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Assessing Sentinel-1 for multi-temporal flood mapping in a topographically-constrained catchment

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The European Space Agency's (ESA) Copernicus Sentinel programme is delivering earth observation data at enhanced spatial and temporal resolutions. This has significant potential for a range of applications related to monitoring of natural hazards, such as seismic events, landslides, wildfires and flooding. Globally each year, floods result in large scale loss of life, human displacement, and severe damage to infrastructure. This ranges from large-scale flooding triggered by seasonal rains, to more isolated extreme rainfall events which can also have significant socio-economic impacts. However, as flooding is usually accompanied by prolonged cloud cover, optical earth observation imagery is of limited value. Alternatively, synthetic aperture radar (SAR), e.g. Sentinel-1, is unaffected by cloud cover, and has been shown by numerous studies to be valuable in identifying flood extents.

Due to the limited spatial resolution of SAR imagery, this technique has often been demonstrated in situations where flooding has occurred extensively over wide areas. However, in recent years, systems including TerraSAR-X, RADARSAT-2 and COSMO-SkyMed have been able to provide high resolution ($\sim$1 – 3 m) SAR imagery, which can be useful for monitoring smaller events, which may have significant local or regional impact. However, access to these datasets is not generally freely available, and thus limits their utility. This research is exploring the potential of Sentinel-1 for mapping flooding in a topographically-constrained catchment in the UK. Sentinel-1 provides medium-resolution (10 m) SAR imagery at relatively high revisit frequency, free of charge. Over November and December 2015, the UK experienced a series of winter storms, including Storm Frank (30th December 2015), which brought significant rainfall. These events resulted in severe disruption, including a 1 in 200 year flood on the River Dee in Aberdeenshire. This research is exploring the spatial and temporal sensitivity of Sentinel-1 to identify flooded extents across this topographically-constrained catchment over a period of several months. Sentinel-2, which provides multi-spectral optical imagery, is being explored for accompanying classification of land use to provide context for the impact of the flooding. Topographic survey data is being utilised to validate the results, alongside other informal sources (e.g. photographs, media reports, etc.). This contribution will report on results-to-date.