

Future Flooding Risk in Ireland based on Satellite Remote Sensing and CMIP6

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Background:

In recent decades, groundwater flood frequency has increased broadly in line with the trend of higher winter rainfall in the west of Ireland (Naughton et al., 2015). If this trend continues, the extreme flooding witnessed during 2009 may become a far more regular event than it has been historically and more permanent, and costly. At the same time, lack of freshwater resources has also been reported in lots of counties in Ireland in recent years and it could become a more severe problem cross the country as witnessed during summer 2018 due to a prolonged norain period. The complexity of groundwater resources and flooding poses unique challenges to policy makers (e.g. Irish Water) and flood risk management agencies. Groundwater flooding has distinctive characteristics that present unique difficulties in quantifying the location and likelihood of flood occurrence (Andrade et al. 2018). Therefore, it is in urgent need to assess the future changes of rainfall in Ireland (e.g. in a 1.5°C, or 2°C, or 3°C warmer world) in terms of frequencies and intensity at various scales and evaluate how these changes could possibly impact on groundwater flooding and water resources.

The main challenges we are facing to manage the risks of flooding and water resources in Ireland are two folds: 1) Lack of enough past records of occurrence of flooding events, particular flash flooding, and continuous observations of groundwater resource information; 2) Huge gaps between fine grid of hydrological information needed (tens of meters and few hours duration) and large scale climate change information provided (tens of kilometers and monthly data). Flash flooding is normally caused by short-duration intensive rainfall events, and long duration flooding is a result of sustained high totals of rainfall over a long, often multi-year, period (Pinault et al., 2005). Water resource availability is more complicated and associated with sustained short and long time rainfall.

The main objectives of this study are 1) to flourish algorithms to apply satellite remote sensing data to estimate the flash flooding and groundwater resource information after validation with limited observations in Ireland. 2) to develop matrix to correlate groundwater information with climate change data. 3) to deliver future flooding risk and water resources availability with different climate scenarios with the application of the matrix from 2).

References:

- Andrade et al., 2018: Surface water flooding, groundwater contamination, and enteric disease in developed countries: A scoping review of connections and consequences. *Environmental Pollution* 236 540-549.
- Naughton et al., 2015: Groundwater flood risk mapping and management: examples from a lowland karst catchment in Ireland. *Flood Risk Management*. DOI:10.1111/jfr3.12145.
- Pinault et al., 2005: Groundwater-induced flooding in macropore-dominated hydrological system in the context of climate changes. *Water Resource Research*, 41, W05001. DOI: 10.1029/2004WR003169.