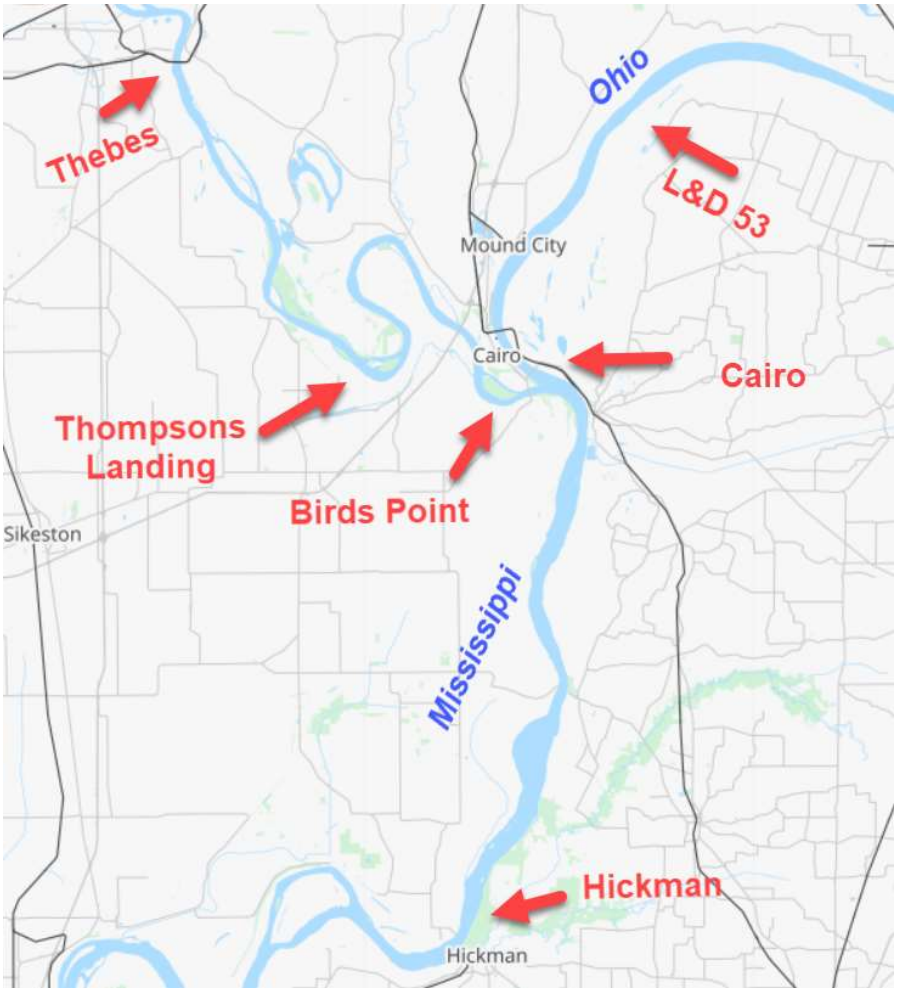
Calibration of the Mississippi – Ohio Model
Solution

1 Objective

In this workshop, you will gain experience calibrating an HEC-RAS model. You will learn how to adjust parameters to replicate water surface elevations, and travel times of observed data for an event.

2 Background

The figure on the following page shows gage locations along the Mississippi River from Thebes, IL to Hickman, KY (approximately 76 river miles) and the Ohio River from L&D 53 to its mouth at Cairo, IL (approximately 17 river miles).



In this workshop you will calibrate an existing Ohio Mississippi model at the gage locations in the table below.

Gage	River- Reach	River Station (RS)
Thebes	Mississippi - Upper	43.7
Thompson Landing	Mississippi - Upper	20.2
Birds Point	Mississippi - Upper	1.4
L&D 53 Tailwater	Ohio - Main Stem	17.39
Cairo	Ohio - Main Stem	0
Hickman (DS Boundary)	Mississippi – Lower	922

3 Calibrate the Model by Adjusting Manning's n Values

The Manning's n values were adjusted for each reach of the model. This was done using the editor found in the **Geometric Data Window** under **Tables**, as shown in the figure below.

Edit Manning's n or k Values

River: Mississippi Riv | Edit Interpolated XS's | Channel n Values have a light green background

Reach: Upper | All Regions

Selected Area Edit Options

Add Constant ... | Multiply Factor ... | Set Values ... | Replace ... | Reduce to L Ch R ...

	River Station	Frctn (n/K)	n #1	n #2	n #3
1	43.7 THEBES - RM 43.7	n	0.15	0.035	0.15
2	43.2	n	0.15	0.035	0.15
3	42.7	n	0.15	0.035	0.15
4	42.3	n	0.15	0.035	0.15
5	41.7	n	0.15	0.035	0.15
6	41.1	n	0.15	0.035	0.15
7	40.6	n	0.15	0.035	0.15
8	40.1	n	0.15	0.035	0.15
9	39.5	n	0.15	0.035	0.15
10	39.1	n	0.15	0.035	0.15
11	38.6	n	0.15	0.035	0.15
12	38.1	n	0.15	0.035	0.15
13	37.6	n	0.15	0.035	0.15
14	37.1	n	0.15	0.035	0.15
15	36.6	n	0.15	0.035	0.15
16	36.1	n	0.15	0.035	0.15
17	35.6	n	0.15	0.035	0.15
18	35	n	0.15	0.035	0.15
19	34.5	n	0.15	0.035	0.15
20	34	n	0.15	0.035	0.15
21	33.6	n	0.15	0.035	0.15
22	33.1	n	0.15	0.035	0.15
23	32.1	n	0.15	0.035	0.15
24	31.1	n	0.15	0.035	0.15

OK | Cancel | Help

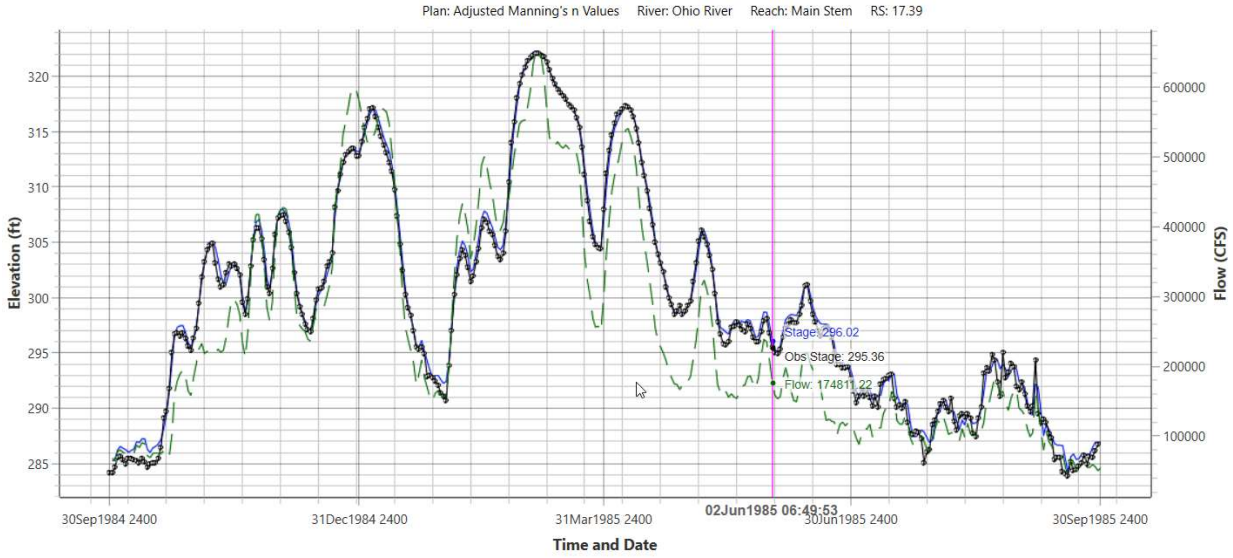
The values for the main channel were initially set to 0.035. As seen on the original stage and flow hydrograph plots, the computed water surface was above the observed water surface. This indicates that the Manning's n value was too high for the simulation. The value of Manning's n was adjusted to 0.030 for the Ohio River and 0.032 for the Lower Mississippi River. The value of Manning's n in the Upper Mississippi River ranged from 0.032 to 0.022, beginning with river station 43.7 set to 0.032.

Note: For the last 5 cross sections on the Upper Mississippi River, which are just above the Cairo Junction, a Manning's n value of 0.022 was entered. Because of backwater just above the junction, this low Manning's n value was used for a better calibration at the Birds Point Gage. This phenomenon is common on large rivers with flat slopes and should therefore be considered when calibrating around a junction.

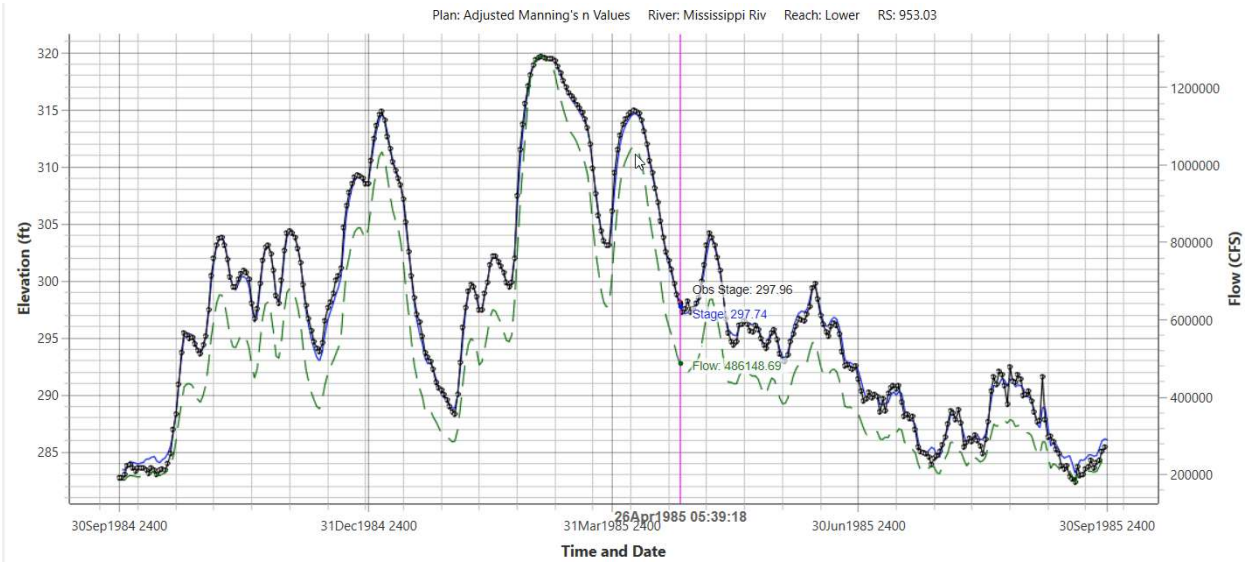
For a majority of the cross sections in the model the conveyance within the left and right overbanks is insignificant relative to the conveyance within the main channel. Consequently, the Manning's n values for the overbanks were left unchanged.

The figures below display the computed and observed stages after adjusting Manning's n values for each reach. Ohio L&D 53 TW and Mississippi at Cairo gages show a good calibration after only adjusting Manning's n values.

Ohio L&D 53 TW

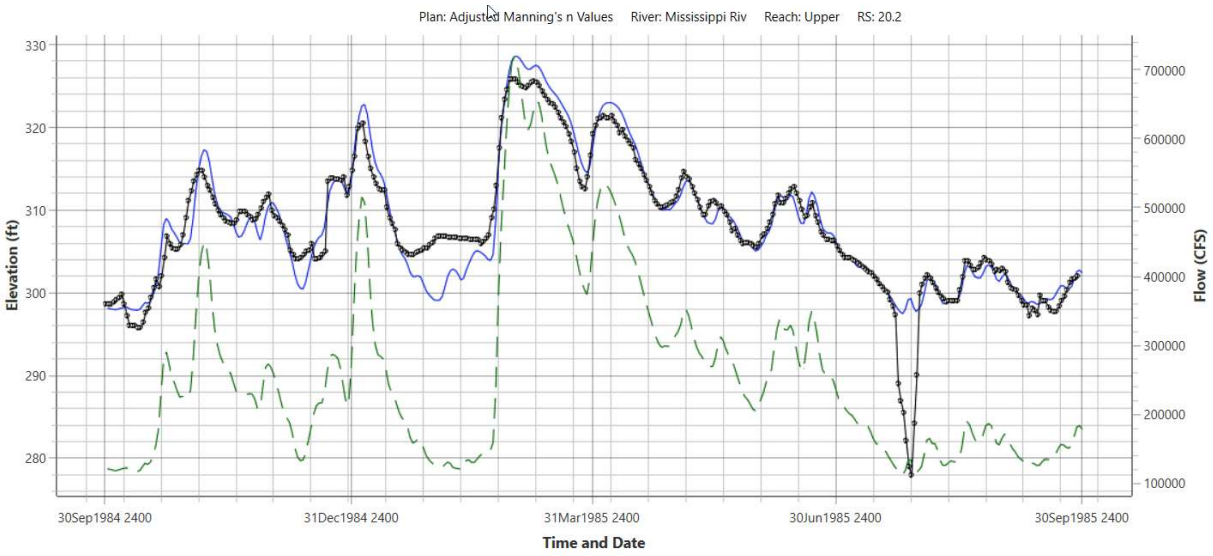


Mississippi at Cairo

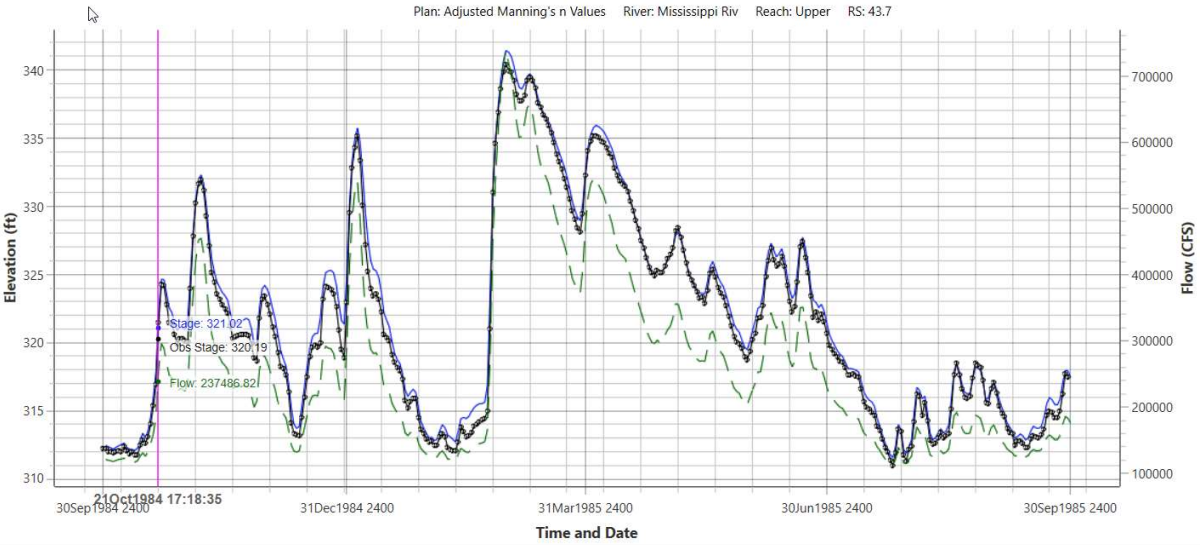


Thompson Landing and Thebes gage are not as well calibrated throughout the flow ranges. In particular, the Thompson Landing gage shows computed stages are above observed stages for high flows and below observed stages and below the observed stages for low flows. This gage will be adjusted using the ***Flow Roughness Change Factors*** *option, as explained in Task 2.*

Mississippi Upper at Thompson Landing



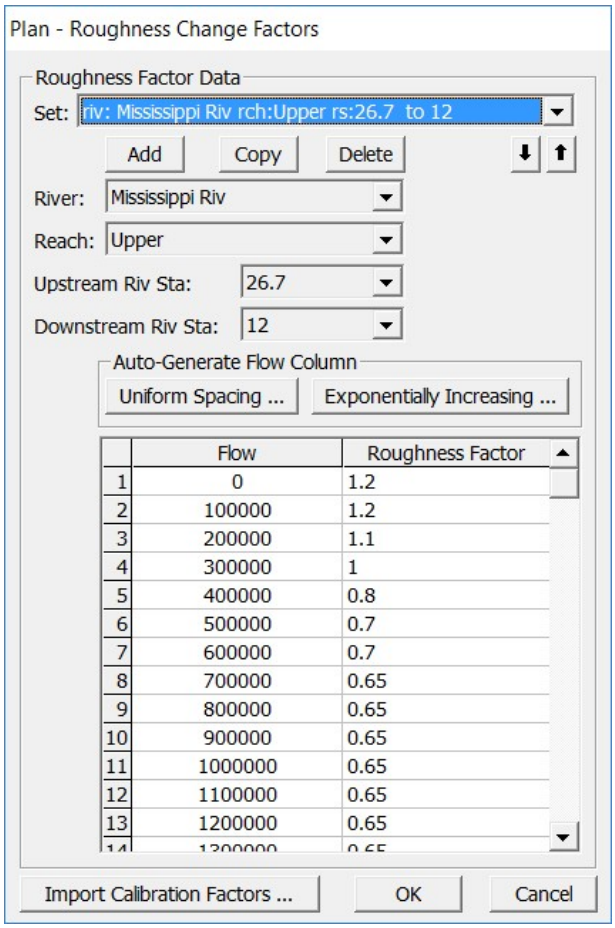
Mississippi Upper at Thebes



4 Tune the Calibration by Adjusting Flow Roughness Factors

*In the **Unsteady Flow Analysis Window** under **Options**, **Flow Roughness Factors** was selected.*

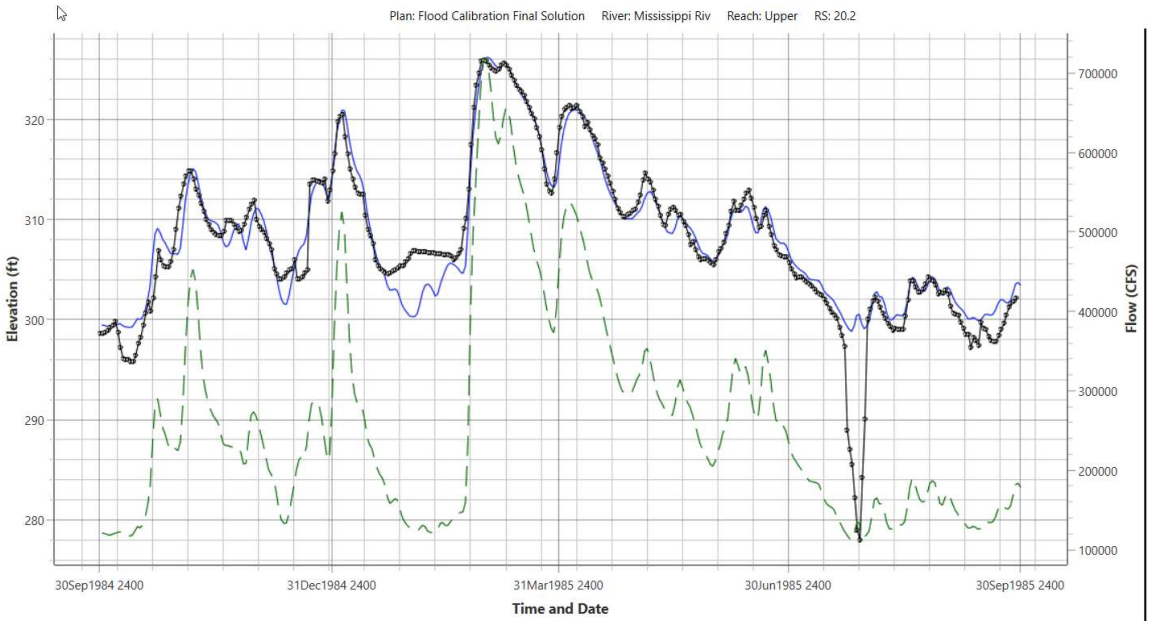
Data was entered for river stations immediately above and below Thompson Landing (river stations 26.7 to 12), in increments of 100,000 cfs. The factors used for this calibration are shown in the figure below.



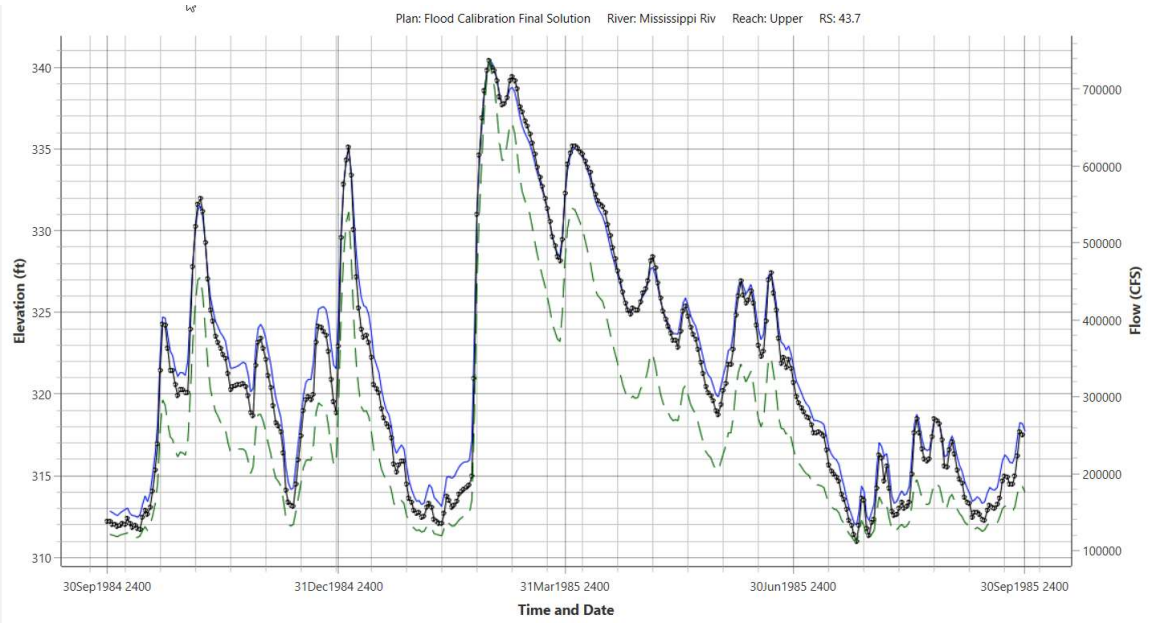
At lower flows the effect of surface roughness is predominantly greater than at high flows. Hence, the Manning's n value was increased for lower flows and decreased for higher flows.

The figures below show the results after adjusting Flow Roughness Factors around the Thompson Landing gage and Thebes gage. The Flow Roughness Factor adjustment not only provide better results for Thompson Landing, but Thebes as well.

Mississippi Upper at Thompson Landing



Mississippi Upper at Thebes



5 Evaluate the Calibration

Location	Time		
	06 Nov 1984	04 Jan 1985	01 Mar 1985
Thebes - RS 43.7 On Upper Mississippi	-0.44	-0.19	+0.02
Thompson Landing - RS 20.2 On Upper Mississippi	+0.29	+0.40	+.26
L&D 53 - RS 17.39 On Ohio River	+0.22	-0.05	+0.14

Question: How well does the timing match for the observed and computed stages?

The overall timing of the calibrated model is good. The calibrated model reasonably matches the shape of the observed stage hydrographs. Most of the peaks and troughs at each gage are reproduced by the computed data.

Question: How well are the stages at Thompson Landing reproduced? Are there any inconsistencies between the observed stage and computed flow at Thompson Landing which make it difficult to calibrate?

The observed data at Thompson Landing is difficult to replicate because the data includes some inconsistencies where flow is decreasing but observed stage is increasing. Consequently, this calibration is not as accurate compared with other gages.