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Remote Sensing for Monitoring and Mapping Karst Groundwater Flooding in the Republic of Ireland

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Karst related groundwater flooding represents a significant hazard in many rural communities in Ireland. A series of unprecedented flood events in recent years have reinforced the need to improve our ability to quantify the location and likelihood of flood occurrence. Geological Survey Ireland, in collaboration with Carlow Institute of Technology and Trinity College Dublin, has established a collaborative project to investigate groundwater flooding, with particular emphasis on seasonal karst lakes known as turloughs. There are over 400 recorded turloughs across Ireland, the majority of which located on limestone lowlands. Turloughs can completely dry during summer months but extend to hundreds of hectares during the winter flood season. The practical limitations of establishing and maintaining a network of over 400 turloughs supported the use of remote sensing and GIS techniques to delineate flood extents and monitor flood prone areas using satellite imagery such as of the ESA Copernicus programme. Measurements at 50 sites for over 18 months were used to calibrate and validate results from satellite data. With limited recorded groundwater flood data in Ireland, the use of remote sensing data provides historical archives of images to look at past flood conditions to optimise the detection of groundwater and delineate maximum groundwater flood maps. These new data improve the fundamental hydrological understanding of groundwater flooding in Ireland, enabling key stakeholders to develop appropriate flood mitigation measures and allow for informed flood assessments to be made in future. Additionally, it is a first step towards implementation of near-real time monitoring and forecasting of groundwater levels, and the evaluation of the impact of climate change to groundwater systems in Ireland.