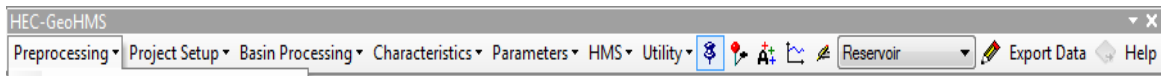
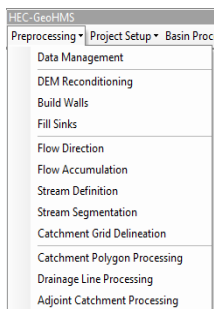


Hands on exercise on Rainfall-Runoff Modelling

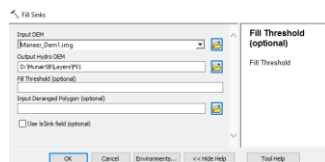
1. Create a new .mxd map document.
2. Add DEM to the map document.
3. Right-click on the map window to activate the HEC-GeoHMS toolbar.



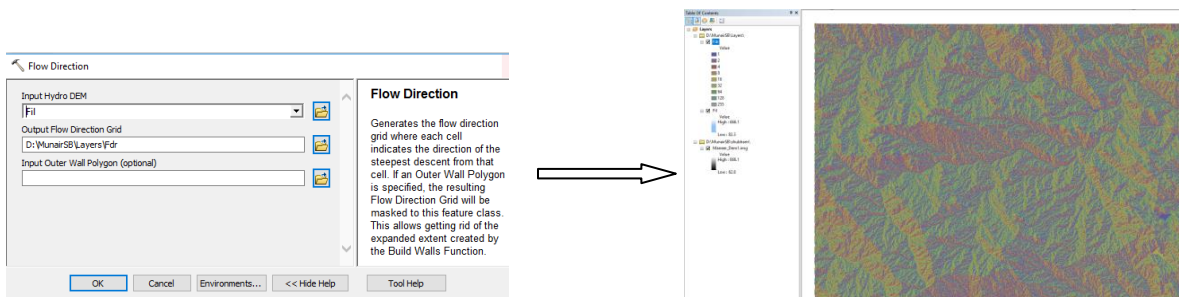
4. Right-click on the map window to activate the ApUtilities tool bar.
5. Drop Down the Pre-Processing menu on the GeoHMS Toolbar, and run all the steps in sequential order (Note - We can leave DEM Recondition, Build walls). In the step (Stream Definition) while creating the stream grid, define the area as 700 Sq.km



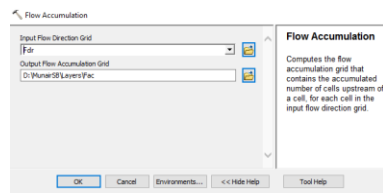
Step 1. Fill the DEM



Step 2. Flow Direction

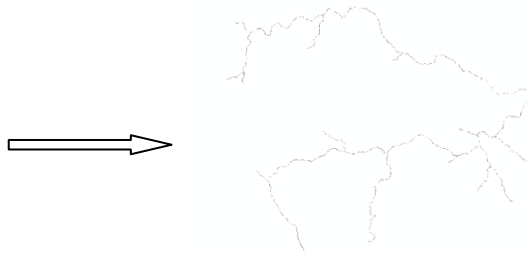
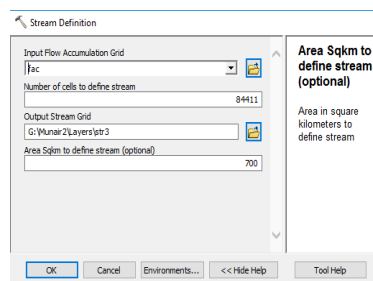


Step 3. Flow Accumulation

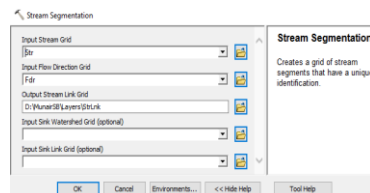


Step 4. Stream Definition

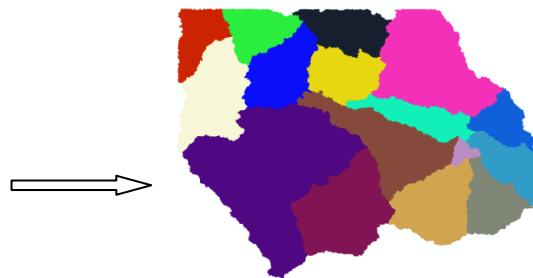
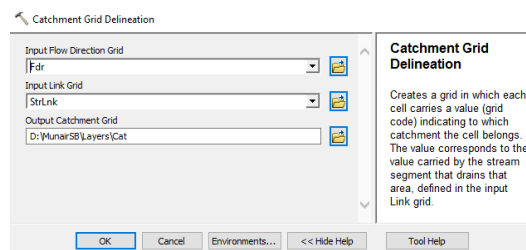
We have to give proper threshold in terms of area or number of cells to adjust sub basins according to one. For the current project we have given area option for the threshold value and keep it 700 sq. km.



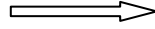
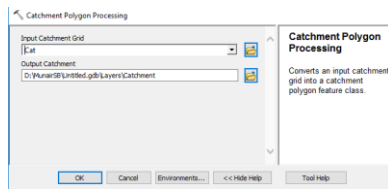
Step 5. Stream Segmentation



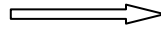
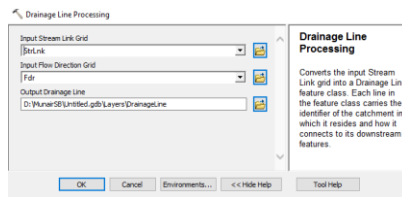
Step 6. Catchment Grid Delineation



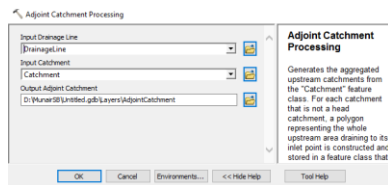
Step 7. Catchment Polygon Processing



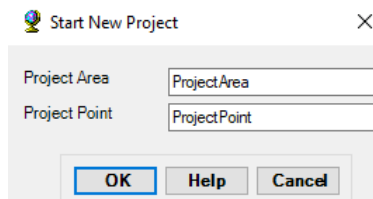
Step 8. Drainage Line Processing



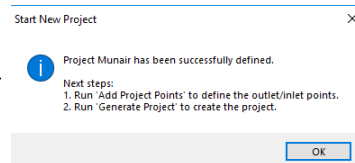
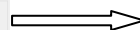
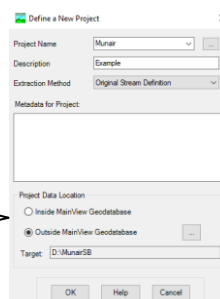
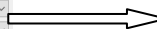
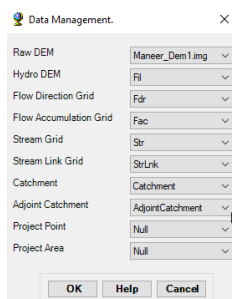
Step 9. Adjoint Catchment Processing




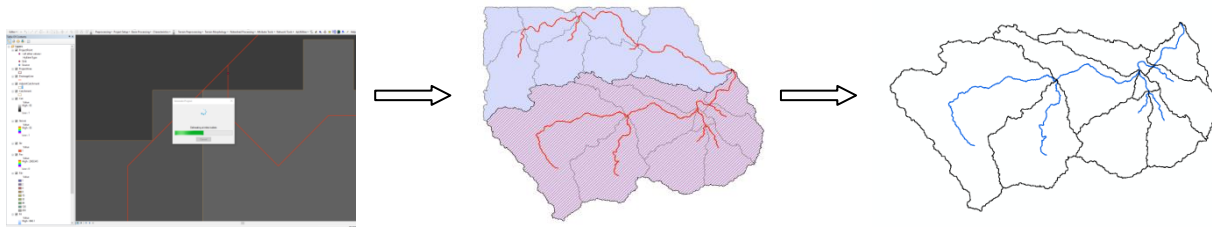
6. Go to Project Setup > start new project. Project Area and Project Point are created and a new dialog box opens. Define the new project by giving name and a brief description. Leave other fields as default.



7. Select Project Setup > Data Management, to check if all the fields are filled appropriately.



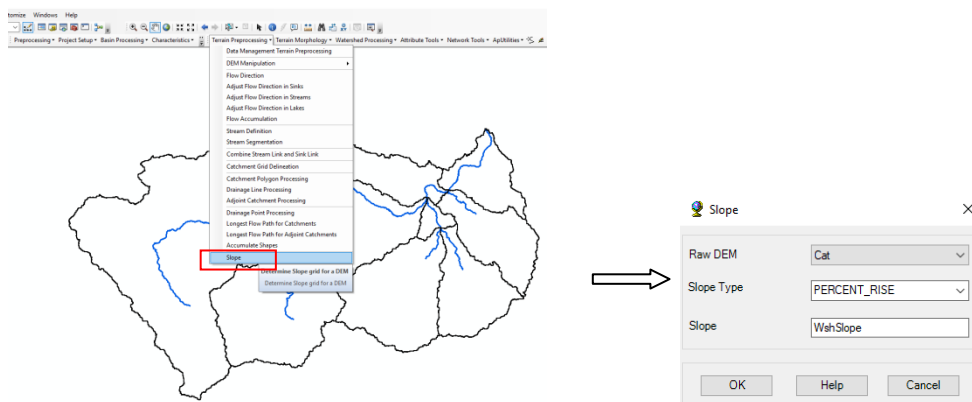
8. Add project point, using  icon on the GeoHMS toolbar and give the default name. Generate project of based on the given project point at outlet of the basin. It will take few seconds to complete the process.



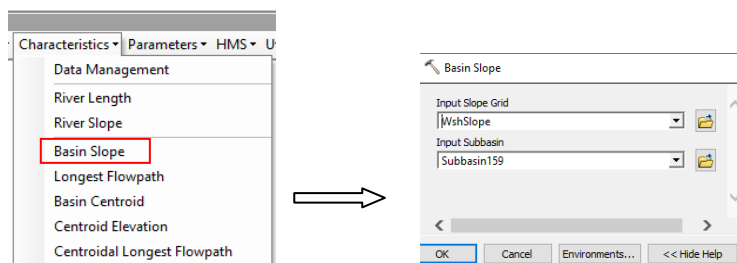
9. Once, the setup is completed, sub-basin and river datasets are created, whose characteristics are now to be computed. Drop-down Characteristics tab on GeoHMS toolbar, and run all the steps in a sequential order.

10. Drop-down Characteristics tab on GeoHMS toolbar, and run all the steps in a sequential order.

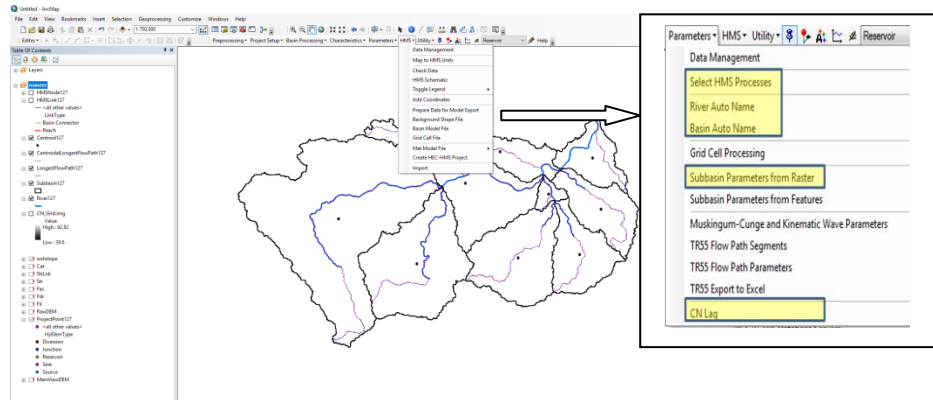
In the step Basin Slope, navigate to Slope.img to compute Basin Slope. For this Enable Arc Hydro tool to go to Terrain Processing → Slope



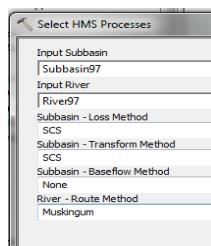
Click ok and generate the slope grid. Further come to GeoHMS tool and create Basin slope with input slope Grid.



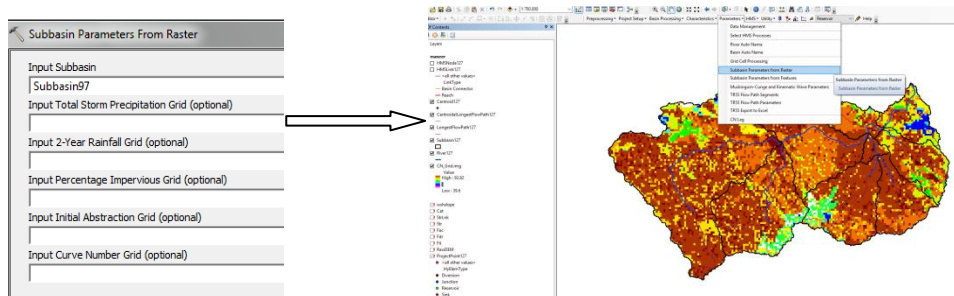
11. Next, drop-down parameters on the GEO-HMS toolbar and run the steps which are highlighted in yellow one by one -



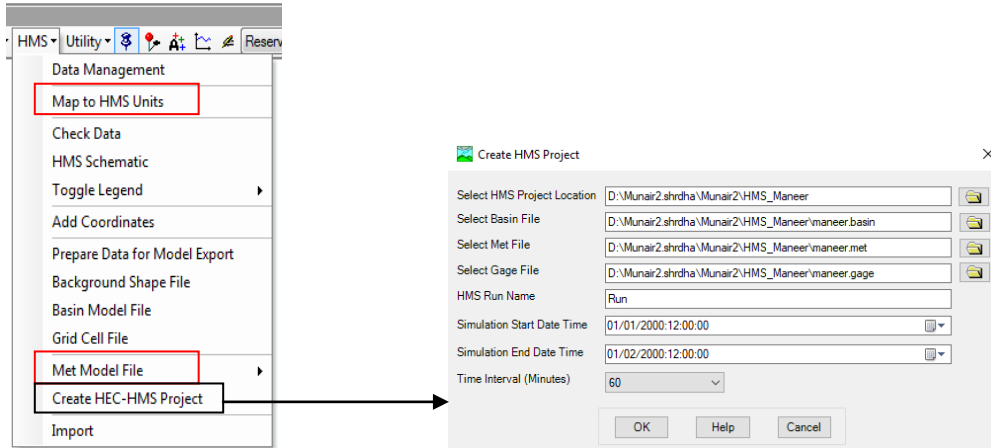
12. In Select HMS processes, select the same methods as shown in the snap shot-



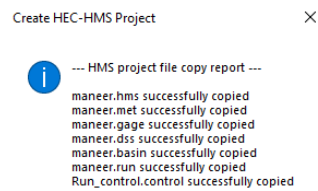
13. In the option Sub basin Parameters From Raster, select the last option i.e., CN Grid, and add the Curve Number grid provided in the zipped folder.



14. Run all the steps under the HMS tab, to create the HMS project file. Select SI units under Map to HMS units option and, Met Model file → Specified Hydrotograph. At last create HEC-HMS Project and import it.

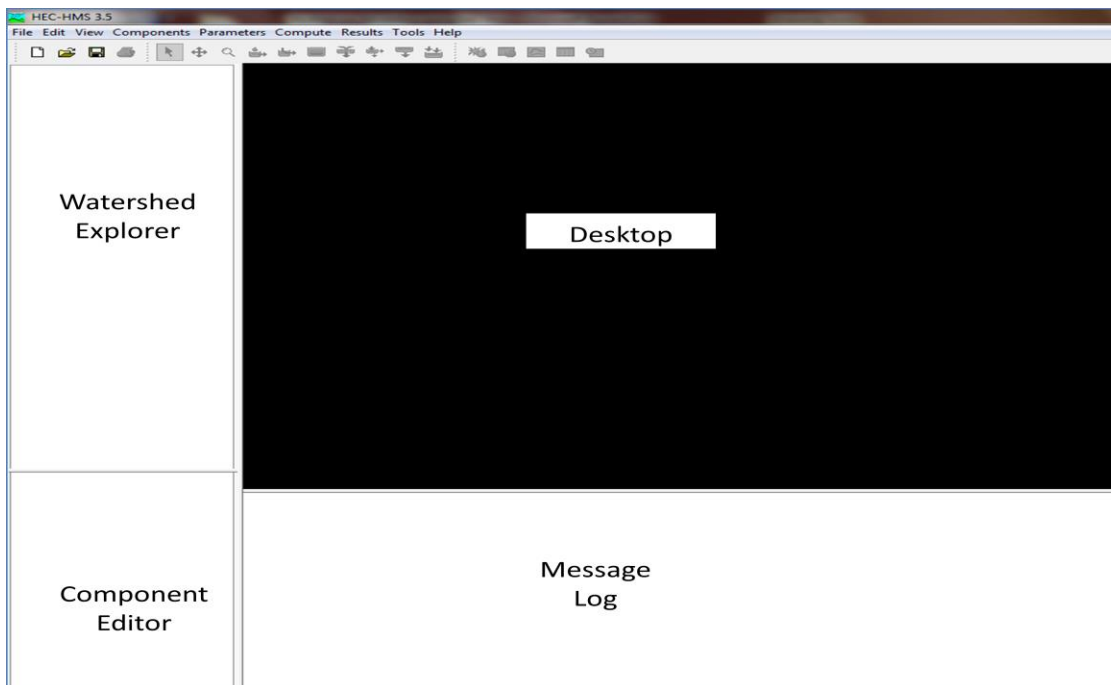


You will see a Message box with successful completion of HMS Project file.



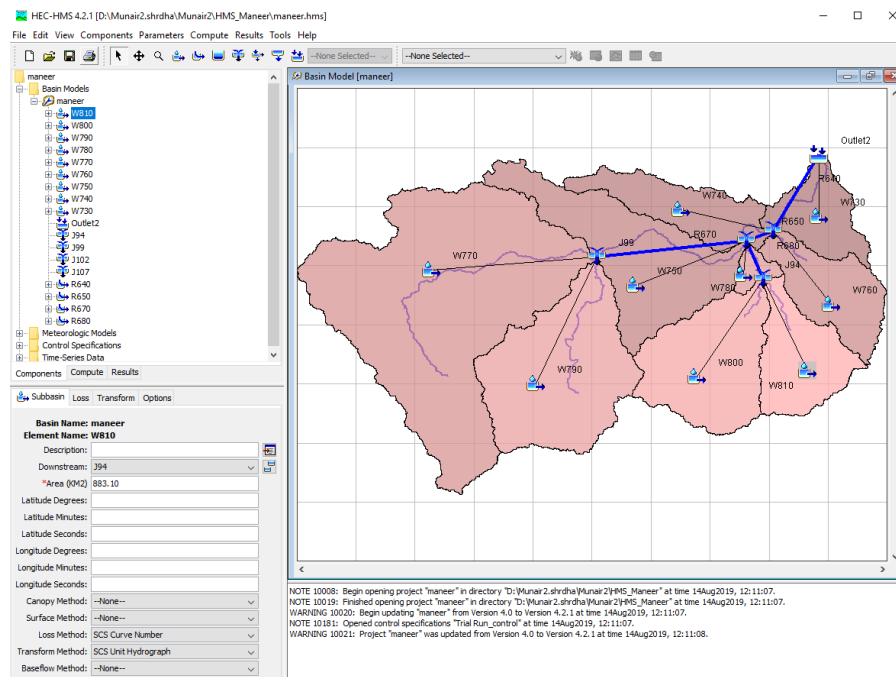
HEC-HMS

15. Open HEC-HMS 4.2.1

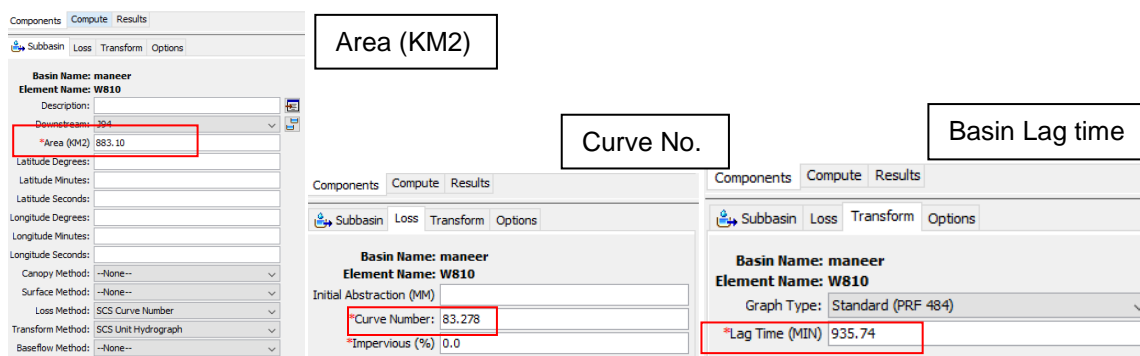


16. Open the .hms project file created using HEC-GeoHMS

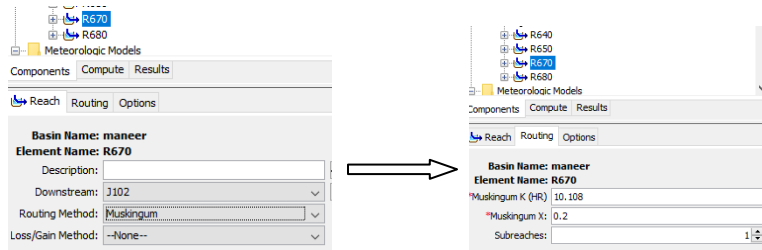
17. You can see three folders in the watershed Explorer, Basin Model, Meteorological Model, control Specifications and Time-series Data.



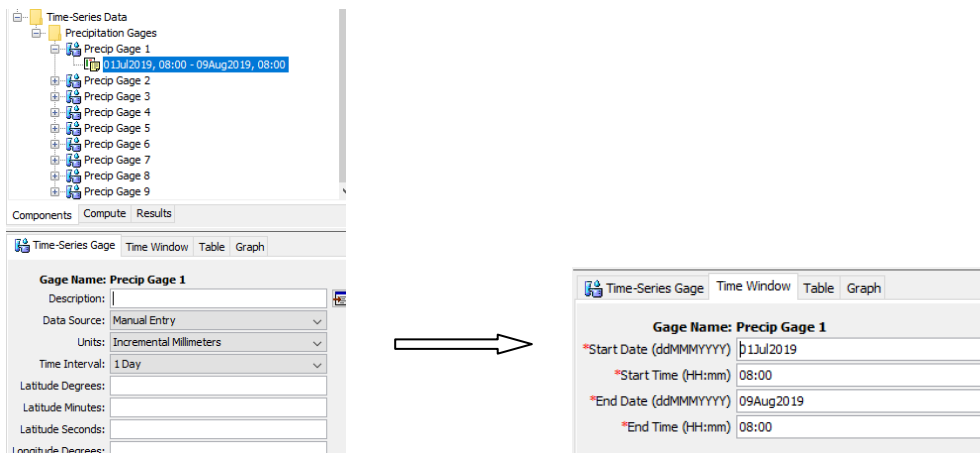
18. Expand Basin model, In the component Editor, basin characteristics computed using Geo-HMS, can be seen as shown in red line the snap-shot.



For Reach we used Muskingum method for routing the river where K (Hr) and x will be calculated.

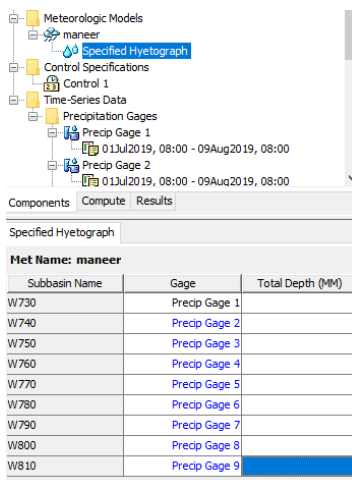


19. click on the time series folder in the Watershed Explorer, you can see that there is a gage associated with each sub-basin, Click on the Gage, default Time-step is defined, change the start date and End Date to 01 Jul 2019 08:00 – 09 Aug 2019 08:00



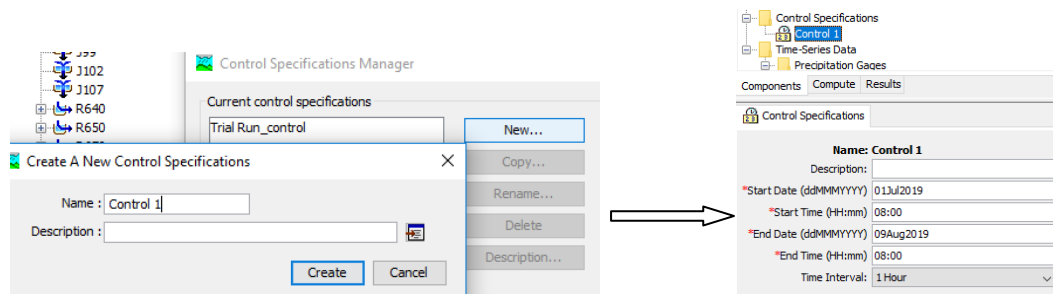
Copy-Paste the rainfall data from Excel sheet into table of these gages.

20. Once, the rainfall gauge is defined, this gauge can be associated with the corresponding sub-basins by using Meteorological Model, expand the Meteorological model > (project name) > Specified Hyetograph > Sub basins



21. Go to components > Control Specifications Manager on the menu bar, and create a new control.

Expand control Specifications to define the time period for simulation which would be same as the Time-series Data Time-step. For better result and hydrograph view we can reduce computation time in control specification.

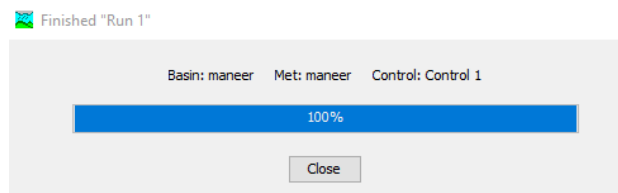


22. Once the set up is finished, the last step is to run the model.

Select compute > create simulation Run.

Click Next to complete all the steps and finally click Finish to complete the run.

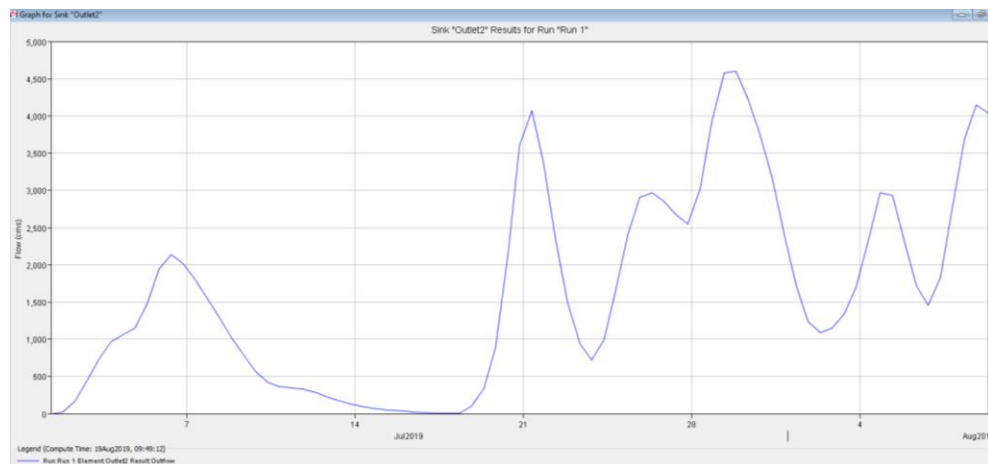
Now to run the model, select compute> select Run > Run 1, and then go to compute > Compute Run [Run 1] to see the following window.



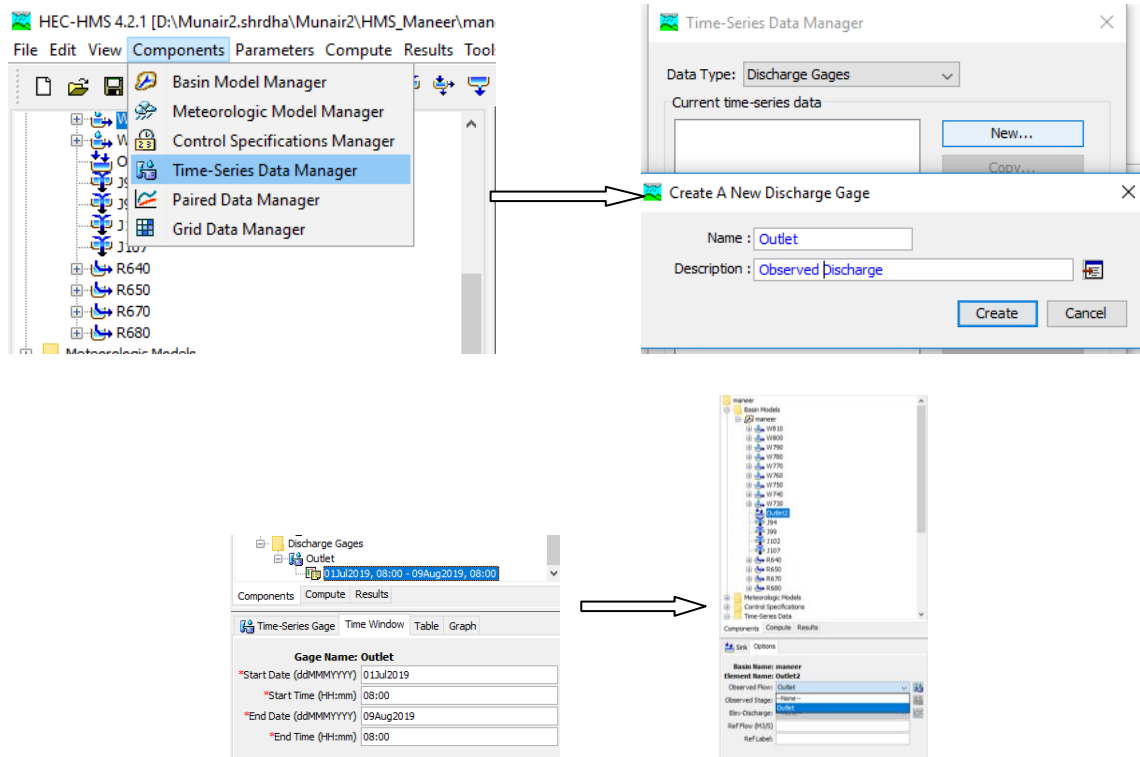
23. Once the simulation is completed successfully, results can be checked in a tabular format, under Results tab > Global Summary Table (Menu Bar)

- Or, results of individual basins can also be seen by expanding the simulation run folder under the results tab in the Watershed Explorer.

Also, the final Hydrograph at the outlet can also be seen by select outlet in the Watershed Explorer.



24. We can match final hydrograph (simulated hydrograph) with observed hydrograph to check how good (accuracy) our model is. For this we have to create a discharge gage in time series component and fill time series with discharge values for same date as rainfall filled earlier.



Simulated vs Observes Graph

