module of the current watershed.

What folder did you select?

Scripts/System/Current Watershed/WS8_Start/Modules/Simulation

- Use the context menu, menu bar, or keyboard shortcut to create a new script.
- Enter **Custom Plot** in the **Label** field to name the script.
- Delete all the text in the editor pane.
- From the Windows Explorer, open the file **Custom Plot.txt** in the **C:\class\WS8_Start\shared** directory and copy all of its contents to the editor pane. You are done with the file.
- Click the **Save and Test** button on the bottom of the Script Editor. A plot displaying inflow, outflow and historic 25 & 50 percentile inflows should be displayed.



- Close the plot and the Script Editor.

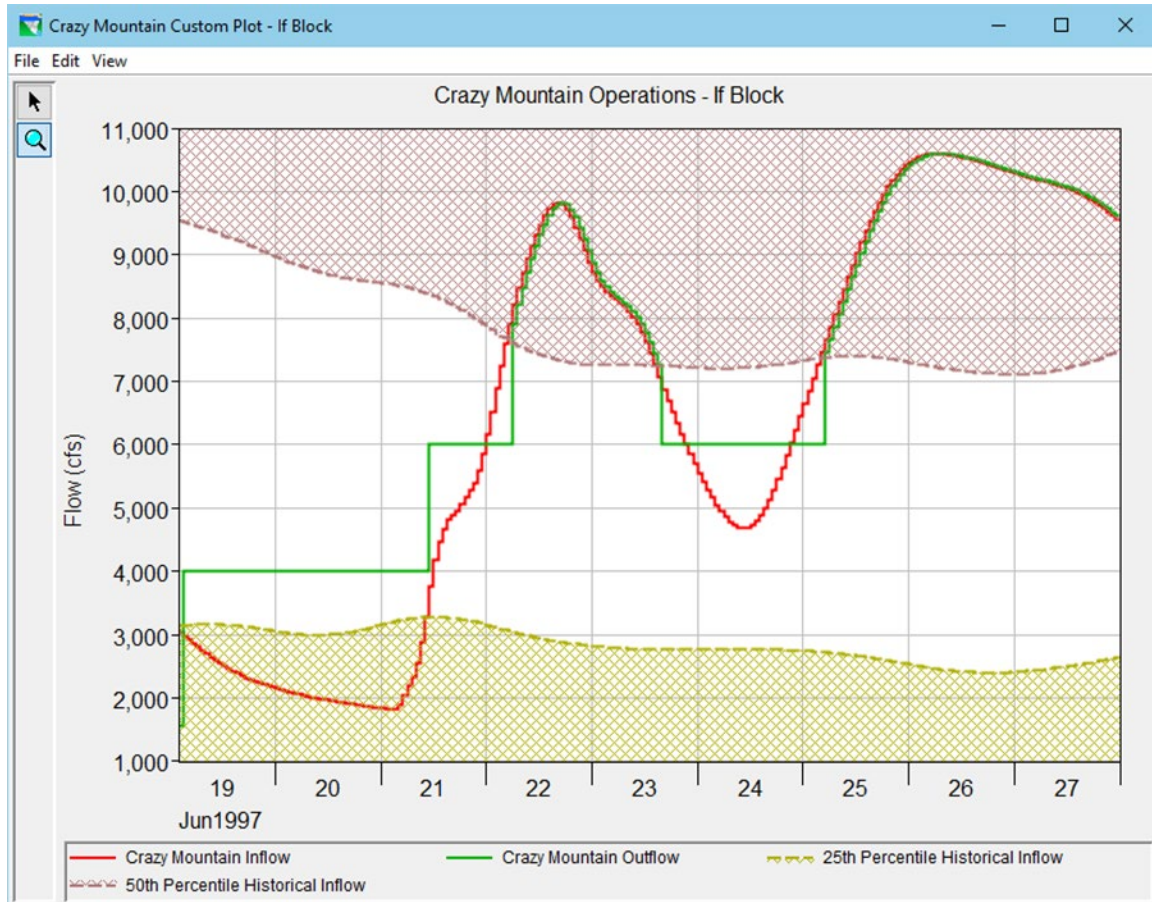
4. Add the **Custom Plot** script to script pane of the Simulation module.

- Use the method described in the scripting lecture (slide 29) to add the **Custom Plot** script to the script pane.
 - Verify that you can execute the script by clicking its button. Close the plot.
5. Create an Alternative that uses an If Block.
- Switch to the **Reservoir Network** module and open the **01 Standard** network for editing.
 - Edit the Crazy Mountain reservoir properties.
 - Duplicate the **Basic GC** operation set to one named **If-Then-Else**.
 - Create a new IF Block named **Conditional Release** in the **Normal Flood Control** zone.
 - Name the **IF Conditional Inflow < 25th Percentile**.
 - Add a condition.
 - Set **Value 1** to the **previous value** of the **model variable time series** for **Crazy Mountain-Pool reservoir inflow**.
 - Set the **operator** to **<**.
 - Set **Value 2** to the **previous value** of an **external variable** named **25th Percentile Inflow**.
 - Right-click on If Block and use the context menu to append an **ELSE IF Conditional**. Name it **Inflow < 50th Percentile**.
 - Add a condition.
 - Use the same **Value 1** and **operator** as in the IF conditional.
 - Set **Value 2** to the **previous value** of an **external variable** named **50th Percentile Inflow**.
 - Append an **ELSE** conditional and leave it unnamed.
 - Create Maximum Release Rules for the conditions of the IF Block.
 - Add a new rule named **Max Release = 4000 cfs** to the **IF** conditional. The rule should be a **release function** operating releases from **Crazy Mountain-Dam**. It should be a **max limit function** of **date**, with a value of **4000 cfs** for the entire year.
 - Add a new rule named **Max Release = 6000 cfs** to the **ELSE IF** conditional. The rule should be a **release function** operating releases from **Crazy Mountain-Dam**. It should be a **max limit function** of **date**, with a value of **6000 cfs** for the entire year.
 - Add a new rule named **Release Inflow** to the **ELSE** conditional. The rule should be a **release function** operating releases from **Crazy Mountain-**

Dam. It should be a **max limit function** of the **model variable time series** for **Crazy Mountain-Pool reservoir inflow** and should use actual inflow of the **previous value** for the limit. You must add values to the table in order to make the rule work. Use the following values:

Flow	Release
0	0
1000000	1000000

- Add the newly-created IF Block to the **Conservation** zone.
 - Close the **Reservoir Editor** and launch the **Alternative Editor**.
 - Save the **above GC** alternative as **If Block** and modify it:
 - Set the **flow computation method** to **period average** because the external time series we are using in the comparisons are period average.
 - Set the **operation set** for Crazy Mountain reservoir to **If-Then-Else**.
 - Map the following pathnames from the **C:\class\WS8_Start\shared\ventura.dss** file to the external variable time series defined above (if rows are not visible for this mapping, close and re-open alternative):
 - //CRAZY MOUNTAIN/FLOW-RES IN-P25/31Dec1996 - 01Jan 1998/1HOUR//
 - //CRAZY MOUNTAIN/FLOW-RES IN-P50/31Dec1996 - 01Jan 1998/1HOUR//
 - Save the alternative and close the alternative editor.
 - Save the reservoir network.
6. Use the **If Block** alternative in a simulation.
- Switch to the **Simulation** module and edit the simulation to include the **If Block** alternative and check the box for **Run New Extract**.
 - Set the **If Block** alternative as active and compute it.
 - Execute the **Custom Plot** script and verify that the releases follow the new rules.

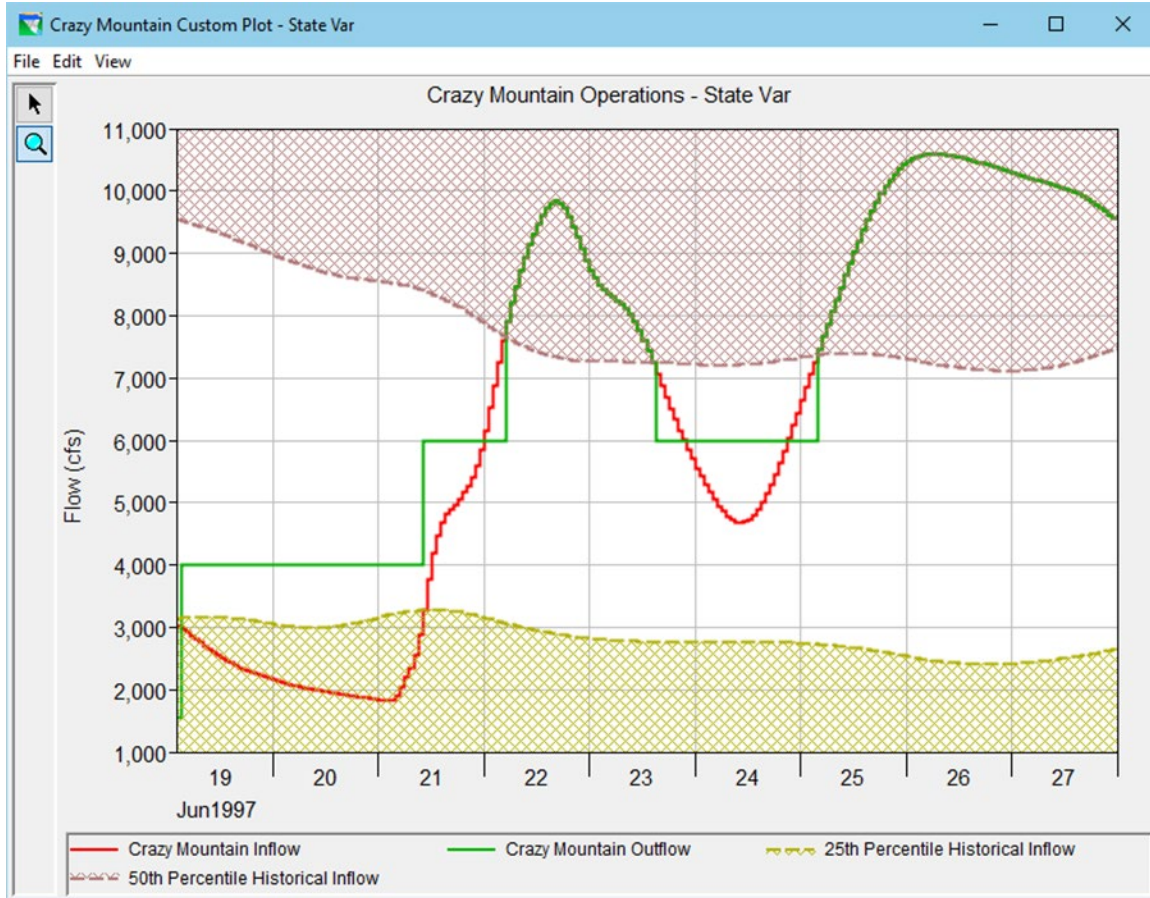


7. Create an Alternative that uses a state variable.

- Switch to the **Reservoir Network** module and open the **01 Standard** network for editing.
- Create a state variable named **MaxRelease** that utilizes the same limits as the **If Block** alternative.
 - Launch the **State Variable Editor** by selecting **Edit→State Variables...** from the ResSim menu bar.
 - Select **State Variable→New** from the **State Variable Editor** menu bar to create a new state variable.
 - Set the state variable **name** to **MaxRelease**, set the **parameter name** to **Flow-Max Out**, and the set the **parameter type** to **Flow**.
 - Make sure that the state variable type is set to **Jython Script**.
 - Select the **Initialization**, **Main**, and **CleanUp** tabs to see that comments are provided in new state variables to help you get started.
 - Code in the **Initialization** tab will be executed once before the simulation starts.

- Code in the **Main** tab will be executed on every iteration of every time step in the simulation.
 - Code in the **CleanUp** tab will be executed once after the simulation ends.
 - Import the state variable code.
 - Select **StateVariable**→**Import** from the **State Variable Editor** menu bar.
 - Navigate to and select **C:\class\WS8_Start\shared\State Variable.py** to import.
 - Click the **Compile Script** button to verify there are no syntax errors.
 - Save the script by selecting **StateVariable**→**Save** from the **State Variable Editor** menu bar and close the editor.
 - Use the **Reservoir Editor** to edit the Crazy Mountain reservoir properties and create an operation set that uses the **MaxRelease** state variable.
 - Duplicate the **Basic GC** operations set to one named **State Variable**.
 - Create a new rule in the **Normal Flood Control** zone named **Max Release** that is a **release function** that operates releases from **Crazy Mountain-Dam**.
 - Define the rule to be a function of the **current value** of the **MaxRelease state variable time series**. The limit type should be **maximum**, and the function should use the actual value of the state variable. You must add values to the table in order to make the rule work. Use the following values:

Flow	Release
0	0
1000000	1000000
 - Set the **Conservation** zone to also use the newly-created rule.
 - Use the **Alternative Editor** to copy the **If Block** alternative to a new one named **State Var**.
 - Set the **operation** set for Crazy Mountain to the one you just created.
8. Use the **State Var** alternative in a simulation and verify its operation using the **Custom Plot** script. Refer to step 6 for details if necessary.



9. Modify the simulation's copy of the State Variable Script.

- Remain in the **Simulation** module and edit the **MaxRelease** state variable to modify the values to **3000** and **5000** cfs.
- Re-compute the **State Var** alternative and verify the changes using the **Custom Plot** script.

