



# Exceptional weather events

**Type of event:**

**Rainfall / flooding**

**Date:**

**November 2002**

## **Precipitation event around 14<sup>th</sup> November 2002.**

(draft 25 November 2002)

There is a suspicion that heavy rainfall events have been increasing in frequency in recent years. Increases in rainfall during the winter half of the year have been reported from a number of countries. This is consistent with what might be expected in a global warming scenario – in particular, many climate model scenarios indicate increases in rainfall over parts of Europe apart from Mediterranean regions (IPCC, 2001). Though more work needs to be done, there is some indication that the intensity of short duration rainfall may be increasing in Ireland (Kiely 1999, Sheridan 2001).

One of the recent flooding events in Ireland affected Dublin in November 2002 and caused significant disruption and damage, especially in the area of the lower Tolka catchment. The rainfall event lasted from 1900 on 13<sup>th</sup> to 0800 on 15<sup>th</sup>. The following is an attempt to put the event in context.

**Comments here refer mainly to the period available in our database. The start dates for database data are 1941 Glasnevin, 1944 Dublin Airport, 1954 Casement Aerodrome.**

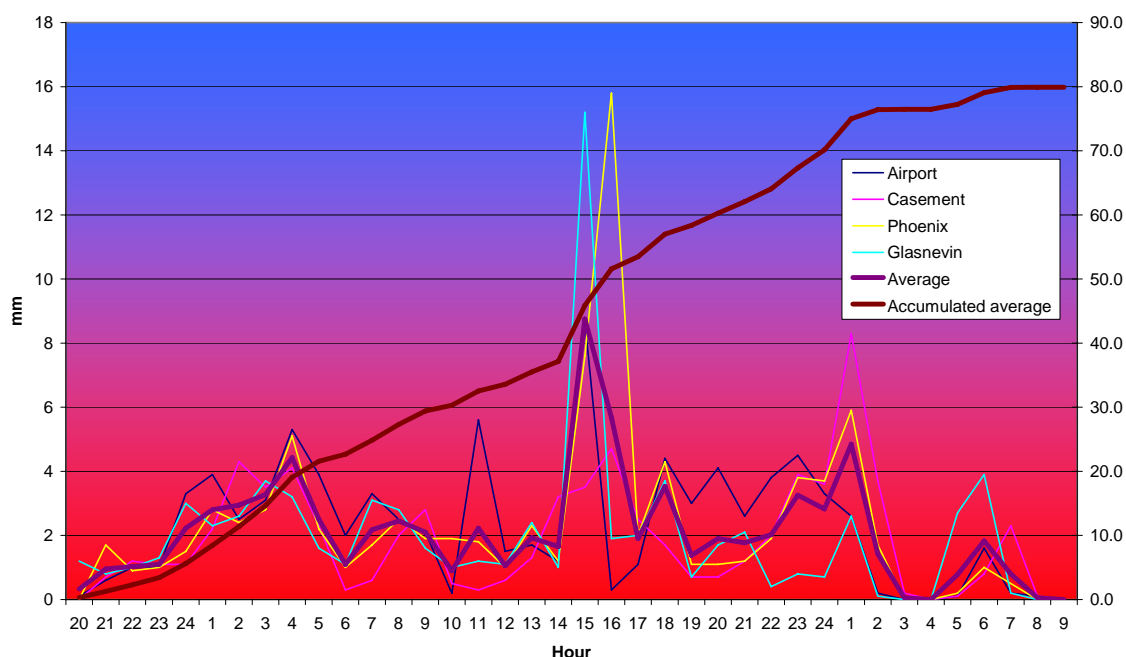
### **The Event**

#### **Preceding days:**

October 2002 was generally a very wet month in the area (Appendix II). Rainfall was 181mm at Dublin Airport (second highest monthly accumulation on record for any month there). At Casement it was the wettest month on record at 178.9mm. At 161.1 at Glasnevin (Botanic Gardens) it was the second wettest October (sixth wettest month) in the database records (Appendix III).

November also started wet with about 50mm being measured up to the morning of the 13<sup>th</sup> compared to a normal November total of about 65mm. The event in question brought the total for first half of November well above the normal total for the whole month. Soil moisture deficit calculations indicate that the ground was well saturated (see appendix I).

13 - 15 November 2002



### Rainfall on 13<sup>th</sup> to 15<sup>th</sup> November

The graph shows the hourly falls at a selection of stations during the event (left axis), the average falls at these stations and the total accumulation for this average (right hand axis). Water levels in the river Tolka (Botanic Gardens) started to rise late on 13<sup>th</sup>, peaked initially at 1930 on 14<sup>th</sup> (four to five hours after the rainfall peak) and rose subsequently by a further 0.23m to the overall peak at 0145 on 15<sup>th</sup> (Mac Carthaigh, 2002, see <http://www.epa.ie/Press%20Releases/default.htm>)

The following table gives an indication of the maximum falls of specific durations surpassing certain thresholds for on 13<sup>th</sup> to 15<sup>th</sup>, extracted from chart recorders

Station	Casement	Glasnevin	Phoenix Park
Duration			
15 min		5.8	
30		10.3	
60	8.3	15.5	15.8
2 hours	12.0	17.5	23.4
3	15.6	20.1	25.4
4	19.5	22.9	29.7
6	21.5	26.2	33.2
12	36.5	37.0	50.1
24	58.6	61.3	76.2

During this period an average total of about 80mm fell in the Dublin area (87.5 in the Phoenix Park, 85.4 in Dublin Airport, 74.7 in Glasnevin and 72.1mm at Casement Aerodrome).

Observed 14 November 2002 (00-24)

Dublin Airport           74.6mm

Casement                 52.5

## **Radar**

During the night of 13-14<sup>th</sup>, there was a large area of rainfall with the most intense parts over the Irish Sea and a sharp western edge. It was circulating cyclonically around a point somewhere to the between Wexford and Land's end. While the individual radar images through the day seemed to show the rain moving south over the west of Ireland, the line of most intense rainfall seemed to pivot about the Dublin area.

It should be noted that quantitative rainfall estimation from weather radar has large margins of error and the very close proximity to the radar at Dublin Airport may cause some further problems in quantitative estimation over Dublin city.

### 24-Hour radar precipitation accumulation

The 24 hour Dublin radar accumulation from 00 on 14<sup>th</sup> showed a large area of 16 to 32mm accumulation centred approximately on Dublin with the most intense (48 to 64mm) area centred on a small area (c 3km radius) located about 12km from the radar, bearing about 250 degrees.

### 6-Hour radar precipitation accumulation

The midnight to 0600 radar accumulation (see Appendix V) showed a number of 16 to 32mm pixels within 25km of the radar location, mainly in the northwestern sector. The more intense rainfall on the 0600 to 1200 image appears to the west of the radar with a number of 16 to 32mm pixels between 15 and 30 km distant from the radar bearing about 260 degrees. The largest number of pixels of this value were in the 1200 to 1800 accumulation in the sector between 180 and 280 degrees from the Airport clustered mostly around 10km and 25 km distant.

The 1800 – 2400 image shows the rainfall area to have significantly contracted with only a very few 16 to 32mm pixels remaining.

## **Context**

While hourly rainfalls are reported from some stations and can be extracted from charts for others, almost all rainfall stations report daily rainfall (measured at 0900 and assigned to previous day). On the basis of these 0900 to 0900 rainfalls, the 14<sup>th</sup> November was the seventh / tenth / eighth wettest day on record at Dublin Airport, Casement Aerodrome and Glasnevin respectively (Appendix IV). Interestingly, in the case of all three stations, the rainfall on 20<sup>th</sup> October 2002 was actually higher than that of the current event.

## Met Éireann – The Irish Meteorological Service

As mentioned before, the data presented here is from the electronically held records. In the case of Glasnevin where some data is available back to 1860, for example, we have paper records indicating daily falls on 25/8/1905 of 90.9mm, on 3/9/1931 of 77.5mm and on 27/10/1880 of 75.7mm

### Return periods

For the Dublin area, north of the Liffey, the following ranges (mm) are calculated:

Return period	20 years	50 years	100 years
12 hour duration	53 – 57mm	64 – 69mm	72 – 78mm
24 hour duration	63 – 68mm	76 – 82mm	87 – 93mm

For comparison, the maximum 12- and 24-hour (end time) falls for Dublin area for the event under consideration were

Location	Airport	Casement	Phoenix	Glasnevin
12 hour	39.6 (150100)	36.5 (150200)	50.1 (150200)	37.0 (141800)
24 hour	74.6 (150000)	58.6 (150100)	76.2 (150100)	61.3 (142100)

From this perspective, the 12-hour return observed rainfalls are not dramatically exceptional – return periods less than 20 years. The 24-hour rainfalls are somewhat more significant (15 to 45 years approximately).

T. Sheridan  
26 November 2002

---

### References

IPCC, 2001: *Climate Change 2001, The Scientific Basis*. Contribution of Working Group 1 to the Third Assessment Report of the Intergovernmental Panel on Climate Change. [Houghton, J.T, Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, C.A. Johnson(eds.)], Cambridge University Press. 881 pp.

Kiely, G. 1999. Climate Change in Ireland from Precipitation and Streamflow Observations. *Adv. in Water Res.*, 23, 141 – 151.

Mac Carthaigh, M. 2002. Flooding in the Tolka Catchment 15 November 2002. Environmental Protection Agency.

Sheridan, T. 2001. Analysis of Trends at Some Irish Rainfall Stations. Met Eireann, Dublin. 44pp

## Appendix I

### Soil moisture deficits (mm)

	<b>2002</b>	<b>Casement</b>	<b>Dub. Apt</b>
Thur	<b>03-Oct</b>	38	30
Mon	<b>07-Oct</b>	56	56
Thur	<b>10-Oct</b>	37	19
Mon	<b>14-Oct</b>	8	2
Thur	<b>17-Oct</b>	-3	0
Mon	<b>21-Oct</b>	-10	-10
Thur	<b>24-Oct</b>	-1	-1
Mon	<b>28-Oct</b>	-2	-1
Thur	<b>31-Oct</b>	-3	-3
Mon	<b>04_Nov</b>	-6	-5
Thur	<b>08_Nov</b>	0	0
Mon	<b>11-Nov</b>	-7	-7
Thur	<b>14-Nov</b>	-10	-10
Mon	<b>18-Nov</b>	0	-1

## Appendix II

### Some daily rainfalls November 2002

Dublin Airport					Casement Aerodrome				
	year	month	day	rainfall(mm)		year	month	day	rainfall(mm)
	2002	11	1	3.4		2002	11	1	5.6
	2002	11	2	21.6		2002	11	2	8.3
	2002	11	3	2.5		2002	11	3	3.2
	2002	11	4	0.0		2002	11	4	0.0
	2002	11	5	0.5		2002	11	5	0.3
	2002	11	6	1.8		2002	11	6	3.4
	2002	11	7	0.2		2002	11	7	0.1
	2002	11	8	11.5		2002	11	8	13.8
	2002	11	9	7.9		2002	11	9	5.9
	2002	11	10	4.1		2002	11	10	2.2
	2002	11	11	0.2		2002	11	11	1.9
	2002	11	12	0.6		2002	11	12	1.4
	2002	11	13	6.4		2002	11	13	4.1
	2002	11	14	74.6		2002	11	14	52.5
	2002	11	15	5.8		2002	11	15	15.9
	2002	11	16	0.0		2002	11	16	0.0
	2002	11	17	0.0		2002	11	17	0.0
		<b>Total</b>		141.1			<b>Total</b>		118.6
October	2002	<b>Total</b>		181.0	October	2002	<b>Total</b>		178.7

### Appendix III

#### Maximum monthly falls

Station	Dublin Airport (532 / 2132)		Casement (3723)		Glasnevin (1823)	
Period	1/1944 – 10/2002		1/1954 – 10/2002		1/1941 – 10/2002	
Rank	Date (year month)	Fall	Date	Fall	Date	Fall
1	1978 12	217.0	<b>2002 10</b>	<b>178.9</b>	1978 12	218.8
2	<b>2002 10</b>	<b>181.0</b>	1960 10	171.2	1965 11	192.6
3	1965 11	178.8	1978 12	168.9	1960 10	183
4	1960 10	178.2	1965 11	165.9	1948 1	175.2
5	1948 1	171.1	1993 6	164.1	1993 5	161.4
6	1958 6	168.5	1999 9	161.6	<b>2002 10</b>	<b>161.1</b>
7	1986 8	159.2	1986 8	159.8	1956 8	159
8	1976 10	156.3	1967 5	148.6	1958 6	157
9	1993 5	152.5	2000 11	146.4	1976 9	155.8
10	1990 10	149.2	2000 12	140.8	1986 8	153.4

#### 1961-1990 Normals

Station	Dublin Airport	Casement	Glasnevin
October	70	69	66
November	64	66	63



**Appendix IV**

**Annual max daily 09-09 falls**

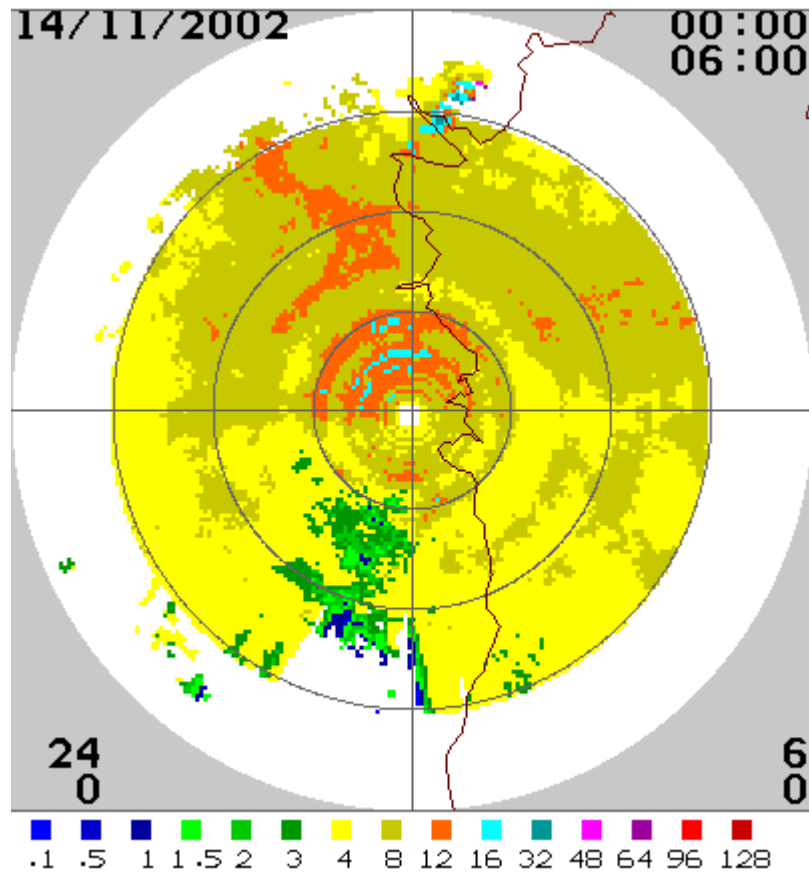
Station	Dublin Airport (532 / 2132)		Casement (3723)		Glasnevin (1823)	
	1/1/44 – 31/10/02		1/1/54 – 30/10/02		1/1/41 – 30/10/02	
Rank	Date	Fall	Date	Fall	Date	Fall
1	11/06/93	73.9	11/06/93	97.5	11/06/93	76.7
2	25/08/86	72.2	25/08/86	89.3	25/08/86	73.5
3	05/11/00	62.8	05/11/00	82.0	05/08/78	67.0
4	19/09/46	57.5	01/11/68	55.6	05/11/00	61.9
5	21/08/55	53.2	09/06/66	53.1	19/09/46	61.0
6	20/10/02	53.2	20/09/99	51.1	20/10/02	59.7
7	04/08/99	48.4	20/10/02	50.1	16/11/65	52.2
8	09/06/66	48.4	08/12/54	47.4	09/06/66	44.9
9	16/08/68	47.7	07/12/00	46.8	16/08/63	44.4
10	16/11/65	46.0	15/07/73	44.7	25/05/93	44.0

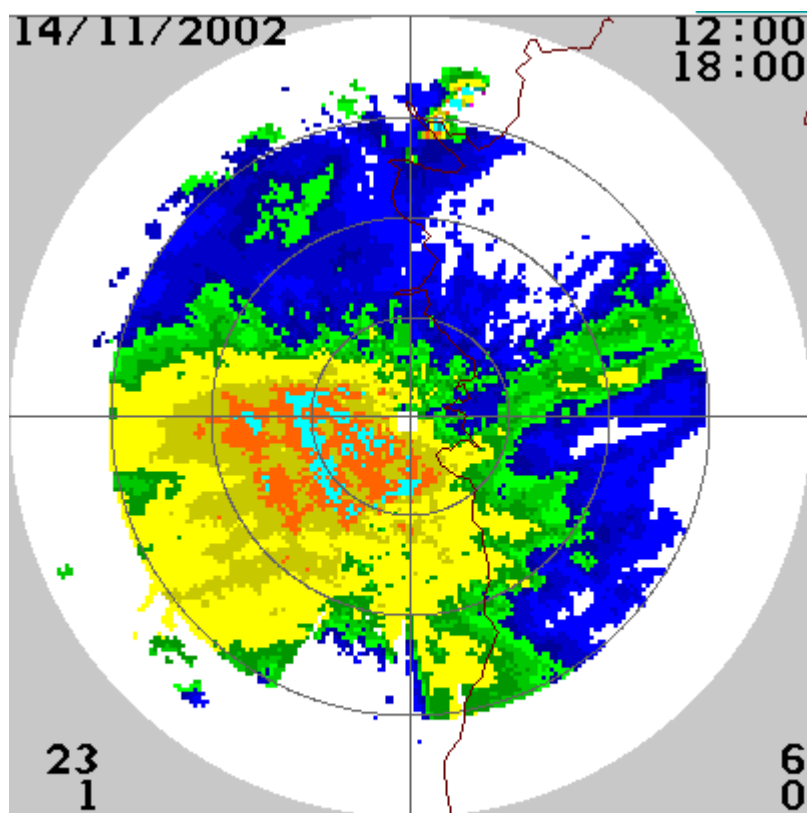
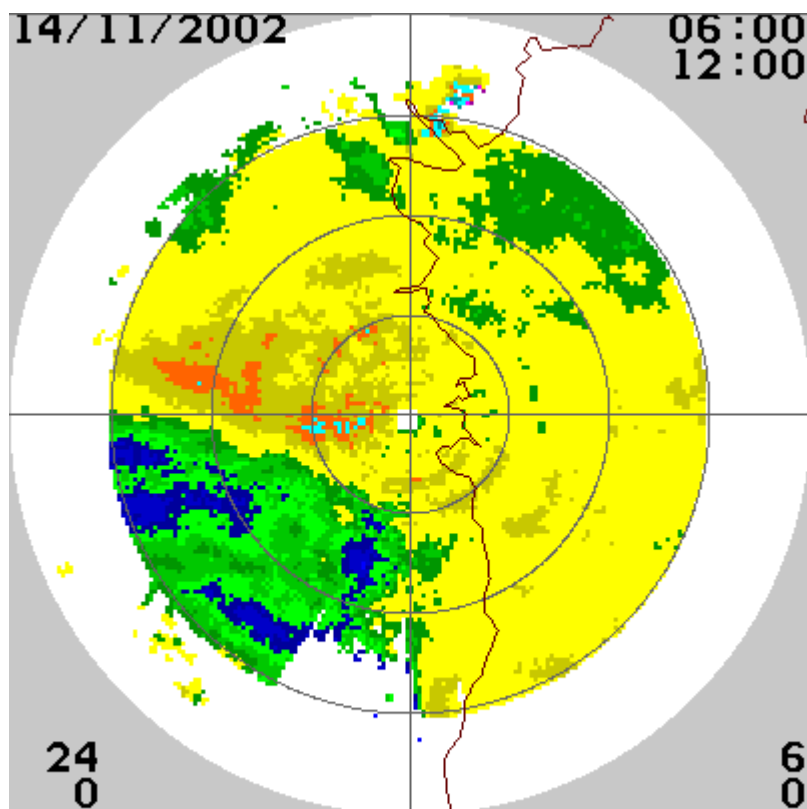
0900 14 to 0900 15/11/02

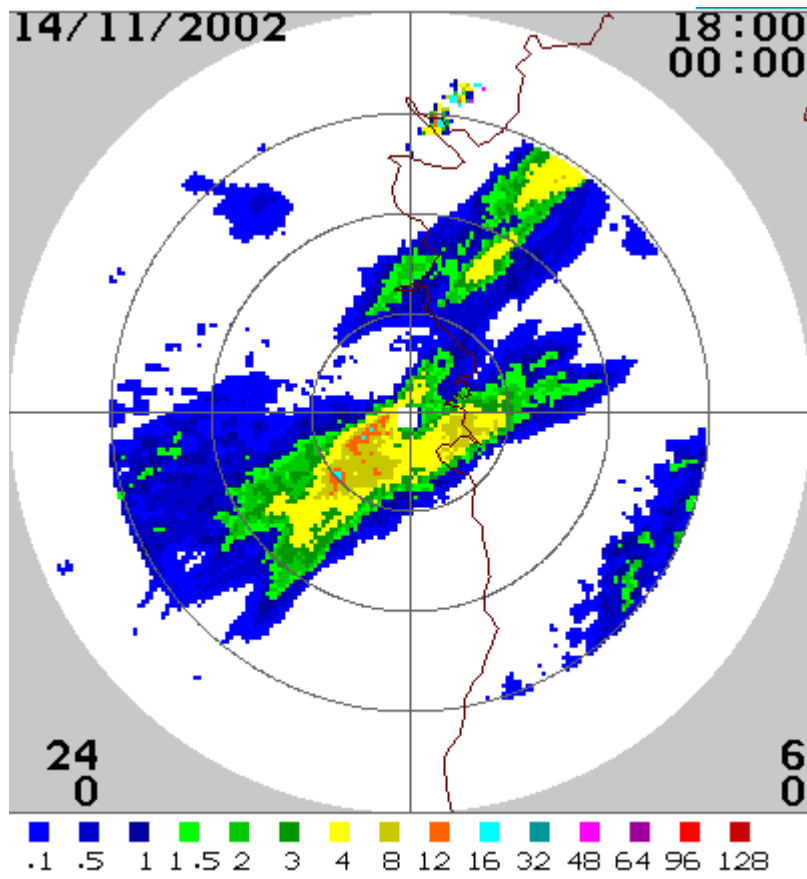
Dublin Airport	50.8mm
Casement	45.9mm
Glasnevin	45.4mm
Phoenix Park	60.0mm

Appendix V

Six hourly radar precipitation accumulations





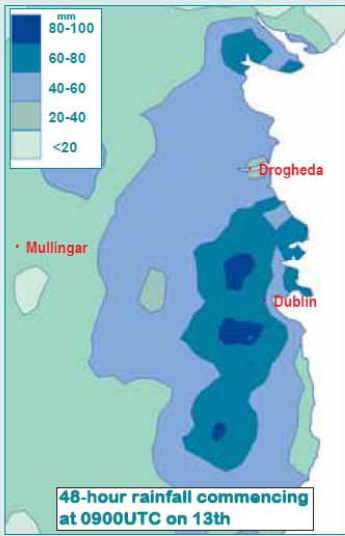


## Flooding follows heavy rain in east and south



Late on the 13th, an area of heavy rain moved into eastern areas, associated with a deep depression of 966hPa which became slow-moving over the Irish Sea (see satellite image below left). Rain continued for over 30 hours in the Dublin area and was heavy at times, causing some severe flooding, especially along the valley of the River Tolka. The graph below shows the hourly falls at a selection of stations during the event (left hand axis), the average falls at these stations and the total accumulation for this average (right axis). After a period of very wet weather extending back to October, soil moisture levels in the area were already near saturation, so that almost all of the rain that fell was immediately discharged into water courses. Water levels measured on the Tolka at Glasnevin (Botanic Gardens) started to rise late on the 13th, peaked initially at 1930 on the 14th (four to five hours after the rainfall peak) and rose subsequently by a further 0.23m to the overall peak of 2.42m at 0145 on the 15th, corresponding to a flowrate of 97m<sup>3</sup>/s. This was the highest level recorded in over 50 years at the station, including the major flood of December 1954 (Mac Cárthaigh, see [www.epa.ie/Press%20Releases/default.htm](http://www.epa.ie/Press%20Releases/default.htm)).

As shown by the map on the left, between 60 and 100mm of rain fell over a 48-period in many eastern areas. Dublin Airport's daily fall of 75mm up to midnight on the 14th was its highest for November since records began there in 1941; the only previous higher daily fall at the station was measured in June 1993.



Maximum 12-hour and 24-hour falls for Dublin stations over the period were as follows (date and time of ending in brackets):

	Dublin Apt	Casement	Phoenix Pk	Glasnevin
12 hour	39.6 (150100)	36.5 (150200)	50.1 (150200)	37.0 (141800)
24 hour	74.6 (150000)	58.6 (150100)	76.2 (150100)	61.3 (142100)

These values compare with calculated return periods for north Dublin as follows:

Return period	20 years	50 years	100 years
12 hour duration	53 - 57mm	64 - 69mm	72 - 78mm
24 hour duration	63 - 68mm	76 - 82mm	87 - 93mm

From this perspective, the 12-hour observed rainfalls have a return period of less than 20 years, while 24-hour falls are more significant, with 15- to 45-year returns.

Little or no rain fell over the south and southwest of the country during the 14th, but heavy falls on subsequent days brought flooding in these areas also, especially affecting Cork city. Cork Airport and Valentia Observatory measured over 120mm in the 8-day period between the 20th and 27th, or the equivalent of the normal total for all the month of November. Overall it was the wettest November on record at a number of stations; in consecutive months, Rosslare had both its wettest October and November since records began there in 1956.

(satellite image courtesy Dundee University, pictures Peter Lennon)

