

FwDET (Floodwater Depth Estimation Tool) Test and Analysis

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The FwDET (Floodwater Depth Estimation Tool) calculates water depth based only on a inundation map and a DEM (Digital Elevation Model). The aim of the placement was to see how well the results will be, what is involved with the workflow, get an idea on when it works well or badly and how the performance changes with different datasets.

Background:

In November 2019 severe flooding occurred across United Kingdom mainly affecting the Yorkshire and the Midlands. SAR data was downloaded to map inundation maps along with high resolution and low resolution DEM in order to test the FwDET.

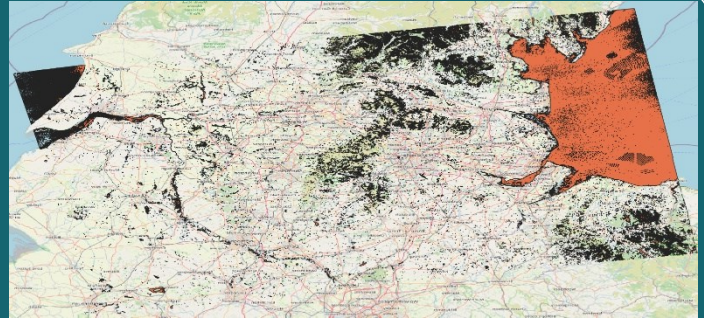


Figure. 1: Created flood map of a Sentinel-1 SAR image from the 19th of November 2019

FwDET Process:

1. Converts inundation polygon to a line layer.
2. Creates a raster from the line layer which has the same grid-cell size and alignment as the Dem
3. Extracts the elevation from the DEM.
4. Allocates the local floodwater elevation of each grid-cell within the flooded domain from its nearest boundary grid-cell.
5. Calculate floodwater depth from deducting the local floodwater elevation from the topographic elevation.

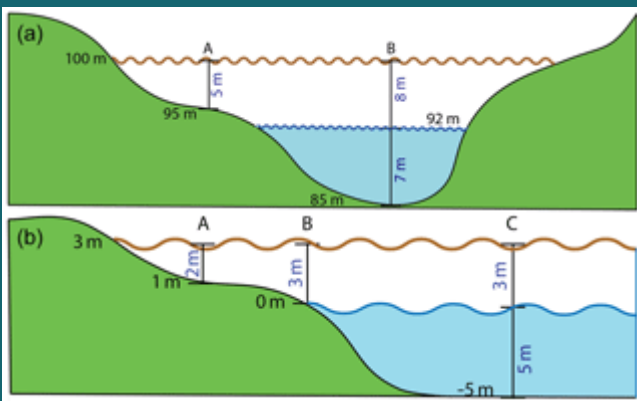


Figure.2: Theoretical floodplain (a) and coastal (b) cross sections illustrating a FwDET floodwater depth calculation approach. The FwDET calculates the water depth by deducting local floodwater elevation above mean sea level from the topographic elevation. (Cohen et al., 2019)

Skills Gained:

- The FwDET project helped to improve my python skills in QGIS. I learnt how to create flood extent maps.
- How to access a range of datasets, from DEM (NASADEM and various LiDAR data), satellite imagery (Sentinel-1 and 2) and gauge (discharge flowrates and gauge height).
- How to analyse flood maps as an asc.file in excel.

Conclusions

- In the area of interest, the tool shows that the volume of water is at its highest (x10) when the peak of rainfall on a day by day comparison.
- In rural areas where the elevation is ever changing, causes a vast difference in the high resolution 25cm-1m LiDAR and low resolution 30m NASADEM.
- In order to for the tool to work in urban areas, a high resolution satellite image must be used to create a flood extent map within a built up area.

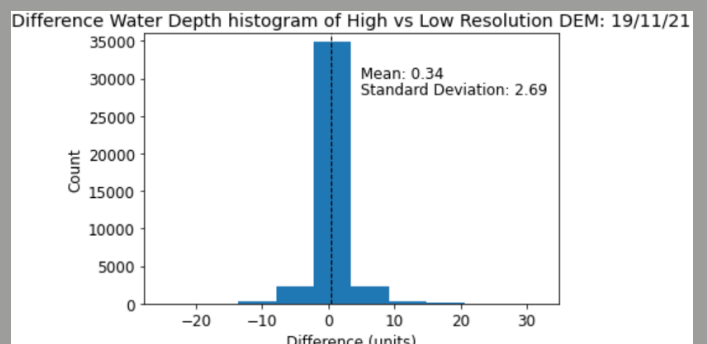


Figure 3.: Histogram showing the difference between the results of the FwDET with a high resolution DEM and a low resolution DEM

References:

Cohen, S. et al. (2019) 'The Floodwater Depth Estimation Tool (FwDET v2.0) for improved remote sensing analysis of coastal flooding', Natural Hazards and Earth System Sciences, 19(9), pp. 2053–2065. doi: 10.5194/NHESS-19-2053-2019.