Geophysical Research Abstracts
Vol. 20, EGU2018-1652, 2018
EGU General Assembly 2018


# Near Real-time Dynamics and Volume Estimation of Flooding using SAR

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Synthetic Aperture Radar (SAR) imagery is commonly used to derive flood extent, with multiple techniques available for identifying the expected dark areas caused by water's specular reflection of the radar signal. In addition to flood extent, the derived areas can be combined with terrain datasets to determine the flood slope, approximate the water surface, and provide an estimate of volume. Recently launched satellites, such as Sentinel-1, have enhanced the spatial and temporal resolution of the available data, allowing for improved observation of the flood hydrographs and volume dynamics during an event. We review the challenges associated with using SAR data to identify water surfaces, including accurately deriving flooding in urban or forested areas, increased backscatter caused by wind roughening of the water surface, and differentiating between low backscatter characteristics of water and wet snow. A methodology based on change detection and variable statistical thresholding has been applied to Sentinel-1 scenes to identify flooding. These have been combined with high-resolution LiDAR data, with the waterline heights interpolated to create a flood surface, allowing for volume estimation. Results will be presented for the flooding in a number of large catchments in northern England during the 2015-16 winter storms. These results have been compared with other data, including in-situ flood extent measurements, precipitation records, modelling outputs and other satellite imagery to validate the accuracy of the derived flood extents and volumes. The methodology shows the prospect of global near real-time flood monitoring using satellite data.