Morphological Acceleration Workshop

Objective: This workshop will introduce you to the workflow associated with the morphological acceleration approach to improving run time and testing protocol.

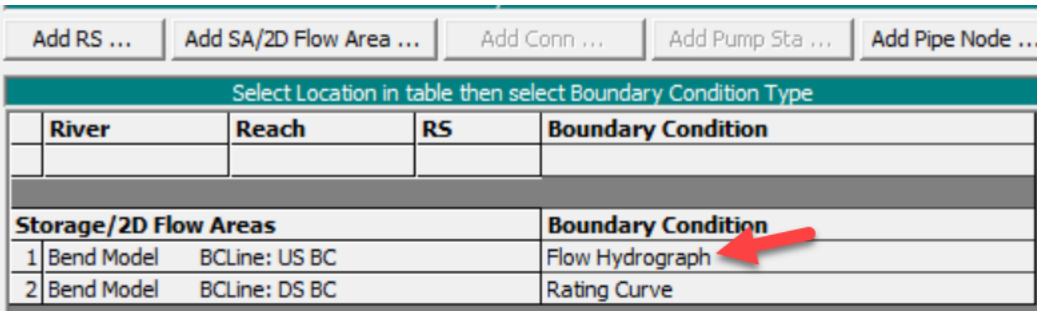
Morphological acceleration can decrease your run time by accelerating morphological response and compressing the time series. But this requires several steps to synch your flow data with your acceleration parameter. This workshop guides you through those steps.

Convert DSS Flows to Tabular Data

If your flows are already in the manual flow data editor, you can just adjust the time step. However, this model gets the flows from DSS, so we have to copy them into the manual data editor.

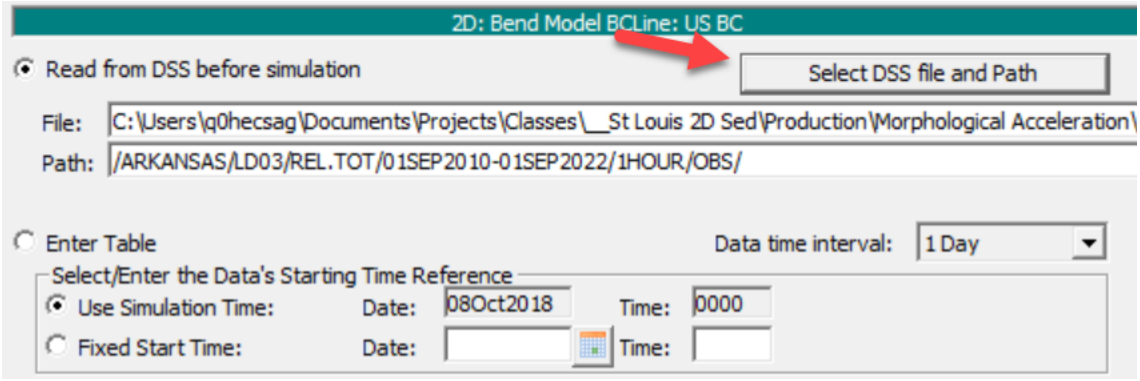
1. Open the **Unsteady Flow** file.

2. Open the **Flow Hydrograph** associated with the upstream boundary condition.



The **Enter Table** portion of the editor is empty, but the **Read from DSS before simulation** is selected with a DSS file and path.

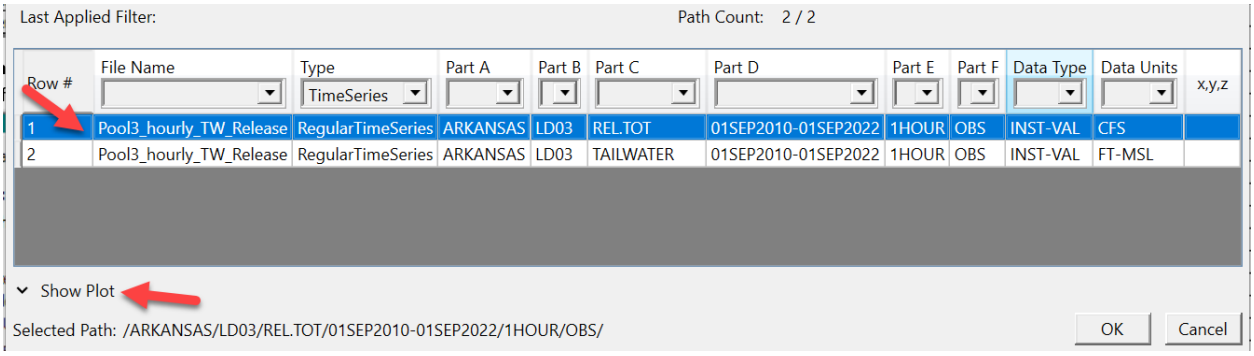
3. Press the **Select DSS file and Path** button to launch the DSS editor.



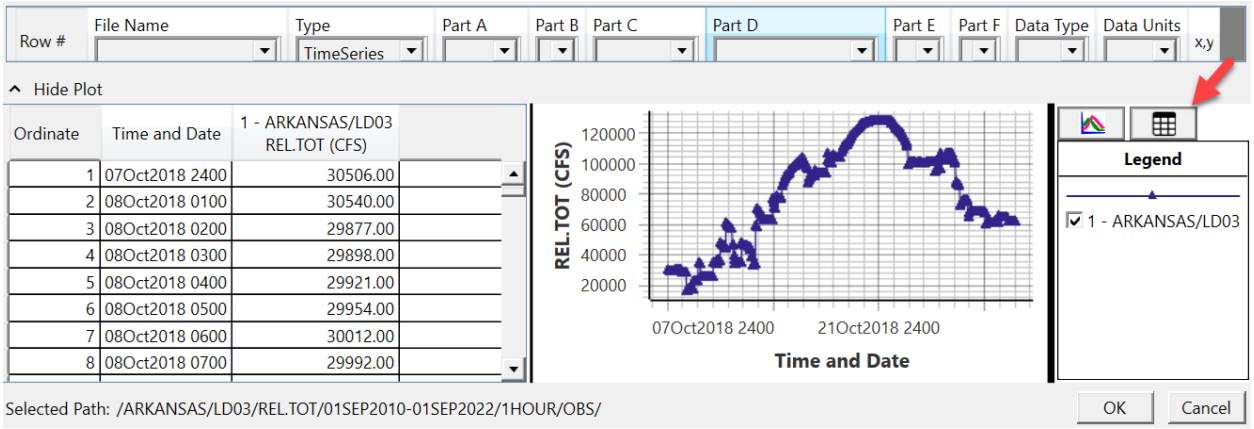
This should open the DSS file which has two boundary conditions, **Rel.TOT** is the total flow upstream and **Tailwater** is a stage downstream which we will not use.

4. Click on **Rel.TOT** and press the **Show Plot** arrow at the bottom of the editor.

This should plot the hydrograph in the DSS file which is a large event from 2018 (WY2019).



5. Press the Data grid button  to switch to the tabular data.



These are hourly data.

6. Copy the flow column by selecting it (you cannot just click on the heading, you will have to select the first one and scroll down, hold S**hift** and select the last one) and pressing **CTRL-C**.

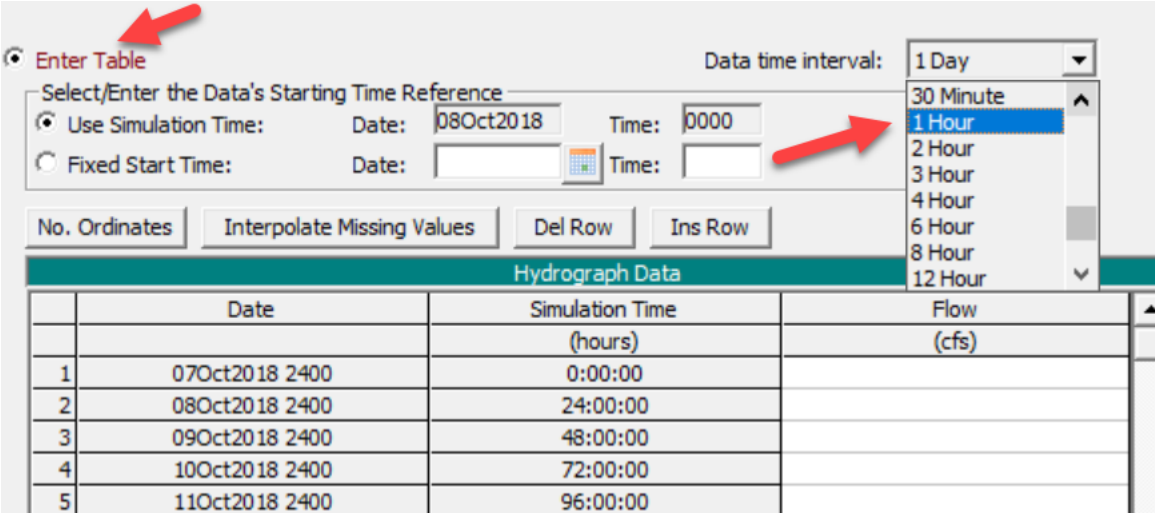
7. Press **OK** to close out of the DSS editor and Return to the Flow Editor.

8. Select the **Enter Table** radio button to use the manual data table.

9. Switch the **Data time interval**: to the time step of the data we are pasting (1 hour)

10. Then paste the data by clicking the heading of the **Flow** column so the whole column turns blue and pressing **Ctrl-V**. (Note: you no longer have to change the **No. Ordinance** first, RAS recognizes that you are pasting >100 flows).

11. Press OK to save the flows and select **File→Save** As and name your file something like "Morphological Acceleration Flows."



Set The Morphological Acceleration Factor

12. Open your sediment file by pressing the sediment data button 

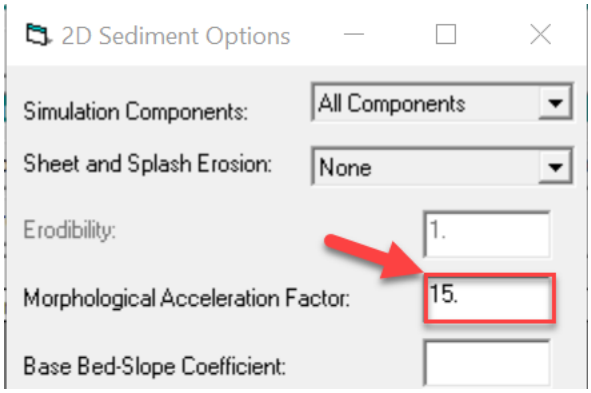
or selecting **Edit→Sediment Data** .

13. Select **Options→2D Options** from the Sediment Data Editor.

Because we have to change our input time to use the Morphological Acceleration, it is useful to choose a Morphological Acceleration Factor that is easily divisible by the time step.
For example, if a boundary condition data increment is 15 minutes, selecting Morphological Acceleration Factors of 3, 5, or, 15 makes it easier to adjust these data to accommodate the temporal dilation.

What are some Morphological Acceleration Factors that will make the time shift easier with a 1 hour time step? _____

This is a workshop which we want to run fast, so a morphological acceleration factor of 30 (though this is on the high side of what you would use for a project, I would start with 4, 6, 10, 15, or even 20).



14. Select **File→Save As** and call the file something like “Morphological Acceleration 24.”

Adjust your Time Series to Sync with Your Morphological Acceleration Factor

15. Return to your flow file and your upstream hydrograph.

Because HEC-RAS does not automatically update the flow series to match the morphological acceleration of the sediment model, you must change your time step.
If you speed up the bed change, you must dilate time to match, reducing the time of each flow proportionately.

Fill out the following chart with the appropriate accelerated time step for your hourly data for different Morphological Acceleration Factors:

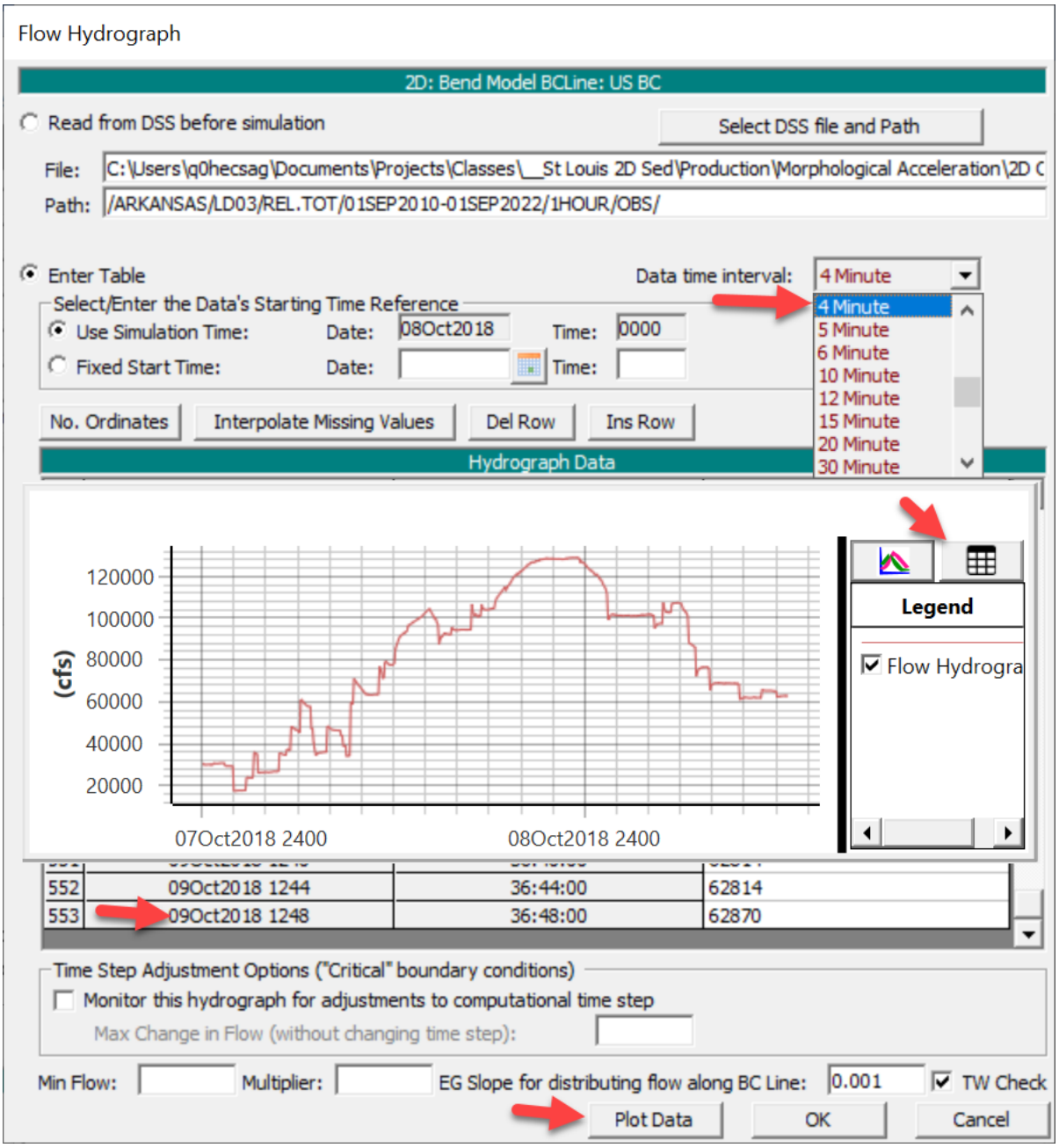
Morphological Acceleration Factor	Updated Time Step
2	
5	
6	
10	6 Minute
15	
20	
30	

https://www.hec.usace.army.mil/confluence/rasdocs/h2sd/ras2dsed/latest/sediment-data/2d-options#id-.2DOptionsv6.3-MorphologicAccelerationFactor

16. Open the Unsteady Flow file again and open the flow hydrograph associated with the upstream boundary condition.

17. Change the time step to compress your flow time series to match the morphological acceleration. (See Figure on next page).

18. Then scroll down to the final row of the flow table and/or press **Plot Data** and choose the data table to determine the new final date and time associated with the end of your compressed time series. You will need that to define your plan.

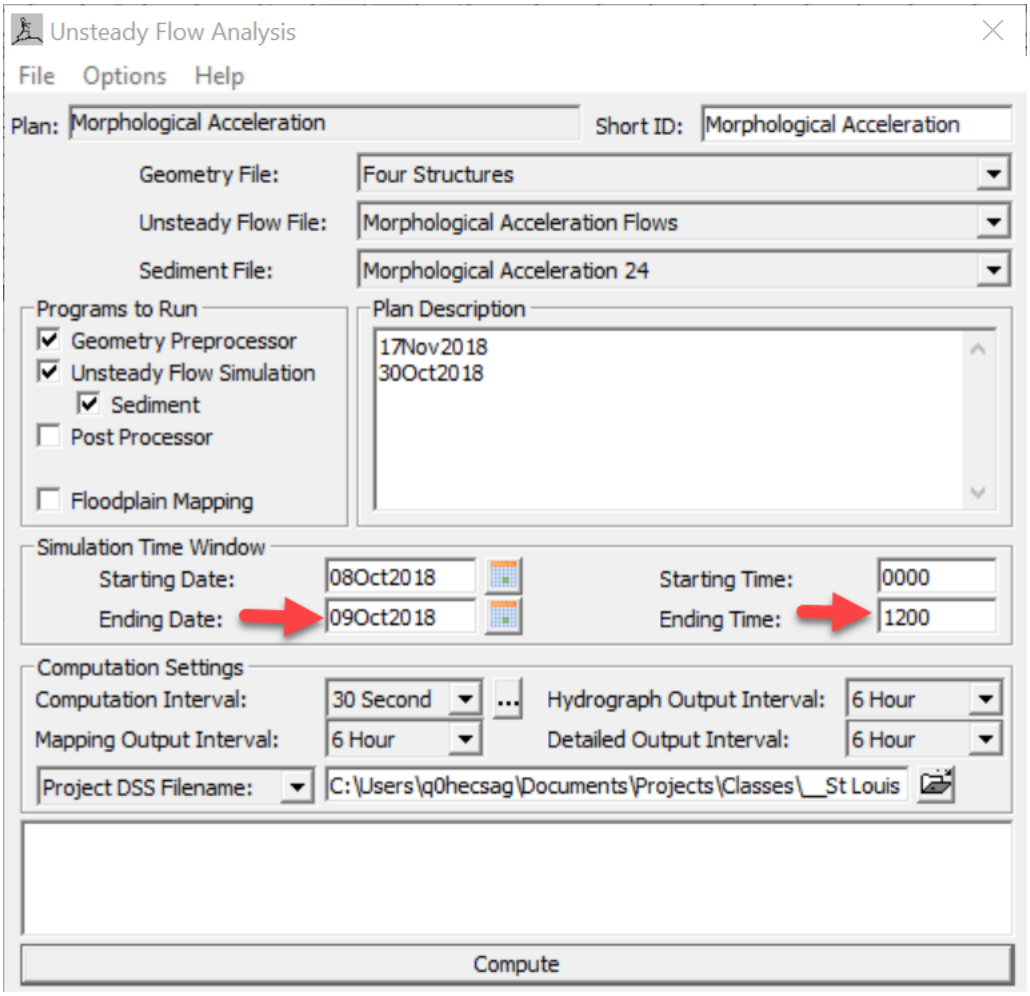


19. Open the **Unsteady Flow Analysis** widow either by selecting **Run→Unsteady Flow Analysis** or by pressing the unsteady simulation button. 

20. Select **File→Save As** and give the simulation a new name and Short ID like “Morpological Accleration.”

21. Change the Ending date and time to match the end of your compressed flow time series.

22. Press the **Compute Button**.



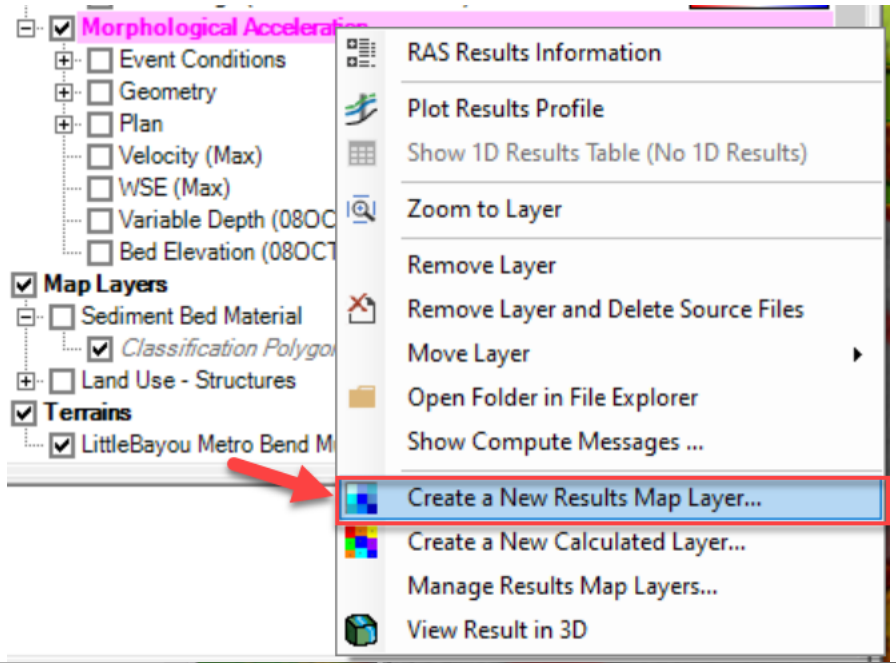
Review Results

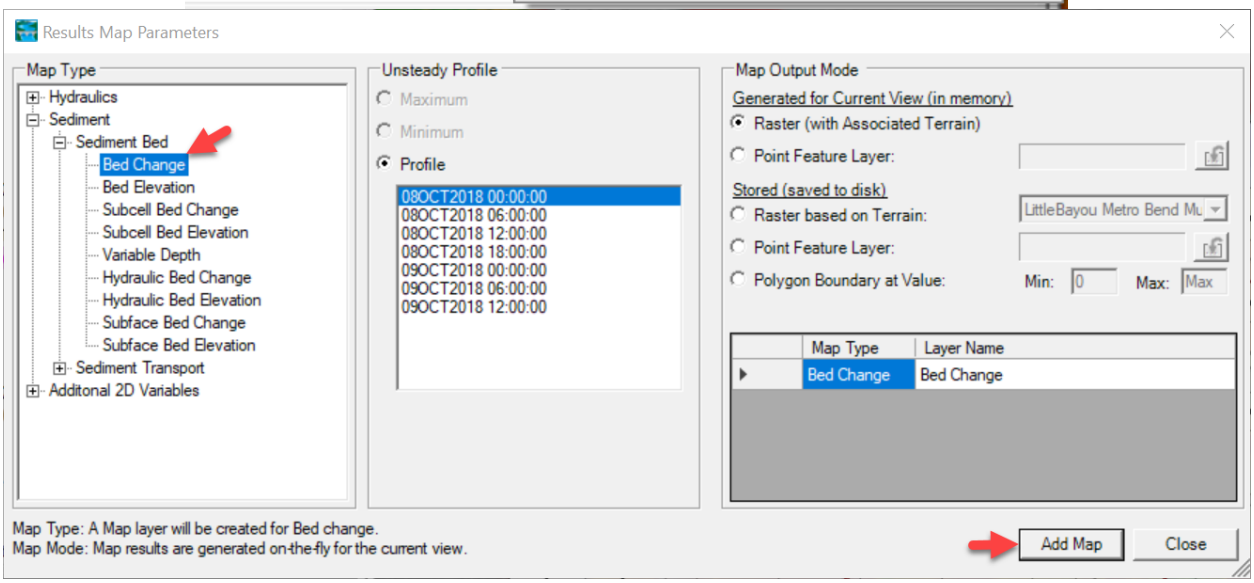
23. Open RASMapper by pressing the Mapper button  or selecting **GISTools→RASMapper**.

24. Add the bed change variable to the new result.

25. Under the Result Node, Right click on the new result and choose **Create a New Results Map Layer…**

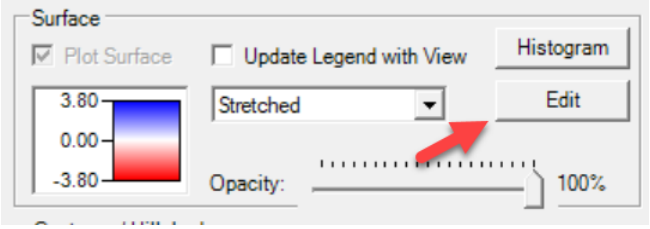
26. Then select **Bed Change** under the **Sediment Bed** variables and press the **Add Map** button.



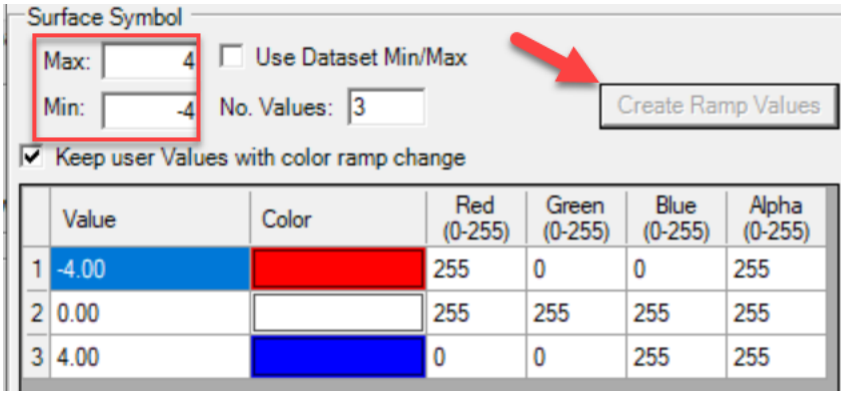


27. To visually compare the results, you must make sure the plot range is consistent between the results maps. For both the existing and new plans, right click on **Bed Change** result and choose **Layer Properties.**

28. In the Surface section of this editor, press the **Edit** button.



29. Choose consistent and *symmetrical* (max and min have the same magnitude but opposite signs) max and mins for both results and press the **Create Ramp Values** button to apply them.



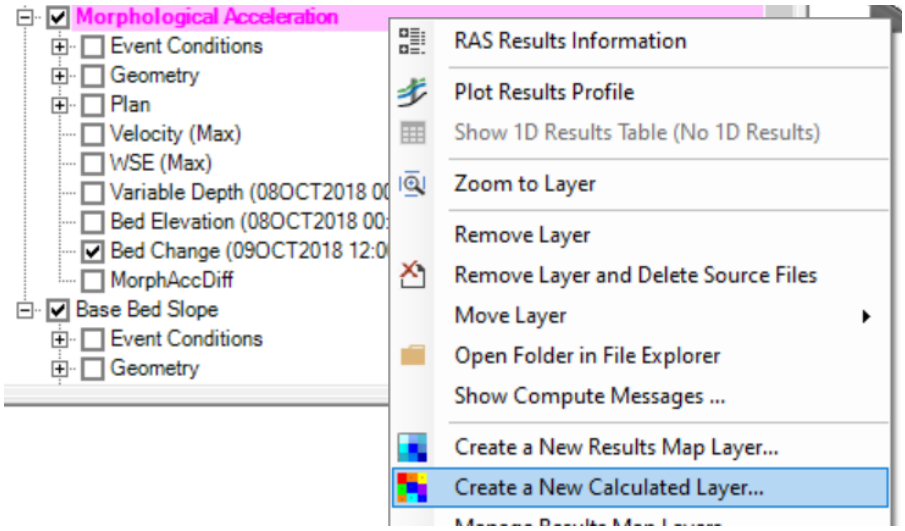
	Value	Color	Red (0-255)	Green (0-255)	Blue (0-255)	Alpha (0-255)
1	-4.00		255	0	0	255
2	0.00		255	255	255	255
3	4.00		0	0	255	255

30. Visually inspect your results.

Does the Morphological Acceleration seem like an appropriate approximation of the unaccelerated simulation? _____

You can also compute a difference map to evaluate the error introduced by morphological acceleration.

31. Right Click on one of the results nodes in the Mapper tree and select **Create a New Calculated Layer.**

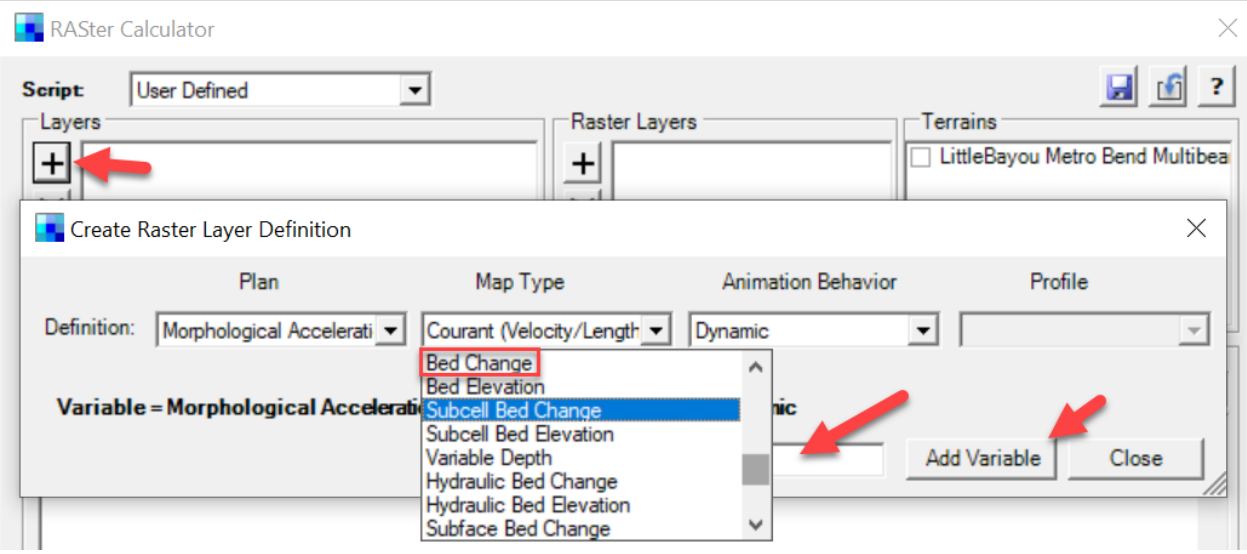


32. Add the bed change for both plans by adding variables with the + button.

33. Select **Bed Change** under **Map Type**.

34. Name the variable.

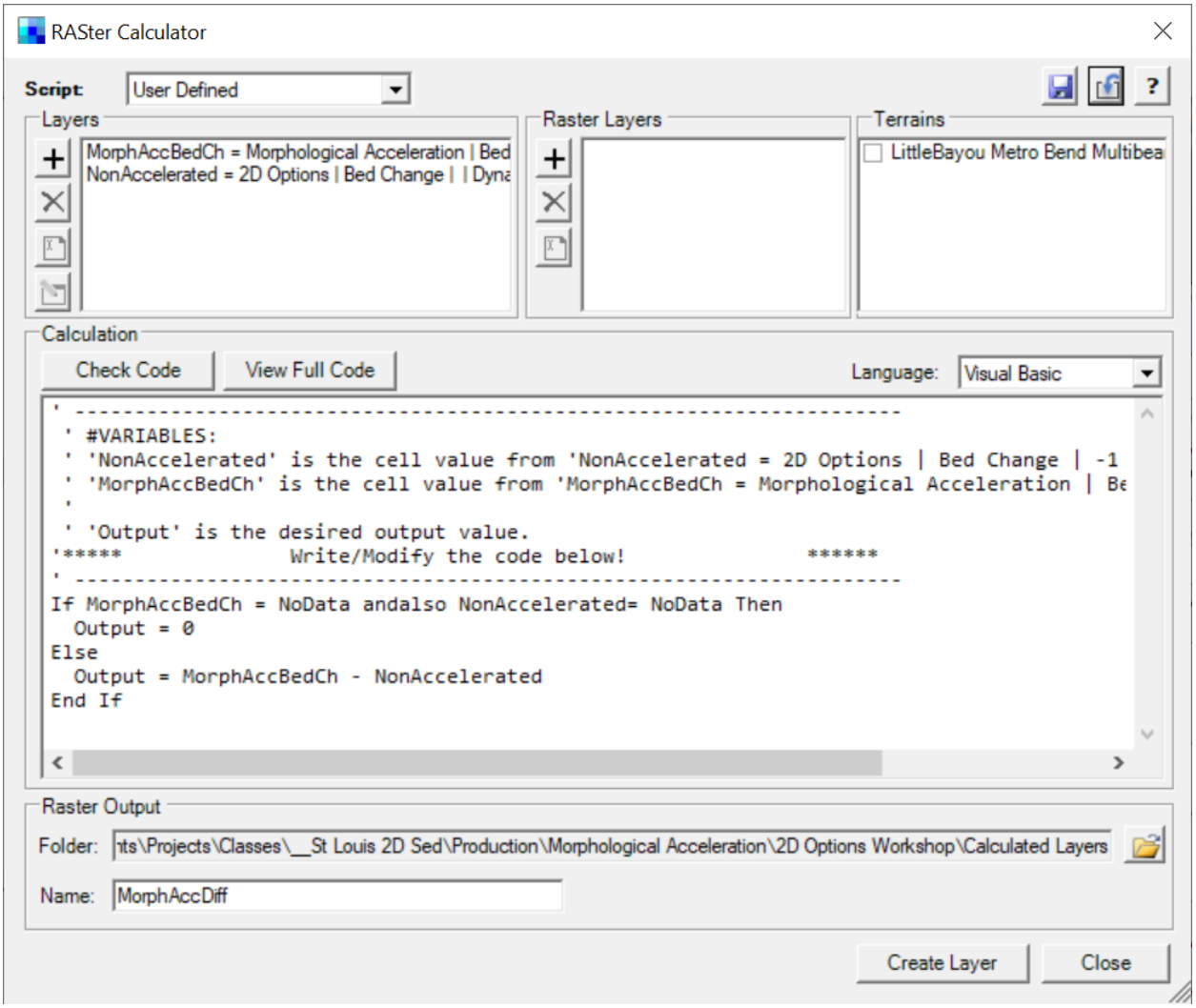
35. Press the **Add Variable** Button.



36. After you have defined the bed change for both plans as variables, edit the script with the **andalso** command in the opening line and a simple difference in the else statement (see example on next page).

37. When you plot the results in the bed change color ramp turn off hill shade.

Does the Morphological Acceleration seem like an appropriate approximation of the unaccelerated simulation? _____



If you have time, make another sediment file and try to explore the effect of overloading the boundary condition. Open the sediment file, choose the **Capacity Ratio** boundary condition, and select a boundary condition >1 (e.g. 1.5 introduces 50% more sediment than the equilibrium load.