River Flow and Flood Modelling (D21RV)

Development and Application of HEC-RAS model for the River Severn (UK)

Introduction

You will build a linked 1D/2D HEC-RAS model of a portion of the River Severn, near the English village of Upton-upon-Severn. The area has been subjected to regular flooding in the past (Figure 1), and has recently benefitted from investment in flood management infrastructure. Although interesting from both a technical and political point of view, this project is not concerned with these recent developments. Rather, it is an opportunity to develop your modelling skills and understanding.

The site to be modelled is shown in Figure 2. It is approximately 7 km long by 0.75 to 1.75 km wide and consists of a river channel and three distinct floodplains. There are a number of bridges and other features (in the river channel and on floodplains) that could influence flow conditions, however these are ignored for the purpose of this project.

This project consists of 4 tasks, and will eventually result in the development of a linked 1D/2D HEC-RAS model to simulate a variety of different conditions and mitigation measures.

Task 1

Task 1 is to develop a 1D HEC-RAS model using the topographic data you have been given; Figure 2 shows the extent of the river reach that will be modelled. To achieve this you need to:

1. Create the model using RAS mapper; instructions for how to do this are given in a recorded tutorial available on Canvas.
2. Ensure your model has 30 (reasonably evenly spaced) cross-sections including in the vicinity of the locations marked on the LiDAR image in Figure 3. Points A and B represent the upstream and downstream boundary conditions, whilst points 1/2/3 represent points of interest for later calibration.
3. Ensure the basic model can run by applying a steady flow upstream boundary condition ($100 m^3/s$ should be fine), and a downstream boundary condition of normal depth (a slope of 1/1000 should be fine).

When developing your model remember:
- To digitise features from left to right looking downstream (left bank before right bank, left edge of cross section to right edge, etc). Also try and keep cross-sections perpendicular to flow lines.
- In places, you will probably find that your cross-sections include portions of low lying floodplain, which can cause some modelling issues (e.g. water "appearing" in the floodplain before it overtops the river bank); do not worry, as it is reasonably straightforward to either specify where flow cannot go or "tweak" affected cross-sections once the river geometry is developed.

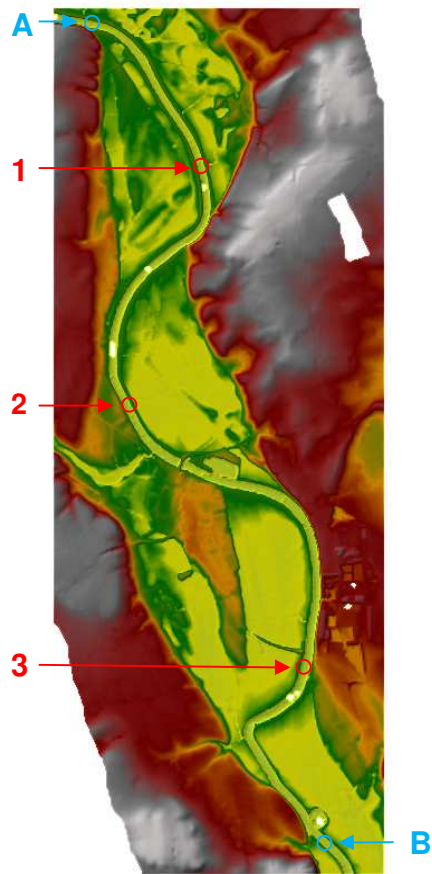**Figure 1: Upton on Severn flooding 2007 (itv.com)**

Figure 2: Modelled river reach. Left: Satellite image (GoogleMaps). Right: 1.0m resolution LiDAR Digital Terrain Model (Environment Agency)