

## 06 – The Rainfall of Winter 2015/16 in Ireland

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### ABSTRACT

Winter 2015/16 was an exceptionally wet season over Ireland, leading to widespread flooding. New records for both monthly and seasonal rainfall accumulations were set in many parts of the country. It was the wettest winter and month of December in a time series from 1850. It was also a very mild winter, with mean air temperatures over 1°C above their *seasonal* means. This paper presents an analysis of the monthly and seasonal rainfall and places the rainfall in historical context.

### 1. Introduction

A succession of winter storms moved across the country during the period November 2015 to February 2016, these brought persistent and in places record-breaking rainfall to Ireland and Britain (McCarthy, 2016). This followed an extremely stormy and wet winter in 2013/2014 and exceptional rainfall in November 2009 (Walsh, 2010).

A joint Met Éireann and United Kingdom Meteorological Office pilot wind-storm naming project was announced in September 2015, the purpose of which was to communicate the approach of severe weather and raise the awareness of the impacts of severe weather and improve public safety. This paper will refer to the storm names, but it should be noted that the storm naming in 2015/16 was related to wind storms, some of the extreme rainfall events were caused by un-named weather systems.

Both November and December were exceptionally wet and mild months across the country as a result of a persistent moist south-westerly flow; while colder interludes occurred in January and February, above average rainfall was also recorded in most parts of the country. Exceptional 24 and 48 hour rainfall accumulations occurred from storm Desmond from 4<sup>th</sup> to 6<sup>th</sup> December and storm Frank on 28<sup>th</sup> and 29<sup>th</sup> December.

A recent study (Noone, 2015) of homogenised rainfall data for 25 rainfall stations produced a monthly time series of precipitation for the island of Ireland from 1850, this has been updated to include winter 2015/16. In this series it was the wettest winter (December, January and February, DJF) throughout Ireland since 1850, December 2016 was also the wettest month in the series. Over winter, rainfall in excess of twice the long-term average amount was observed across most of Ireland.

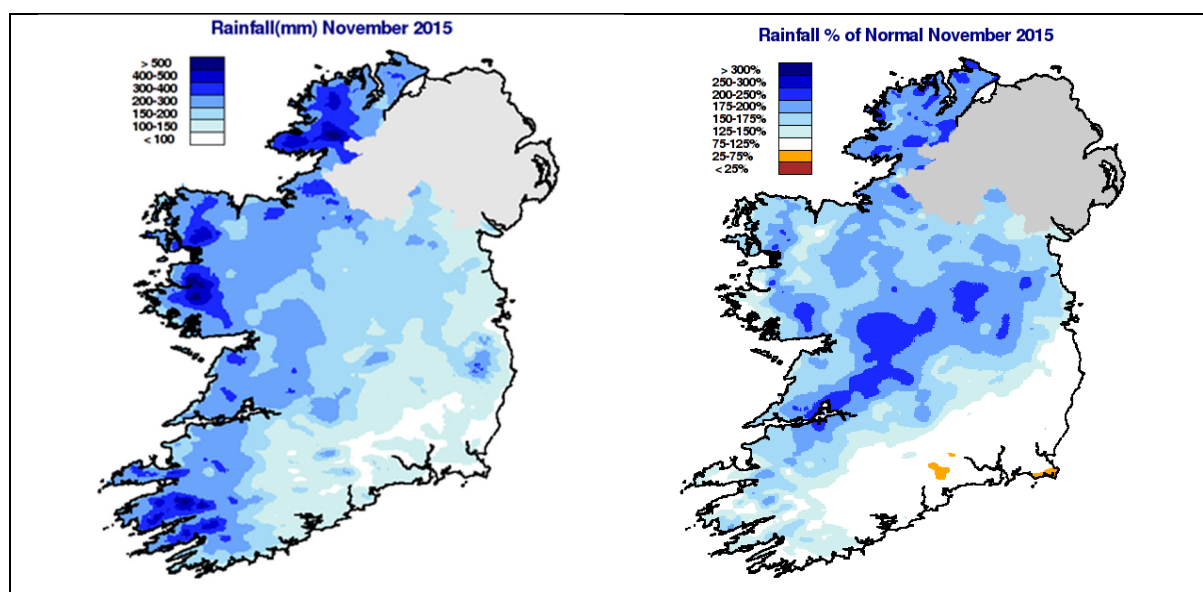
Five stations in counties Cork and Kerry broke the previous record monthly accumulation of 790 mm, with the new record of 943.5 mm occurring at Gernapeka, County Cork. Impacts, especially from significant flooding, were of national significance following these remarkable rainfall accumulations. The impact of this rainfall was exacerbated by the already saturated ground in many areas following the high rainfall during November.

### 2. Monthly Analysis:

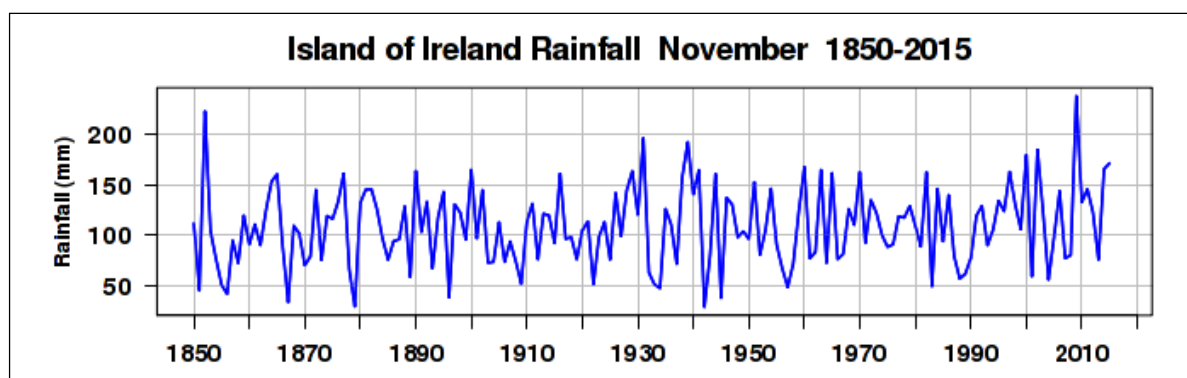
#### November 2015

Most of the country reported above long-term average rainfall while below average values

occurred in parts of the east, southeast and south (Figure 1). The wettest days of the month were during Storm Abigail on the 13<sup>th</sup> and 14<sup>th</sup>, when over 80mm was recorded in a 24 hour period in parts of the west and northwest, and during storm Barney (17<sup>th</sup>) and storm Clodagh (29<sup>th</sup>). In the island of Ireland precipitation series November 2015 ranked as seventh wettest since 1850, with November 2009 the wettest month in the series (Figure 2).



**Figure 1:** November 2015 rainfall, monthly total (left) and percentage of 1981-2010 long term average (right).



**Figure 2:** Island of Ireland precipitation series for November 1850-2015. November 2015 is the seventh wettest in the series, November 2009 is the wettest.

## December 2015

Rainfall totals were well above their long-term average everywhere. Most parts of the country received double or more of their normal December rainfall, with parts of Cork, Tipperary and Kilkenny reporting over 350% of their averages (Figure 3). Approximately 80% of recording stations reported their wettest December on record.

Five stations exceeded the previous record for Ireland's highest monthly rainfall total (the previous record occurred in October 1996 in the Cumberagh Mountains, Co Kerry with 790.0 mm). The five stations were; Ballingearry (Tooreenaneen), Co. Cork with 800.2mm, Ballingearry Vocational School, Co. Cork with 818.2 mm, Breenreagh Mountains, Co. Kerry with 879.9 mm, Cloone Lake (Caragh River Area), Co. Kerry with 910.7mm and Gernapeka, Co. Cork with 943.5 mm, the new Irish record for both December and for any month.

The month's wettest days mainly occurred around the time of storms Desmond (4<sup>th</sup> and 5<sup>th</sup>) and Frank (29<sup>th</sup> and 30<sup>th</sup>). The month's highest daily rainfall was reported at Keenagh Beg, Co. Mayo, on the 4<sup>th</sup> during Storm Desmond with 160.8 mm, its highest daily rainfall on record. The gauge at Leenane, Co. Galway, recorded a 48hr total of 259.7 mm, which is the highest 2-day total on record in Ireland. The highest 48hr rainfall totals recorded in the wettest counties during storm Desmond (4<sup>th</sup> and 5<sup>th</sup>) are shown in Table 1, over 50% of the approximately 480 recording stations received greater than 50 mm of rainfall. Over 60 gauges recorded greater than 100 mm, with the greatest falls occurring in the west and northwest. During storm Frank (28<sup>th</sup> and 29<sup>th</sup>) just under 50% of recording stations received greater than 50 mm, with 11 stations reporting over 100 mm, the highest values occurring in the southern half of the country.

In the island of Ireland precipitation series December 2015 ranked as the wettest, by a margin of over 50mm (Figure 4).

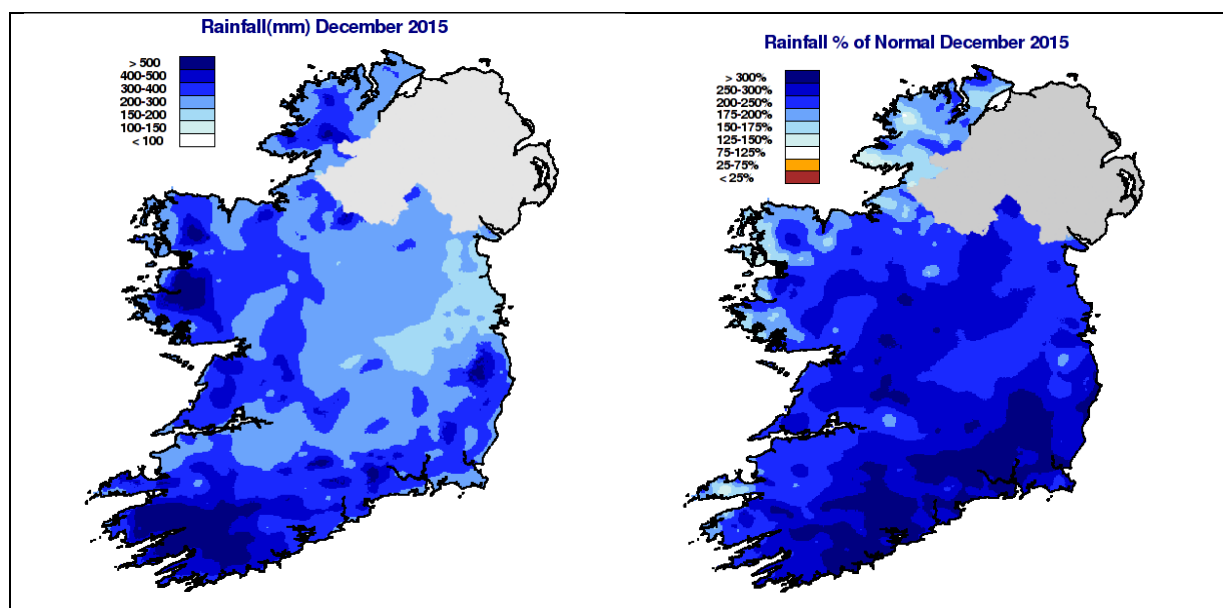


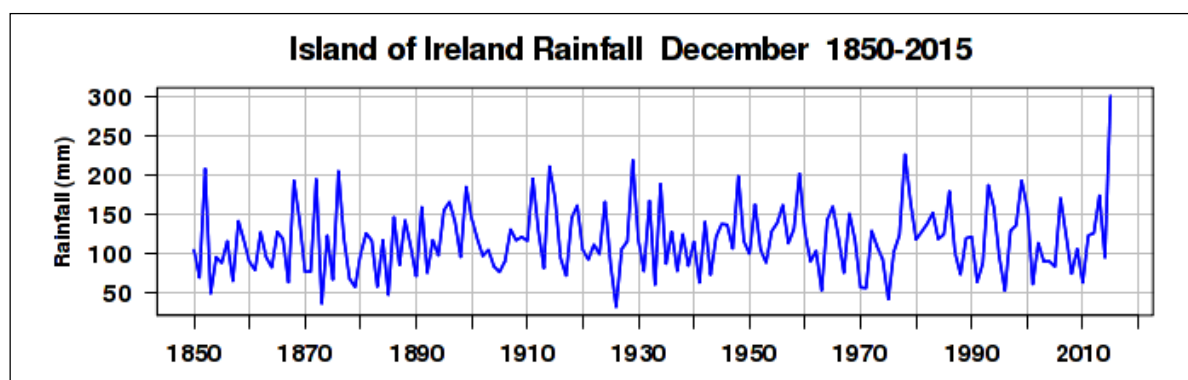
Figure 3: December 2015 rainfall, monthly total (left) and percentage of 1981-2010 long term average (right).

Table 1: Highest recorded rainfall totals in the wettest counties during storm Desmond on the 4<sup>th</sup> and 5<sup>th</sup> December 2015

Location	County	Rain (mm) 4 <sup>th</sup> Dec	Rain (mm) 5 <sup>th</sup> Dec	Total (mm) 4 <sup>th</sup> & 5 <sup>th</sup>
Leenane	Galway	140.2	119.5	259.7
Keenagh Beg	Mayo	160.8	93.6	254.4
Ballingeary	Cork	84.3	84.8	169.1
Glencar	Kerry	88.1	66.9	155
Fintown	Donegal	80.8	63.8	144.6
Cloonacool	Sligo	62.4	71.3	133.7
Derryhillagh	Mayo	73.2	59.8	133
Rossinvor	Leitrim	20.8	110.4	131.2
Cuilcagh Mtn	Cavan	55.4	73.2	128.6
Carron	Clare	61.7	39.9	101.6

**Table 2:** Highest recorded rainfall totals in the wettest counties during storm Frank on the 28<sup>th</sup> and 29<sup>th</sup> December 2015

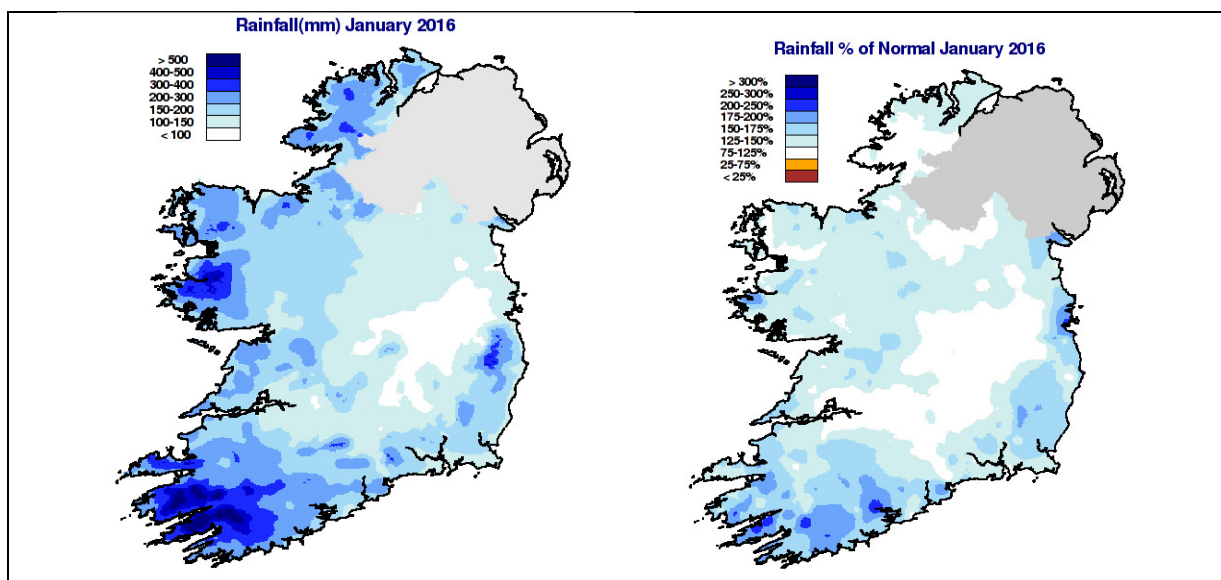
Location	County	Rain (mm) 28 <sup>th</sup> Dec	Rain (mm) 29 <sup>th</sup> Dec	Total (mm) 4 <sup>th</sup> & 5 <sup>th</sup>
Cloone Lake	Kerry	31.3	128.6	159.9
Glenamcnass	Wicklow	44.6	72.9	117.5
Kiltealy	Wexford	11.4	102.4	113.8
Carrick on Suir	Tipperary	25.2	81.1	106.3
Millstreet	Cork	23.3	76.9	100.2
Dungarvan	Waterford	38.2	58.2	96.4
Mullinavat	Kilkenny	18.2	60	78.2
Derrypark	Mayo	23.4	49	72.4
Clonaslee	Laois	35.1	36.3	71.4
Tullyco	Cavan	30.1	40.5	70.6



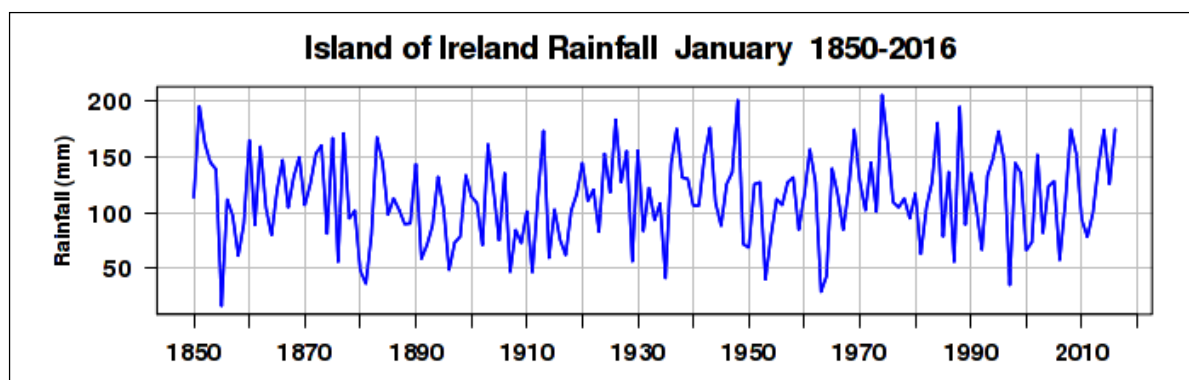
**Figure 4:** Island of Ireland Precipitation Series for December 1850-2015, December 2015 ranks as the wettest.

## January 2016

Most parts of the country recorded above long-term average rainfall, with up to twice the average in parts of the southwest and west (Figure 5). The wettest days of the month were the 1<sup>st</sup>, 5<sup>th</sup>, 9<sup>th</sup> and 26<sup>th</sup> (on the 5<sup>th</sup> and 9<sup>th</sup> some parts of the country received half of their monthly total). In the island of Ireland precipitation series January ranked as the 9<sup>th</sup> wettest (Figure 6).



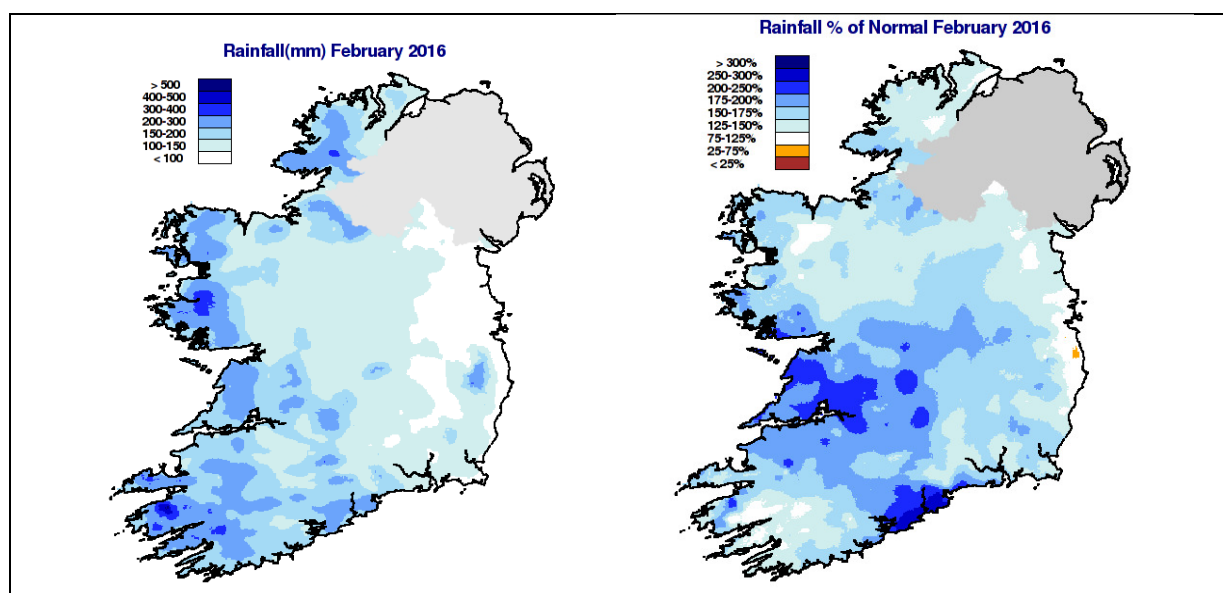
**Figure 5:** January 2016 rainfall, monthly total (left) and percentage of 1981-2010 long term average (right)



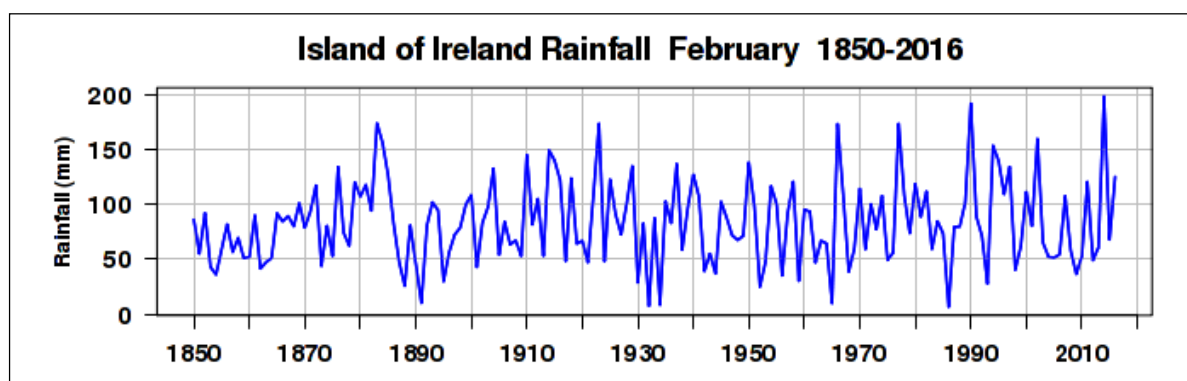
**Figure 6:** Island of Ireland Precipitation Series for January 1850-2016. January 2016 ranks as the 9<sup>th</sup> wettest.

## February 2016

Nearly all parts of the country again recorded above long-term average rainfall, with more than twice the average being reported in parts of Munster (Figure 7). The wettest days of the month were the 8<sup>th</sup>, 9<sup>th</sup>, 16<sup>th</sup>, 26<sup>th</sup> and 29<sup>th</sup>. In the island of Ireland precipitation series February ranked as the 9<sup>th</sup> wettest (Figure 8).



**Figure 7:** February 2016 rainfall, monthly total (left) and percentage of 1981-2010 long term average (right).



**Figure 8:** Island of Ireland Precipitation Series for February 1850-2016. February 2016 ranks as the 21<sup>st</sup> wettest.

### 3. Winter Season Analysis 2015/2016

It was the wettest winter (DJF) season on record in Ireland, seasonal rainfall totals were above the long-term average everywhere, with more than twice average rainfall reported in parts of the south, east and southeast midlands (Figure 9). Rainfall totals were above their monthly average in all three months of winter with December reporting the wettest conditions. The winter season was the wettest on record for the Island of Ireland in a rainfall series from 1850, at 189% of long-term average (602 mm), followed by 2013/14 at 173% (550 mm).

The persistent nature of the rainfall throughout November and the winter season can be seen on the accumulated rainfall plots for a number of geographically dispersed rain gauges (Figure 11). While the impacts of storms such as Desmond (4<sup>th</sup> and 5<sup>th</sup> December) is clear, there was also a steady increase in the rainfall accumulation throughout the period due to the persistence of the mild, moist, southwesterly airflow.

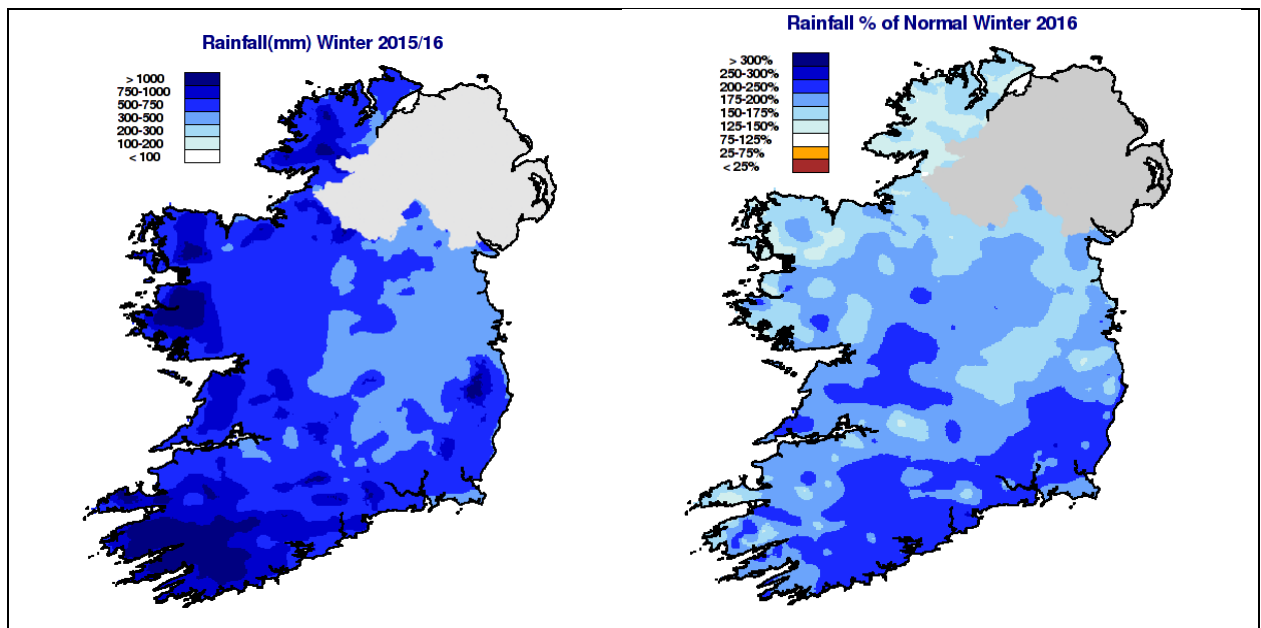


Figure 9: Winter 2015/16 rainfall, monthly total (left) and percentage of 1981-2010 long term average (right).

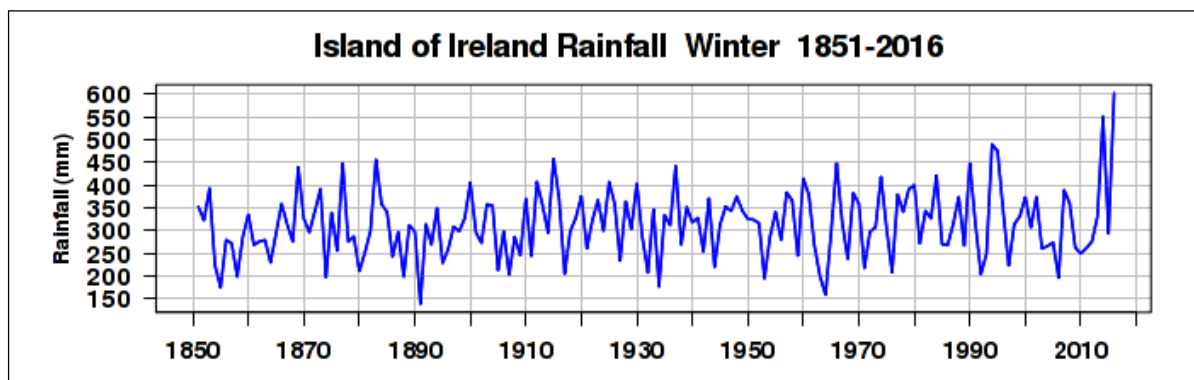
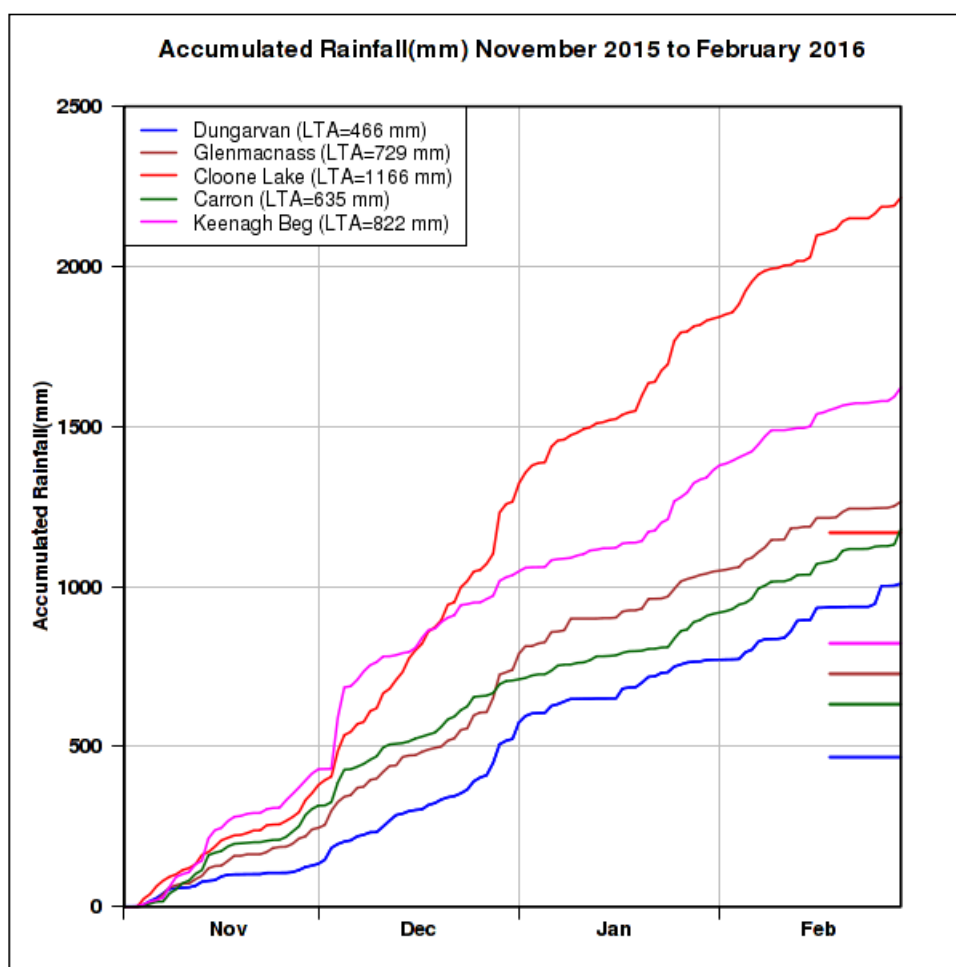


Figure 10: The meteorological winter season spanning December 2015 to February 2016 was the wettest on record for the Island of Ireland in a rainfall series from 1850.



**Figure 11:** Rainfall accumulation from 1st November 2015 to 29 February 2016 at selected rain gauges, Cloone Lake (Kerry), Keenagh Beg (Mayo) and Dungarvan (Waterford), Glenmacnass (Wicklow) and Carron (Clare). Long term averages (1981-2010) for the Nov-Feb period are shown in the legend and as horizontal segments on the right-hand axis of the plot.

#### 4. Conclusions

The winter of 2015/16 was certainly exceptional, following on from the very wet winter of 2013/2014 and the rainfall of November 2009. These extreme rainfall events are significant outliers in a time series dating from 1850. Whether these events are part of an underlying trend related to anthropogenic climate change, or due to natural climate variability requires further study. The pilot-storm naming scheme with the United Kingdom Meteorological Office has been successful in raising public awareness of the impact of such severe weather, the scheme has been extended to 2016/17 and its scope has been widened to include severe rainfall or snow events.

#### 5. Acknowledgements

Thanks to Sandra Spillane and Ruth Coughlan of Met Éireann and Mark McCarthy of the United Kingdom Meteorological Office for assistance in data analysis.



## 6. References

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