

MONITORING GROUNDWATER FLOODING IN IRELAND USING SENTINEL-1 SAR

The winter of 2015/2016 saw unprecedented groundwater flooding across western Ireland. Sentinel-1 SAR was used to map regional flooding.

The challenge

Mapping how floodwaters develop and recede accurately and on a large spatial scale is critical for flood risk management. However, this posed a major challenge to regional authorities across the western region of Ireland following the extensive groundwater floods of 2015/2016. Little or no hydrometric data was recorded during the flood event. Earth Observation imagery collected by the EU Copernicus Programme provided a solution to this otherwise insurmountable problem.

The space based solution

Earth Observation satellites represent a growing data source for environmental monitoring. The Synthetic Aperture Radar (SAR) capability of the Sentinel-1 constellation is particularly valuable because of its ability to detect differences in land cover and provide an all-weather, day-and-night supply of imagery.

SAR systems emit radar pulses and record the return signal at the satellite. Flat surfaces such as water operate as specular reflectors for the radar pulses, giving a clear contrast between dry and flooded areas. This makes Sentinel-1 SAR data a powerful tool for flood delineation.

In this context, Geological Survey Ireland used imagery from the Copernicus Sentinel-1 mission to map the extent of the 2015/2016 extreme flood event, which would otherwise not have been possible by conventional means.

An additional benefit of Sentinel-1 is the frequency of image capture; the satellites have been collecting imagery over Ireland at a 3-4 day revisit time since late 2014. Whilst this revisit time may be inadequate for observing flash floods, which appear and

dissipate within hours, it is suitable for monitoring groundwater flooding which occurs at a much slower rate.

Groundwater floods typically appear and recede over a timescale of weeks to months. The considerable catalogue of Sentinel-1 imagery available has allowed us to track groundwater flood development through time, increasing our understanding of this complex flood form and help identify vulnerable areas and communities.

Benefits to Citizens

Groundwater flooding was not traditionally recognised as posing a significant flood risk in Ireland, and so historically authorities saw little benefit in routinely recording groundwater flooding. Attitude has changed dramatically in the last decade, driven in part by the introduction of the EU Floods Directive, but also by two major groundwater flood events in 2009 and 2016.

Remedying this lack of monitoring poses significant technical challenges. In Ireland, groundwater flooding occurs in isolated



Groundwater flooding in County Galway, Western Ireland, 2016.

basins across the landscape. The large number and wide distribution of these basins makes them impractical to monitor

Thematic Area



CLIMATE, WATER AND ENERGY

Region of Application



IRELAND

Sentinel mission used



S1

Copernicus Service used



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Usage Maturity Level



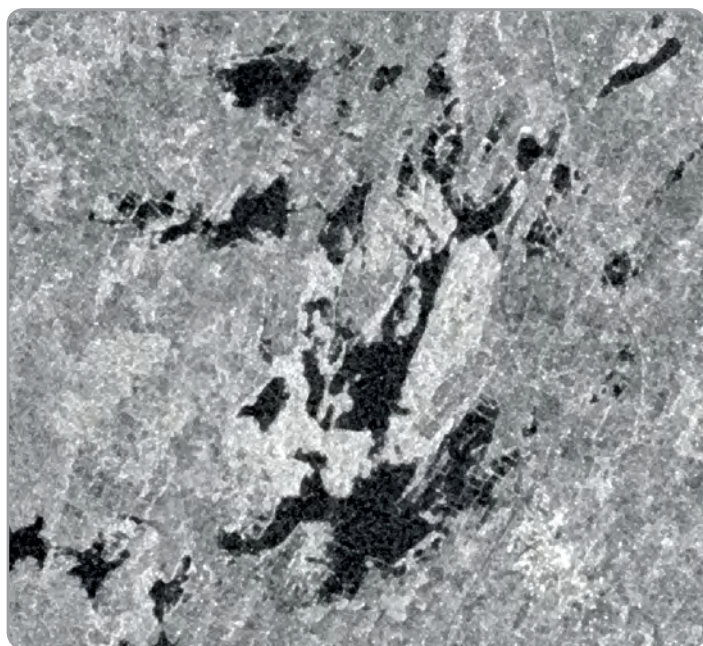
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using traditional field instrumentation. The availability of Copernicus EO data represents a practical and cost-effective alternative.

Critical flood data can now be gathered on a scale that was previously thought unachievable, and provided to relevant regional authorities and local communities in a timely manner. Flood maps derived from Sentinel-1 imagery also aid in regional planning and development and limiting future flood vulnerability.

Outlook to the future

Our intention is to incorporate near real-time Sentinel-1 SAR imagery into an operational groundwater flood forecasting scheme that will benefit those at risk of flooding. The continued work of the Copernicus programme is essential to achieve this goal. This will give local authorities and vulnerable communities valuable time before impending floods to mitigate damage to property and disturbance to economic activity.



Sentinel-1 imagery of groundwater flooding in County Galway, Western Ireland, 2016 (flooded areas displayed in black).

Credit: Contains modified Copernicus Sentinel data [2016]

“Sentinel 1 data has transformed the way we monitor groundwater flooding in Ireland. It provides a practical method to monitor a complex problem.”

Koen Verbruggen, Geological Survey Ireland

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ABOUT COPERNICUS4REGIONS

This Copernicus User Story is extracted from the publication “**The Ever Growing use of Copernicus across Europe’s Regions: a selection of 99 user stories by local and regional authorities**”, 2018, Edited by NEREUS, the European Space Agency and the European Commission.

The model cases focus on local and regional authorities who successfully applied Copernicus data in 8 major public policy domains. The views expressed in the Copernicus User Stories are those of the Authors and can in no way be taken to reflect the official opinion of the European Space Agency or of the European Commission.

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