

Modelling flooding at Mar Lodge, Cairngorm National Park, Scotland.

In August 2014 hurricane Bertha caused heavy rain and flooding across parts of Scotland, including Mar Lodge in the Cairngorms National Park (Fig.1). The SEPA gauge on the Dee river at Mar Lodge (drainage area 289 km²) peaked at 376 m³/s at approx. 9.00 am on 11 August 2014 (Fig.2). Additional to the Dee discharge would have been water from Quoich Water which joins the Dee approximately 2.5Km downstream of the SEPA gauge. Flooding at Mar Lodge inundated the floodplain and destroyed a bridge.



Fig 1. Flooding at Mar Lodge: August 2014.

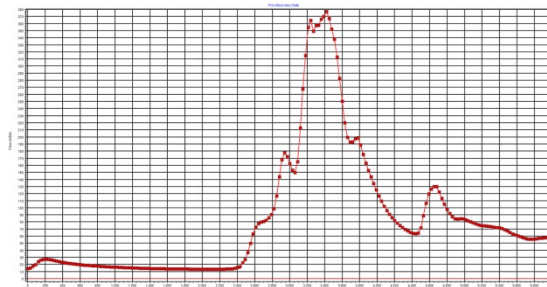


Fig2. Hydrograph of SEPA gauge data: August 2014.

James Hutton Institute researchers have an interest in understanding the hydrological and geomorphological processes taking place at Mar Lodge with a view to assessing the impacts of removing a levee known as the 'car barrier', approx. 3.7Km downstream of the SEPA gauge. The 'car barrier' consists of old cars, concrete blocks, railway sleepers and corrugated metal and was used to plug a historical levee that was breached in 1974, resulting in an avulsion. Potential benefits of removing the barrier include increased floodwater storage, improved habitat area and riparian habitat diversity, the acquisition of data for similar restorations in other river systems, and the removal of potential pollutants.

A 1D / 2D linked model of a 8.5 Km section of the Dee, stretching from the SEPA gauge to the village of Braemar, was modelled at 30 minute intervals in Flood Modeller Free using SEPA gauge data for the August 2014 event. The simulation begins at 16:00 on the 10th August and finishes at 16:00 on the 11th August. Discharge from the junction of Quoich Water and the Dee was also incorporated. The 2D results were exported as polygons from Flood Modeller Free as shape files and merged with a polygon representing the river channel at each 30 minute time step. The resulting images were then exported as .png image files and incorporated into a Google Earth .kmz file as ground overlays using Google Earth's Timespan animation feature. A hydrograph of the SEPA gauge data, exported from Flood Modeller, was included as a screen overlay. The entire model is 2.3 Mb and can be viewed in Google Earth in 3D.

Modelled flood extents match well with surveyed trash lines. However there are limitations in the accuracy of the model – particularly as the grid cell size had to be increased to 10 x 10 metres in order to remain within Flood Modeller Free's limitation of 100 000 ADI cells. Furthermore there is no gauge data for the Quoich Water and its discharge had to be approximated. However, given the considerable volume of water measured at the SEPA gauge on the Dee at the peak of the flood, the margin of error resulting from the Quoich water's contribution is probably fairly small.

Running the Google Earth Model

Clicking on the Mar_Lodge_Flood.kmz file will open the model in Google Earth. Wait until the model is fully loaded - the big white patch will disappear. Please note, there are a lot of overlays so it may take a couple of minutes depending upon PC processing speed! The model opens with the hydrograph on (Fig 3) – which can be turned off on the side menu. To animate the flood (Fig.4):

- A) Drag the left time slider (top left) right across to the right
- B) Drag both sliders right across to the left
- C) Click on the clock toggle to start the animation.

If you click on the spanner (settings) you can set the speed of the animation and whether it loops. If you have Terrain turned in the side menu you can rotate the model in 3D.



Fig 3. Model loaded into Google Earth

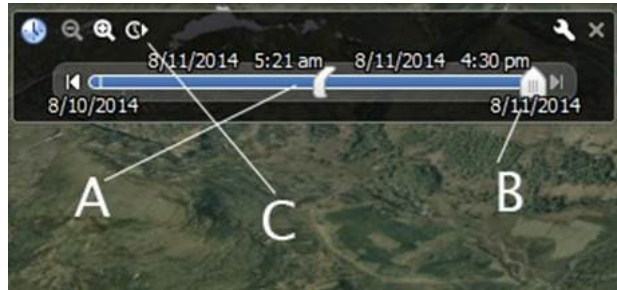


Fig 4. Flood animation controls

Gillian Donaldson-Selby
Landscape and Marine Modeller
James Hutton Institute
Aberdeen

<http://www.hutton.ac.uk/staff/gillian-donaldson-selby>

