Attribution study of the December 1998 flooding in the South of Ireland

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What is *ClimAtt*?

The **main objective** of this project is to carry out evidence-based attribution studies of extreme weather events such as heavy rainfalls, floods or droughts for the first time in Ireland. In order to do so, currently *ClimAtt* is reviewing the different methods and datasets to find the best approach to attribution studies in the country. The final output will allow *ClimAtt* to recommend the most appropriate procedure/s to perform attribution studies of extreme weather events. This would be accompanied by the dissemination of the probabilistic results of the effects of climate warming on Irish extreme weather and the engagement with stakeholders to adopt the necessary measures of adaptation and mitigation to climate change in Ireland.

1. BACKGROUND

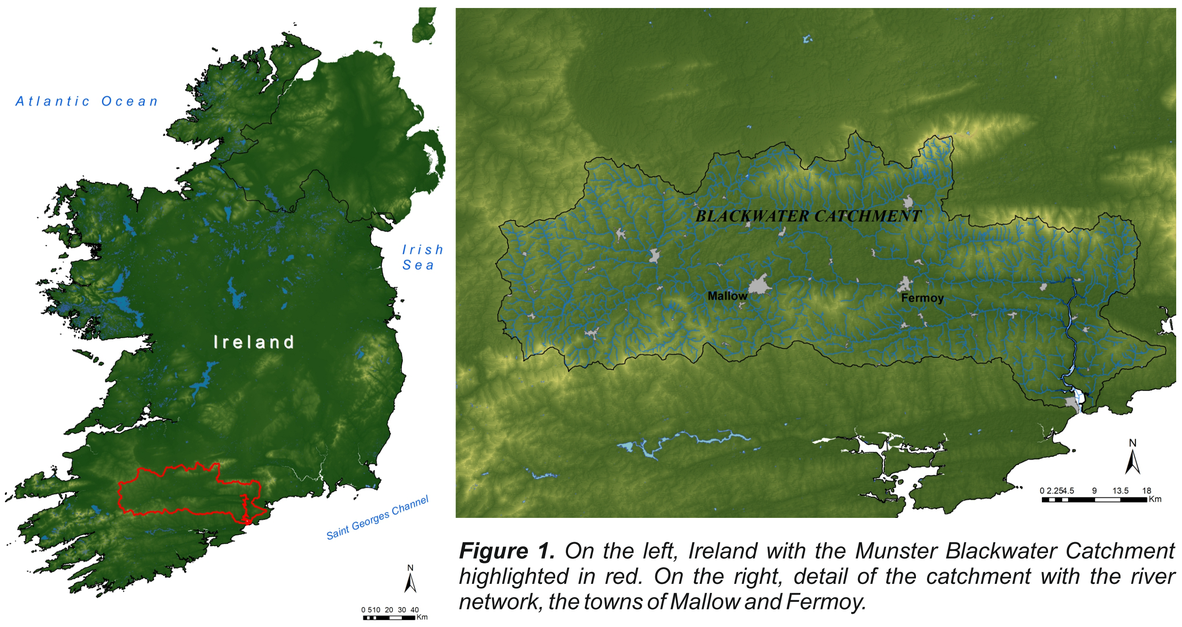


Figure 1. *On the left, Ireland with the Munster Blackwater Catchment highlighted in red. On the right, detail of the catchment with the river network, the towns of Mallow and Fermoy.*

The atmospheric warming it's making more frequent the heavy precipitation events in Ireland. A 20% increase in events of heavy precipitation has already been observed.

The year 1998 was wetter than normal and even the wettest for 30 years in some places.

In December 1998 heavy precipitation hit Ireland leading to widespread flooding on the south of the country. The precipitation of the 26th December almost saturated the soils worsening the posterior event from the 29th to the 31st.

Rain started to spread from the southwest during the 29th December, with up to 20 mm to 35 mm in the south midlands and southwest.

During three consecutive days, from the 29th to the 31st of December, more than 50 mm were registered in Cork and more than 100 mm in the area of Kerry. The saturation of the soils unfold a quick response of the river.

One of the most affected areas was the Blackwater catchment, with more than £5 million damages, affecting badly to Fermoy and Mallow. The long history of floods records in the Blackwater catchment, together with the fact that this catchment is quite naturalised makes it a good area of study in the south of Ireland.

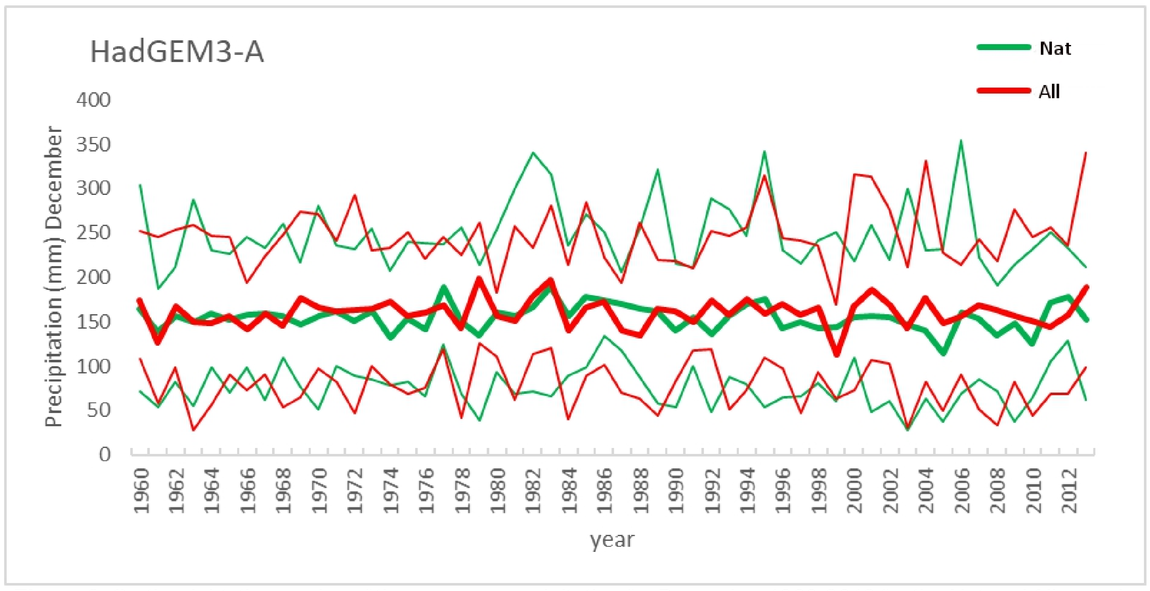
2. METHODOLOGY AND RESULTS

We use the HadGEM3-A climate model with a N216 L85 resolution from the *Met Office Hadley Centre* to obtain the precipitation of December from 1960 to 2013. We chose December in order to examine a particular high impact event: a flooding in 1998 which severely affected the catchment, in particular Mallow and Fermoy.

The area for extracting the model's data was 10°W-7°W longitude and 51°N-53° N latitude. We employed two different scenarios, with and without anthropogenic influence, called *All* and *Nat,* respectively. The experiment *All* includes all the external, anthropogenic and natural, forcings and is driven by a standard set of boundary conditions. The experiment *Nat*, only includes the natural forcings. Each one of these experiments has 15 ensembles (runs from *1i1p1* to *1i1p15*), which makes a total of 810 values per experiment.

Time series of the mean of precipitation were extracted for each ensemble from 1960 to 2013.

Figure 2. *Picture taken in the surroundings of Mallow during a flooding. Author: Gerard Kiely.*



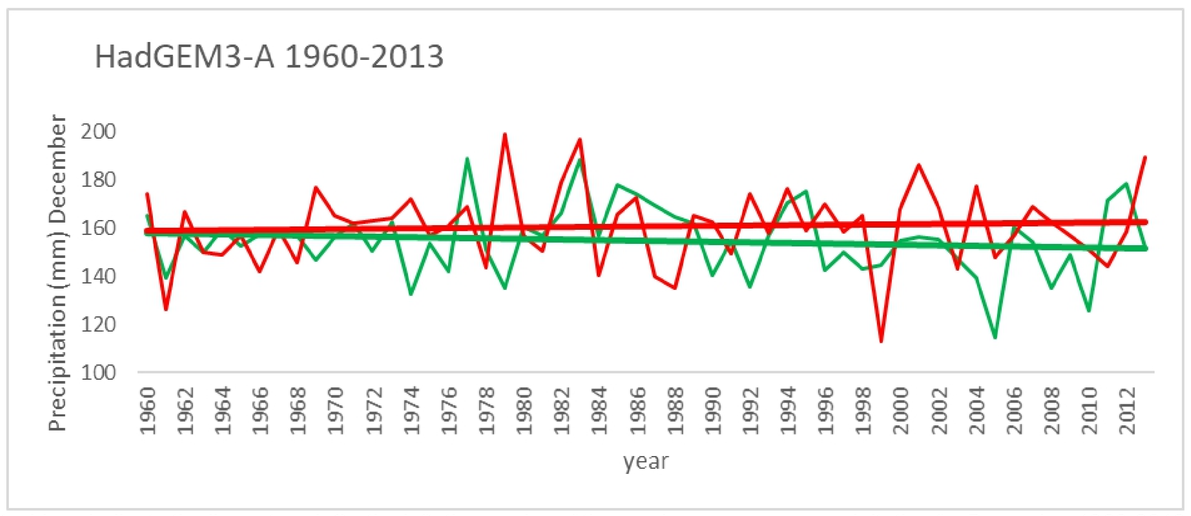


Figure 3. *On the right, time series of the average precipitation for December 1960-2013 for the Nat and All experiments. Lines indicate the linear trend. On the left, time series of the maximum average precipitation for December 1960-2013 from the HadGEM3-A model for two scenarios, with (red) and without (green) human influence. Upper and lower lines represent the amplitude of the 15 ensembles for each experiment. The lines in the middle are the average of the ensembles.*

5. DISCUSSION AND CONCLUSIONS

The abscence of major confounding factors such as large-scale urbanisation or other land use changes in the Blackwater catchment allows a good assessment of the reanalysis data and the models potentially useful for attribution studies.

Although in general, regional scales have a low signal-to-noise ratio, the study area defined around the Blackwater Catchment has showed the human influence on the increase of the average precipitation of December for the period 1960-2013, even if the model didn't show 1998 as date of extreme precipitation.

The model HadGEM3-A has shown the anthropogenic influence in the time series of the average precipitation in the study area for the period 1960-2013. Given the different spatial and temporal resolution of the existing models which reproduce the factual and counterfactual world, a complete comparison should follow the results found here. Also, the collection of long and quality control time series of observational data is a key component.

Observational data (stations and gridded) are necessary not only for detection of extreme weather or climate events, but also in order to assess the performance of the models to be used. These validations allow us to analyse how well are the events capture by the model and applied a bias correction if required.

We highlight the importance and necessity of a unified and high quality database for obsevational data over Ireland. This database would be useful for a complete study of the climate change in Ireland, with special interest in attribution studies of extreme weather events, since this will allow us to perform almost near real time attribution studies in the aftermath of an extreme event such as the precipitation which led to floods such as those of 1998.

Acknowledgements

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