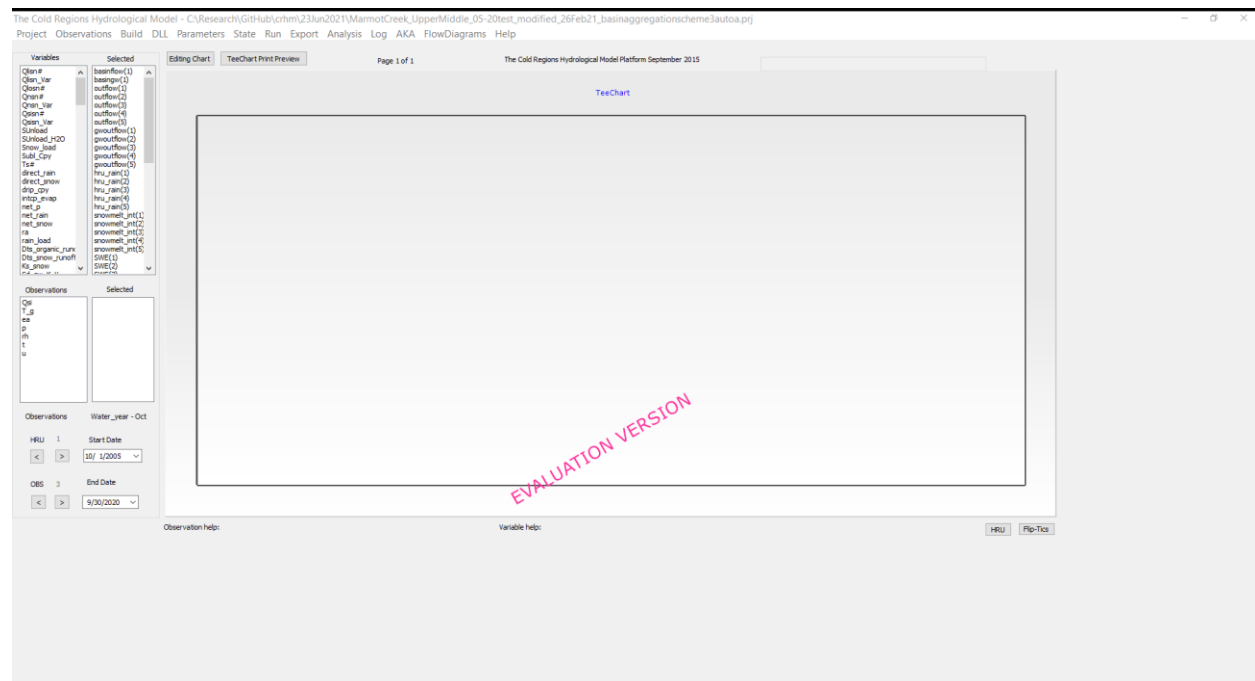


CRHM_GUI features assessment:

When clicking “Maximize” button on upper right corner, the GUI window does not show the full size but keeps same size with white margins around. See screen shot below:

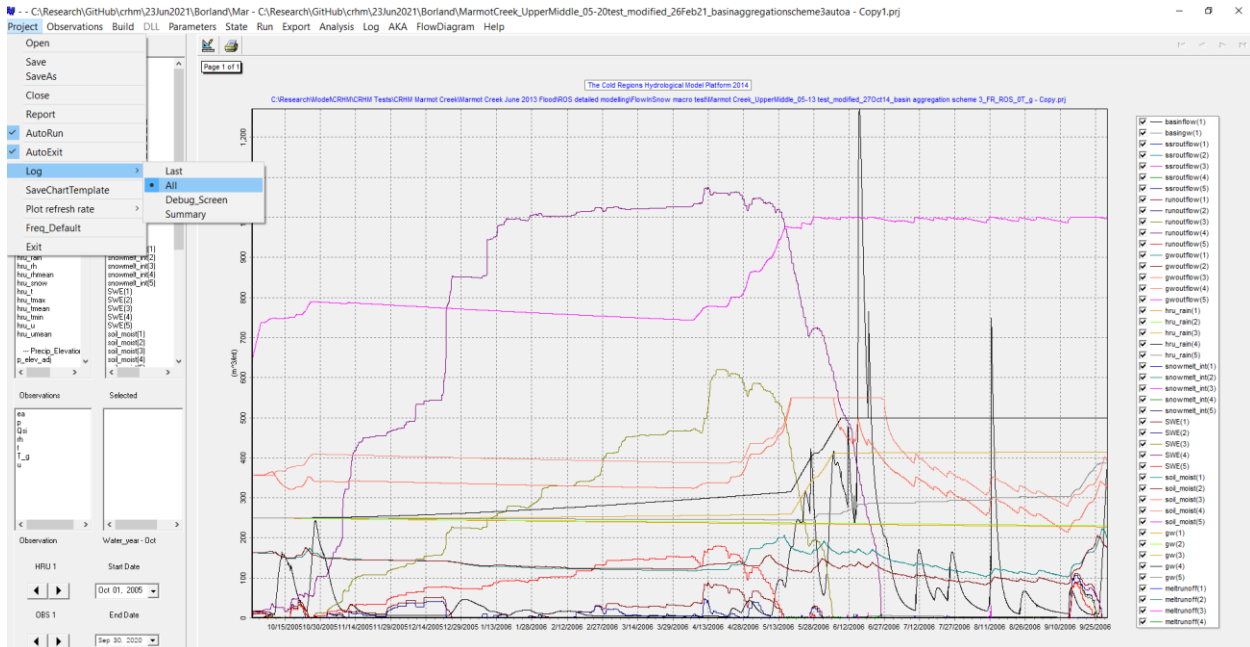


“MarmotCreek_UpperMiddle_05-20test_modified_26Feb21_basinaggregationscheme3autoa.prj” is used for discussion here and obs file “Marmot_Hourly_ArrayMetData_withT_g_1Oct05-30Sept20_update_22Jan2021.obs” should be found from previous GitHub Issue discussion:

The following is for Project menu:

In Borland CRHM, clicking “AutoRun” button once for the first time will show a check mark beside it, and clicking “AutoRun” button again, the check mark will disappear. Similarly, clicking “AutoExit” button once for the first time will show a check mark beside it, and clicking “AutoExit” button again, the check mark will disappear. Clicking “Log”, there are Log options: Last, All, Debug_Screen, and Summary; these are features can be set for a project to run automatically, automatically close after run completion, and save the selected variables at Log option.

Take “MarmotCreek_UpperMiddle_05-20test_modified_26Feb21_basinaggregationscheme3autoa.prj”, “AutoRun” and “AutoExit” buttons have check marks, and Log is set as All. This means when this prj is called to run, it will run automatically, closes itself automatically and saves the selected variables for entire simulation time period in CRHM_output_3.txt (as Run_ID is set 3). I have screen shot showing that from Borland CRHM.



When viewing this prj in Text Editor, the following values are shown from Lines 389 to 412.

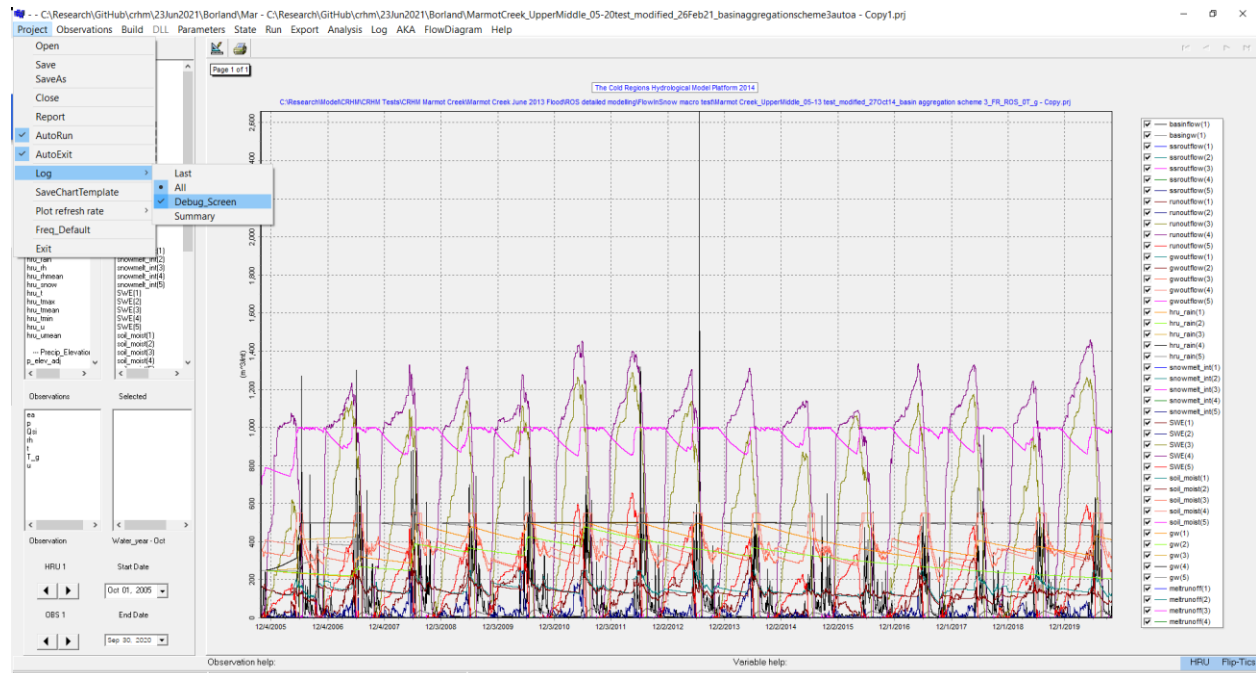
```
#####
Display_Variable:
#####
Netroute_M_D basinflow 1
Netroute_M_D basingw 1
Netroute_M_D sroutflow 1 2 3 4 5
Netroute_M_D runoutflow 1 2 3 4 5
Netroute_M_D gwoutflow 1 2 3 4 5
obs hru_rain 1 2 3 4 5
SnobalCRHM snowmelt_int 1 2 3 4 5
SnobalCRHM SWE 1 2 3 4 5
SoilDetention soil_moist 1 2 3 4 5
SoilDetention gw 1 2 3 4 5
frozenAyers meltrunoff 1 2 3 4 5
frozenAyers runoff 1 2 3 4 5
SoilDetention redirected_residual 1 2 3 4 5
#####
Display_Observation:
#####
#####
Auto_Run
#####
Auto_Exit
#####
Log_All
```

In addition, when Last is selected for Log option and combining with “AutoRun” and “AutoExit” with check marks, this will have prj run and close automatically, but **only** save the selected variables for the last time interval: ie. 2020 09 30. The following will be shown when viewing prj in Text Editor:

```
#####
Auto_Run
#####
Auto_Exit
#####
Log_Last
```

Comment: Last option for Log is not often used.

Moreover, Debug_Screen option can be clicked when All option is selected, see the screen shot below:

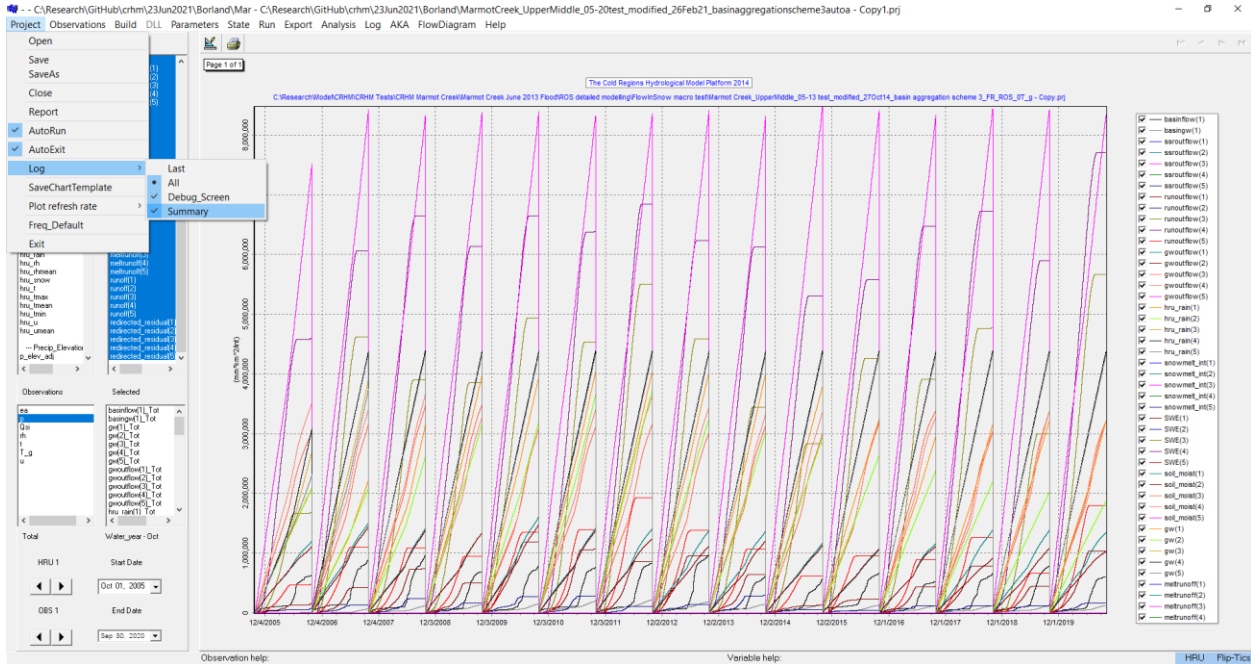


Viewing prj in Text Editor:

```
#####
Auto_Run
#####
Auto_Exit
#####
Log_All
#####
Log_Screen
```

This will save the selected variables for all simulation time period in CRHM_output_3.txt, and also will save Log window information from the run in CRHM_output_3.log. **Comment: I am not sure how useful this Debug_Screen for Log option is, and this is pretty much same as that crhmRun.txt showing the Log information from gcc crhm.**

Furthermore, Summary option can be selected with Debug_Screen and All options being selected, see the screen shot below:



Then, the selected variables can be added as a observation function (i.e. Total) to a right small window under Observations. Viewing the prj in Text Editor:

Display_Variable:

#####

```

Netroute_M_D basinflow 1
Netroute_M_D basingw 1
Netroute_M_D ssroutflow 1 2 3 4 5
Netroute_M_D runoff 1 2 3 4 5
Netroute_M_D gwoutflow 1 2 3 4 5
obs hru_rain 1 2 3 4 5
SnobalCRHM snowmelt_int 1 2 3 4 5
SnobalCRHM SWE 1 2 3 4 5
SoilDetention soil_moist 1 2 3 4 5
SoilDetention gw 1 2 3 4 5
frozenAyers meltrunoff 1 2 3 4 5
frozenAyers runoff 1 2 3 4 5
SoilDetention redirected_residual 1 2 3 4 5

```

#####

```

Display_Observation:
#####
Netroute_M_D basinflow 1 _Tot
Netroute_M_D basingw 1 _Tot
SoilDetention gw 1 2 3 4 5 _Tot
Netroute_M_D gwoutflow 1 2 3 4 5 _Tot
obs hru_rain 1 2 3 4 5 _Tot
frozenAyers meltrunoff 1 2 3 4 5 _Tot
SoilDetention redirected_residual 1 2 3 4 5 _Tot
frozenAyers runoff 1 2 3 4 5 _Tot
Netroute_M_D runoutflow 1 2 3 4 5 _Tot
SnobalCRHM snowmelt_int 1 2 3 4 5 _Tot
SoilDetention soil_moist 1 2 3 4 5 _Tot
Netroute_M_D ssroutflow 1 2 3 4 5 _Tot
SnobalCRHM SWE 1 2 3 4 5 _Tot
#####
Auto_Run
#####
Auto_Exit
#####
Log_All
#####
Log_Screen
#####
Summary_Screen

```

With above Log option, the prj will automatically run and close and save the selected variables for all simulation time period in CRHM_output_3.txt, and will save Log window information from the run in CRHM_output_3.log, and also will save summary (i.e. water year total value) of those selected in CRHM_output_3.sum.

Comment: Summary option for Log is useful, but it is not a must-have as I mentioned in GitHub Issue channel before. Users now can often do their own summary calculation outside Borland CRHM.

In Borland CRHM, clicking “SaveChartTemplate” button the first time, a check mark will be shown, and viewing it in Text Editor, something like this will be shown:

```

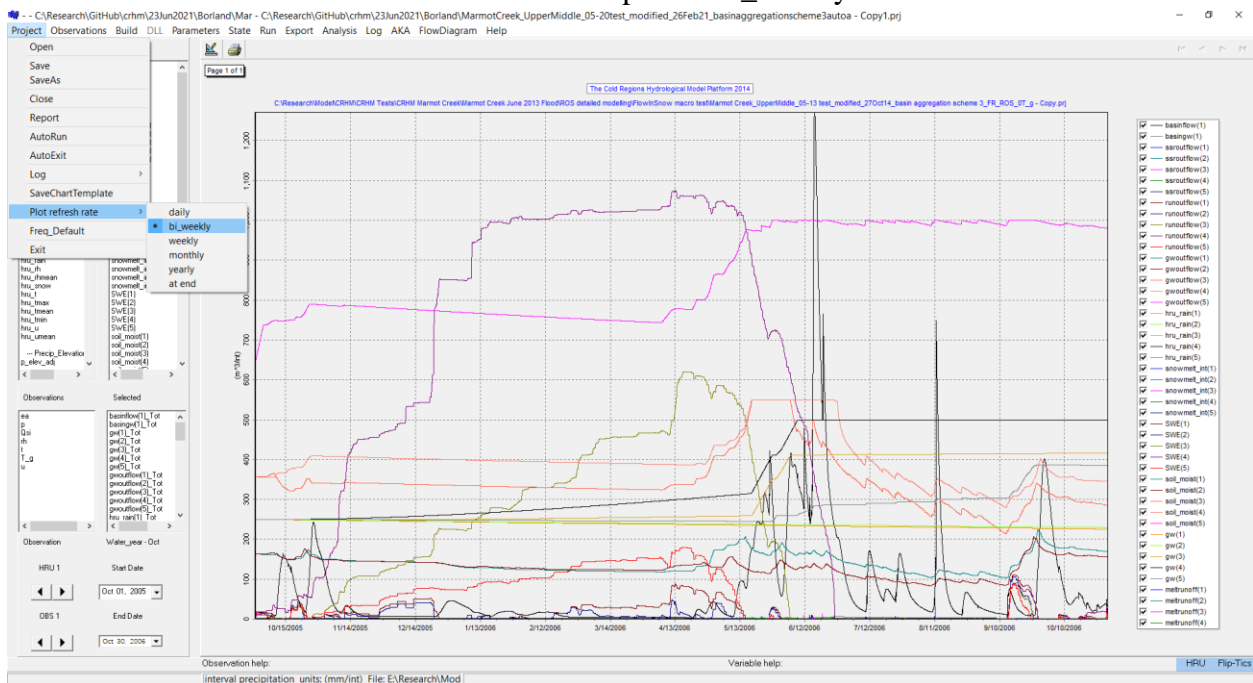
#####
Auto_Run
#####
SaveChartTemplate
#####
Auto_Exit

```

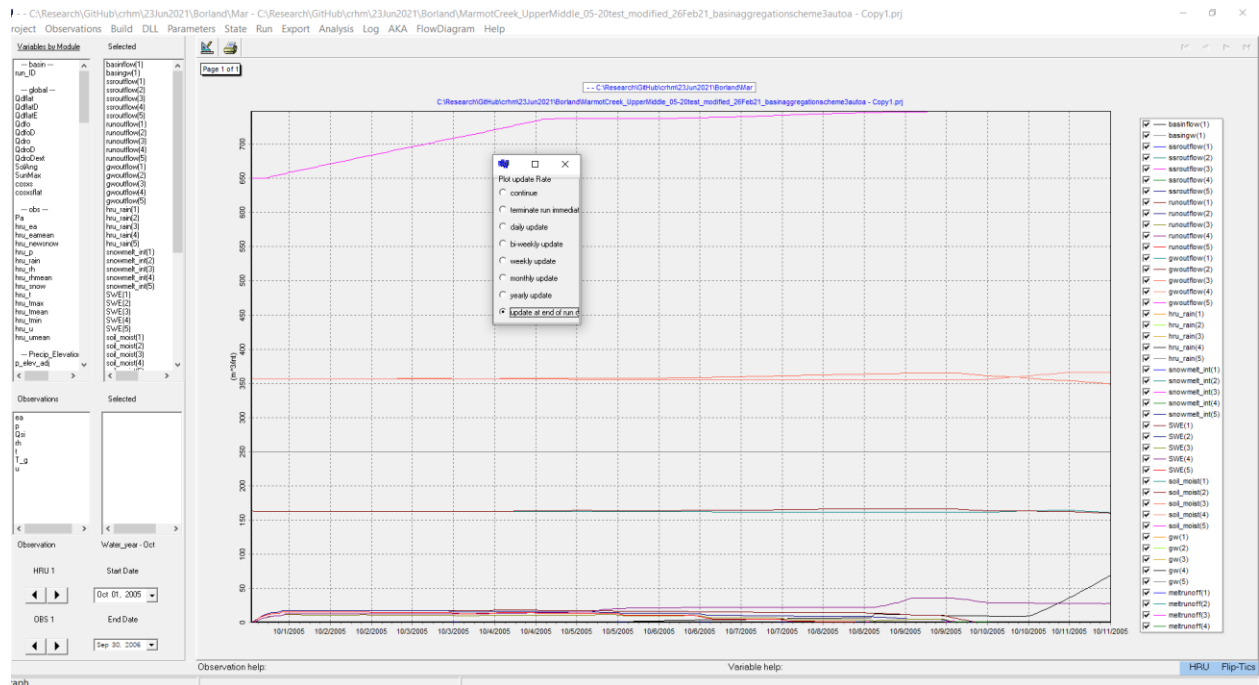

Log_All

When this SaveChartTemplate option is chosen for MarmotCreek_UpperMiddle_05-20test_modified_26Feb21_basinaggregationscheme3autoa.prj, Borland CRHM will save the graph of GUI as MarmotCreek_UpperMiddle_05-20test_modified_26Feb21_basinaggregationscheme3autoa.TEE file. However, this is not often used and is not really that useful. Often Borland CRHM crashes at the end when this SaveChartTemplate option is chosen.

In Borland CRHM, there are options for “Plot refresh rate”: daily, bi_weekly, weekly, monthly, yearly, and at end. The default option is bi_weekly; this means when prj is running, the graph information of those selected variables will be updated bi_weekly. See screen below:

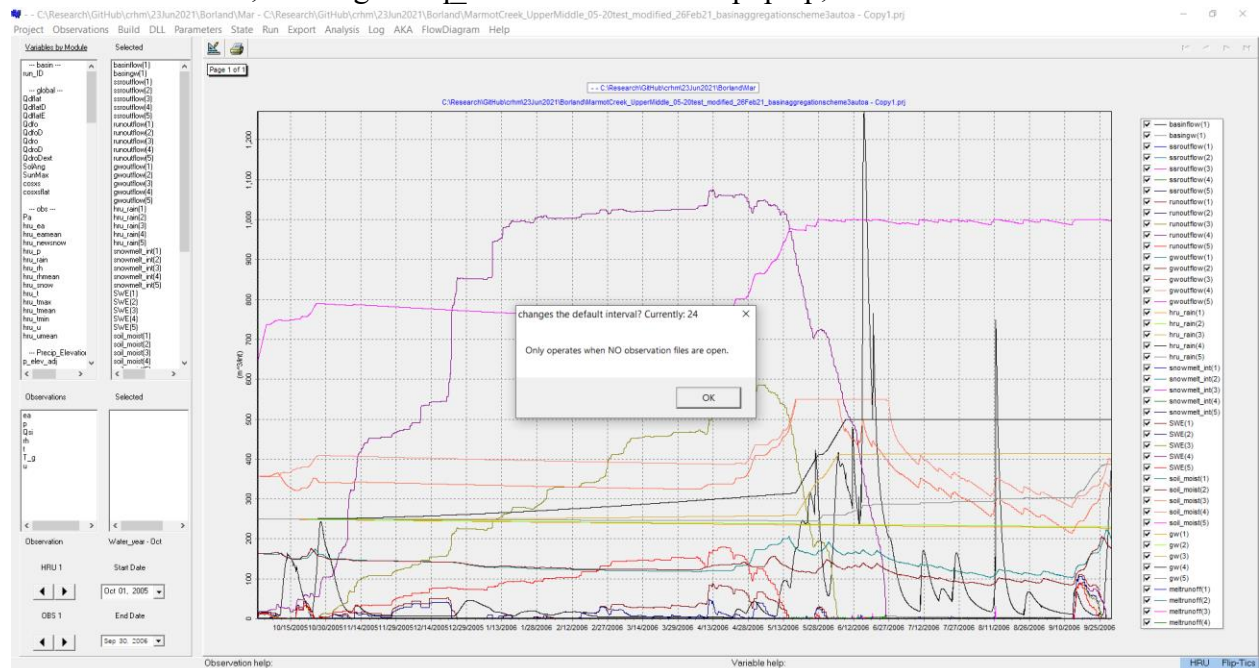


However, I do not think this is working in Borland CRHM. Instead, users have to click left mouse once in the graph area after pressing Run button, then a Plot update Rate window appears. Users then can choose “update at end of run only” from default “bi-weekly update”. “update at end of run only” option can speed up run without showing graph update during run. See the screen shot below:



After this project finishes, if users want to re-run it and also want no graph update during run, then they will have to choose “continue” from last selected option “update at end of run only”.

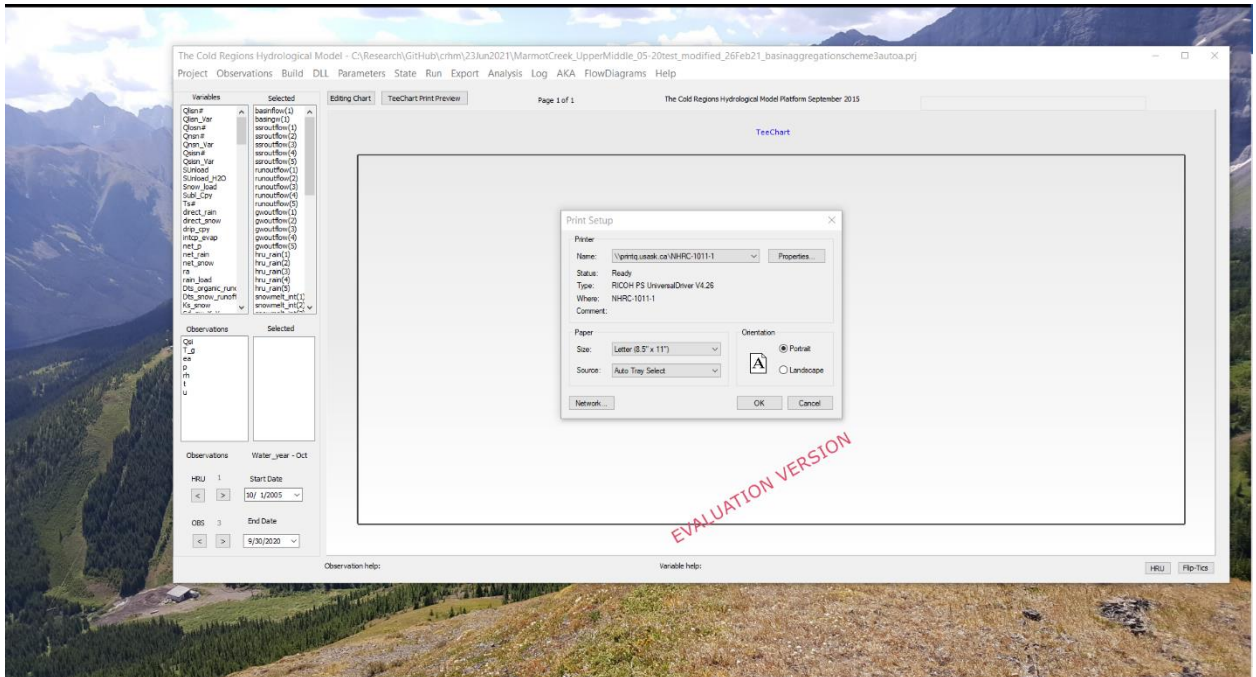
In Borland CRHM, clicking “Freq_Default” button will pop up, see screen below:



Comment: This is not useful. I have never used it before.

Comment: for CRHM_GUI, in ‘Project’ menu,

When clicking “AutoRun” button, a Print Setup window appears. It should have a check mark when clicking it the first time, and then clicking it again, the check mark disappears.



When clicking “AutoExit” button, the CRHM_GUI closes itself. It should have a check mark when clicking it the first time, and then clicking it again, the check mark disappears.

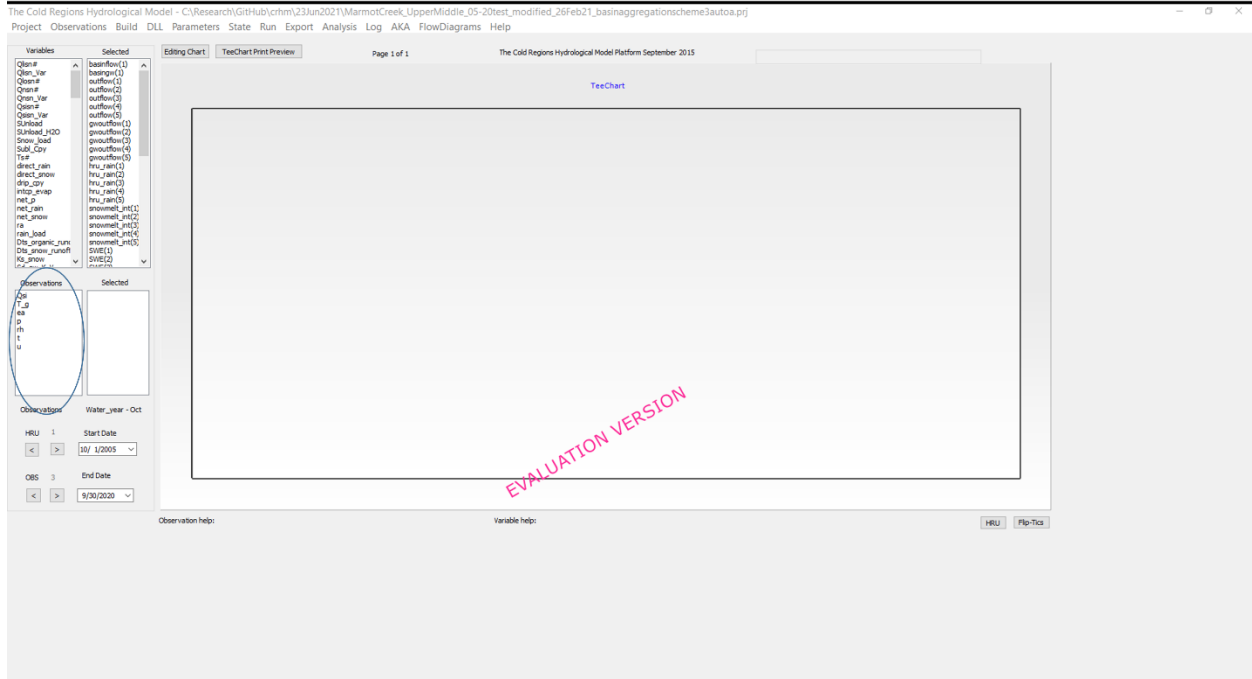
When clicking “Log” button, there is no option for Log in CRHM_GUI. At least “All” option should be implemented; as discussed in Borland CRHM cases above, other options like Last and Summary are either not often used or can be easily done outside CRHM, gcc crhm already has the log file that is equivalent to option like Debug_Screen.

“SaveChartTemplate”, “Plot refresh rate”, and “Freq_Default” buttons are not implemented at the moment in CRHM_GUI. Frankly, they are not that useful and rarely used in Borland CRHM. However, the method of changing Plot update Rate by clicking graph area after pressing Run button from previous two pages probably should be considered for CRHM_GUI.

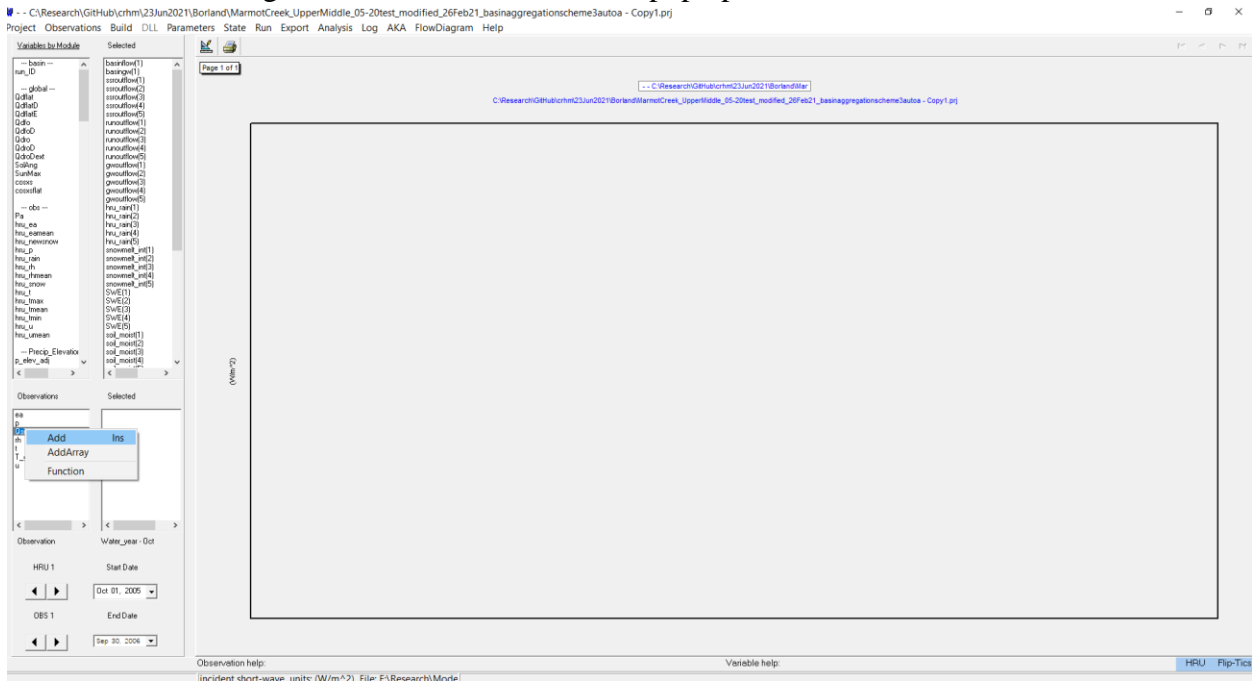
Comment: for CRHM_GUI, in ‘Observations’ menu,

Both “Open” and “CloseAll” are implemented; I tested them, and function the same way as Borland CRHM.

However, when I used left mouse key to click one of them variables in “Observations” window see the circle area from screen shot below, CRHM_GUI crashed and closed itself. The “Add”, “AddArray”, and “Function” buttons should be implemented in CRHM_GUI. See the demonstration from Borland CRHM for these buttons.



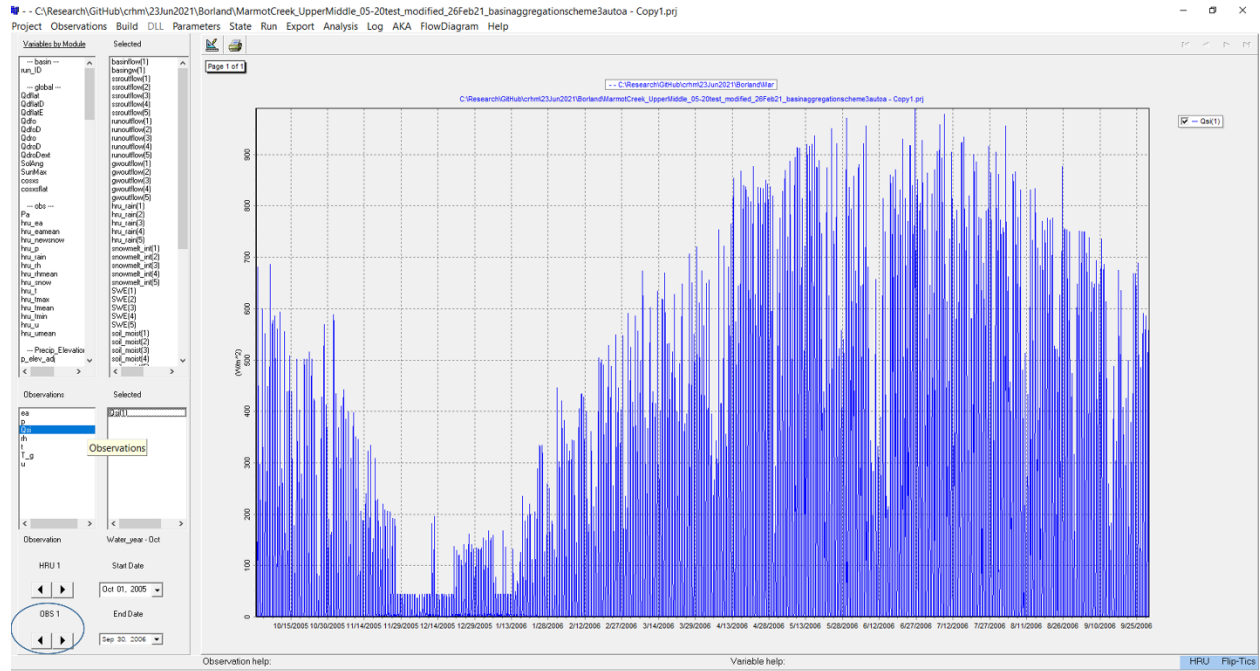
For the “Observations” window in Borland CRHM, I can first left click mouse to highlight a variable, and then right click mouse. A menu will pop up like screen shot below:



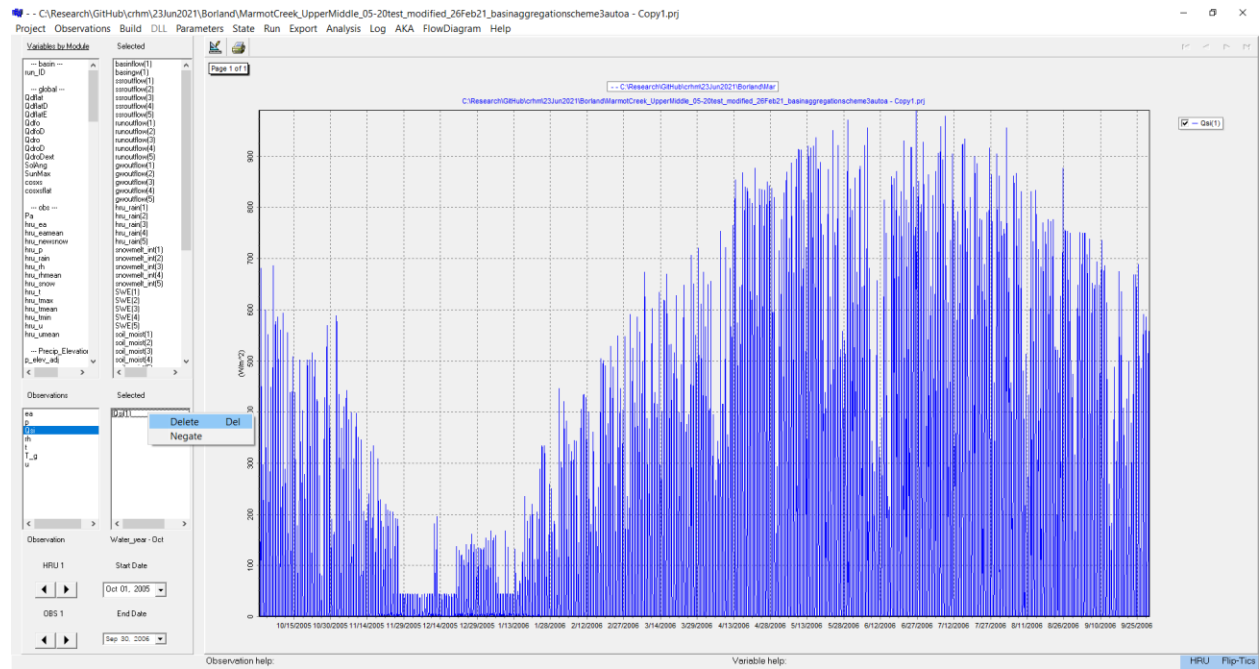
In this pop up menu, click “Add” will add a variable. Generally speaking, if there is only one Qsi defined in the obs file, then “Add” will only add one Qsi (ie. Qsi(1)).

In “MarmotCreek_UpperMiddle_05-20test_modified_26Feb21_basinaggregationscheme3autoa.prj” that uses “Marmot_Hourly_ArrayMetData_withT_g_1Oct05-30Sept20_update_22Jan2021.obs”; there are

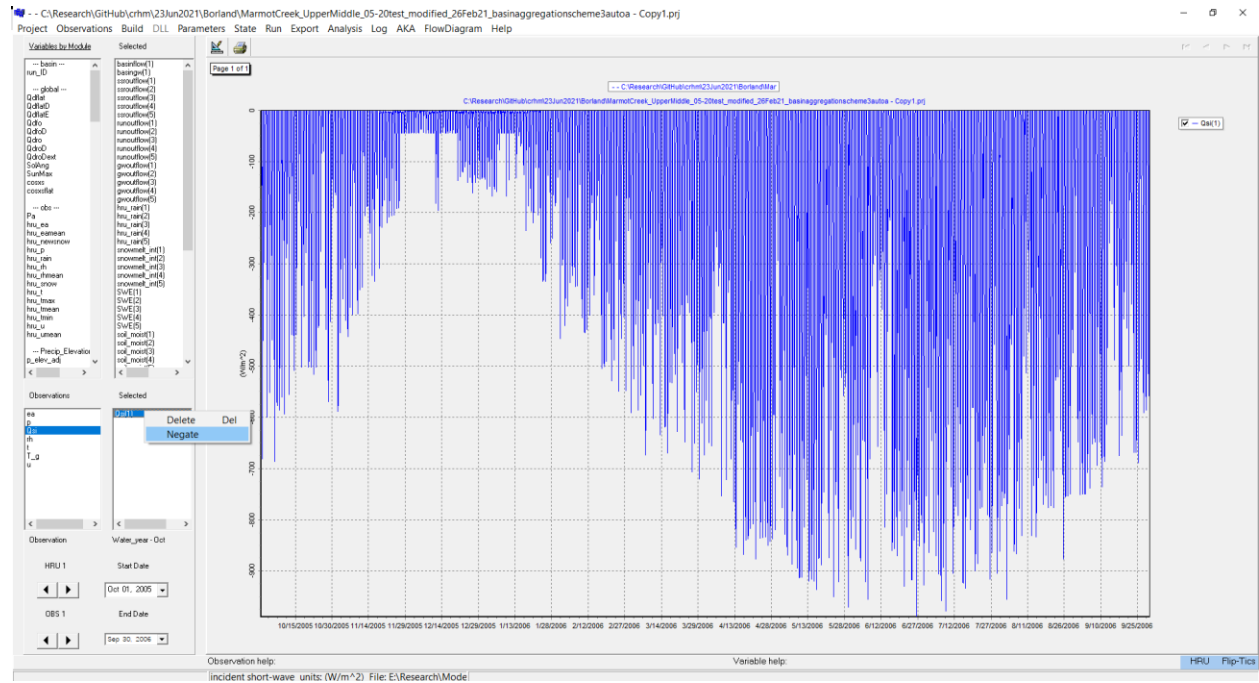
seven arrays of variables defined for those listed in the “Observations” window. The default information on the lower left corner is OBS 1, so when clicking “Add”, Qsi(1) will be added:



If I click left mouse key to highlight the Qsi(1) in Selected window and then click right mouse key, menu will be appear: “Delete” and “Negate”. Click “Delete” will delete the Qsi(1) from Selected window.

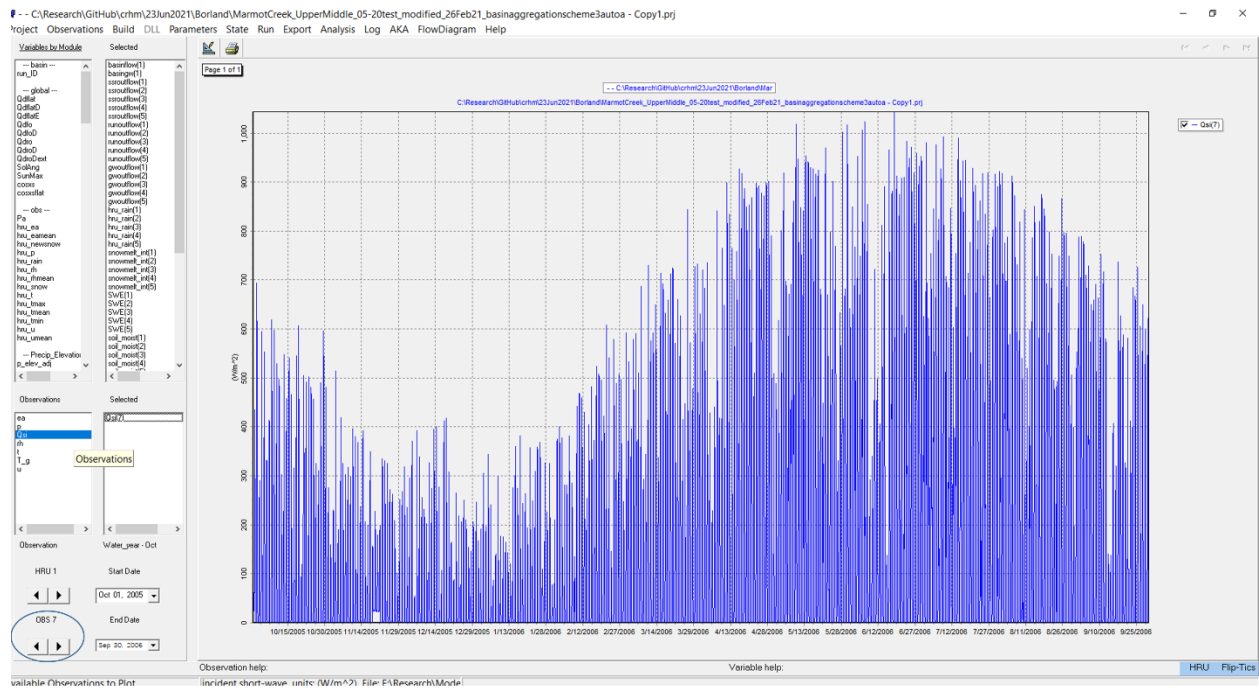


Click “Negate” once will show Qsi(1) as negative value (ie. multiply -1 to its original value) on the vertical axis:

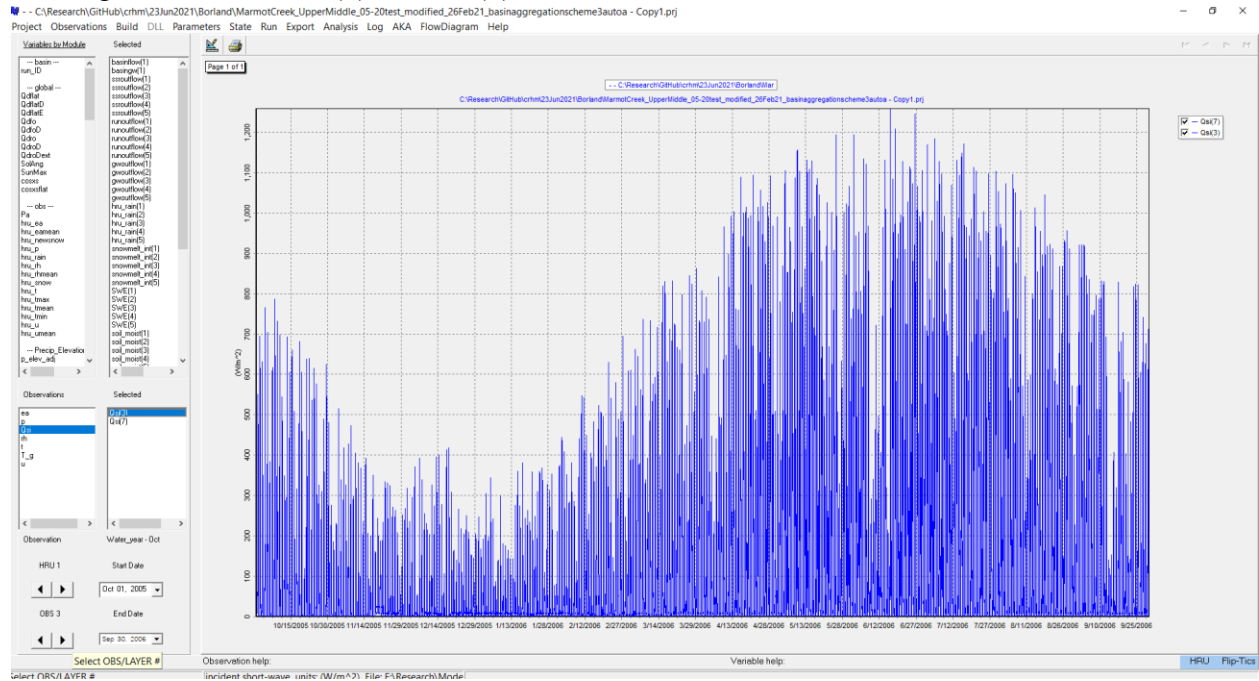


Then, Click “Negate” again, Qsi(1) will restore its the default value on the vertical axis.

In addition, if I delete Qsi(1) from the Selected window and then I click the arrow on the lower left corner to change OBS 1 to any OBS number, say OBS 7, and then I click “Add”, Qsi(7) will be added, see below,

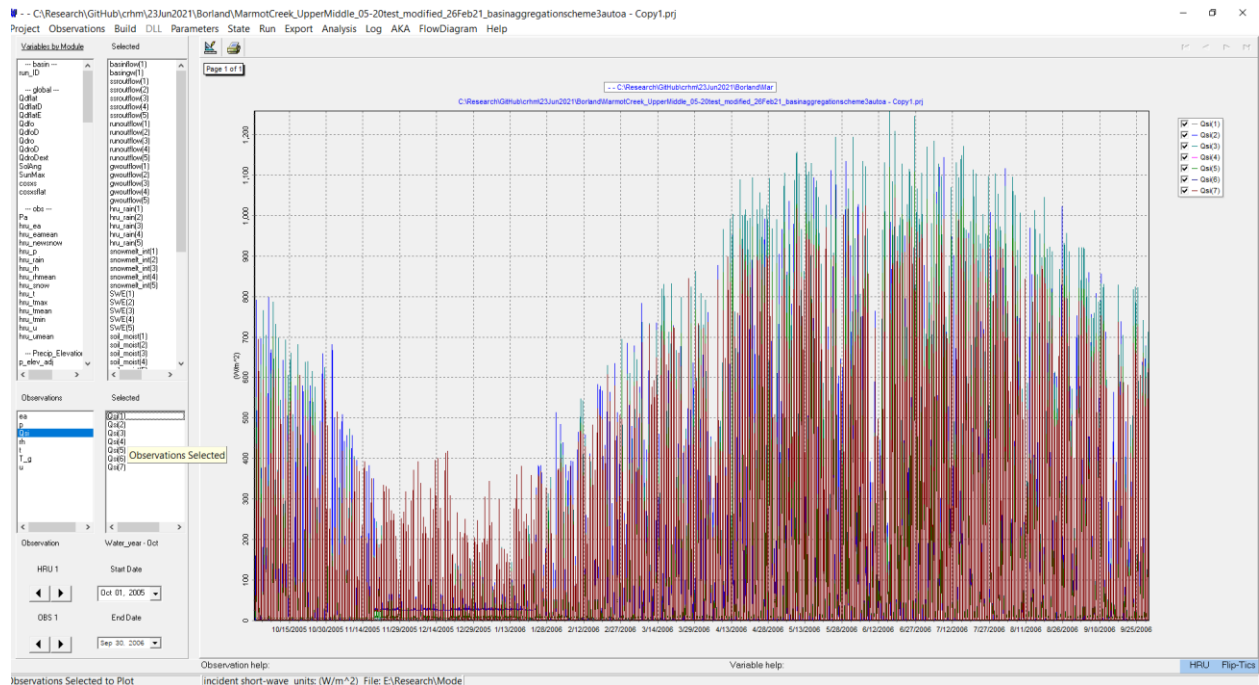


After that, if I changed to OBS 3 from OBS 7 on the left corner, then Qsi(3) will be added when clicking “Add”; both Qsi(3) and Qsi(7) will be shown in the Selected window:

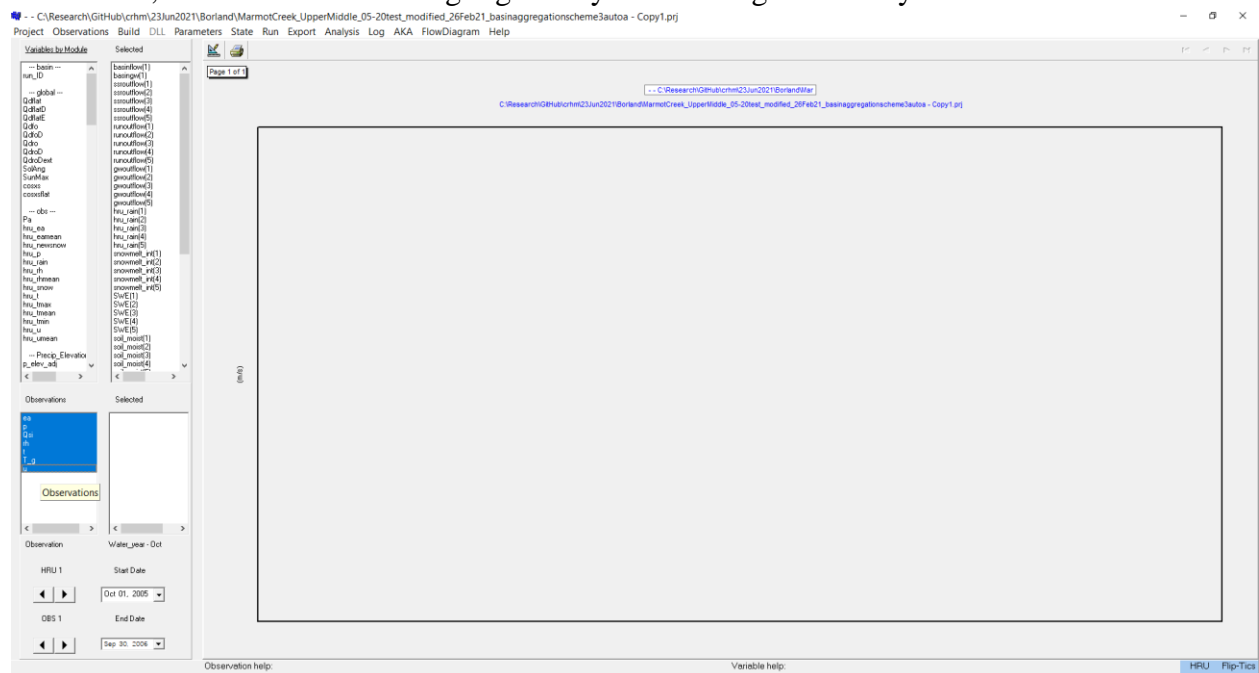


Moreover, in pop up menu, click “AddArray” button will add all arrays of a variable. In “MarmotCreek_UpperMiddle_05-20test_modified_26Feb21_basinaggregationscheme3autoa.prj” that uses “Marmot_Hourly_ArrayMetData_withT_g_1Oct05-30Sept20_update_22Jan2021.obs”; there are seven arrays of each variables, clicking “AddArray” for Qsi will add all seven Qsi in the Selected window:

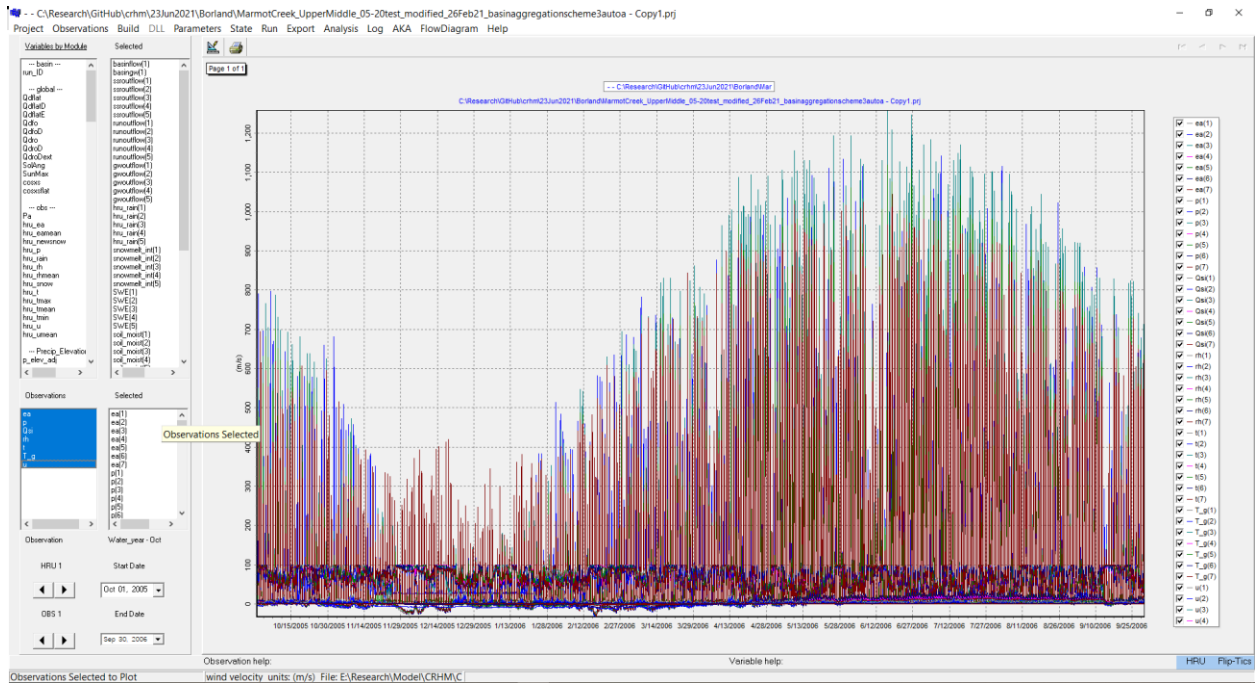




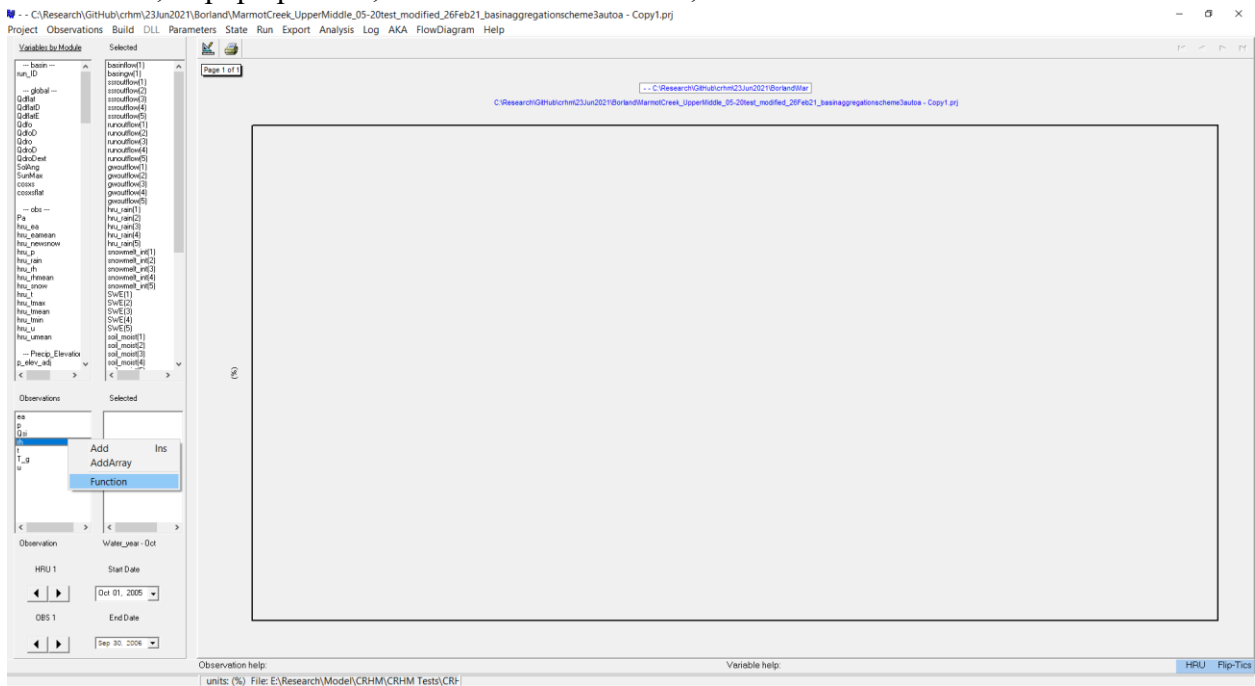
In addition, all variables can be highlighted by left clicking mouse key in Observations window:



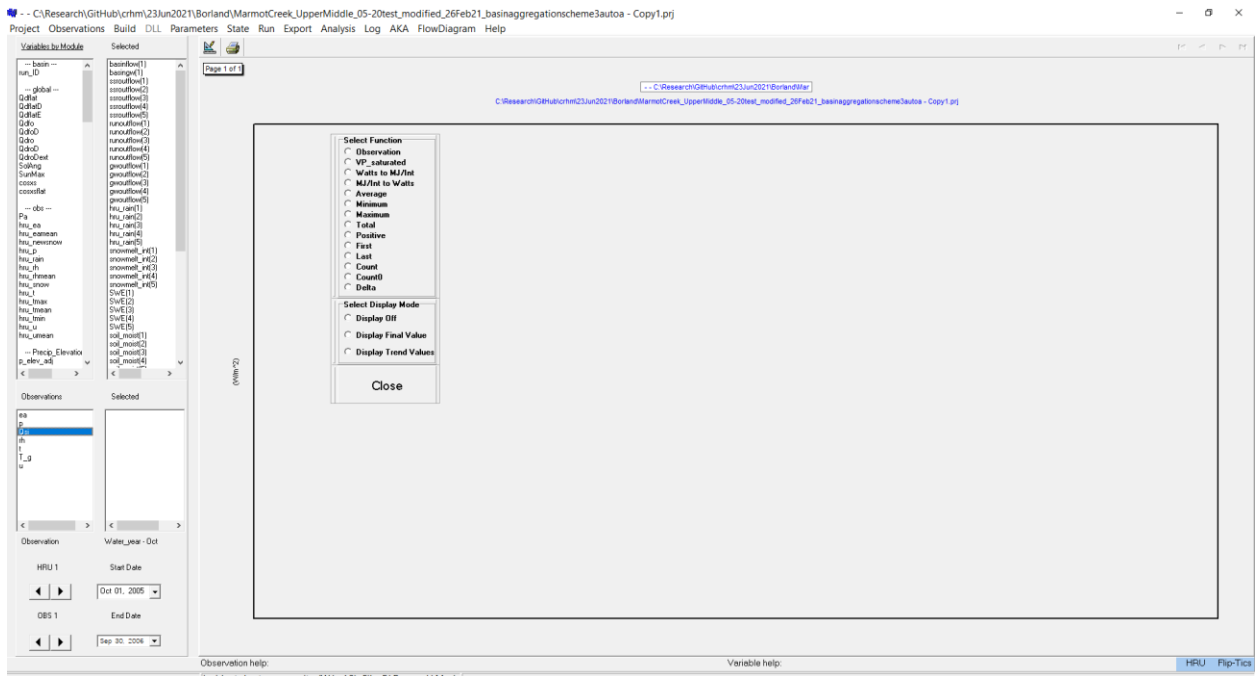
The, right clicking mouse key to pop up menu for “Add”, “AddArray”; if clicking “AddArray”, then all seven arrays of these variables will be added to the Selected widow:



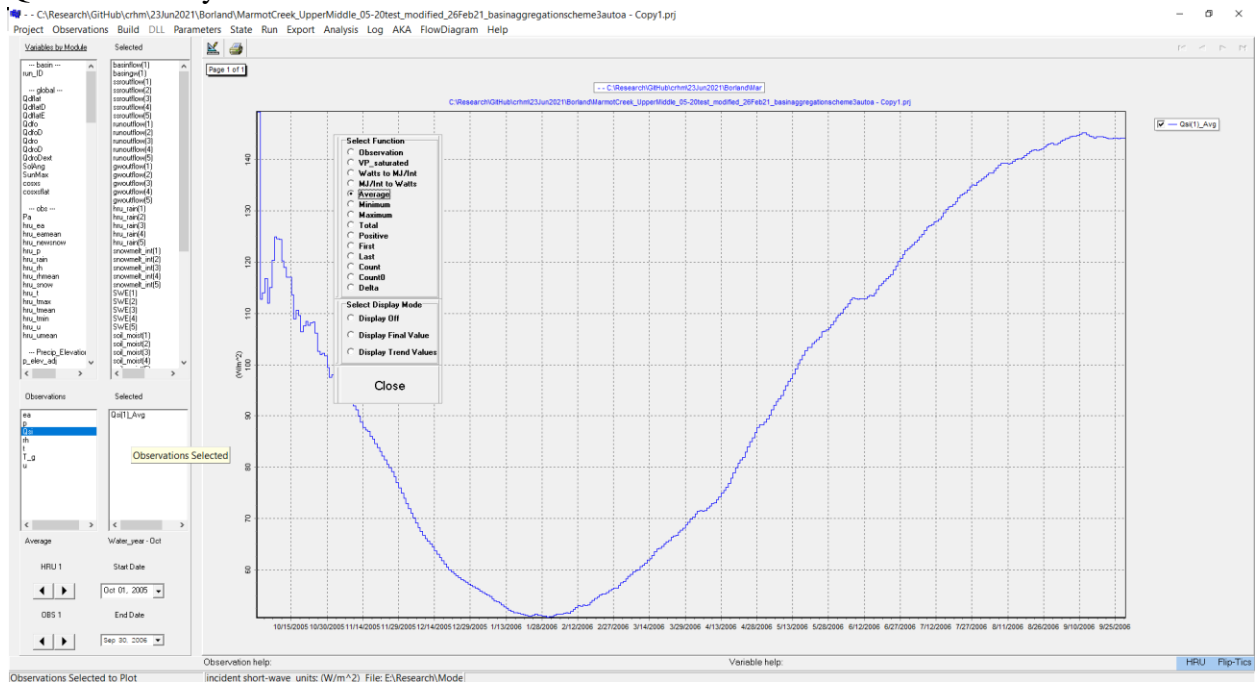
Futhermore, in pop up menu, click “Function” button,



A window will be popped up to show: “Select Function”, “Select Display Mode”, and “Close” buttons:

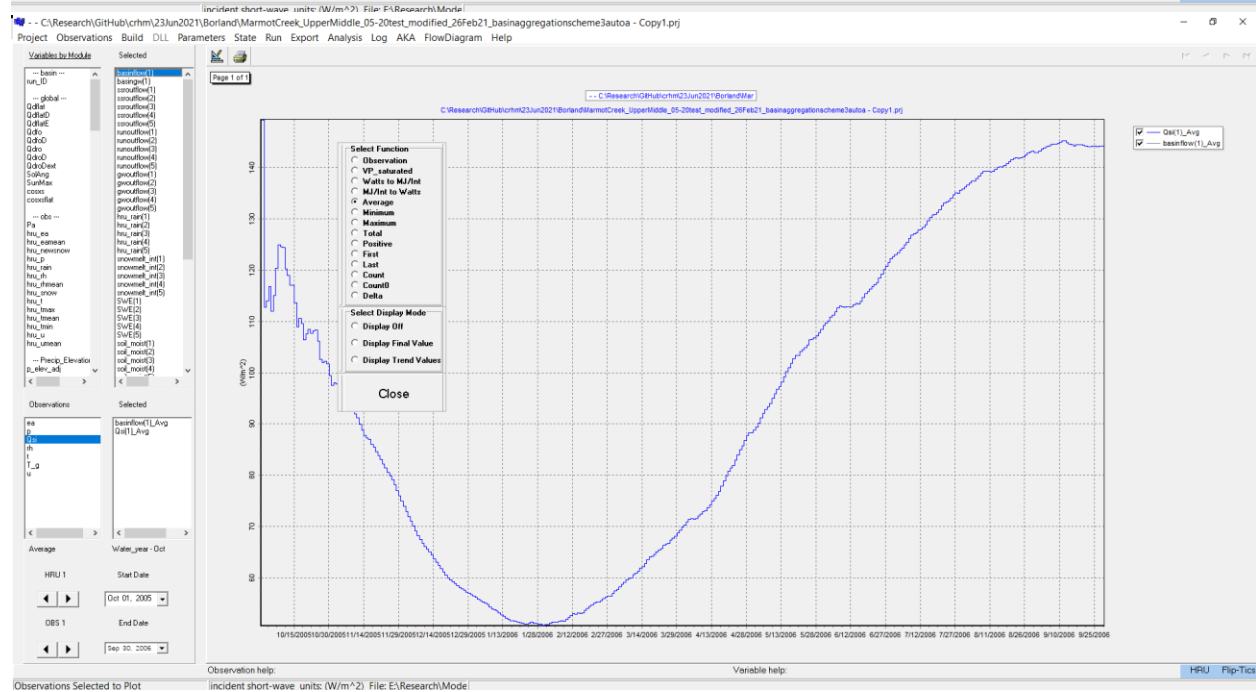
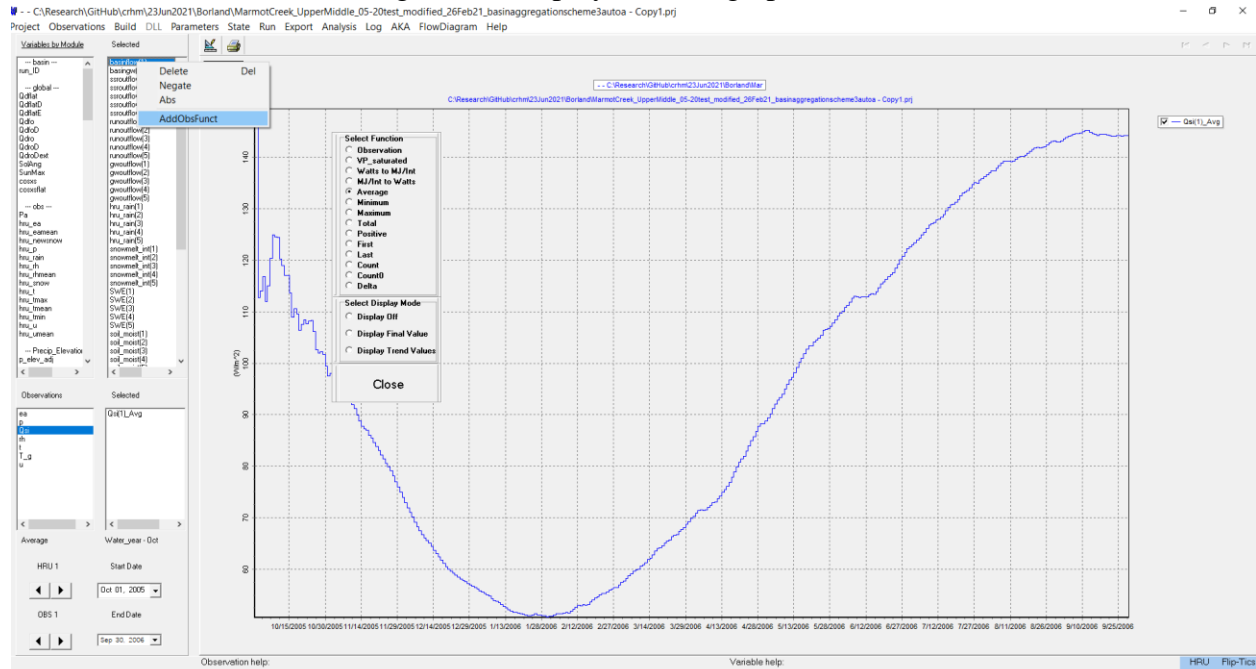


There 14 functions: Observation, VP_saturated, to Delta that can be selected for observation variables. For instance, if Average function is selected and then click Add Qsi, Qsi(1)_Avg will be added to Selected window, this is daily average Qsi(1) from the hourly observation variable Qsi in first array:

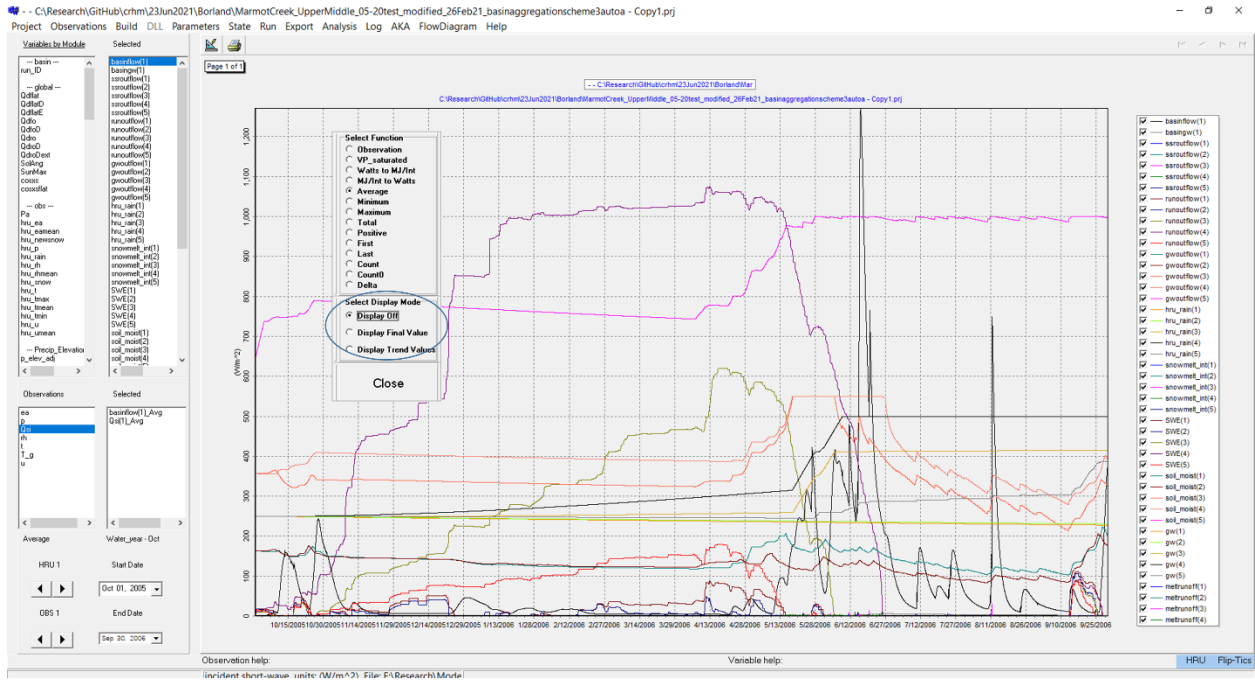


In addition, these functions can also be applied to selected variables. For instance, right mouse click basinflow(1), a window pops up, and select “AddObsFunc”, basinflow(1)_Avg will be

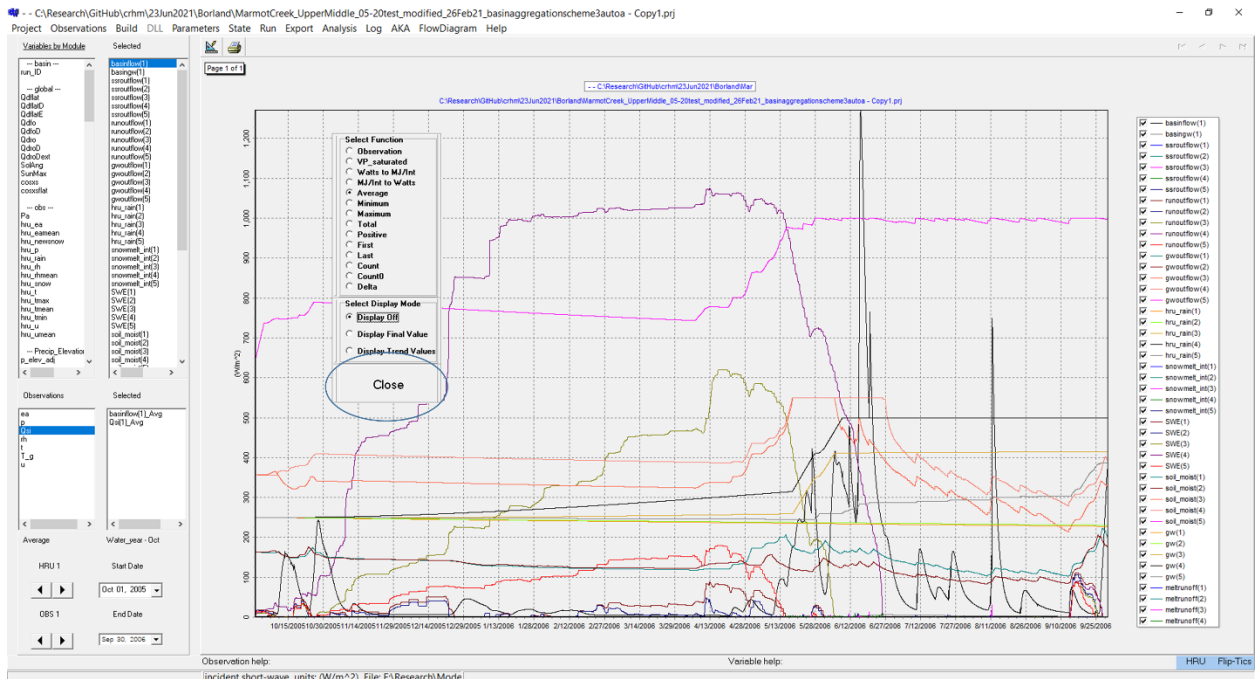
added the lower Selected window beside the “Observations” window. Next time when the prj finishes run, basinflow(1)_Avg will be displayed in the graph area.



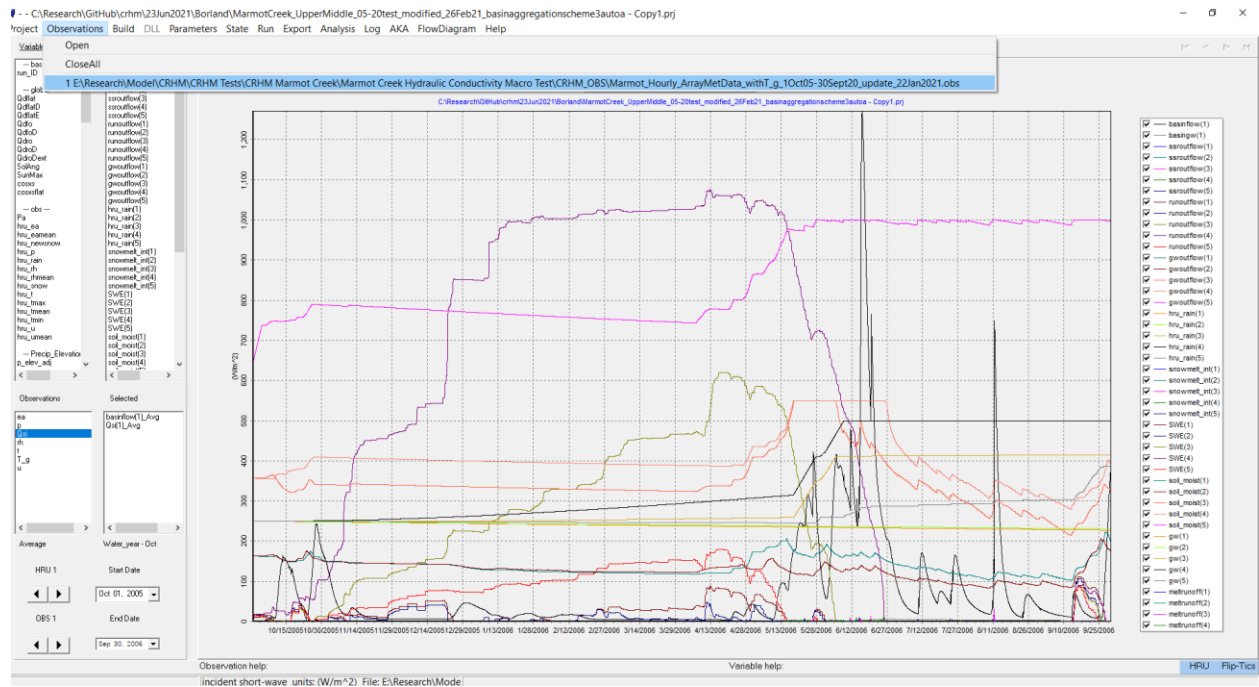
In addition, “Select Display Mode” shown in circle below is not implemented in Borland CRHM and is not really used. This is probably not that useful and CRHM_GUI does not have to implement this.



In addition, “Close” shown in circle below, click this button will close the pop up window.

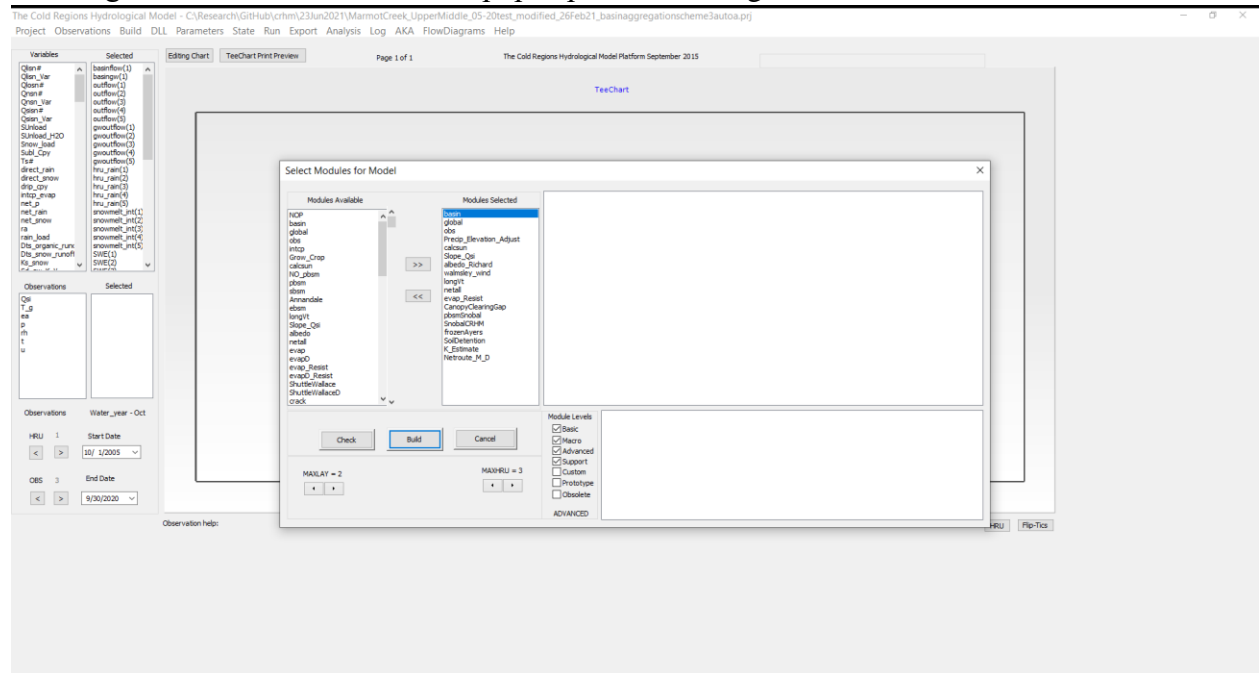


Lastly, from the “Observations” menu, the name of obs file used by the prj is shown, see below. This is not currently shown in CRHM_GUI, which indicates that CRHM_GUI might not read or load the obs file correctly.

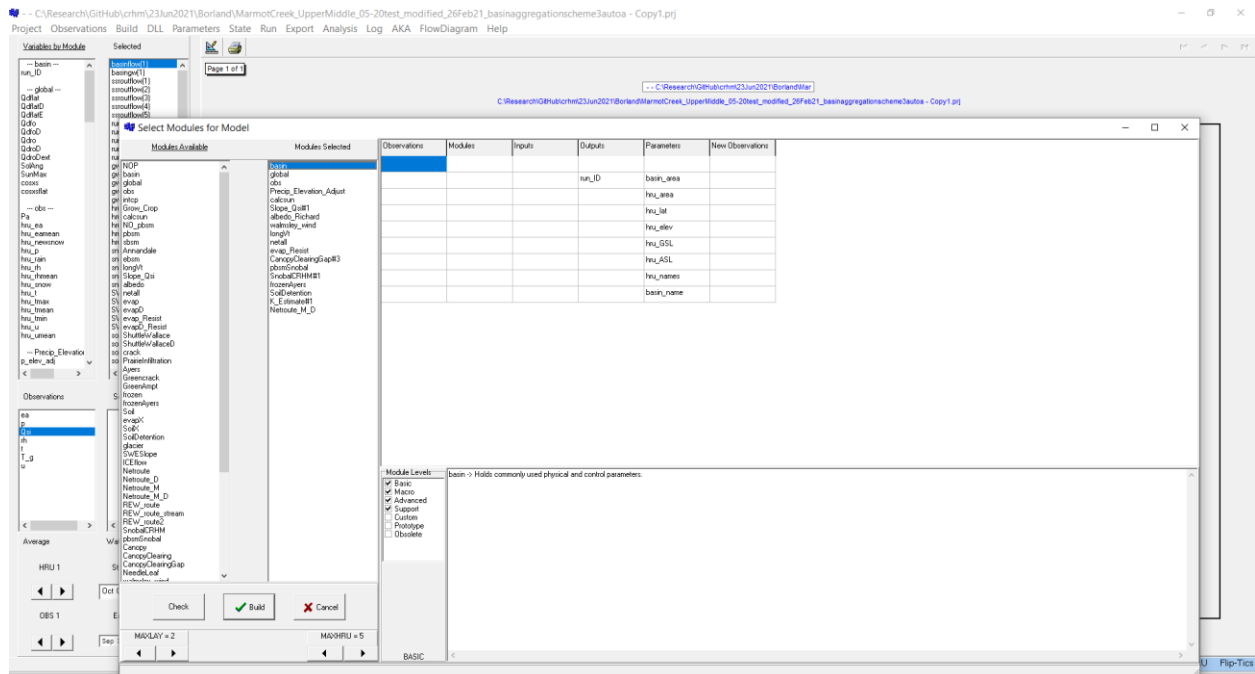


Comment: for CRHM_GUI, in 'Build' menu,

Clicking "Build – Construct" button pops up the following window in CRHM_GUI:



Clicking the same "Build – Construct" button pops up the following window in Borland CRHM:



As shown in the screen shots above from CRHM_GUI and Borland CRHM, CRHM_GUI does not currently show information on the upper right panel window for a highlighted module: Observations, Modules, Inputs, Outputs, Parameters, New Observations, it does not show short description of the highlighted module on the lower right panel window. These are shown in Borland CRHM.

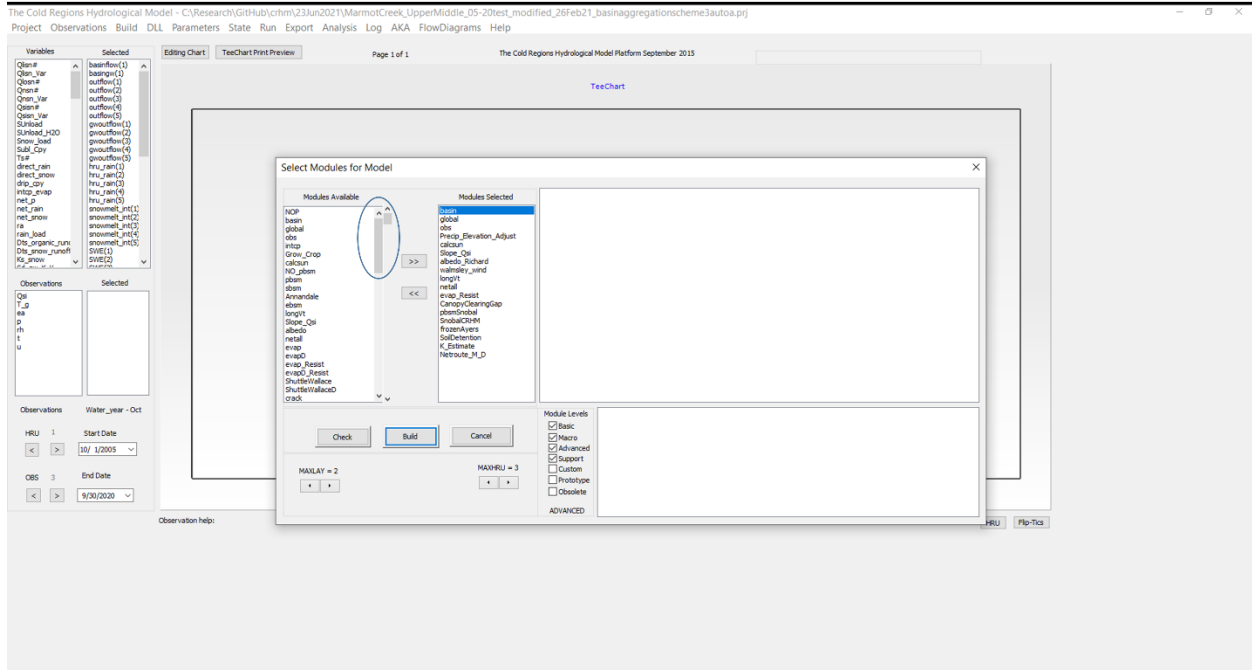
In addition, CRHM_GUI does not show correct information for the opened prj: on the lower left corner, **MAXHRU = 3** is shown in CRHM_GUI; while the correct information **MAXHRU = 5** is shown in Borland CRHM. This indicates that CRHM_GUI might not read this information from the prj file correctly.

Moreover, in Borland CRHM, there are different variations for the same module. For instance, right-click CanopyClearingGap#3 in Borland CRHM, there is a pop-up menu: Delete, Next variation, Last variation. Delete will remove the module from the Module Selected window; Next variation will move the next variation of the module: if clicking Next variation on CanopyClearingGap#3, then CanopyClearingGap#4 will appear. Last variation will move back one variation: if clicking Last variation on CanopyClearingGap#3, then CanopyClearingGap#2 will appear. CRHM_GUI does not currently implement the variation for modules; this is evident in the above screen shot: there is Slope_Qsi#1, CanopyClearingGap#3, SnobalCRHM#1, K_Estimate#1 shown in CRHM_GUI. This indicates CRHM_GUI does not read the module information correctly from the prj file.

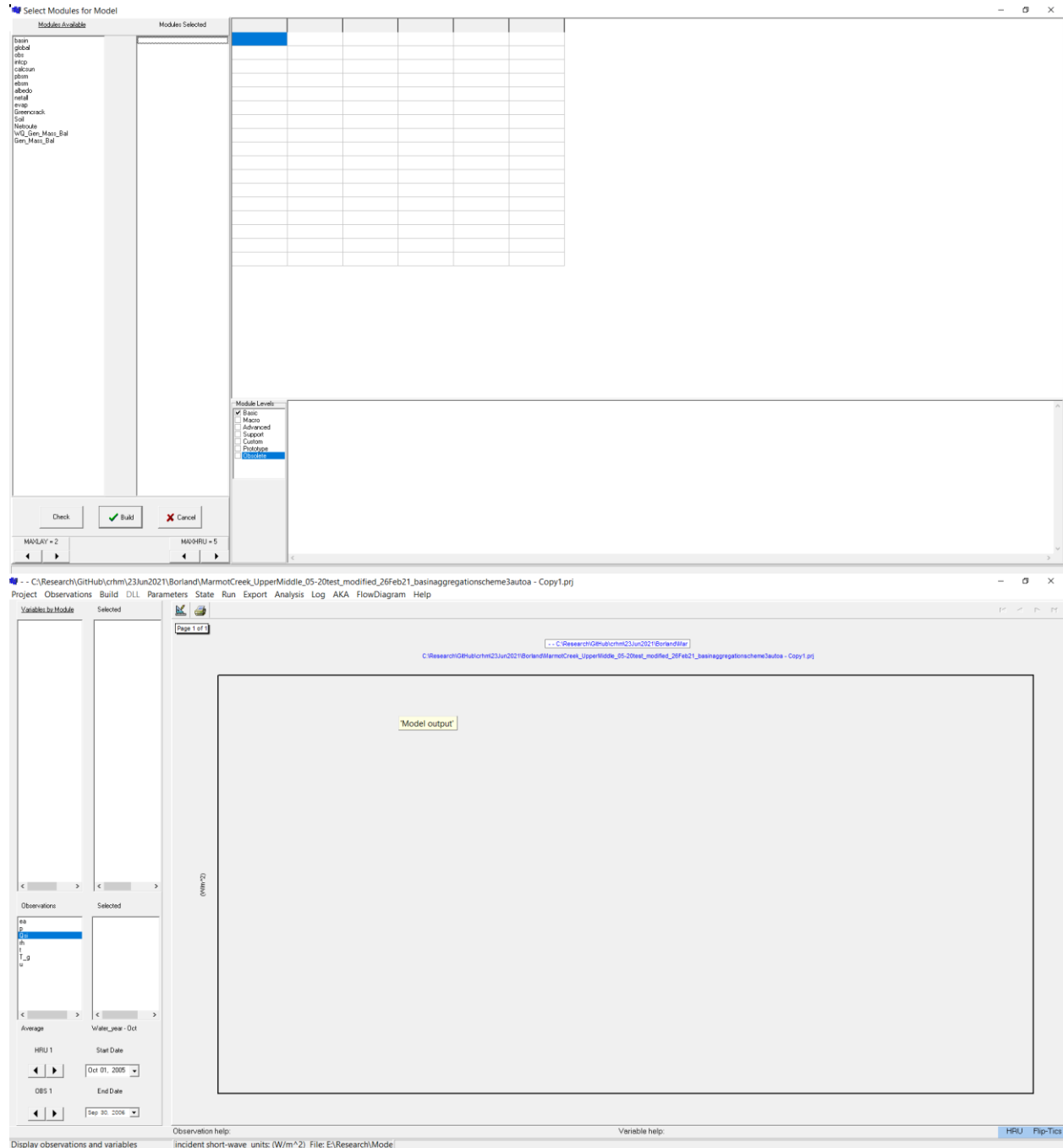
Other things not implemented in CRHM_GUI are the maximize and minimize buttons on the upper right corner of the "Build - Construct" window.

On the other hand, CRHM_GUI has more intuitive ways to add or remove modules from “Module Selected” window by using >> and << buttons. I think this is better than right click module to add or remove in Borland CRHM.

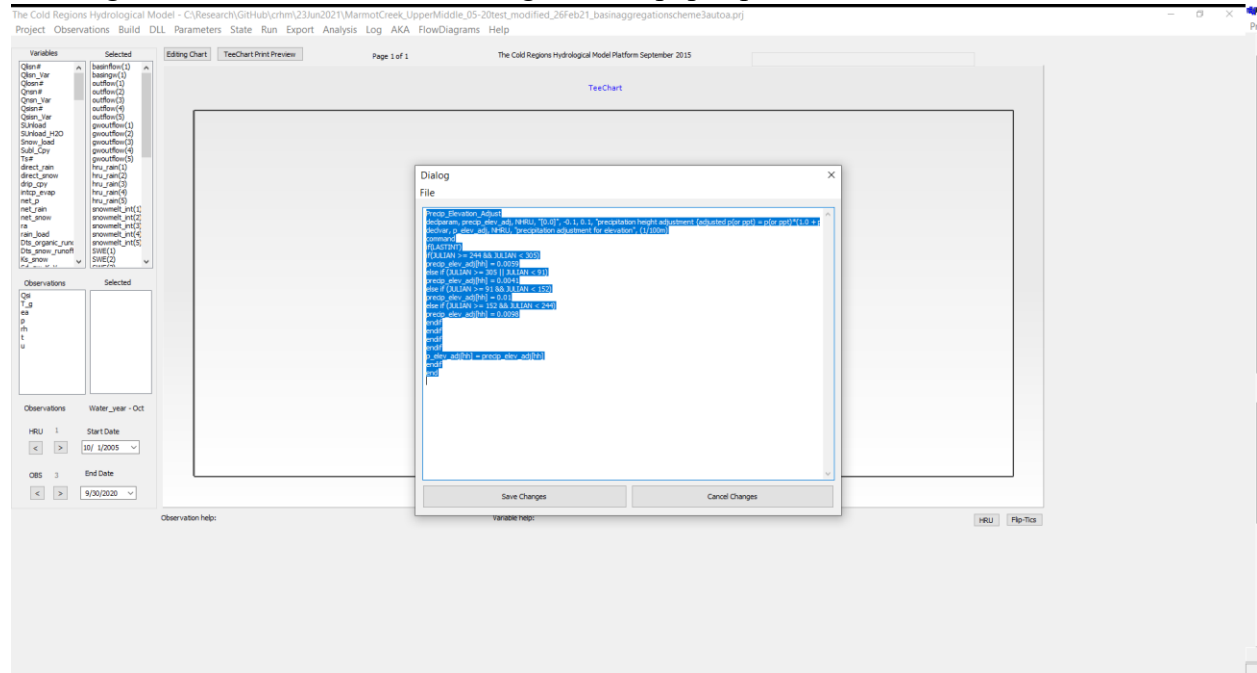
In CRHM_GUI, it appears there are two drop down bars in the circle area shown in the screen shot below; the left bar is active, but the right shorter bar is not active.



Clicking “Build – Clear Modules” button, nothing happens in CRHM_GUI; clicking “Build – Clear Modules” button, all the selected modules will be removed from the “Construct” window and all Variables by Module and selected variables are removed in Borland CRHM, see screen shots below:



Clicking “Build – Macro” button, Dialog window pops up in CRHM_GUI:

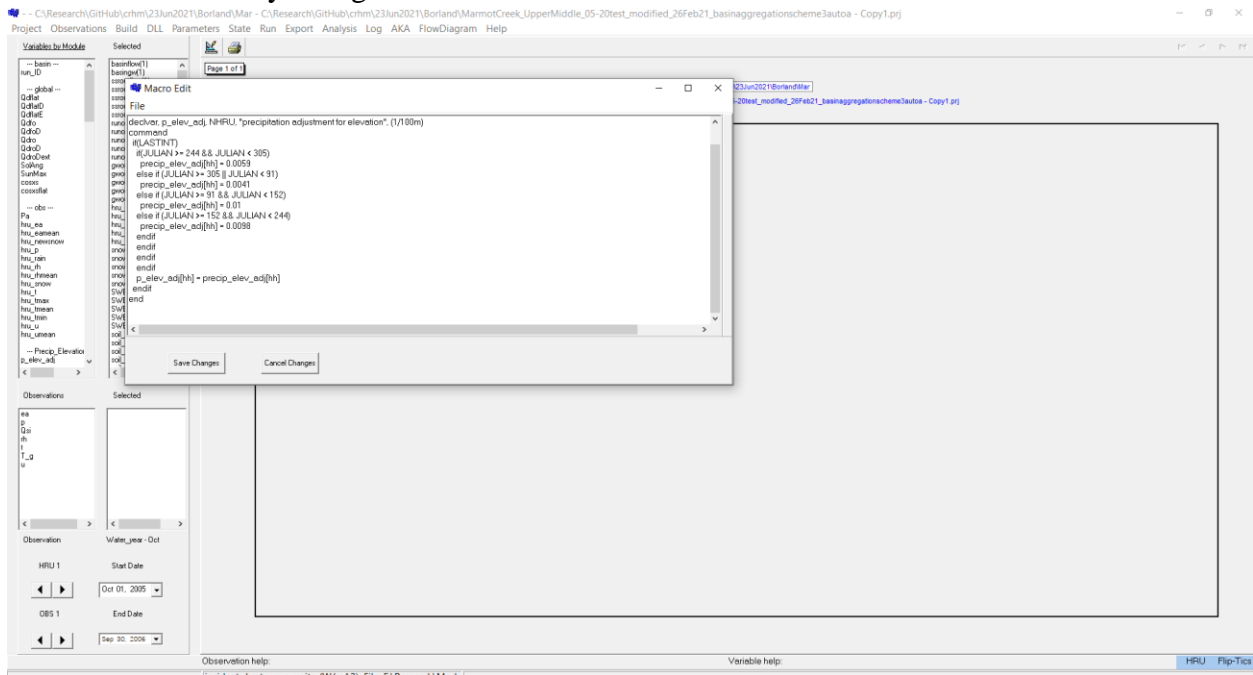


When any changes are made to the Marco code, clicking “Save Changes” button is working in CRHM_GUI. However, clicking “Cancel Changes” button will remove all the selected modules will be removed from the “Construct” window and all Variables by Module and selected variables are removed in CRHM_GUI. Also, if clicking the “Close” button on the upper right corner of Dialog window, all the selected modules will be removed from the “Construct” window and all Variables by Module and selected variables are removed in CRHM_GUI are removed. There appears something not implemented corrected for “Cancel Changes” button and “Close” button.

In Dialog window, clicking “File” button, I checked “Open”, “SaveAs”, “CreateGroup” buttons are working. However, “Clear” and “Exit” button do not work at the moment. In Borland CRHM, clicking “Clear” button will clear all Macro code from the code panel; clicking “Exit” button will close the Macro window.

Also, there are no Maximize and Minimize buttons implemented in the Dialog window for CRHM_GUI.

Clicking “Build – Macro” button, Macro Edit window pops up in Borland CRHM; clicking “Save Changes” will save any changes made to Macro code, and clicking “Cancel Changes” button will revert any changes made to Macro code.

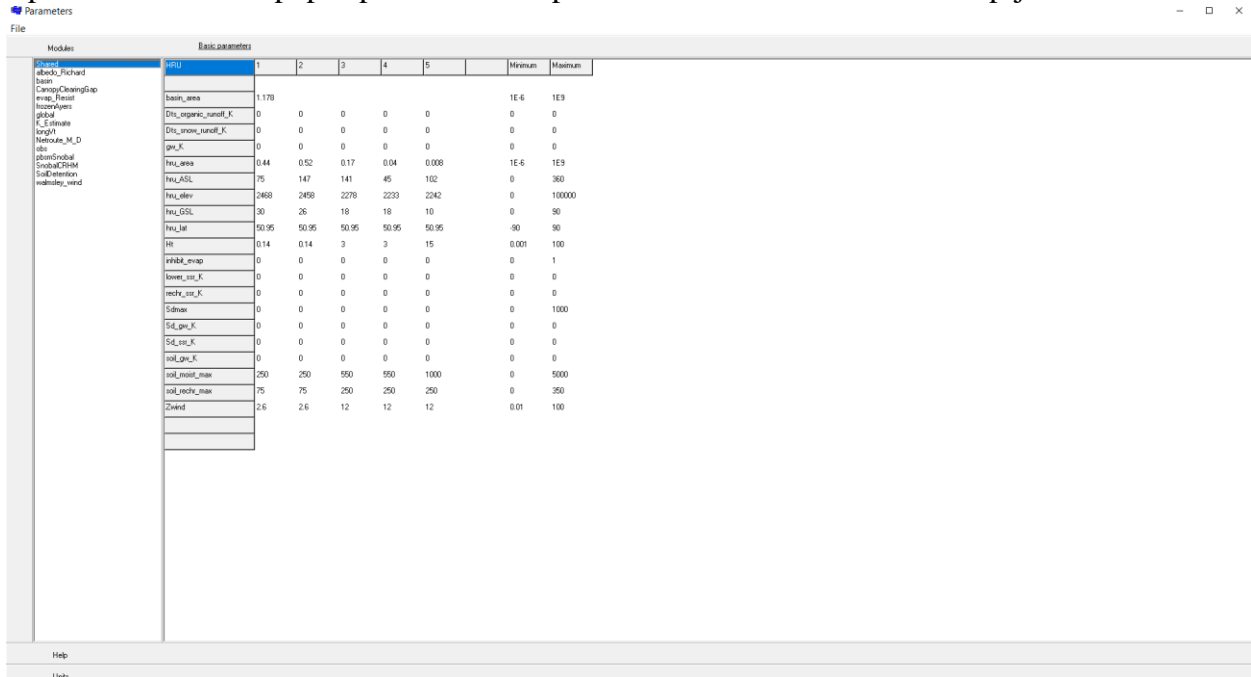


Comment: for CRHM_GUI, in ‘DLL’ menu,

It is not implemented in CRHM_GUI at the moment, which is same as that in Borland CRHM. Just a note, the DLL version Borland CRHM was used more than 15 years ago and was used to implement code from students written in the file as .DLL extension.

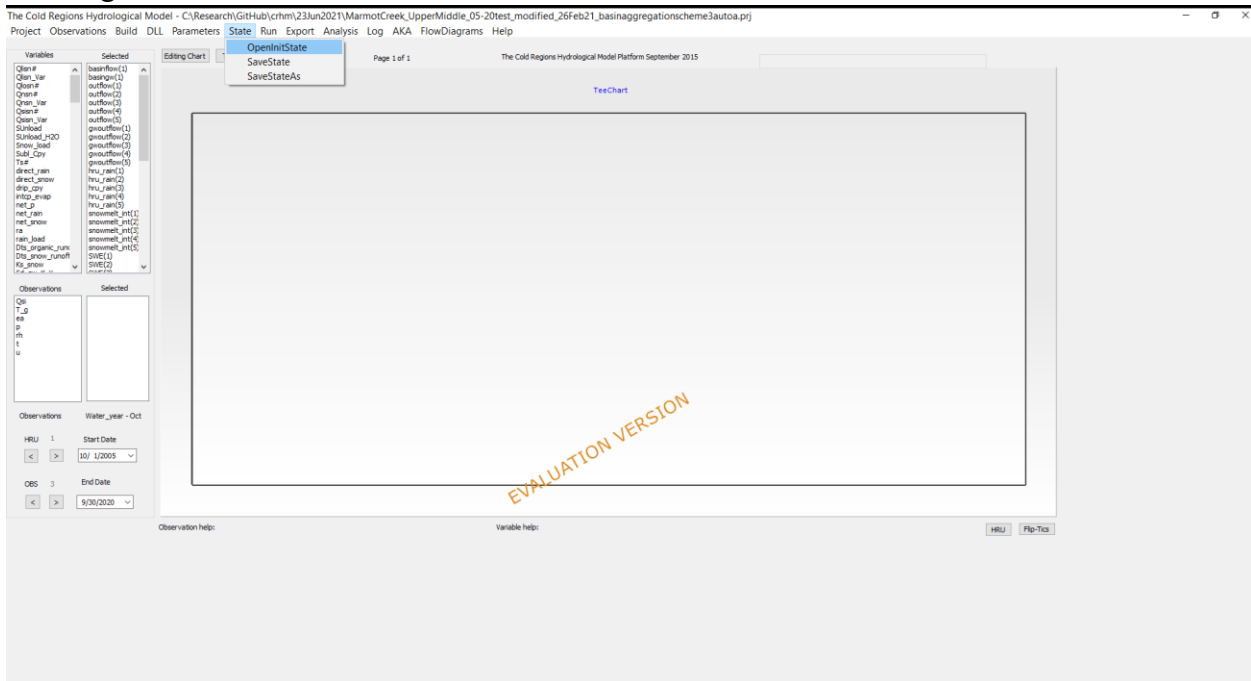
Comment: for CRHM_GUI, in ‘Parameters’ menu,

Clicking “Parameters” button, nothing happens in CRHM_GUI. Doing same in Borland CRHM, a parameter window pops up and contains parameters for the modules in the prj:



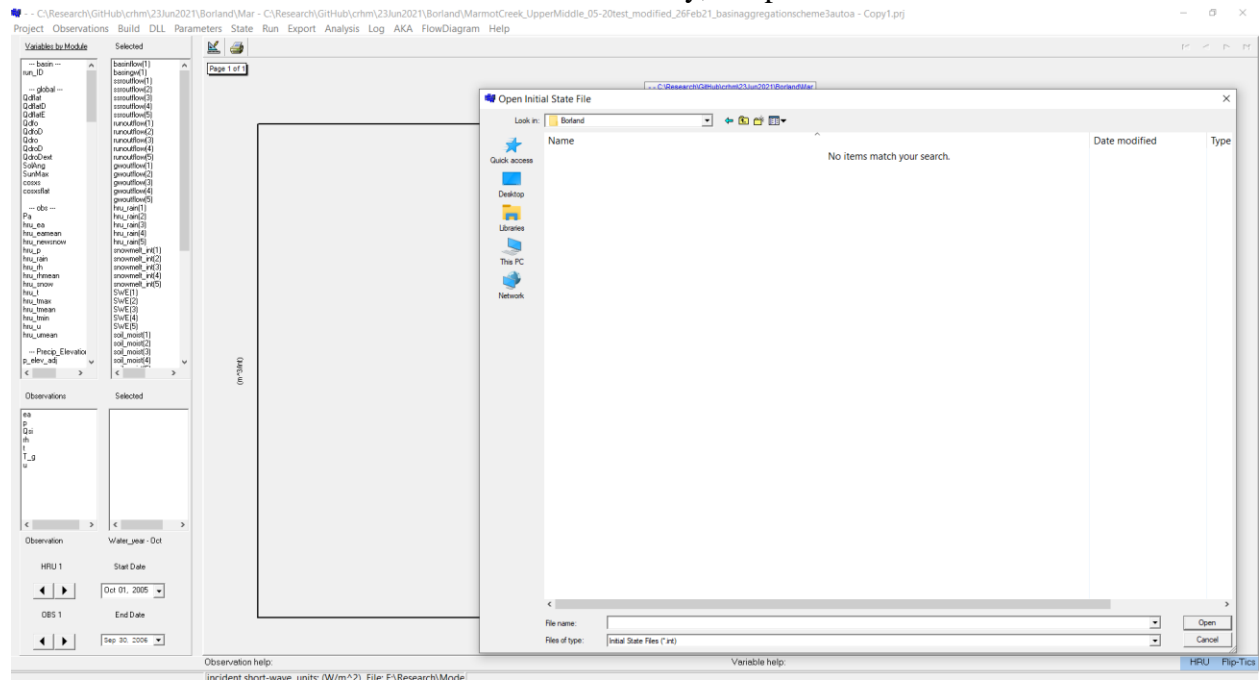
Comment: for CRHM_GUI, in ‘State’ menu,

Clicking “State” button, a menu:

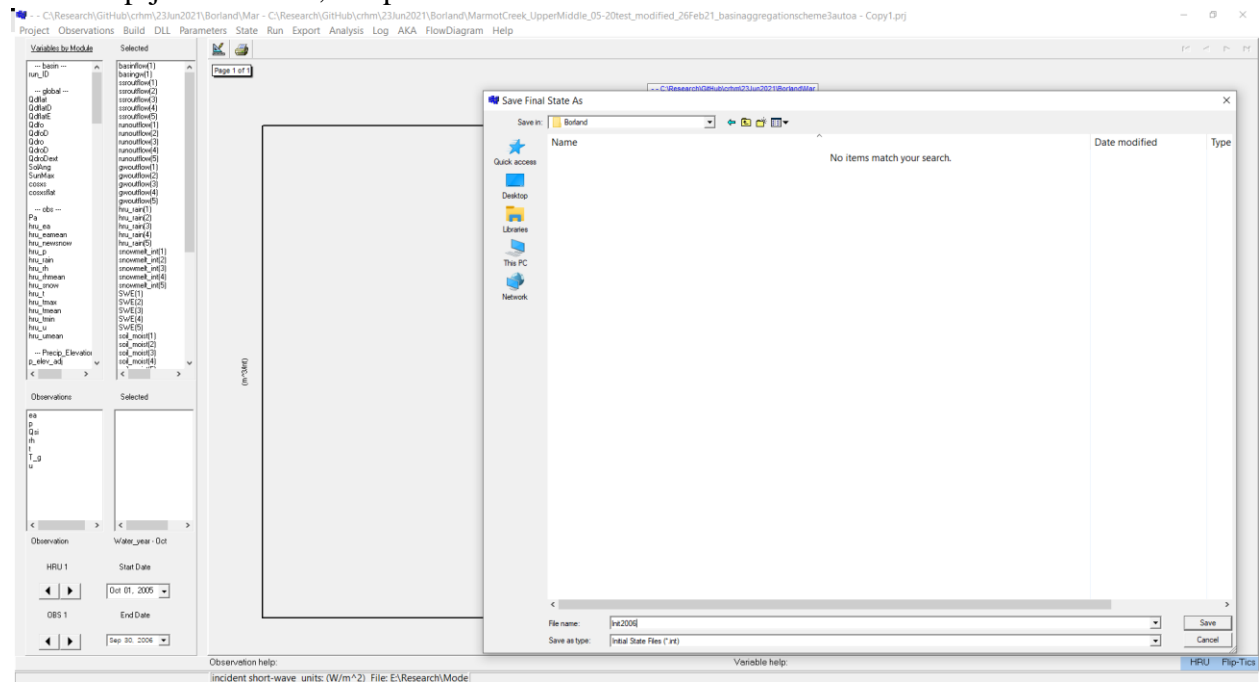


However, click “OpenInitState”, “SaveState”, and “SaveStateAs” buttons, nothing happens in CRHM_GUI.

In Borland CRHM, click “OpenInitState” button, a window pops up and users can choose an Initial State Files in .int extension from a file directory, see plot below:



In Borland CRHM, click “SaveState” or “SaveStateAs” button, a window pops up and users can save the Final State as .int extension to a file directory; eg. Init2006.int is saved the file directory after the prj finishes run, see plot below:



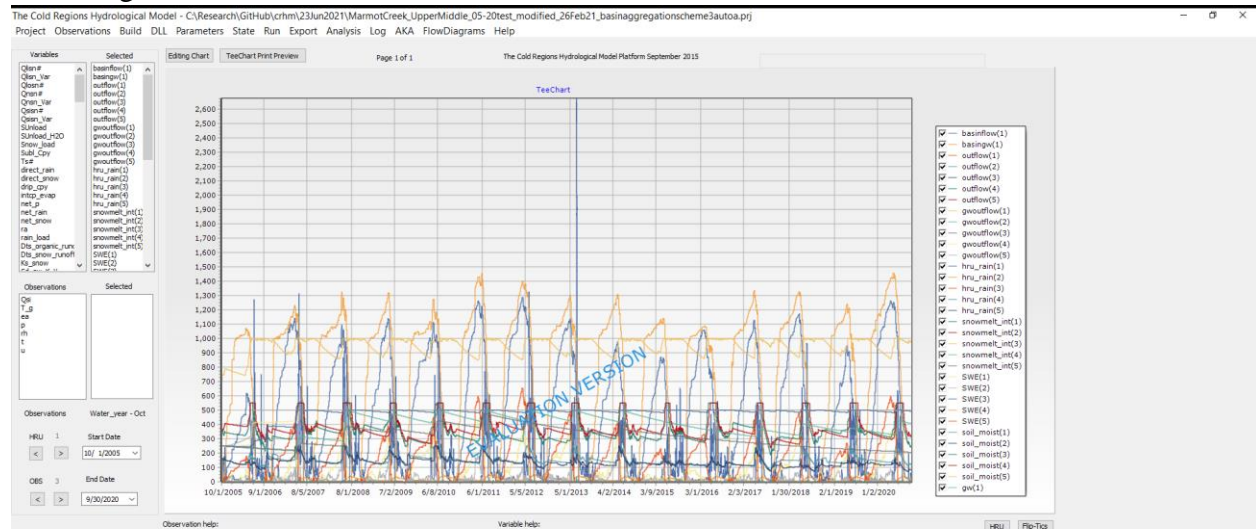
Comments: Saving the final state file from a project and using that as initial state for other project are very useful features from Borland CRHM, as I demonstrated in GitHub issue. These should be implemented in CRHM_GUI.

Comment: for CRHM_GUI, in ‘Run’ menu,

For “MarmotCreek_UpperMiddle_05-20test_modified_26Feb21_basinaggregationscheme3autoa.prj”, this prj has Auto_Run, Auto_Exit and Log_All setup. When this prj is opened in Borland CRHM, it will automatically run without graph update, then automatically save all variables in CRHM_Output_3.txt, and it would close itself when calling this prj and run it from command line.

At the moment, when this prj is opened in CRHM_GUI, it does not automatically run and save variables. I notice there is Log file crhmRun.txt up to crhmRun5.txt generated each time when opening this prj in CRHM_GUI. To run this prj, I have to manually click “Run” button once even though “Run Model” button already has check mark. When this prj is running, it has graph update rate as bi-weekly (default graph update rate), and when I click the graph area once, it stops graph update and finishes the run faster, and there is CRHM_Output_3.txt saved in the end. When I do this in Borland CRHM, there will be a pop up window to choose graph update rate, see comments on Page 7. **I notice that after the first run in CRHM_GUI, CRHM_GUI will automatically save the “MarmotCreek_UpperMiddle_05-20test_modified_26Feb21_basinaggregationscheme3autoa.prj”, and five ssroutflow variables are removed from the saved prj file.**

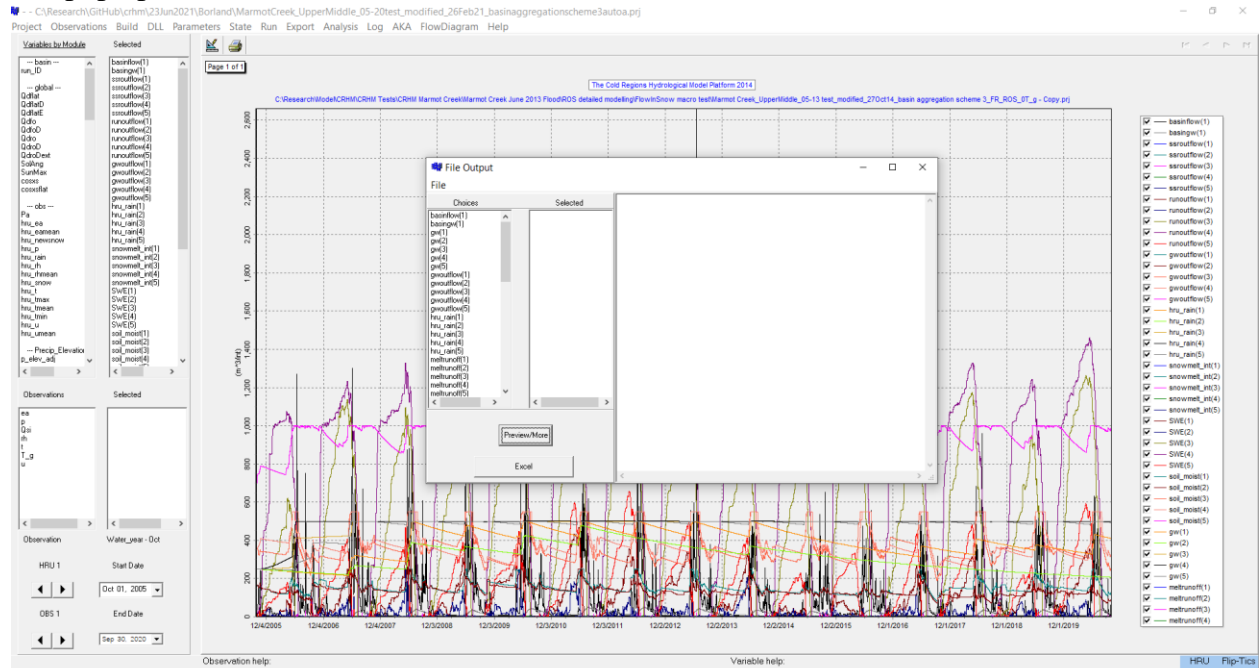
I also compare the output file: CRHM_Output_3.txt from Borland CRHM and CRHM_GUI. The comparisons are shown in UM_basinflow_vcc vs Borland CRHM_comp.pdf and UM_SWE_vcc vs Borland CRHM_comp.pdf files. The results are comparable between vcc CRHM_GUI and Borland CRHM, and vcc CRHM_GUI produces the same results from gcc crhm. Anyway, the following is screen shot for Run from CRHM_GUI:



Comment: for CRHM_GUI, in ‘Export’ menu,

When I click “Export” button after I finish running the above prj, there is no pop up window. It indicates that “Export” button is probably not implemented correctly in CRHM_GUI.

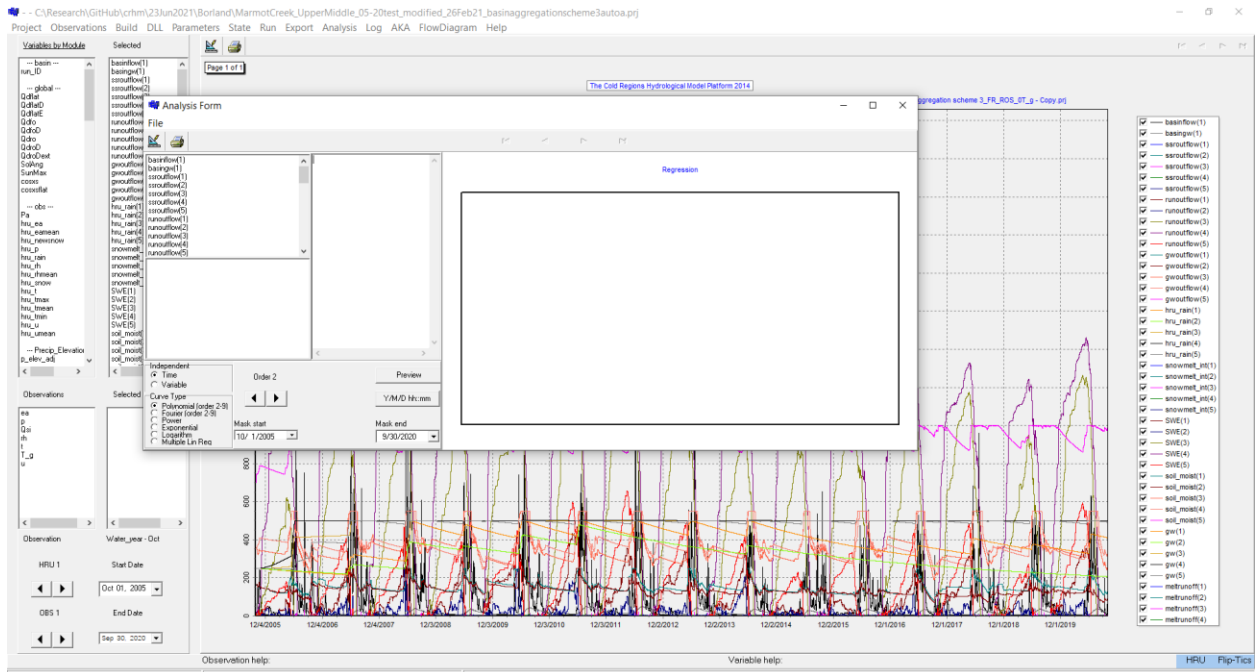
When I do the same in Borland CRHM, there is a pop up window called “File Output” opened, and I can select variables to save and choose the format of output file. I have the screen shot of this pop up window from Borland CRHM:



Comment: for CRHM_GUI, in ‘Analysis’ menu,

When I click “Analysis” button after I finish running the above prj, there is no pop up window. It indicates that “Analysis” button is probably not implemented correctly in CRHM_GUI.

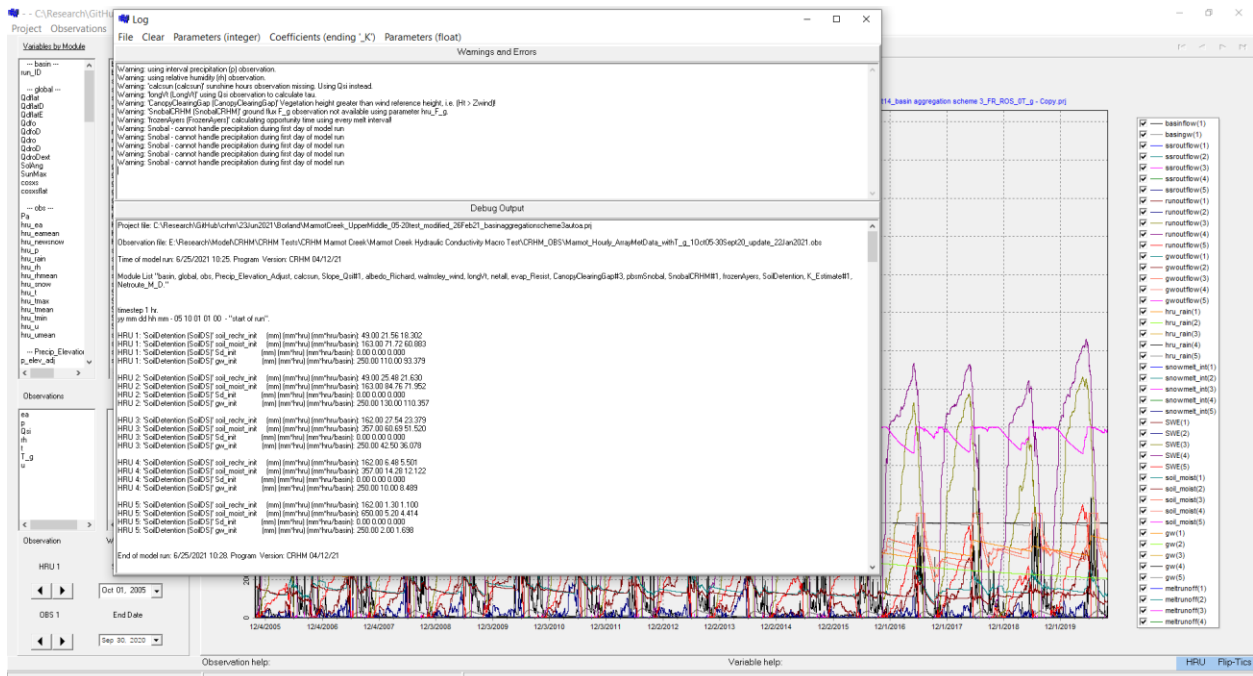
When I do the same in Borland CRHM, there is a pop up window called “Analysis Form” opened, and I can select variables to do some simple analysis using the Curve Type provided. I have the screen shot of this pop up window from Borland CRHM:



Comment: for CRHM_GUI, in ‘Log’ menu,

When I click “Log” button after I finish running the above prj, there is no pop up window. It indicates that “Log” button is probably not implemented correctly in CRHM_GUI. CRHM_GUI produces up to five Log files externally containing the information: crhmRun.txt up to crhmRun5.txt files.

When I do the same in Borland CRHM, there is a pop up window called “Log” opened, and this shows the information of values for the list of module variables during the simulation period. I have the screen shot of this pop up window from Borland CRHM:



Comment: for CRHM_GUI, in ‘AKA’ menu,

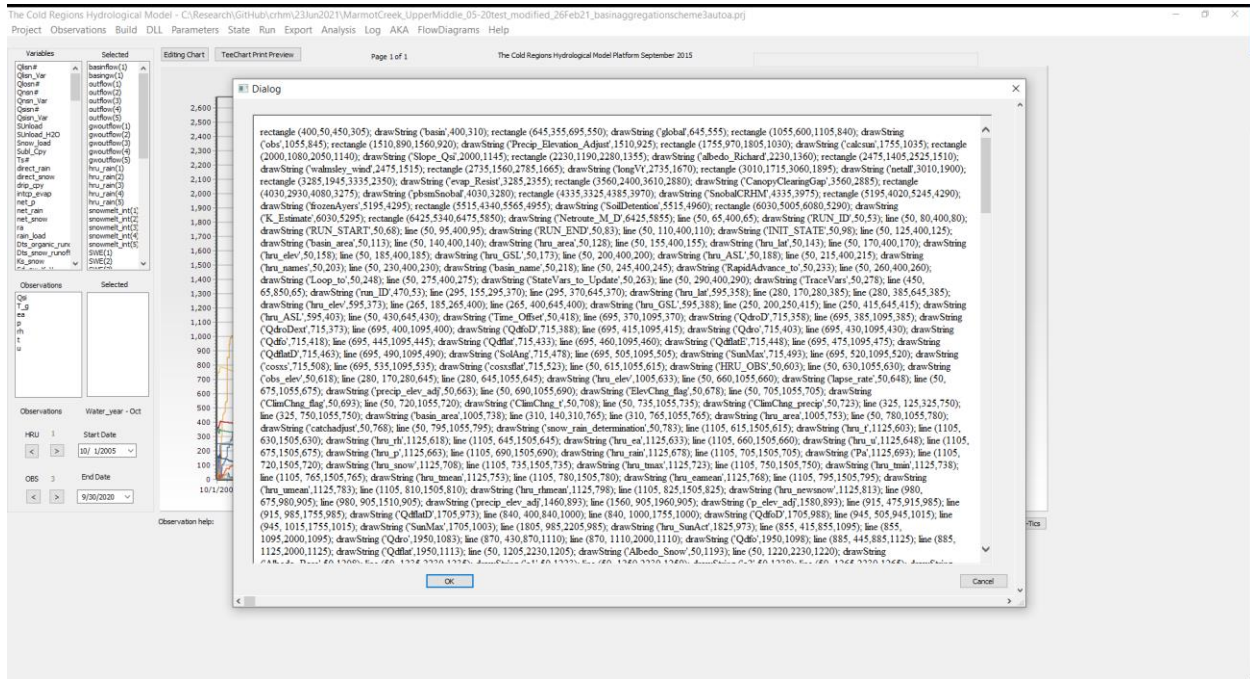
When I click “AKA” button after I finish running the above prj, there is no pop up window. It indicates that “AKA” button is probably not implemented correctly in CRHM_GUI.

When I do the same in Borland CRHM, there is a pop up window called “Module customization” opened. More than 10 years ago, this is only way to have user ability to customize the input observation or input variable for a module by forcing output observation or output variable from another module. Now, there are variations of modules in Borland CRHM (eg. CanopyClearingGap, CanopyClearingGap#1 to #4), which does that without using AKA.

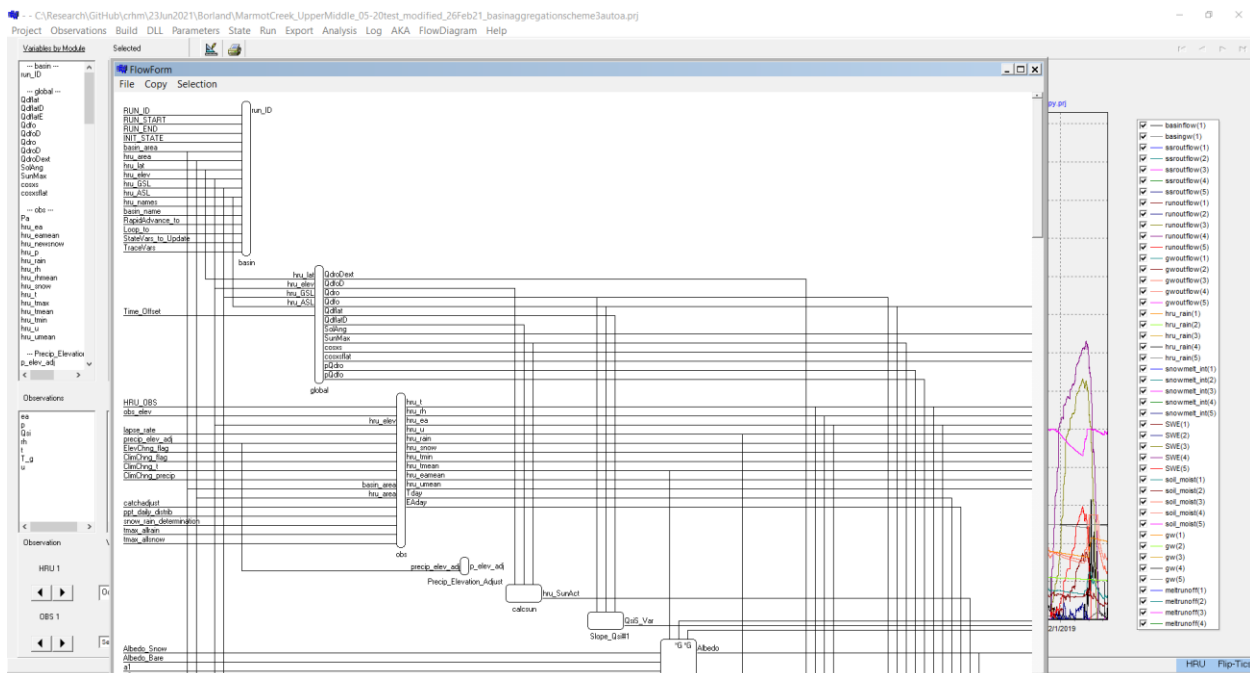
AKA feature might still be useful, so it could be implemented in CRHM_GUI.

Comment: for CRHM_GUI, in ‘FlowDiagrams’ menu,

When I click “FlowDiagrams – Show Diagram” button after I finish running the above prj, there is a pop up window that shows the following screen shot:



When I click “FlowDiagrams” in Borland CRHM, a pop up window shows the flow chart of the prj:

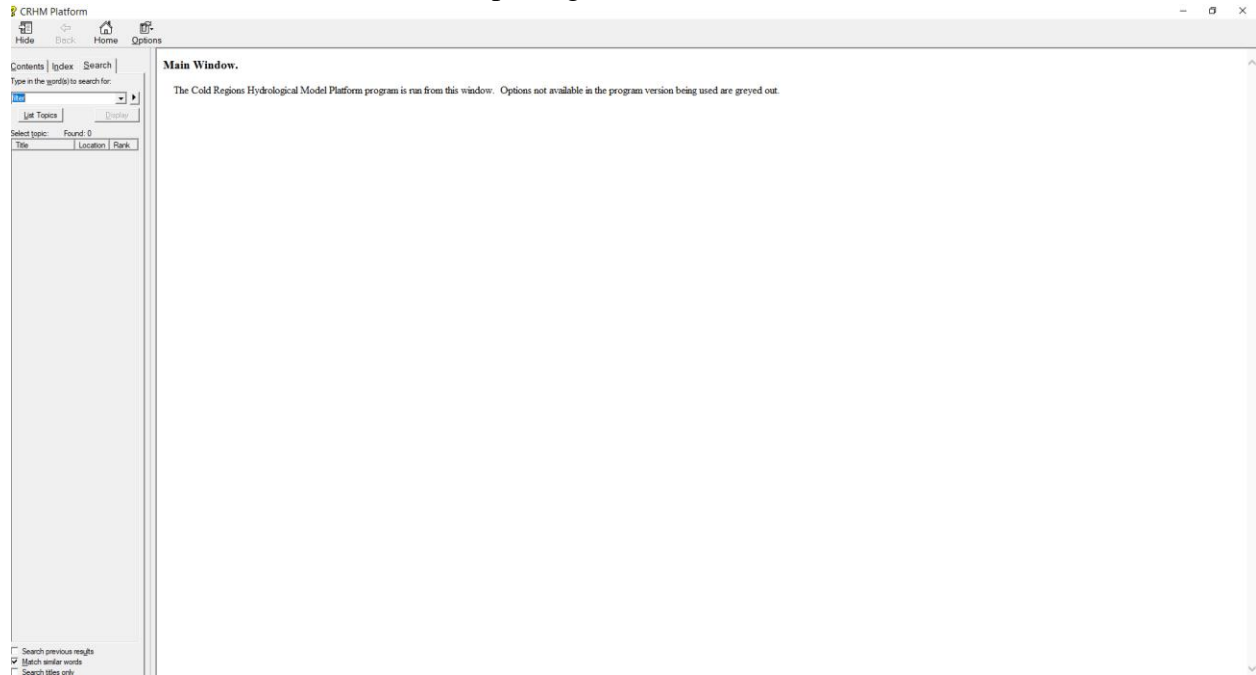


Comments: this indicates that CRHM_GUI does not implement flow chart correctly at the moment.

Comment: for CRHM_GUI, in ‘Help’ menu,

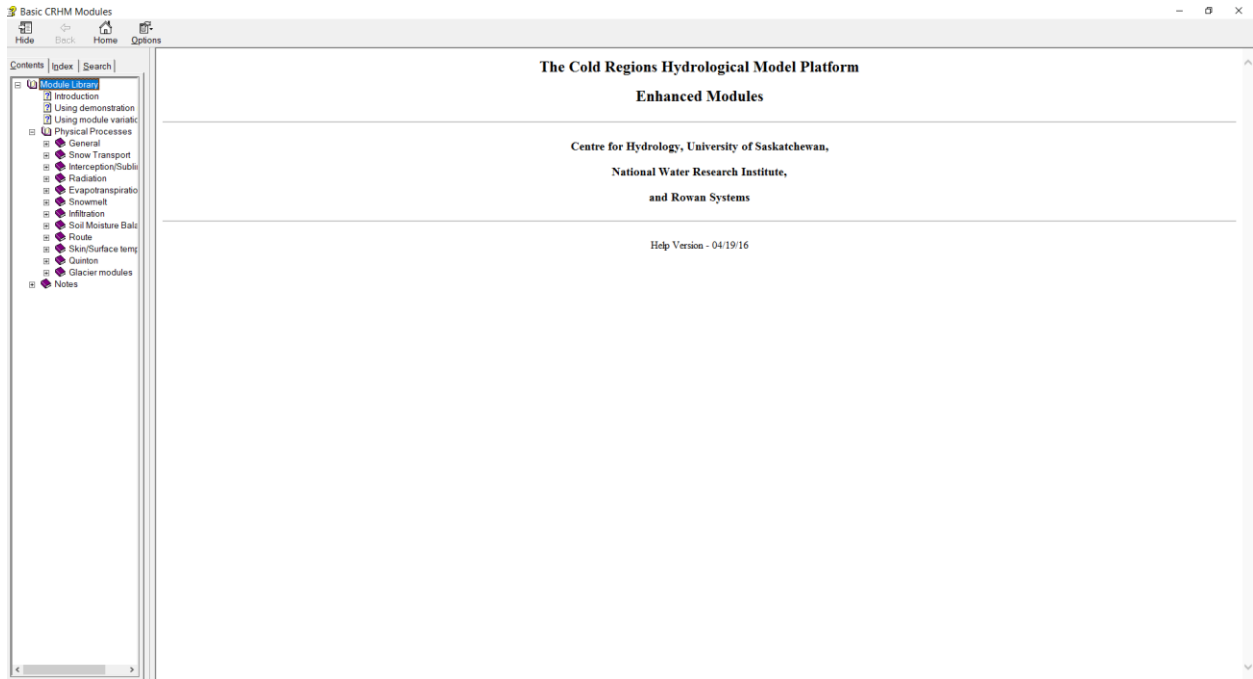
When I click “Help – CRHM help” button, there is no pop up window.

When I do the same in Borland CRHM, a pop window “CRHM Platform” opens. See below, this provides general information for the CRHM platform, and it is linked to the “Crhm.chm” file from the Borland CRHM installation package.

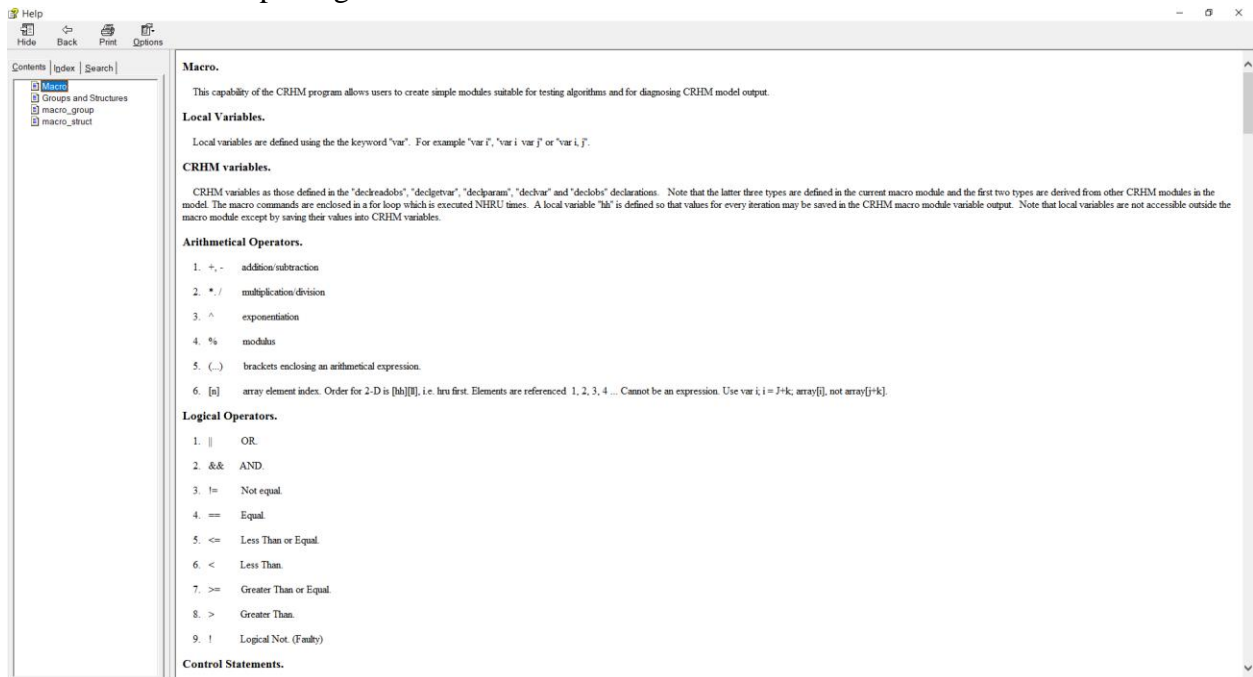


When I click “Help – Modules_New” button, there is no pop up window.

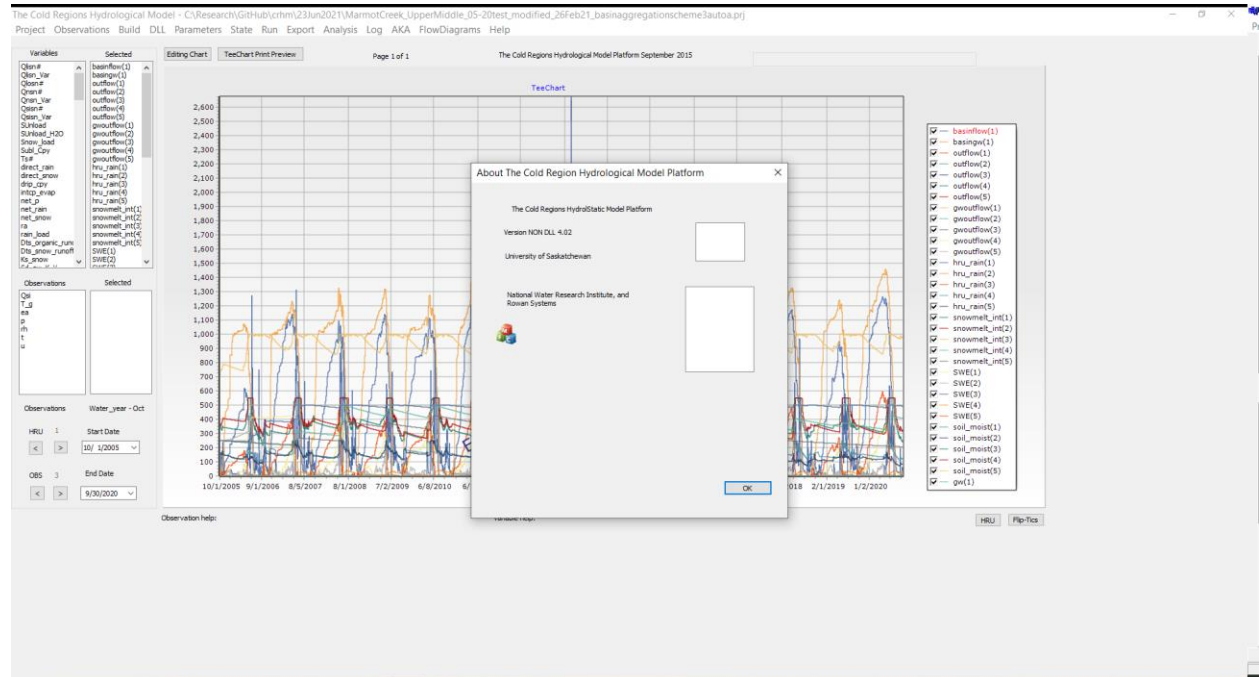
When I do the same in Borland CRHM, a pop window “Basic CRHM Modules” opens. See below, this provides information for CRHM modules and it is linked to the “Modules_new.chm” file from the Borland CRHM installation package.



In addition, when the “MarmotCreek_UpperMiddle_05-20test_modified_26Feb21_basinaggregationscheme3autoa.prj” is opened in Borland CRHM, as this prj uses Macro, I can click “Help – Macro” button. The following window pops up and shows the information for Macro, and this is linked to the “Macro.chm” file from the Borland CRHM installation package.



When I click “Help – About” button in CRHM_GUI, there is pop up window showing the version of CRHM_GUI:



When I click “Help – About” button in Borland CRHM_GUI, there is pop up window showing the version of Borland CRHM:

