Steady Flow Modelling: Modelling Water Surface Profiles for Natural Rivers with a Junction

Confluence: A confluence is a junction where two or more rivers are met at one point.

Bifurcation: A bifurcation point is a junction where one river is divided into two or more rivers.

For the simulation of a junction we need two extra boundary conditions. The first condition is based on the continuity equation.

1. For a confluence, the continuity equation becomes $Q_1+Q_2=Q_3$. …….(a)

In equation (a), Q_1 and Q_2 indicates the two upstream discharge meeting at a junction and Q_3 indicates the total downstream discharge.

For a bifurcation, the continuity equation becomes $Q_1 =Q_2+Q_3$ ……..(b)

In this equation (b), Q_1 is the upstream discharge and Q_2, Q_3 indicates the downstream discharge of a bifurcated river.

2. The second condition comes from the momentum or energy condition. This states that energy level or water surface elevations for all the rivers meeting at a junction should be equal. Therefore, mathematically it can be said that $WSE_1=WSE_2=WSE_3$.

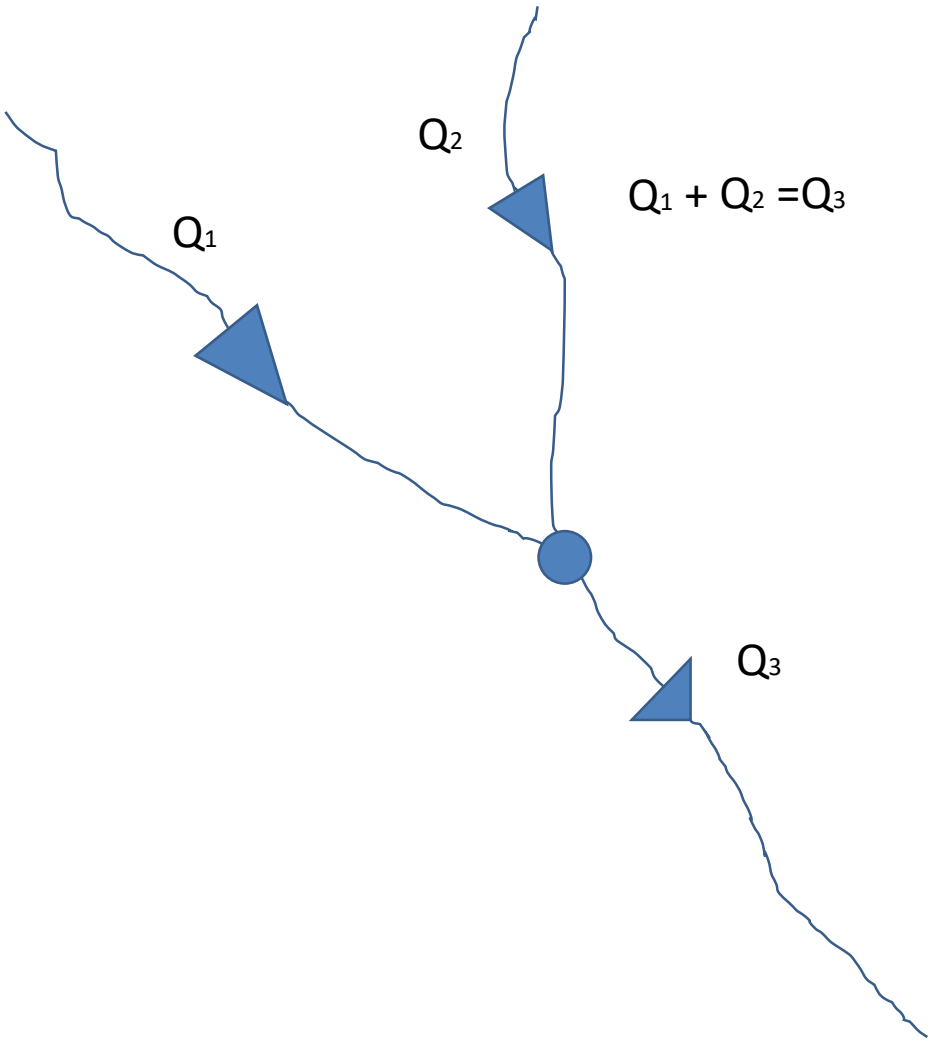


Figure: Confluence

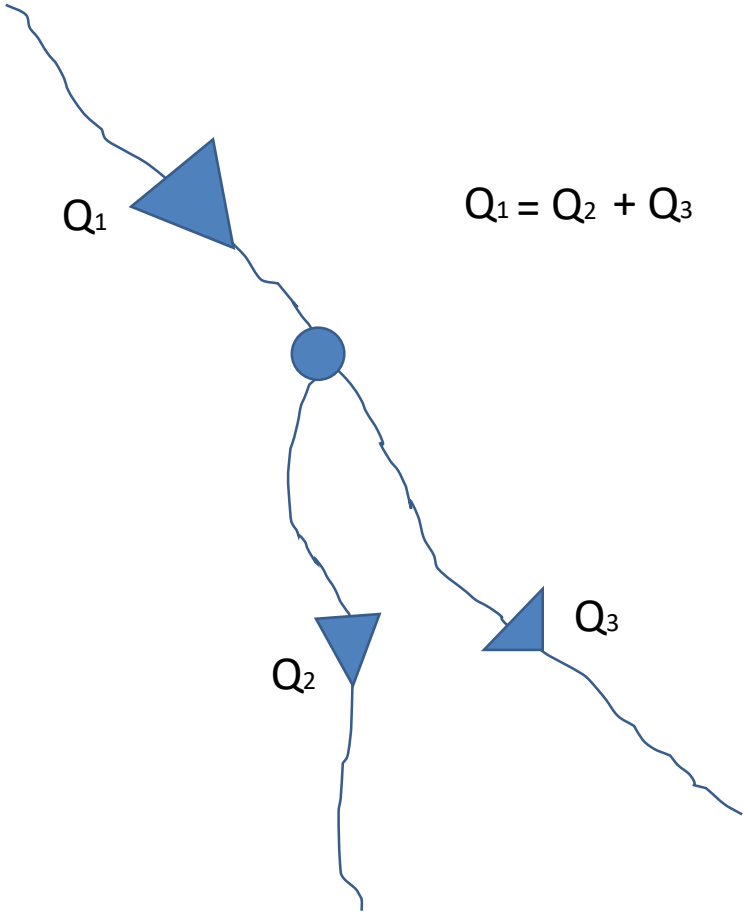


Figure: Bifurcation

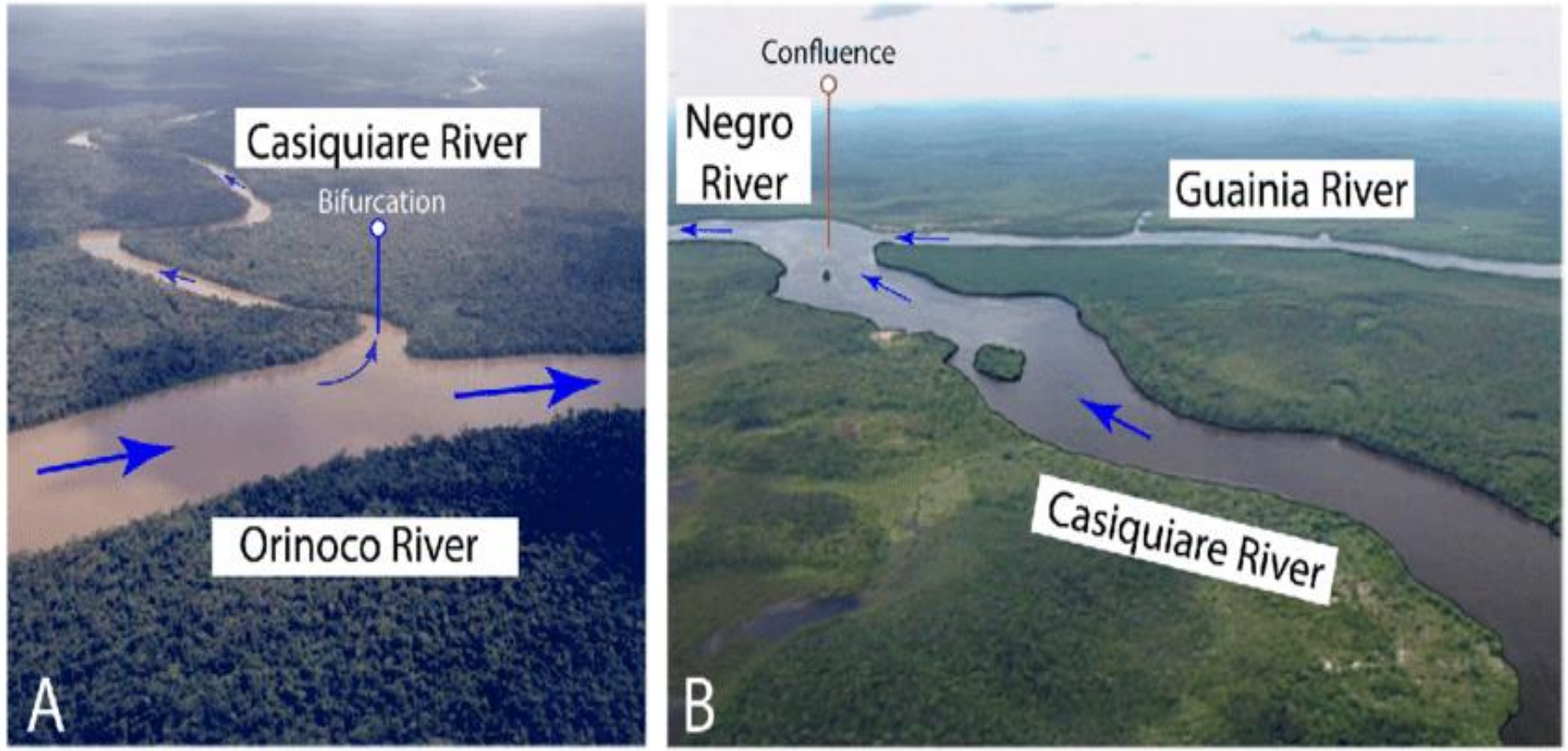


Figure: Confluence and Bifurcation (Collected from Website)

Calibration *:*Calibration means tuning of model parameters with one set of data.

Validation*:* Validation means further verification of calibrated model results using another set of data.

Note: In the class, I have given example of calibration for the year 2020 and for validation I have given example of the year 2021.

Objectives of This Experiment:

1. Using the given data draw a schematic diagram of a river
2. Assign the cross sectional data
3. Assign the necessary boundary condition data.
4. Perform a steady flow analysis.
5. View and present the results.
6. Calibrate the model.

Given Data:

1. Cross sectional data
2. Boundary condition data.

All the data are given in a excel file.

Submissions

1. Longitudinal profile of water surface elevation.
2. What is calibration and validation?
3. What do you mean by confluence and bifurcation. Explain with figures.
4. What is a junction? How a junction is handled in HEC-RAS?