Resolving mountainous topography with satellite data to inform natural hazards research

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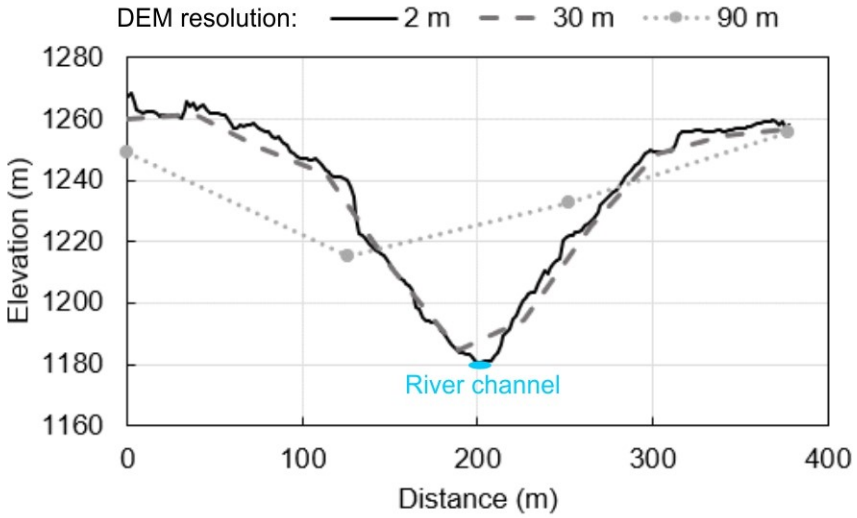
An example of a valley profile from three DEMs:



Modelling natural hazards such as floods and landslides requires topographic data from digital elevation models (DEMs). Open access global DEMs are mostly limited to ~30 m spatial resolution, which affects their ability to represent mountainous topography. This is usually not quantified due to the absence of ground control points or other validation data. Flood model outputs are particularly impacted, since a poorly resolved valley floor would produce erroneously high flood depths and inundation extents that are spatially mismatched to the locations of exposed buildings and roads.

This project will use Ice, Cloud and land Elevation Satellite (ICESat-2) altimetry and high-resolution DEMs as reference data to quantify the elevation differences

in mountainous topography related to open access DEMs. The student will quantify these differences in respect to variables such as slope, aspect, valley width, and land cover, in addition to investigating the influence of DEM source (e.g. optical or radar satellite data) and acquisition date. The student will also investigate different types of DEMs, including digital surface models (DSMs) and digital terrain models (DTMs). Here, DSMs represent the elevation of resolved surface features such as woodland and buildings, and DTMs represent a model of the ground surface. The project aims to identify strategies to improve the utility of open access DEMs in mountainous catchments.

The student should be familiar with a GIS package (e.g. QGIS or ArcGIS) and have an interest in satellite and topographic data. Some programming experience (e.g. R or Python) would be beneficial but is not required. Full training in the methods required to complete the project will be provided. The project will be 100% computer-based with the option to work remotely if desired.