Groundwater flood hazards in lowland karst terrains

Owen Naughton (1) and Ted McCormack (2)

(1) National University of Ireland, Galway, (2) University of Dublin, Trinity College

The spatial and temporal complexity of flooding in karst terrains pose unique flood risk management challenges. Lowland karst landscapes can be particularly susceptible to groundwater flooding due to a combination of limited drainage capacity, shallow depth to groundwater and a high level of groundwater-surface water interactions. Historically the worst groundwater flooding to have occurred in the Rep. of Ireland has been centred on the Gort Lowlands, a karst catchment on the western coast of Ireland. Numerous notable flood events have been recorded throughout the 20th century, but flooding during the winters of 2009 and 2015 were the most severe on record, inundating an area in excess of 20km2 and causing widespread and prolonged disruption and damage to property and infrastructure.

Effective flood risk management requires an understanding of the recharge, storage and transport mechanisms during flood conditions, but is often hampered by a lack of adequate data. Using information gathered from the 2009 and 2015 events, the main hydrological and geomorphological factors which influence flooding in this complex lowland karst groundwater system under are elucidated. Observed flood mechanisms included backwater flooding of sinks, overland flow caused by the overtopping of sink depressions, high water levels in turlough basins, and surface ponding in local epikarst watersheds. While targeted small-scale flood measures can locally reduce the flood risk associated with some mechanisms, they also have the potential to exacerbate flooding down-catchment and must be assessed in the context of overall catchment hydrology. This study addresses the need to improve our understanding of groundwater flooding in karst terrains, in order to ensure efficient flood prevention and mitigation in future and thus help achieve the aims of the EU Floods Directive.