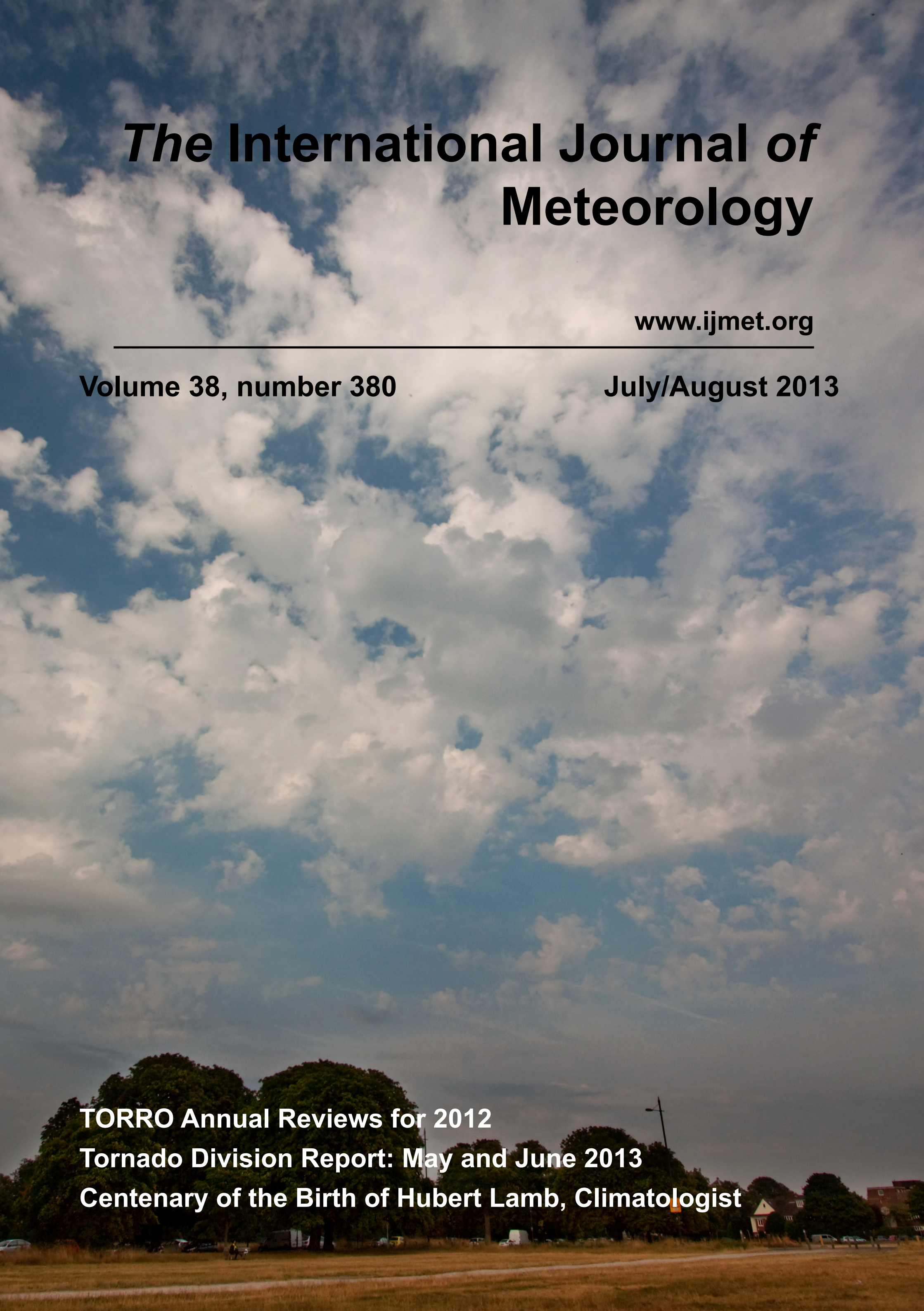


The International Journal *of* Meteorology

www.ijmet.org

Volume 38, number 380 July/August 2013

TORRO Annual Reviews for 2012

Tornado Division Report: May and June 2013

Centenary of the Birth of Hubert Lamb, Climatologist

To advertise on these pages please email advertise@ijmet.org

July/August 2013 Vol. 38, No. 380

The International Journal *of* Meteorology

Volume 38 - 2013
Number 380

Email: editor@ijmet.org

www.ijmet.org
ISSN 1748-2992 (since 1975)

"An international magazine for everyone interested in weather and climate, and in their influence on the human and physical environment."

July/August 2013 Vol. 38, No. 380

THE INTERNATIONAL JOURNAL OF METEOROLOGY

This Journal is published by The Tornado and Storm Research Organisation (TORRO), a privately supported research body serving the international public interest.

www.ijmet.org is sponsored by Simply Mail Solutions www.simplymailsolutions.com

Editor: Paul Knightley, 18 Fakenham Close, Reading, RG6 4AB, United Kingdom
editor@ijmet.org

NOTES AND GUIDELINES FOR SUBMISSION

Research papers, letters, books and scientific reports for review, news items, conference information, advertising and other communications should be addressed to the Editor in the first instance. Authors should send their contributions initially to editor@ijmet.org in UK English.

Research papers should commence with a short abstract summarising its content and contain full contact details. Keywords relevant to the paper are also appreciated.

References should be referred to in the text by the author's name and year of publication e.g. Browning et al. (1995). Responsibility for opinions expressed in articles rests with the authors who should obtain copyright permission where necessary.

The text should be sent through in MS Word or similar. All figures, diagrams, photos etc must be numbered and supplied as independent graphics files separate to each other and from the text file with no embedded captions. The graphics should also be sent in the highest resolution possible so they are suitable for printing.

Please note that for universal citation purposes the recommended abbreviation for the **The Journal of Meteorology (ISSN 0307 – 5966)** was ***J. Meteorology, UK.*** The recommended abbreviation for the **International Journal of Meteorology (ISSN 1748 – 2992)** is ***Int. J. Meteorology, UK.***

All contributors will receive a free copy of the Journal that their work features in.

Photographs should also be emailed to editor@ijmet.org as digital originals where possible or as high resolution image files (bmp, tiff, jpg etc) digitised at least 300 dpi. Please include as much detail as possible about the photograph(s) e.g. what it features, where and when it was taken, and supply contact details.

The International Journal of Meteorology is a non-profit making research periodical. Donations are always gratefully welcomed and go towards supporting our valuable research.

Published by Artetech Publishing Company, UK.
ISSN 1748-2992

The International Journal *of* Meteorology

Editor: PAUL KNIGHTLEY, MeteoGroup UK

editor@ijmet.org

July/August 2013, Vol.38, No. 380

CONTENTS

Front cover image: © **MATT DOBSON** After temperatures peaked at 33.5°C on 22 July 2013, lines of altocumulus castellanus clouds erupted across London during the early evening.

Back cover image: © **MATT DOBSON** A glorious summer evening over Wimbledon Common on 24 July 2013 is accompanied by an impressive display of altocumulus clouds that covered nearly the entire sky.

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

TORNADOES AND OTHER WHIRLWINDS IN THE UNITED KINGDOM 2012

BY PAUL R BROWN AND G. TERENCE MEADEN
Tornado Division, Tornado and Storm Research Organisation

Terence.meaden@torro.org.uk

Abstract: Tornadoes, waterspouts, funnel clouds, and other whirlwinds are summarised for the United Kingdom for 2012, and the data compared with those for the preceding five years. 2012's totals were very similar to those in 2011 for tornadoes, waterspouts, and land devils, but there were far more funnel cloud reports.

COMPARISON OF WHIRLWIND TOTALS FOR 2012 WITH THOSE FOR RECENT YEARS

The number of known tornadoes for 2012 was almost the same as in 2010 and 2011, and again somewhat below the long-term average. The number of waterspouts reported was also very similar to those of the previous two years, and somewhat higher than in earlier years. The continuing pattern of very unsettled summers meant that 2012 had only isolated reports of land devils. For the United Kingdom we know of 23 tornadoes over land, of which 16 have been classified as definite (seven probable); one of the tornadoes began over the sea as a waterspout, and there were another 11 reports of waterspouts that did not reach land. The total of all tornadoes, whether over land or sea, is therefore 34. Funnel clouds that did not reach the surface totalled 139 sightings, an unusually large number. This gives a combined annual total for all tornado-related events (TN+WS+FC) of 173.

Table 1. UK whirlwinds: Annual totals 2007 to 2012.

	2007	2008	2009	2010	2011	2012
Tornado	53	14	36	22	22	23
Waterspout	9[1]	9[1]	5[2]	12	11[1]	12[2]
Funnel cloud	165	69	85	54	65	139
Total tornadic events	***225[3]***	***90[3]***	***125[3]***	***88***	***96[3]***	***173[3]***
Total No of days (UK) having TN, WS, or FC	***69***	***52***	***57***	***51***	***54***	***73***
Land and water devils	6	4	4	22	8	8
Eddy whirlwinds	2	0	1	1	1	1

[1] Two of these also included in Tornado total
[2] One of these also included in Tornado total
[3] Total excludes WSs that were also TNs

Tornadoes or waterspouts occurred on 24 different days during 2012, and there were an additional 49 days on which only funnel clouds were reported, making a total of 73 days with tornado-related events of some sort.

SUMMARY OF WHIRLWINDS FOR 2012 BY MONTH AND TYPE

Tornadoes in 2012 were fairly evenly distributed through the year, no month having more than six, but only four months having none at all; dates with more than one tornado were 25 April (4), 7 May (3), 28 June (2), 29 August (2), 12 September (2), 16 December (2). July and August had exceptionally high funnel cloud counts, and they were also numerous in April and June (see Table 2).

Table 2. UK whirlwinds: Monthly and annual totals 2012.

2012	TN	WS	FC[1]	TN+WS+FC	LD+WD	EW
Jan	1	1	1	3	0	1
Feb	0	0	1	1	0	0
Mar	0	0	1	1	0	0
Apr	6	0	20	26	3	0
May	3	0	5	8	3	0
Jun	3	1	18	22	1	0
Jul	2	2	47	51	1	0
Aug	4	1[2]	36	40[3]	0	0
Sep	2	1	5	8	0	0
Oct	0	2	4	6	0	0
Nov	0	3	1	4	0	0
Dec	2	1	0	3	0	0
Year	**23**	**12**	**139**	**173[3]**	**8**	**1**

[1] Excluding any that were seen together with tornadoes or waterspouts
[2] Also included in Tornado totals
[3] Total excludes WS that was also TN

Of the 23 tornadoes, three were rated T4 (severe tornado) on the International Tornado T-Scale, two were T3, two were T2-3, four were T2, two were T1-2, five were T1, and three were either T0 or T0-1; the remaining two were not assigned a strength.

Table 3a. Tornadoes in the United Kingdom in 2012.

TYPE/DATE	PLACE	COUNTY	NGR	STRENGTH
TN2012Jan03	Chigwell	Greater London	TQ458923	T1
tn2012Apr04	Evershot?	Somerset	ST5604?	T0-1
tn2012Apr25	Newport	Monmouthshire	ST291911	T1
TN2012Apr25	Rugby	Warwickshire	SP493743 to SP494752	T1-2
tn2012Apr25	Brede	East Sussex	TQ806183	
TN2012Apr25	Halstead	Essex	TL796309 to TL801321	T2-3

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

TYPE/DATE	PLACE	COUNTY	NGR	STRENGTH
tn2012Apr26	Carcroft	Yorkshire, West Riding	SE5110	T0
TN2012May07	Ducklington	Oxfordshire	SP370061 to SP3907	T4
TN2012May07	Eynsham	Oxfordshire	SP4309	T2
TN2012May07	Yarnton to Kidlington	Oxfordshire	SP472120 to SP4913	T2
TN2012Jun21	Long Sutton	Lincolnshire	TF~434223 to TF440235	T1-2
TN2012Jun28	Newbold Verdon to Cropston Reservoir	Leicestershire	SK4403 to SK547123	T4
TN2012Jun28	Swarby to Ewerby	Lincolnshire	TF034392 to TF1247	T2-3
tn2012Jul04	Earlston	Berwickshire	NT5738	T0
TN2012Jul18	Soham	Cambridgeshire	TL603723	T2
2WS-TN2012Aug04	Clevedon	Somerset	ST401717	
TN2012Aug15	Bolton	Lancashire	SD754067 to SD743093	T4
TN2012Aug29	New Milton	Hampshire	SZ~247953	T1?
TN2012Aug29	North Standen, near Hungerford	Berkshire	SU313672	T2?
tn2012Sep12	South Wigston	Leicestershire	SP593981	T1
tn2012Sep12	Swanley	Kent	TQ520685	T1
TN2012Dec16	Sancreed	Cornwall	SW412287 to SW450305	T3
TN2012Dec16	St Erth	Cornwall	SW540336	T3

The totals given so far in this summary exclude events in the Republic of Ireland, but when these are included (Table 3b) the 2012 totals for tornadoes and waterspouts rise to 26 and 13 respectively (see the annual summary by John Tyrrell for full details of the Irish whirlwinds).

Table 3b. Tornadoes in the Irish Republic in 2012.

TYPE/DATE	PLACE	COUNTY	IGR	STRENGTH
TN2012Jun12	Cloncurry	Kildare	N8041	T0
TN2012Aug29	Dunlavin	Wicklow	N8601	T4
TN2012Oct17	Dublin	Dublin	O131319 to O123345	T2

Brief descriptions of all whirlwinds for 2012 can be found in the monthly summaries published in this journal.

ACKNOWLEDGEMENTS
TORRO thanks all those people who have helped us in any way in 2012, and especially those who conducted site investigations.

WEATHER IMAGES
THUNDERSTORM, CHARMOUTH, DORSET, 21 JULY 2013

TORRO member Matt Clark went out storm chasing on the evening of the 21 July. He says “I was actually aiming for Weymouth, but saw a huge Cb forming to the west of the initial storms as I was en route, lit up by the moon. It started producing lightning, one of the few occasions that I’ve seen the cumuliform part of the Cb being lit from inside by lightning in the UK, so I decided to head to Charmouth where you can park right on the sea front. As it moved in the storm produced occasional (one every 2 - 4 minutes), but very powerful CGs, mixed with some intracloud lightning, which eventually were occurring over or just west of Lyme Regis, not much more than a mile from where I was. The thunder was extremely loud! All this was between about 2230 and 2315 BST. The cell seemed to die as it moved inland, but a couple of other ones developed behind it, which produced the odd flash, including a huge CG less than a mile away as I was driving past Kilmington on the A35, around midnight, amidst torrential rain (the raindrops were colossal in size!).”

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

THUNDERSTORM DIVISION REVIEW FOR BRITAIN AND IRELAND 2012
(also incorporating the TCO annual survey)

BY JONATHAN D C WEBB
Thunderstorm Division,
Tornado and Storm Research Organisation

Jonathan.webb@torro.org.uk

Abstract: Days with thunder heard were close to average for many in Britain and Ireland, and, likewise in line with normal expectation, observers in eastern England recorded the highest incidences. Despite the very wet summer, this was another year with very few occasions of widespread severe thunderstorms, a notable exception being on 28 June when an unusually severe hailstorm traversed the English Midlands.

1. OVERVIEW

Thunder day totals for 2012 are mapped in Figure 1 (with a map of 1971-2000 means for comparison in Figure 2) and are also presented, for selected stations with long term averages (1981-2010 where available), in Table 1. Days with thunder heard were close to average for many in Britain and Ireland, and, likewise in line with normal expectation, observers in eastern England recorded the highest incidences with 28 days at Calthorpe, Norfolk (ten of these in August). The usual caveats apply with respect to the interpretation of maps of thunder frequencies such as the distribution of observers, the number of observations based on a 24 hour watch and the impact (arguably an increasing one) of background noise (see also section 5). Prichard (1985) discusses various issues associated with this statistic. Notwithstanding the very wet summer, this was another year with very few occasions of widespread severe thunderstorms, a notable exception being 28 June when an unusually severe hailstorm traversed the English Midlands (see section 4). Hours with thunder were mostly below average (Table 2).

2. WIDESPREAD THUNDERSTORM OUTBREAKS IN 2012

The identification of days of widespread thunderstorm activity across England and Wales has again been based on a geographical spread of stations used by Prichard (1986), the automation of synoptic stations being compensated for by the use of more reports from voluntary observers. Based, broadly, on the aforementioned criteria, the mean annual total is around 15 days. Thunder could be described as widespread over England and Wales on 11 days in 2012 (April 12, 22; May 15, 30; June 15, 28; July 11, 29; August 4, 5, 25). Significantly, with two exceptions (30 May and 28 June), all these occasions were essentially ‘thundery shower’ situations associated with very unstable polar air in the circulation of low pressure either over the British Isles or the adjacent North Sea. These showery scenarios tended to be more potent, at least regarding precipitation, later in the summer when air mass (and sea) temperatures were higher.

Figure 1. Thunder days in 2012.

Figure 2. Mean number of thunder days 1971-2000.

Key:
Number of days >20 15-19 10-14 5-9 <5

3. REPORTED INCIDENCE OF OVERHEAD STORMS, LIGHTNING DAMAGE AND OTHER SEVERE THUNDERSTORM EVENTS IN 2012

Overhead thunder is defined as electrical activity reported by an observer to be at a distance of 5km or less, or “close”. Observations of overhead thunder and the duration of thunder are given for selected locations in Table 2. Overhead activity was reported on 11 days at Claygate (Surrey) and Carlton-in-Cleveland (North Yorkshire) while thunder was heard during 48 hours at Calthorpe (Norfolk) and 41 hours at Claygate (Surrey).

The reported lightning incidents (assumed to be only a proportion of the total and subject to future review) totalled 77. The seasonal distribution of reported lightning incidents and damage is shown in Table 3. The reported incidents were well below the average for the previous 20 years. However, sadly, two lightning related fatalities occurred. A bricklayer was struck and killed near Crewe (Cheshire) on 11 April while a kayaker died from a lightning induced heart attack at Bradwell (Suffolk) on 6 August.

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

Table 1. Thunder days in 2012 at selected locations.

STATION	COUNTY	2012 total	Average 1981-2010 (unless otherwise stated)	Diff +/-
Calthorpe	Norfolk	28	17 (1987-2011)	+11
Bury St Edmunds	Suffolk	19	19 (2001-2010)	0
Waddington	Lincolnshire	17	15	+2
Carlton-in-Cleveland	N. Yorkshire	15	13	+2
Oxford	Oxfordshire	13	12	+1
Guernsey Airport	Channel Isles	13	12	+1
Cosby	Leicestershire	12	13	-1
Llangyndeyrn, Carmarthen	Dyfed	12	11 (2001-2010)	+1
Epsom Downs	Surrey	12	17	-5
Llansadwrn	Anglesey	11	7	4
Stony Stratford	North Bucks	11	14 (1986-2010)	-3
Great Malvern	Worcestershire	11	10	+1
Gloucester	Glos.	10	10 (Innsworth 1961-1981)	0
Wokingham	Berkshire	9	16	-7
Drumburgh	Cumbria	9	8 (2001-2010)	+1
Knockroe, Co Monaghan	Ireland	9	5 (Clones)	+4
Ardpatrick, Co Limerick	Ireland	9	11 (1991-2005)	-2
Bulford	Wiltshire	8	11 (Boscombe Down 1957-85)	-3
Velindre	Powys	8	10	-2
Casement Airport, Dublin	Ireland	7	5	+2
Barnstaple	Devon	6	9 Chivenor 1957-1973	-3
Elderslie	Renfew	6	6	0
Dun Laoghaire, Dublin	Ireland	6	8 (2001-2010)	-2
Eskdalemuir	Dumfries	5	7	-2
Leuchars	Fife	5	5	0
Lymington	Hampshire	5	11 (Southampton 1969-85)	-6

STATION	COUNTY	2012 total	Average 1981-2010 (unless otherwise stated)	Diff +/-
Woodlands St Mary	Berkshire	5	12 (1990-2009)	-7
Fishponds	Bristol	5	10 (1950-2010)	-5
Fair Isle	Northern Isles	5	6 (1975-2000)	-1
Straide, Co Mayo	Ireland	4	9 (2001-2010)	-5
Ebbw Vale	Gwent	4	8 (1988-2010)	-4
Newtownards, Co Down	Ireland	3	6	-3
Cork Airport, Co Cork	Ireland	2	3	-1
Ronaldsway	Isle of Man	2	4	-2
Camborne	Cornwall	1	8 (St Mawgan)	-7

Table 2. Duration of thunder in 2012 and number of hours of thunder heard.

Station (County)	Thunder days (Overhead thunder days)	Storm hours 2012	Comparative notes ref thunder duration
Fishponds (Bristol)	5 (4)	8	Mean hours 2002-2011 were 14 (mean t hours at Filton 1971-1980 were 23)
Oxford (Oxon)	13 (5)	19	Mean 2002-2011 was 21 hours (mean t hours at Brize Norton 1971-1983 were 24)
Calthorpe (Norfolk)	28 (8)	48	
Bury St Edmunds (Suffolk)	19 (3)	25	Mean t hours 2002-2011 were 31 (Wattisham 1971-1983 mean was 34)
Llangyndeyrn (Carmarthen)	12 (8)	20	
Knockroe, Monaghan (Ireland)	9 (4)	13	
Bulford (Wiltshire)	8 (4)	10	Mean t hours at Boscombe Down 1961-1980 were 24
Carlton-in-Cleveland (North Yorkshire)	15 (11)	28	Mean hours 2002-2011 were 25 (mean t hours at Leeming 1971-1983 were 22)
Elderslie (Renfrew)	6 (3)	10	Mean t hours at Abbotsinch 1966-1980 were 16

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

Table 3. Reported lightning incidents by month 2012.

January	1
February	0
March	0
April	9
May	7
June	14
July	11
August	29
September	1
October	2
November	3
December	0
TOTAL	**77**

4. DAMAGING HAIL IN 2012

The following occasions of significant hail (size 20 mm diameter or more) were reported. Notably, the events of 7 May, 28 June and 16 December which were associated with supercell-type thunderstorms.

20 April 2012

A complex area of low pressure covered Britain and Ireland with a broad upper trough across Europe. During a severe thunderstorm in the Ardpatrick area of Co Limerick, Ireland, hailstones over 16 mm diameter (“larger than Euro cent coins”) were observed.

7 May 2012

Hailstones of “marble size” fell along a swath through central Oxfordshire: Witney-Freeland-Yarnton-Kidlington-Bicester. The hail caused slight damage to greenhouse glass and a garden veranda and was associated with a T4 tornado on the right flank of the supercell storm (Culling and Horton 2013, Westbrook and Clark 2013).

28 June 2012

This was by far the most outstanding hail event of the year (Figure 3). Surface charts show a double structured cold front moving northeast with pre-frontal troughing. At 500 mb, there was a major upper trough west of the British Isles. However, the overall mid level flow remained progressive, with southwesterly winds of 40-50 kn; the situation was similar to the classic Spanish Plume.

Very large hail (20mm diameter plus) fell in association with a single, severe supercell thunderstorm, along a 110-km-long swath from Coventry (West Midlands) to Sleaford (Lincolnshire). Hail 50 mm or more in diameter fell along much of this swath, with hail 75 mm (3 inches) or more in diameter falling in the Hinckley/Burbage area and (more locally) just north of Melton Mowbray. Radar returns indicate the swath of hail

10 mm diameter or more extended for around 120 km. The hail resulted in extensive damage to crops, vehicles, glasshouses and roofing materials; the severest damage rated H6 on the TORRO scale. As an example of the impacts during the severest phase of the hailstorm of 28 June 2012, the following is a first-hand description of damage at one property in Burbage, Leicestershire :-

About 20 roof tiles broken (Marley concrete type), uPVC guttering bracket broken, two holes made in uPVC guttering, 10 leaded panes broken in the front (north side of house), most of the greenhouse roof broken, blue engineering brick wall coping chipped, old cast iron downpipe into soft water tank dislodged, about 15 dents in car, many leaves and twigs broken off oak and magnolia trees (Gaisford, M – Pers comm).

A more detailed account of this extreme event has been prepared for publication (Clark and Webb, 2013). At least two other more localised large hail events occurred on this day, in the Brecon area of east Wales and at Telford in Shropshire (netweather.tv 2012).

Figure 3. Hailstones which fell at Melton Mowbray (Leics) on 28 June 2012 © John Wildman 2012

11 July 2012
Pressure was low over the North Sea with a slack west to northwest airflow across England and Wales. At 500 hPa, a very deep trough extended across Britain and Biscay to Iberia. There were widespread thundery showers across southeast England. At Coulsdon (Surrey) hail caused damage to garden plants and punched holes in hydrangea leaves. Hail lay some six hours afterwards. At Epsom Downs (also Surrey) hailstones of irregular shape, 17 mm at their widest, made jagged holes in garden vegetation.

July/August 2013 Vol. 38, No. 380

25 August 2012
A slack area of low pressure covered England while a broad upper trough was situated across western Europe. There were widespread slow moving thundery showers, some of which developed into lengthy multicell storms.

At Littleport (Cambs), a hailstorm caused severe damage to sugar beet crops. At Whittlesey (also Cambs) hail of around marble size (some bigger) fell for 15 minutes during prolonged late afternoon thunderstorms.

16 December 2012
A depression was situated west of Ireland with unstable returning maritime polar air across these islands with embedded showery troughs. Near Penzance (Cornwall), hailstones over 20 mm diameter were reported and photographed (*Western Morning News* 2012). The hail was associated with a tornadic event at nearby Sancreed, and, about 3 miles northeast of Treganhoe Farm, an eye-witness described hailstones 25-35 mm diameter (Clark, M – Pers Comm; Clark and Pask, 2013).

5. SOME COMMENTS ON THE APPLICATION, INTERPRETATION AND SUMMARISING OF THUNDERSTORM DATA
Table 4 outlines methods of summarising thunderstorm observational data and both the usefulness and limitations of the various extracted statistics.

Widespread reports of thunder/lightning can be attributable to thundery showers occurring widely, with gaps in the 'overhead activity'. On the other hand, if there are reports of widespread overhead thunder, this indicates very organised convection such as long track supercell storms, mesoscale convective systems (MCS's) or (a sub division of the latter) thundersquall lines.

Showery situations are more likely to be replicated on several successive days than are situations favouring major thunderstorm systems though, even with the former, subtle day by day variations in the distribution of convective showers must be expected. Prichard (1986) and Grant (1995) both refer to the unusual sequence of widespread thunderstorm days from 22-26 June 1980 and from 12-22 May 1983.

Thunderstorm severity is also difficult to define precisely. It can be based on the peak intensity (lightning flash frequency) of a storm or on the total number of discharges. The main risks of personal injury and damage to buildings and infrastructure derive from cloud to ground strokes (though aerial lightning strikes are significant hazards for aircraft). Moreover, ground strikes vary in power; considerable damage and disruption can be associated with a single powerful cloud to earth discharge (usually a positive strike). Public (and observers') perception of storm severity will also be influenced by the intensity of precipitation. The international definition of a severe thunderstorm does not refer to electrical activity but it is a definition which implies the need for highly organised convection. It is defined as a storm with either a tornado, wind gusts over 50 kn or hail 20 mm diameter or more.

Criteria, statistic	Comments, methodology	Advantages	Caveats
Days with thunder heard	Any days on which thunder is heard between 0000 and 2359 UTC	Most easily available data, simple definition (in theory!)	Ideally requires a 24 hour watch on the weather. Audibility of more distant thunder very dependent on background noise with quiet rural locations likely to record the most realistic results. No indication of how active a storm is.
Days with overhead thunder	Definition used by TORRO is 'within 5km (3 miles)' or reported 'close'	Much less subject to back-ground noise	Requires a consistent definition and consistent application of it. Does not indicate how active the storm is
Hours of thunder.	The methodology usually involves the total number of hours (0000-2359 UTC) during which thunder was heard at least once. Alternatively, it can refer to the total duration of thunderstorms, based on the official criteria that a thunderstorm ceases 10 minutes after the last audible thunder.	More indication of significant events	Requires a close '24 hour watch'. No direct relationship to how active a storm is.
Number of lightning damage incidents	Compiled from observers' reports, news reports etc	Indication of the impacts of electrical activity	Can be heavily influenced by one major storm episode; also dependent on reporting of events (tends to be biased towards populated areas). Reports need careful quality control as incidents may be incorrectly attributed to lightning in news stories.
Days of widespread thunder.	Widespread reports of thunder/lightning can be attributable to thundery showers occurring widely (with gaps in the 'overhead activity'). If there are reports of widespread overhead thunder, this indicates very organised convection such as long track supercell storms, Mesoscale Convective Systems (MCS's) or (a sub division of the latter) Thundersquall lines.	Potentially, the best indicator of how thundery a specific month or year is	Consistent definition can be difficult because of changes to available station reports. Does not distinguish between showery situations (with distant thunder reported at many locations) and instances of widespread overhead thunder associated with a large storm system such as an MCS. Not necessarily indicative of severity.
Lightning strikes recorded	As recorded by sferics networks	Not dependent on audibility of thunder	Can be heavily influenced by one major storm episode, spurious data still possible – so, preferably, requires 'ground truth' support

Table 4. Methods of summarising thunderstorm observational data.

ACKNOWLEDGEMENTS

Sincere thanks are again due to all TORRO and other (e.g. COL, WON, also UKWW internet forum) observers who have contributed information on thunderstorms and associated severe weather in 2012. **New thunderstorm observers are always welcome.** Further details of reporting are available from Jonathan Webb.

REFERENCES

Clark, M and Pask, J (2013). Site investigations in west Cornwall following the tornadoes of 16 December 2012. *Int. J. Meteorology, UK* 38, 92-103.

Clark, M. R and Webb, J. D. C (2013). A severe hailstorm across the English Midlands on 28 June 2012. *Weather* 68 (in press).

Culling, S and Horton, S (2013) Oxfordshire tornado 7 May 2012. *Int. J. Meteorology, UK* 38, 4-16.

Grant, K (1995) Thunderstorm-days and hail-days in the United Kingdom 1972-91. *J. Meteorology, UK* 20, 281-297.

Prichard, R. J (1985) The spatial and temporal distribution of British Thunderstorms. *J. Meteorology, UK* 10, 227-230.

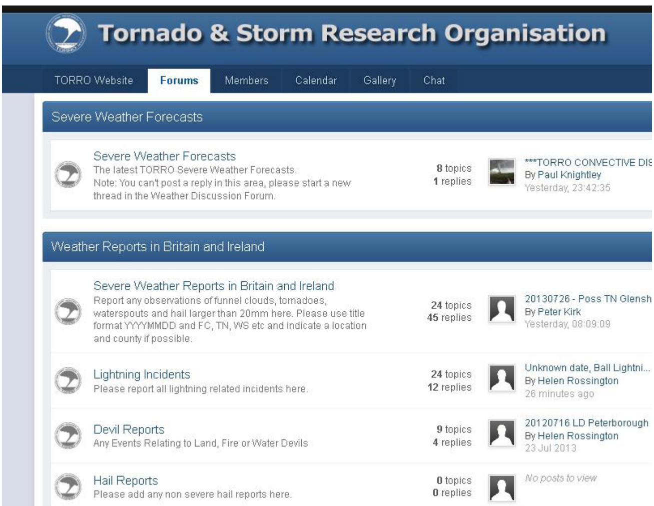
Prichard, R. J (1986) The incidence of outbreaks of widespread thunderstorms in England and Wales: 1946-1985. *J. Meteorology, UK* 12, pp 83-86.

Western Morning News (2012)
http://www.thisiscornwall.co.uk/Floods-cliff-falls-threaten-Westcountry/story-17608692-detail/story.html#axzz2UJcBpd8z (accessed 25 May 2013).

Westbrook, C and Clark, M (2013) Observations of a tornadic supercell over Oxfordshire using a pair of Doppler radars. *Weather* 68, 128-134.

Netweather.tv (2012) UK Convective General Discussion & Forecasts, 28th June 2012
http://forum.netweather.tv/topic/73697-uk-convective-general-discussion-forecasts-28th-june-2012/page-10?p=2325486 (accessed 27 June 2013)

New TORRO forum now online



The new TORRO forum went online in June 2013.

It is a private forum only available to TORRO members and individual IJMet subscribers.

If you have not received a log on via email please contact **membership@torro.org.uk**

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

THE INVESTIGATION OF TORNADOES, WATERSPOUTS AND FUNNEL CLOUDS IN IRELAND 2012

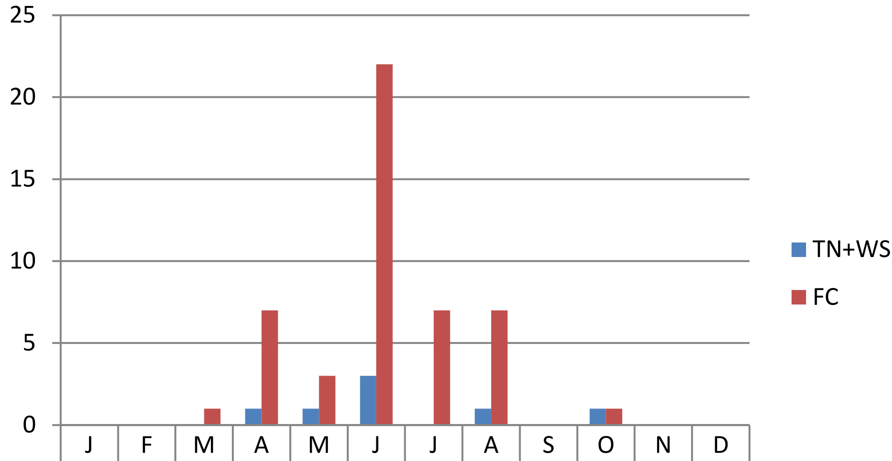
BY JOHN TYRELL
University College Cork, Ireland

Abstract: Investigations were carried out for all reports of tornadoes or severely localised storm damage initially reported as tornado damage, during 2012. Seven of these were confirmed as tornadoes or waterspouts. Their intensity ranged up to T4. The damage track for each tornado is assessed from site investigations. In addition, the distribution of the 48 funnel cloud events are reported and clusters are identified and discussed.

Keywords: tornado, waterspout, funnel cloud, site investigation, Ireland

INTRODUCTION

Tornado activity in Ireland during 2012 was consistent with that of recent years. Detailed on-site investigations were carried out for all reports of possible tornadoes. Only three of these were confirmed as tornadoes and a further four were confirmed as waterspouts. In contrast, funnel clouds were much more numerous. Of the 48 recorded, 36 of these were clustered between June and August, particularly in June (Figure 1).



	J	F	M	A	M	J	J	A	S	O	N	D
TN+WS				1	1	3		1		1		
FC			1	7	3	22	7	7		1		

Figure 1. Monthly distribution of tornadoes, waterspouts and funnel clouds in Ireland 2012.

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

TORNADOES AND WATERSPOUTS

The first confirmed event of the year occurred just before 0700 hrs (all times local unless otherwise stated) on 13 April when a waterspout was reported and recorded by numerous eyewitnesses, as it came inshore at Bray Head, County Wicklow (Figure 2).

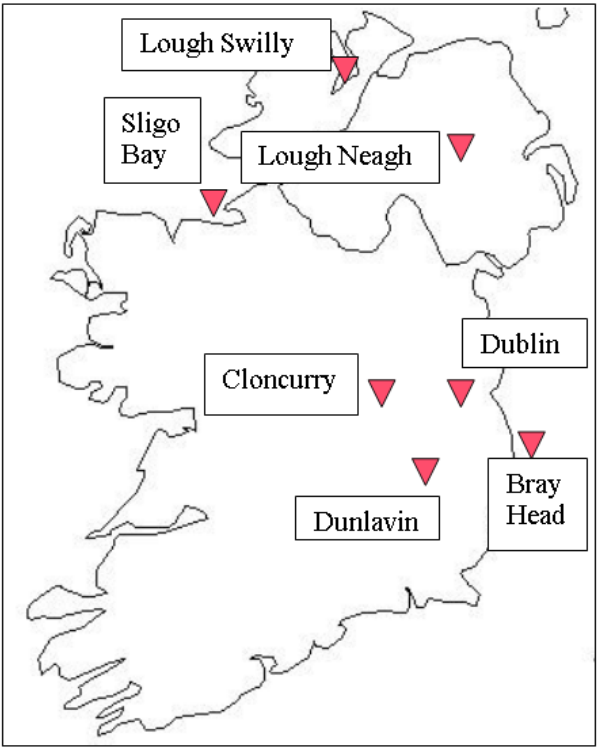


Figure 2. The distribution of tornadoes / waterspouts in Ireland during 2012.

Eyewitness accounts as well as photographic evidence have been combined to establish some of its main characteristics. Its development was associated with a storm cell that was part of a convergence zone embedded in a NNE surface airflow from arctic regions. This single cell triggered a thunderstorm offshore, which was traceable both by radar and sferics as it progressed towards land and then across County Wicklow. The waterspout developed on the eastern edge of the cell and measurements from photos and video-clips combined with eyewitness records show that it tracked at least 2 km across inshore waters before it encountered the coastline (Figure 3). A longer track could not be established from visual evidence because all eyewitness vantage points were on the western side of the storm cell and had little view of the eastern side as it approached. However, the 0000 hrs upper air sounding at Castor Bay recorded a 90 degree directional wind shear between 800 and 700 hPa as well as a small amount of CAPE. Even though the profile of wind speed was not significant, these conditions created an environment strongly favouring vortex development as the air flowed southwards over the Irish Sea. Therefore, it is likely that the waterspout had first formed at a much more distant

Figure 3. A waterspout approaching Bray Head on 13th April 2012. Image emailed anonomously to author and is also available at http://www.irelandsweather.com/forum/index.php?topic=2757.0

point offshore. At Bray Head there are cliffs that rise to a summit of 241 m (791 ft). These disrupted the rotational structure and the funnel quickly dissipated. There is no eyewitness or physical evidence (there was at least one walker on the Bray Head cliff walk at the time) that it had any impact on the shoreline. The storm itself continued across Wicklow for another hour, with frequent thunder, but no funnels or other severe wind events were reported.

The synoptic situation was quite striking in a number of ways. Firstly, the upper westerly jet was located hundreds of miles further to the south, so that the upper winds were extremely slack, unlike what is commonly the case when waterspouts and tornadoes occur. Thus, there was no vertical shear in wind speed in the soundings at Castor Bay and Valentia. But, secondly, there was a remarkable directional shear of nearly 180 degrees in the Castor Bay sounding at 650 hPa, the lowest layers being easterly while at higher levels it was between westerly and northwesterly. Thirdly, at the surface there were no frontal systems with strong thermal and moisture contrasts, but a limited surface zone convergence moved southwards across the Irish Sea. The very small amount of CAPE recorded at Castor Bay was confined to the surface zone, and over the relatively warm Irish Sea, this was enhanced, thereby contributing to the upward ascent of air into the shear zone, producing very strong vorticity within the developing thunderstorm system.

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

The second event was also a waterspout. This occurred on 7 May in Sligo Bay. The funnel was already formed when first observed. Observations were made by the eyewitnesses with considerable care over a three to four minute period in order to accurately locate it within Sligo Bay. It moved northwards towards Raghly, during which time the funnel formed an angle of 15-25 degrees as the parent cloud 'dragged' it northwards. It did not reach the land and there was not significant impact on the inland waters where it occurred. The most significant feature in the synoptic airflow was some low level directional shear, with surface convergence possibly assisting in the vertical stretching process as an occluded front passed northwards over Sligo Bay with two areas of surface convergence, one ahead of the front and one immediately behind the front.

A third waterspout occurred on 6 June, this time on Lough Swilly in Co. Donegal. This was at 1630 hrs, a time when a number of people were in a good position to see it. In case it should threaten boats in the lough, it was reported to the local coastguard station at Ned's Point, north of Buncrana, by local fishermen, who carefully noted that the funnel was touching both the water surface and the cloud base at the same time. The waterspout remained in the southern part of the lough, edging towards Inch Island before dissipating. The small amount of CAPE was spread fairly evenly throughout the lower atmosphere to 625 hPa (at an altitude of about 4000 m). This undoubtedly increased a little during the afternoon and provided some energy for the stretching process. Vertical wind contrasts were marked. Near surface winds were relatively weak. However, directional shear was marked, backing from NNW at the surface to SSW aloft

The first tornado of the year was on 12 June, at Cloncurry in Co. Kildare, just south of the Dublin to Galway motorway, the M4. At about 2000 hrs a northward moving parent storm cell had produced what was described as a torrential shower of rain, at the southern end of which a funnel developed. Camera footage and the subsequent site investigation indicates that surface airflow between two small hills may have contributed some strong surface rotation which combined with the vorticity generated by marked directional shear between 650-550 hPa. The site investigation to confirm and evaluate this event finally assessed its intensity at T1. This occurred in a very rural area and damage was confined to trees along field boundaries and gates. Although an extensive area was covered in the site investigation, the confirmed track was relatively short, being a little less than 1 km.

A number of events occurred at this time. From the 11th to the 13th of June surface and upper air pressure gradients were slight and wind speeds were low at all altitudes. Dew point temperatures below a temperature inversion at 600 hPa were high, particularly to the north and east of Ireland. Within this layer, there were strong directional contrasts in the weak winds, which were sufficient to produce a number of funnels. One of these grew to become a waterspout over Lough Neagh in Northern Ireland, also on the 12th. Eyewitnesses' evidence shows that this was probably over Washing Bay in the southwest of the lough, close to Coalisland. The development of the waterspout was observed by a number of people, who estimate its duration on the water surface at 3-5 minutes.

Figure 4. Fallen trees blocking a local road near Dunlavin, 29 August, 2012. Image © John Tyrrell.

On 29 August a tornado occurred at Dunlavin in Co. Wicklow. This was a severe tornado which did considerable damage (Figure 4). As a result of an extensive site investigation, its intensity was assessed as a T4. This marks out the event as the most severe tornado that has occurred in Ireland since 2006 (Tyrrell, 2007). It was unusual in that it occurred in the early hours of the morning. Towards the end of its track, a number of local people confirmed that it had occurred at 0040 hrs. However, some distance to the south where it had first touched down, the time would have been about 0010-0015 hrs. Along the damage track that was investigated subsequently, large segments of trees (the upper 25 metres of mature trees) were found displaced by up to 100-150 metres. Sometimes these had become suspended in the upper sections of other mature trees, while elsewhere they had been driven into the ground, trunk first, giving a parachute-like effect. The amount and size of the debris blocked local roads for some hours. In addition, structural damage to a large barn had occurred and building equipment, bathroom fittings and garden furniture had gone missing at various points along the damage track. The track was 11 km long and up to 20-25 metres wide, though mostly less than that. Its track was northwards until it reached the hill of Knockandort (179 m), where it diverted towards the north east.

This event was associated with much more classic tornado producing atmospheric conditions. In particular, the vertical wind conditions showed marked (although not exceptional) wind speed shear and there was positive CAPE spread through most of the troposphere in the 00z sounding at Valentia. This was associated with a rapidly moving occluded front that swept over Co. Wicklow from the south, as a depression edged eastwards from the Atlantic, across the west of Ireland. This was being influenced by an upper westerly jet which at 0000 hrs had a left exit region over south eastern Ireland.

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

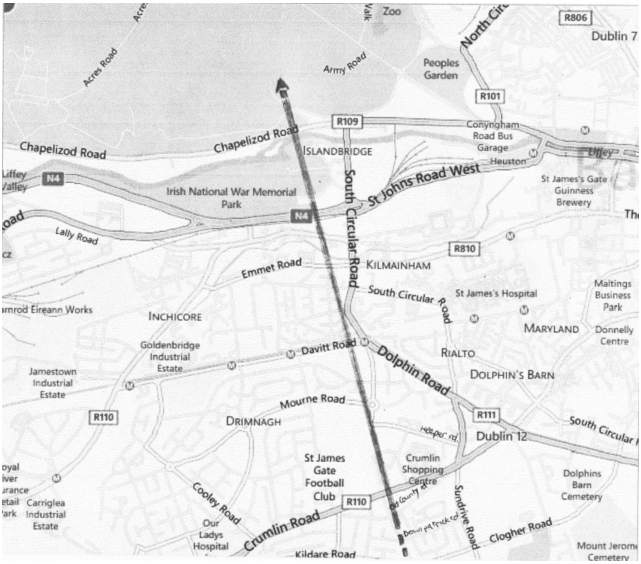


Figure 5. The track of the tornado across parts of Dublin, 17 October 2012. © John Tyrrell. Base map © Microsoft 2012.

The final tornado of the year was on 17 October, in the suburbs of Dublin. This was an early morning event, at 0615 hrs, when most residents of the area were indoors. Despite this, it took only 90 minutes for the first notifications of the event to trigger a detailed investigation that was to last some weeks. This began almost immediately involving local residents and businesses, local libraries and the generous assistance of Met Eireann, followed by a site investigation. This established that it touched down initially in Crumlin and then passed through Drimnagh and Inchicore, until it reached the rising ground of Phoenix Park (Figure 5). The 2.75 km damage track at its northern end was 30-40 metres wide. The resulting damage ranged from severe damage to roofs and large trees to extensive damage to garden structures. Large and small items of debris were scattered over significant distances, some never to be seen again. It occurred before dawn and the early hour meant that no one was on the streets where they would have been at risk of serious injury. However, many reported having heard its noise “never heard anything like it before, my room shook”, before they were confronted with the damage and debris in their gardens and along their roads. The conclusion was that this was a T2 event – a tornado of moderate intensity with winds within the vortex reaching 33-41 ms^{-1} (73-92 mph).

The early morning meteorological interest was focussed on an advancing occlusion that posed a potential threat of flooding in the south and southwest of Ireland from a series of successive occluded fronts wrapped around a depression advancing north-eastwards from the southwest coast. Wind shear due to wind speed and directional variations was evident at a number of levels within this system, but there were few thermal influences at work at this time of day. The tornado occurred after a high rainfall occluded front had passed over the city, 26 mm having been recorded between midnight and 6am in a nearby suburb, although no thunder was reported.

FUNNEL CLOUDS

There was a total of 48 funnel clouds across Ireland during the 12 months of 2012. This included funnel clouds that were initially reported as tornadoes (see below). Although the 48 events were spread between January and October, they were most frequent in the month of June. That month had 21 funnel clouds in all, 44.8 per cent of the total.

During the year there were some interesting clusters of funnel clouds, sometimes with tornadoes or waterspouts. For this discussion a cluster is arbitrarily taken as four or more such events in one day, inclusive of any tornadoes or waterspouts on the same day. On 7 May three funnel clouds and the waterspout in Sligo Bay described earlier, occurred between Sligo Bay and Co. Laois between 1550 and 1855, along an occluded front as it moved northeastwards. On 6 June there was also a cluster of four events, three funnel clouds and the waterspout on Lough Swilly. On that occasion, the vertical wind shear characteristics and slight instability described for the Lough Swilly event were widespread and helped to produce funnel clouds near Tralee, over Lough Neagh and in Co. Tipperary.

The third cluster was the major one. This really extended over a two day period, 11-12th June. On 11 June an occluded front within an extensive, slow moving, slack low pressure system produced two funnel clouds. One was in Co. Donegal and the other in Co. Clare. By the morning of the 12 June, this had aligned itself north-south over the middle and eastern parts of Ireland, now as a relatively stationary trough. It then produced a series of seven funnel clouds, together with the tornado in Co. Kildare. The sequence began with a funnel cloud over the Lougheramore Mountain (Co. Derry) at 1030 hrs and ended with the tornado at 2000 hrs. Between these there were funnel clouds in Co. Dublin, the Sperrin Mountains, the Comeragh Mountains, Co. Kilkenny, Co. Tyrone and over Lough Neagh. The upper air soundings at Castor Bay show winds were slack right to 600 hPa, but directionally diverse. A key feature for this rather exceptional cluster of funnel clouds was that it was also extremely humid throughout this depth. As a result, condensation was readily triggered, revealing localised vortices. Above Valentia, in the west, these features were not present.

It is not unusual for funnel clouds to be reported as tornadoes. There were two such events during 2012. The first occurred on 24 April near Fintown, Co. Donegal. This funnel was photographed from a distance and shows no surface contact. In subsequent research interviews, eyewitnesses state that the funnel did not reach the ground. The report in this journal under 'TN2012April24' is based on incorrect media reports (Brown and Meaden, 2012).

The second funnel event of this kind was on 11 June. Some media reported a tornado on Slieve Snaght, Co. Donegal. Investigations and eyewitness accounts have established that this was a funnel cloud, not a tornado. There was no surface contact and the widely reproduced photo was taken at a considerable distance, showing the funnel disappearing behind the mountain. Eyewitness accounts from different, closer viewpoints state no ground contact occurred and local investigations failed to establish any evidence of surface contact.

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

ACKNOWLEDGEMENTS
The staff of Met Eireann have been supportive of this research throughout the year. Particular acknowledgement is made to Ruth Coughlan of the Climate Division. But several members of the Forecast Division were also extremely helpful. I am also deeply grateful to numerous other people across Ireland who have given of their time and assistance in many ways to make site investigations as effective as possible. I would also like to thank the experience and enthusiasm of TORRO staff and members.

REFERENCES
BROWN, P.R. and MEADEN, G.T. (2012). TORRO Tornado Division Report. *Int. J. Meteorology, UK*, 37, nos 370-371, 90.
TYRRELL, J. (2007). Site Investigation Results of Tornado Reports in Ireland, 2006. *Int. J. Meteorology, UK,* 32, no. 322, 266-270.
TYRRELL J. (2012). The Investigation of Tornadoes and Related Events in Ireland, 2010. *Int. J. Meterorology, UK,* 37, nos 370-371, 72-81.

TORRO SEVERE WEATHER FORECAST SUMMARY FOR BRITAIN AND IRELAND 2012

BY PAUL KNIGHTLEY
Forecast Division, Tornado and Storm Research Organisation

INTRODUCTION
Summer 2012 generally continued in the fairly cool and unsettled theme of recent years, with widespread thundery outbreaks somewhat lacking once again. However, several notable thunderstorm episodes occurred within strongly sheared airmasses, leading to at least 3 days where several supercell thunderstorms occurred. These, in turn, provided a variety of severe weather, including tornadoes and large hail.

In 2012, TORRO issued 27 verifiable forecasts.

TORRO's FORECASTS
TORRO issued 3 types of verifiable forecast in 2012. These were:

Convective discussion (TCD)

Issued when conditions are favourable for either isolated severe weather events, or when marginally severe events are expected (e.g. T0 to T2 tornadoes; damaging hail, or heavy hail, but <20 mm diameter).

Severe weather watches, which include:

Severe thunderstorm watch (SVR)

Issued when conditions are expected to be favourable for organised severe thunderstorms/convective storms.

Tornado watch (TOR)

Issued when either organised severe thunderstorms are expected, and they bring a risk of tornadoes, or when tornadoes are deemed possible, even though thunder may not occur (e.g. strong cold front, non-electrified showers).

In 2012, TORRO issued:

19 convective discussions

8 weather watches

- 8 tornado watches
- 0 severe thunderstorm watches

There is, as yet, no formal recording of severe convective winds within TORRO although some damaging wind events get assigned a 'squall' rating. However, verification of forecasts is not possible in regard to winds at this time.

HAIL

There were 5 days with significant hail in 2012, which is not really enough to make a meaningful analysis of forecasts. Within these, there were 2 days with 'severe' hail, i.e. with hail greater than 20 mm in diameter. The largest hail of the year occurred on 28 June, and a tornado watch was in force at this time. The forecast mentioned that severe hail was possible, with 40 mm mentioned. This somewhat underestimated the largest hail, which was ~60-80 mm in diameter. This is very large by UK standards. Forecasting the maximum size of hail is notoriously tricky to do. However, if supercells are possible, the threat of large hail goes up markedly. Even them, selecting a possible maximum size is rather difficult. One can use sounding software which has hail-size prediction to make a starting estimate, e.g. RAOB.

In the case of 28 June, the storm mode was supercellular. The largest hailstones (i.e. greater than about 'golf ball' size, ~44 mm diameter) are associated with supercell thunderstorms. However, not all supercells produce hail greater than this size.

This event has proved to be a good learning curve for forecasting large hail in the UK. If significant supercells are expected in a 'warm' environment (i.e. with Convective Available Potential Energy – CAPE values of >1,500 J/Kg), then forecasts should probably mention that any supercell could produce hail in excess of 50-60 mm in diameter. Discussion on this point is welcome.

TORNADOES

Provisionally, 28 verifiable tornadoes/probable tornadoes occurred in 2012 across the UK and Eire (Brown/Meaden/Tyrrell, pers comm.). This number does not include tornadoes over the sea which did not make landfall, or tornadoes which occurred during the period of the author's holidays.

Tornadoes were reported in 6 tornado watches and not in 2 tornado watches. This gives a probability of detection (POD – the % number of watches containing at least one tornado) of 75%, and a false alarm rate (FAR) of 25%. This compares to a POD of 37.5% in 2011, 11% in 2010, 19% in 2009, 24% in 2008, 27.5% in 2007, 29% in 2006, and

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

35% in 2005. Within the successful watches, 12 tornadoes occurred. This means 43% of 2012's tornadoes occurred within watches; for comparison, 35% of 2011's tornadoes occurred within tornado watches; 4% of 2010's tornadoes were within watches; 13% of 2009's tornadoes were within watches; 38% of 2008's tornadoes were within watches; 31% of 2007's tornadoes were within watches, 32% of 2006's were within watches, and 2005's figure was 33%.

Table 1 (below) shows the number of tornadoes within each type of TORRO forecast.

Table 1. Number of tornadoes by TORRO forecast type

Forecast Type	**Number of tornadoes**	**Percentage**
TORNADO WATCH	12	43
SEVERE THUNDERSTORM WATCH	0	0
CONVECTIVE DISCUSSION	3	11
NOT FORECAST	13	46
TOTAL	**28**	**100**

In addition, 3 tornadoes occurred in convective discussions, with 0 occurring in severe thunderstorm watches. In total, 15 out of the 28 tornadoes occurred within a TORRO forecast, which means 54% of the tornadoes developed within a TORRO forecast.

Table 2 below shows tornado occurrence in 2004-2012 as a function of TORRO's forecasts.

Table 2. Tornadoes within TORRO forecasts.

Year	**Tornadoes**	**No. of tornadoes within TORRO forecast**	**No. of tor-nadoes not forecast**
2004	51*	26 (51%)	25 (49%)
2005	63*	41 (65%)	22 (35%)
2006	70^	39 (56%)	31 (44%)
2007	51*	32 (63%)	19 (37%)
2008	13*	7 (54%)	6 (46%)
2009	39	21 (54%)	18 (46%)
2010	25	9 (36%)	16 (64%)
2011	26	15 (58%)	11 (42%)
2012	28	15 (56%)	13 (44%)
2004, '05, '06, '07, '08, '09, '10, 11, 12	**366**	**205 (56%)**	**161 (44%)**

* - figures based on provisional figures for those years, at the time the reviews were written.
^ - 5 more occurred, but due to forecaster absence, are not included.
Note figures for 2004-06 are based on those used in these years' forecast reviews, and may not match the actual, final tornado numbers.

CONCLUSIONS

As in recent years, an attempt was made to limit tornado watches to those situations where it was deemed, somewhat subjectively, that there was a higher risk of stronger tornadoes. This was done, as much as possible, by using TCDs when vertical wind shear was weak, or when instability was very low. An example of the former would be a slack environment in the summer, where local convergence zones might foster enough vertical vorticity for a passing thunderstorm updraught to stretch it into a non-mesocyclone tornado; an example of the latter might be a strong winter-time cold front, where misocyclones might develop along the front, with an attendant brief tornado risk, but the overall pre-front environment is stable.

All 8 tornado watches in 2012 were issued between April and August inclusive. This is of interest due to the number of incidences of reasonable instability coincident with sufficient wind shear for organised, severe thunderstorms.

ACKNOWLEDGEMENTS

MeteoGroup UK, for allowing the author time on shift to construct and issue TORRO forecasts, and for the provision of the NWP model data; Paul Brown, Terence Meaden, Jonathan Webb, and John Tyrrell for providing the data sets for tornadoes and hail; TORRO and UKWW members for their observations of severe weather, and severe weather discussion/forecasts/comments.

TORRO's forecasts are visible on the TORRO website and are also posted to the TORRO forum, TORRO Facebook page and TORRO Twitter.

TORRO AUTUMN CONFERENCE 2013

The TORRO Autumn conference will be held on Saturday 12 October 2013 at the Oxford Brookes University in Oxford, United Kingdom.

The programme is still being finalised and will be posted up on the TORRO website www.torro.org.uk and the forum soon.

If you would like to give a presentation on a recent weather event you witnessed or your weather interest, please let us know.

Email: membership@torro.org.uk

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

A REVIEW OF THE 2012 HURRICANE, TROPICAL CYCLONE AND TYPHOON SEASON AND A 5 YEAR SUMMARY 2008-2012

BY KIERAN R. HICKEY
Department of Geography,
National University of Ireland, Galway, Ireland

Abstract: 2012 was an average year, in contrast to the previous 4 years which were below average as regards hurricanes, tropical cyclones and typhoons. There were increases in both the number of storms recorded and the number of events that became full-blown hurricanes, tropical cyclones or typhoons - both the highest values of the last 5 years. Both the Atlantic Hurricane Season and Southwest Indian Cyclone Season were above average and the other regions were near or below average. There were only three Category 5 events, all of which occurred in the NW Pacific region, exactly the same as last year. However the event which received the most publicity and generated the most damage was Hurricane/ Tropical Storm Sandy, particularly its impact on the USA. Typhoon Sanba in the Northwest Pacific region had an exceptionally low barometric pressure of only 900 hPa whereas there was no exceptional high wind speed event.

Keywords: Hurricane, Tropical Cyclone, Typhoon, 2012, 5 Year Average

INTRODUCTION

Worldwide the 2012 tropical storm season was just average, this was the first time in five years that the season was not below average. Of the 48 hurricanes, tropical cyclones and typhoons 23 developed into category 3 or higher events, again an increase on the previous year. Fatalities were low globally at 3,216, but up on the previous year (Hickey 2012). One event dominated the fatalities and this was in the NW Pacific where Typhoon Bopha a category 5 event caused 1,911 fatalities across Micronesia, Palau but mostly the Philippines. Damage globally at just under $79.5 billion was also substantially up. This was mostly as a direct result of the impact of Hurricane Sandy and this resulted in the highest amount of damage of the past 5 years.

The most reported and the most significant in terms of economic impact was Hurricane Sandy. It is currently estimated that this hurricane/ tropical storm caused damage in excess of $68 billion mostly in the US states of New Jersey and New York but affecting a further 22 states. It also generated 286 fatalities and damage stretching from the Greater Antilles to eastern Canada. Most of the fatalities occurred in Haiti and the USA. It was the second costliest hurricane in US history after Hurricane Katrina in 2005 with $81 billion (2005 USD) and at least 1,833 fatalities (NOAA, 2012).

A weak to moderate La Niña occurred in the first three months of 2012 which was followed by neutral ENSO conditions for the rest of the year. Even so it still ranked as the warmest La Niña year on record beating that of 2011. The dominance of neutral ENSO conditions produced an average year globally but with an above-average North Atlantic and Southwest Indian hurricane and cyclone seasons respectively and a below-average

North Indian and South Pacific cyclone seasons. 2012 also saw average precipitation conditions across the globe but with significant variations from region to region. This year was also recorded as the 10th warmest since records began in 1880 and the 36th consecutive year of above average global temperatures. 2012 was 0.57^{o}C above the 20th century average of land and ocean temperatures of 13.9^{o}C (NOAA, 2013).

REGIONAL OVERVIEW

The Atlantic Hurricane Season was well above average with the same number of storms as 2011 (19) but with 3 more hurricanes (Table 1). Hurricane Sandy obviously dominated but Hurricane Isaac also caused significant damage of the order of $2.39 billion along with 41 fatalities mostly in the Caribbean and southern USA. This was only a category 1 hurricane.

The North Indian Cyclone Season was in comparison below average with 5 storms and no hurricanes, down 1 from the previous year. Cyclonic Storm Nilam caused all the 128 fatalities and damage of just under $57 million.

The Southwest Indian Cyclone Season was above average with 10 storms, of which 5 made hurricane status, this is a big increase from the previous year. Tropical Storm Irina which mostly affected Madagascar caused nearly half of the recorded fatalities of 164 which was the highest number for this region since 2007. Although no official damage figures are given for any of the storms in this region clearly damage of the order of tens of millions of USD did occur at least.

The Australian Cyclone Season was considered near average and yielded 11 storms and 5 hurricanes, exactly the same number as the previous year. Of note in terms of fatalities and damage was Tropical Cyclone Oswald which was only tropical storm strength caused $2.5 billion in damage and 6 fatalities in eastern Australia. Cyclone Narelle a category 4 event was the strongest of the season but mostly stayed out to sea but still caused 31 fatalities and slight damage in southern Indonesia.

The South Pacific Cyclone Season was below average for 2012 producing only 5 storms, of which 4 were of cyclone status. Fatalities and damage were relatively light and all the damage and nearly all the fatalities were as a result of the impact of Evan a category 4 event on Samoa, American Samoa and Fiji.

The Northwest Pacific Typhoon Season was considered to be near average producing 25 storms and out of this total there were 14 hurricanes. Both fatalities and damage were up on the previous year. Two events caused damage in excess of 1 billion USD and these were Typhoons Haikui (category 1) affecting Japan and China and Bopha (category 5) affecting the Philippines with estimated damage of just over two billion and 1 billion USD respectively. Typhoon Bopha also caused the most fatalities by far with 1,146 lives lost in the Philippines.

The East Pacific Hurricane Season for 2012 was also recorded as being near average with 17 storms, of which 11 reached hurricane strength. Fatalities and damage was relatively minor with Hurricane Carlotta, a category 2 event, responsible for nearly all the damage and fatalities. This hurricane predominantly affected the southern Mexican province of Oaxaca.

Table 1 Global and Regional Overview of Hurricanes, Cyclones and Typhoon (HCT) Activity in 2012 after NOAA, 2012.

Region	No. of Tropical Storms	No. of Hurricanes, Cyclones and Typhoons	Overview	Fatalities	Damage ($ billions)
Global	92	48	Average	3216	79.473
Atlantic (Hurricane)	19	10	Above Average	355	70.902
North Indian Ocean (Cyclone)	5	0	Below Average	128	0.057
Southwest Indian Ocean (Cyclone)	10	5	Above Average	164	*
Australian (Cyclone)	11	5	Near Average	20	2.5
South Pacific (Cyclone)	5	4	Below Average	16	0.161
Northwest Pacific (Typhoon)	25	14	Near Average	2525	5.73
East Pacific (Hurricane)	17	10	Near Average	8	0.123

* = unknown

INDIVIDUAL EVENTS

The 2012 season consisted of 11 category 3 events a big increase from last year, 9 category 4 events, down from last year and only 3 category 5 events, the same as last year with all three occurring in the NW Pacific region (Table 2).

Hurricane Emilia, a category 4 event in the East Pacific had the strongest winds at 220 km/hr but recorded only a 945 hPa lowest pressure. Two typhoons, Samba and Jelawat from the NW Pacific, both category 5 events, had the next joint highest wind speeds at 205 km/h. No other hurricane, cyclone or typhoon had windspeeds at or in excess of 200 km/h (Table 2). Interestingly although the same region recorded the highest wind speed, wind speeds were somewhat lower than the previous year reflective of more category 3 events and fewer category 4 events.

The lowest recorded barometric pressure of any event was a category 5 event, Typhoon Sanba in the Northwest Pacific with a barometric pressure of only 900 hPa. The second lowest barometric pressure was from Typhoon Jelewat at 905 hPa. The next lowest was Typhoon Bolaven a category 4 event which had a lowest barometric pressure of 910 hPa. No other event had a lowest pressure of less than 930 hPa including the only other category 5 event Typhoon Bopha which had a highest wind speed of 185km/h and a lowest barometric pressure of 930 hPa. All of these typhoons occurred in the NW Pacific region.

Table 2. Most Intense Hurricanes (H), Cyclones (C) and Typhoons (T) in 2012.

Name	Intensity	Month	Location	Max Winds (km/h)	Min Pressure (hPa)
H. Michael	3	September	N. Atlantic	185	964
H. Sandy	3	October	N. Atlantic	185	940
C. Funso	4	January	SW. Indian	195	936
C. Giovanna	4	February	SW. Indian	185	932
C. Narelle	4	January	Australian	185	930
C. Evan	4	December	S. Pacific	185	943
C. Freda	3	December	S. Pacific	185	940
C. Sandra	3	March	S. Pacific	185	930
T. Mawar	3	June	NW. Pacific	140	960
T. Guchol	4	June	NW. Pacific	185	930
T. Viente	4	July	NW. Pacific	150	950
T. Tembin	4	August	NW. Pacific	150	950
T. Bolaven	4	August	NW. Pacific	185	910
T. Sanba	5	September	NW. Pacific	205	900
T. Jelawat	5	September	NW. Pacific	205	905
T. Prapiroon	3	October	NW. Pacific	165	940
T. Son-Tinh	3	October	NW. Pacific	155	945
T. Bopha	5	November	NW. Pacific	185	930
H. Bud	3	May	E. Pacific	185	961
H. Daniel	3	July	E. Pacific	185	961
H. Emilia	4	July	E. Pacific	220	945
H. Miriam	3	September	E. Pacific	195	959
H. Paul	3	October	E. Pacific	195	959

IMPACT ON EUROPE

On the 12 September 2012 the remnants of Hurricane Leslie, a category 1 event, generated high winds in Iceland to such an extent that 30,000 people were left without electricity. The blowing down of the power lines was aided by the fact that many of them were frozen with deposits of ice on them making them much heavier and more vulnerable to damage. It also caused higher winds along the north coast of Scotland.

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

Late in September the remnants of Hurricane Nadine influenced the weather of Britain and Ireland and produced some high rainfall events, although by this stage it was only at tropical storm strength. From September 24th to 26th heavy rain caused flooding in Ireland in particular around Dublin city and Co. Meath. Malahide Castle recorded 70.5 mm of rainfall on the 24th a 1 in 30 year value (Met Éireann, 2012). Northern England was also affected badly with 130 mm of rainfall recorded at Ravensworth in Yorkshire causing flooding and transport disruption. This hurricane/tropical storm was extremely long-lived (more than 21 days) and was the fifth longest-lasting Atlantic cyclone if you include the days it spent as a hurricane and tropical storm.

The remnants of Hurricane Rafael came ashore in central Portugal from the 26th to the 27th October and eventually dissipated but not without causing high winds in Portugal, northern Spain and southern France. In the latter case gusts reached 168 km/h and one fatality was recorded in Gaudeloupe, France when a person drowned trying to cross a flooded river. It may also have contributed to the formation of three waterspouts offshore of Barcelona (European Severe Weather Database, 2012).

FIVE YEAR SUMMARY

The average number of storms recorded globally per annum over the last five years was 83 with highs of 93 in 2012 and lows of 73 in 2010 (Table 3). In terms of actual hurricanes, typhoons and cyclones the average was 39 varying from as low as 32 in 2010 and 48 in 2012. However, it must be noted that 4 out of the 5 years surveyed were below average and only one 2012 was considered an average year for the numbers of these events. In terms of fatalities 4 out of the 5 years recorded values between 1,000 and 4,000 but these are years where no major catastrophic event takes place in terms of loss of life. Cyclone Nargis and its impact on Burma (Myanmar) is responsible for the massive casualties during 2008. The true number of deaths will never be known for this event and could be as high as 200,000. The damage caused each year is much more variable and is very much dependent on the economic development of the countries affected, hence the impact of Hurricane/Tropical Storm Sandy on the 2012 value and Hurricane Ike ($37.5 billion damages) in 2008.

Table 3. Most Five year summary from 2008 to 2012 (values from year of occurrence).

Year	No. of Tropical Storms	No. of Hurricanes, Cyclones and Typhoons	Overview	Fatalities	Damage ($ billions)
2012	92	48	Average	3,216	79.473
2011	77	40	Below Average	2,323	30.255
2010	73	32	Below Average	1,380	19.714
2009	86	34	Below Average	3,378	13.142
2008	89	41	Below Average	149,958++	68.969
5 Year Average	**83**	**39**		**32,051**	**42.311**

REFERENCES
BBC (2012) Tropical Storm Nadine finally breaks up, BBC Weather, 5th October 2012.
EUROPEAN SEVERE WEATHER DATABASE (2012) Severe Wind: Hurricane Rafael, European Severe Storms Laboratory.
HICKEY K.R. (2012) A review of the 2011 Hurricane, Tropical Cyclone and Typhoon Season, *Int. J. Meteorology, UK.* Vol. 37, Nos.374-376, 159-164.
MET ÉIREANN (2012) Flooding in East Leinster, Monthly Weather Bulletin No. 317 September 2012.
NOAA (2012) Significant Climate Anomalies and Events in 2012 @ www.nhc.noaa.gov
NOAA (2013) State of the Climate Report Annual 2012 @ www.nhc.noaa.gov

BALL LIGHTNING REVIEW 2012

BY PETER VAN DOORN
Thunderstorm Division,
Tornado and Storm Research Organisation

In 2012 just two reports of ‘Ball Lightning’ were reported to TORRO – both referred to sightings made on the same date though at two different locations.

25 AUGUST (Evening) – HULL, EAST YORKSHIRE, ENGLAND
According to a report sent to this Division “strange weather” was experienced across the city that day (Saturday). The sender of the report was informed of a ‘lightning’ strike that had caused some serious damage to the house of a friend: The strike “caused quite some damage to the electrical equipment in the house as well as blowing a hole in the window where [it] came in.”

The house struck suffered serious damage to electrical wiring, telecommunications, and satellite equipment. The lounge, its furniture and contents were covered in “soot.” “I assumed that this was an unfortunate but ‘normal’ lightning strike, seems it was far from it. My friend’s son reported a massive glowing ball on the ground before it exploded. His neighbours (3 adults) witnessed a ball or balls of ‘electricity’ roll through their window and across the table, before simply disappearing.”

A “full account of what happened” was promised but this has not yet been received despite further contacts with the correspondent. (1)

Mode: Possible GLO Rollers/Navigators

25 AUGUST; c2000 hrs – NORWICH, NORFOLK, ENGLAND
Sean McManus sent the following account to this Division:
“Regarding the event - it occured at about 2000 hrs on the 25 August on the south side of Norwich city. The weather was humid, there was some quite heavy rain during the day and the temperature was in the mid 20s if I recall correctly. We’ve been having an unusual amount of thunder and lightning recently and the weather has been unusually humid, there’s also been a high frequency of heavy rain. No photos unfortunately - the lightning seemed to be about 20-30 metres away from us across the road - I saw a

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

distinct ball like object which was suspended in midair which flashed once, remained for a moment and then disappeared - as mentioned - my wife said that everything flashed bright white for a second and momentarily she saw nothing but a blanket of bright white light in her vision.

"Also I would note that we were both walking at a brisk pace and did not stop when this occured - the ball, as I witnessed it, had a relatively short life-span - I would approximate it at a second or two, and the ball did not move with my field of vision - that is to say it seemed to be manifesting itself in a definite part of space 20-30 metres away from me - rather than manifesting itself as some manner of optical illusion! I would again note that I am a scientist and a very sceptical one at that!! I'd be open to any scientific explanations of what I saw but it certainly sounds like it shares quite a few characteristics with the object of your research." (2)

Mode: GLO Apparition

(1) Report sent to TORRO/PvD via e.mails. (2) Report sent to PvD via e.mails

TORRO TORNADO DIVISION REPORT: May to June 2013

BY PAUL R. BROWN AND G.TERENCE MEADEN

May 2013 was a rather cool changeable month. There was one report of a probable tornado, eight reports of funnel clouds, and two reports of land devils, one of which was unverifiable. The first ten days of June were mainly anticyclonic but the rest of the month had cyclonic or westerly types. This was an unusually quiet June for whirlwinds, having just two funnel clouds (one of them in the Republic of Ireland), two land devils, and a water devil.

LD?2013May02 *Redruth, Cornwall (50° 14' N 5° 14' W, c SW 7042)*

John Pask of TORRO informed us that Radio Cornwall had broadcast an interview with a lady who had garden furniture sucked into the air and tiles taken off her roof, probably about lunchtime. At 1200 GMT a ridge of high pressure covered England and Wales from a high, 1029 mb, to the southwest. There was rain in the north of Scotland, but England and Wales were mainly sunny.

LD2013May06 *Bell Common, Epping, Essex (51° 41' N 0° 06' E, TL 447011)*

The *Epping Forest Guardian* of 8 May reported that a 'mini-twister' occurred at a children's cricket match at 1030 GMT the previous Monday, when boundary cones were sent spinning in the air, a table and kit bags were blown about, and three chairs were broken. At 1200 GMT a weak ridge of high pressure covered England and Wales from a high, 1027 mb, over eastern Europe. The weather was dry with sunny periods apart from some showers in the north of Scotland.

tn2013May14 *Tewkesbury, Gloucestershire (52° 00' N 2° 09' W, SO 899334)*

This report appeared in the *Gloucestershire Echo* of 16 May, in which 'tornado-like winds' were said to have caused damage in Stanton Road and Carrant Road in the Mitton area of Tewkesbury at 2115 GMT on the 14th. Tiles were removed from roofs, half-a-dozen old trees were blown down, and there was other minor damage to gardens; damage was described as following a straight line through the estate. While the evidence for a tornado is not strong, the straight line together with the synoptic situation (next paragraph) suggests a Force T1-2 tornado.

At 1800 GMT a small but vigorous low, 984 mb, was moving northeast across southwest England, and its occluding frontal system was moving into the Midlands; the triple point of the system would have been close to Tewkesbury at the time of the tornado. There was widespread moderate to heavy rain on the fronts.

FC2013May16/I *Culdrose, Cornwall (50° 05' N 5° 15' W, SW 6725)*
FC2013May16/II *Culdrose, Cornwall (50° 05' N 5° 15' W, SW 6725)*

Funnel clouds were reported in the 0950 GMT and 1450 GMT METARs from RNAS Culdrose. Mr Steve Jones of UKWeatherworld photographed a funnel cloud from near Canon's Town (SW 5335) at 0950 GMT, a thin contorted funnel said to have been much longer before the picture was taken (probably the one seen from Culdrose at that time).

At 1200 GMT a slack southeasterly airstream within a complex area of low pressure covered much of Britain (main low centres were 994 mb near the Faeroes and 993 mb over central Europe). Showers developed in many areas during the day (away from southern and eastern coasts), turning thundery in central England in the afternoon.

FC2013May16/III *near North Petherton, Somerset (51° 05' N 3° 01' W, ST 2932)*

Mr Lee Thorn sent a report of a funnel cloud seen from south of Bridgwater at 1315 GMT.

FC2013May16/IV *Jersey Airport, Channel Islands (c 49° 13' N 2° 12' W)*

A distant funnel cloud was reported in the 0920 GMT METAR from Jersey Airport.

FC2013May16/V *Waddington, Lincolnshire (53° 10' N 0° 32' W, SK 9864)*

A funnel cloud accompanied by a moderate shower was reported in the 1556 GMT SPECI from RAF Waddington. There was thunder shortly afterwards. A photograph of the event was sent to us by Mr Richard Hale showing a well-formed funnel reaching halfway to the ground.

FC2013May28/I *Lusty Beg Island, County Fermanagh (c 54° 30' N 7° 51' W, H 1062)*

A report was received that funnel clouds had been seen in Counties Fermanagh and Tyrone during the afternoon (full name of witness not known). The first, nearly halfway to the ground, was photographed at 1400 GMT from between Belleek and Kesh, looking over Lusty Beg Island.

At 1200 GMT a broad trough lay northwest-southeast across the British Isles within which there was a shallow low, 999 mb, over the Home Counties. Showers developed widely over Ireland while much of central and southern England was cool and cloudy with outbreaks of rain.

3FC2013May28/II *near Omagh, County Tyrone (c 54° 35' N 7° 18' W, H 4571)*

The same person who saw the Lusty Beg funnel cloud (see above) saw three more (mostly small) funnels at or south of Omagh between 1757 and 1825 GMT.

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

FC2013May28/III *Coombe Bissett, Wiltshire (51° 02' N 1° 52' W, SU 1026)*

An anonymous correspondent to UKWeatherworld photographed a funnel cloud to the west of Coombe Bissett at 1200 GMT. The picture shows it a third of the way to the ground but it was said to have been at least halfway down just before.

WD2013Jun03 *Whalley, Lancashire (53° 49' N 2° 25' W, c SD 730360)*

The *Lancashire Telegraph* of 6 June reported that a 'water tornado' had occurred on the River Calder in the afternoon. It was photographed by Mr Dave Spear on his way home from work (so probably late afternoon); it lasted 10 seconds and threw water 20-30 feet in the air, startling a couple of ducks in the process.

At 1200 GMT the British Isles were in the circulation of a large anticyclone, 1034 mb, centred near the east coast. England and Wales were dry with a good deal of sunshine.

FC?2013Jun05 *Paisley, Renfrewshire (55° 50' N 4° 29' W, NS 4563)*

A photograph was received claiming to show a 'mini-tornado' over Paisley but the picture was inconclusive. It was taken by Mr Darren Russell in Barskiven Road at 1515 GMT. At 1200 GMT a very weak easterly flow covered the British Isles between a high, 1034 mb, near north Norway and a low, 1009 mb, over Spain. Most places were dry with variable cloud amounts but showers developed in western Scotland.

2LD2013Jun07 *Upper Llandwrog, near Carmel, Caernarvonshire (53° 04' N 4° 14' W, SH 509551)*

Ms Meredith Knight sent in a report of a 'tornado' at her home in Upper Llandwrog at about 1200 GMT. Various items of garden furniture were either overturned or made airborne, and her husband saw the vortex pass through their fields into neighbouring trees; he also saw a much smaller one earlier in the day, which sent hay spiralling into the air. Weather at the time was warm and sunny. At 1200 GMT the British Isles were in the circulation of a high, 1029 mb, centred near the Hebrides. Most places were dry and sunny but southern England had thundery showers.

LD2013Jun09 *Birmingham (Elmdon) Airport, Warwickshire (52° 27' N 1° 45' W, c SP 1783)*

A report was received from Mr Mujthaba Ahtamad who saw a land devil beneath the landing path into Birmingham Airport at 1145 GMT. It was slightly wider than a tree trunk and raised sand and dirt from a building site. At 1200 GMT the British Isles were in the circulation of a high, 1021 mb, centred over Shetland. England and Wales were dry, rather cloudy in the east, mainly sunny in the west.

Vague reports were received of a funnel cloud or tornado at Nottingham on 13 June and of a funnel cloud at Norwich on the 15th (about 1500 GMT), but there was too little information to document either of them.

FC/TN2013Jun22 *Crawton, Aberdeenshire (56° 54' N 2° 13' W, NO 8779)*

The *Aberdeen Press and Journal* (24 June) and others published a photograph of a large well-formed funnel cloud reaching below the horizon in the middle distance (it looked as though it could have reached the ground, but this would have been over open countryside). It was taken by Mr David Gault at about 1530 GMT looking inland from the Fowlsheugh RSPB reserve at Crawton. At 1200 GMT an occluded depression of 991 mb was moving slowly northeast across Scotland; fronts were affecting the far north, other areas were in the post-frontal showery airstream. Showers and isolated thunderstorms developed widely (away from western and southern coasts).

Whirlwind in the Republic of Ireland

FC2013Jun24 *Ballymote, County Sligo (54° 05' N 8° 32' W, G 6515)*

Ms Samantha Wise submitted a report of this funnel cloud which she filmed at 1100 GMT. The pictures show a narrow slanting funnel reaching perhaps two-thirds of the way to ground at its maximum. It was in view for about 10 minutes. At 1200 GMT a ridge of high pressure was moving slowly east across Ireland followed by a shallow frontal system. The weather was rather cloudy and, despite the ridge, there were a few light showers.

CENTENARY OF THE BIRTH OF HUBERT LAMB, CLIMATOLOGIST

BY PAUL R. BROWN

Abstract: To mark the hundredth anniversary of the birth of one of the greatest climatologists of the twentieth century we present a brief profile of the life and work of Professor Hubert Lamb (1913-1997), based mostly on his own writings.

EARLY LIFE AND UNIVERSITY

Hubert Horace Lamb was born on 22 September 1913. His parents were then living at Bedford but during most of his childhood the family home was at Hampstead in north London. For someone who was to make such a name for himself in the world of meteorology his early life was not as promising as might be expected. Indeed, he came into a meteorological career more by chance than ambition; and even then it nearly came to an early end over an administrative blunder.

Lamb came from a talented family, which proved to be something of a handicap. His grandfather was the renowned mathematician, Sir Horace Lamb[1], most of whose seven offspring also achieved success in one field or another: Ernest (Hubert Lamb's father) was a Professor of Engineering at London University; Walter was for many years Secretary of the Royal Academy of Arts; Henry was an accomplished artist who also qualified as a doctor; Helen became a senior academic at Cambridge; Dorothy was an archaeology lecturer before marrying the brother of Rupert Brooke (the poet); Lettice was a nurse, and Peggy became a nun. Two of them, Henry and Peggy, became estranged from their father because of their respective (and opposite) lifestyles of bohemian artist and austere nun. Notwithstanding their father's fecundity, his sons and daughters produced few children themselves, and they came to look upon the boy Hubert (himself an only child) as the one to carry forward the reputation of the family name. The fear that he might not live up to this expectation preyed on his mind in his adolescent years, to the point where he suffered lack of confidence and became awkward and clumsy.

Lamb's father was a severe disciplinarian whose remedy for every misdemeanour was the cane: Lamb himself, in his father's eyes, was a disobedient

[1] Probably of German stock, though Lamb's own attempts to trace the family history that far back were inconclusive.

© THE INTERNATIONAL JOURNAL OF METEOROLOGY
July/August 2013 Vol. 38, No. 380

child. The result was inevitable. The two of them rarely saw eye-to-eye for long. Yet his parents seem to have had an open-minded attitude towards schooling, sending him first to Tenterden Hall preparatory school then on to Oundle, both institutions having a 'progressive' reputation. His mother, whose family came from the northern cotton mills, had a friend who had married a Captain Huddleston, and Hubert found himself at school with their son, Trevor Huddleston, who was later to become prominent in the anti-apartheid campaign in South Africa. Another schoolboy companion was Olaf Richardson, whose adoptive father, L. F. Richardson, became famous as the first person to try his hand at forecasting by numbers (what we now call numerical weather prediction).

After his school years Lamb followed the birthright of a boy from an educated middle-class family and took a place at Cambridge where he studied chemistry, physics, and mineralogy; but not, as his father wished, mathematics. Lamb, however, did not find these subjects interesting enough, and in his third year he at last felt emboldened to defy his father even more and switch to a geography course. Their relationship, often difficult, thereupon developed into a rift that was never wholly healed. Lamb's time at university was not a great success, and when he came down (as they say) in 1935, having obtained a Second Class Honours Degree in Geography Part 1, he still had little notion of what he wanted to do. After applying for various jobs for which he was not chosen or which were not to his liking he eventually saw an advertisement for trainee forecasters in the Meteorological Office, and replied to that (this was when the Office was expanding to meet the growing needs of the RAF as war again seemed possible). He went for interview by the Director, Sir George Simpson (an ex-pupil of his grandfather), but hearing nothing further he set off on a summer touring holiday, first to Scotland, then to Norway (both countries he fell in love with and to which he would return again and again for holidays throughout his life); but towards the end of the holiday he received a postcard from his father informing him that he had been offered a position on the forecasting course, so he hastened home.

THE METEOROLOGICAL OFFICE YEARS

Boosted by his holiday and a new job, Lamb began work in the Meteorological Office in 1936 in better spirits than he had been for a long time. After initial training at Croydon he was posted briefly to RAF Leuchars then on to Montrose, where he started as he meant to go on by writing, among others, a paper on the haars of the east of Scotland. (Unfortunately the times were against him, and it could not be published until after the war lest it should be of help to the Germans.) From 1938 for the next 40 years scarcely a year would pass without at least one important scientific paper being produced. There was, though, a problem to be overcome.

L. F. Richardson's family, whom he had known since childhood, were Quakers, and while Lamb did not embrace all aspects of their religion he was attracted to their pacifism[2]; which for a man working alongside the military placed him in a delicate position. Just over the horizon from his contented life at Montrose a storm was brewing; and it broke without warning in the early summer of 1939 when a signal suddenly arrived instructing him to go temporarily to another airfield for training in gas warfare. He refused on the grounds of his pacifism. Back came a reply from the head of Personnel (R. Corless) telling him to resign[3], with which Lamb complied. And that would have been the end of his meteorological career; but while he was serving out his notice the

[2] Richardson himself had earlier resigned from the Meteorological Office in protest at its transfer from the Board of Trade to the Air Ministry.

[3] Perhaps things are different now, but for a long time there was no procedure for sacking a civil servant. If they wanted you to go you had to sign your own death warrant.

Director of the Office, Nelson Johnson, who had been abroad on business, returned home and was dismayed to find what had happened in his absence. He promptly wrote asking Lamb to reconsider, and offered him a bolt-hole. The solution was for him to be transferred to neutral Ireland for the duration of the war, where he would be seconded to the Irish Meteorological Service to provide forecasts for the trans-Atlantic flying boats beginning to operate out of Foynes (near what is now Shannon Airport).

So Lamb spent most of the war in Ireland[4]; but towards the end of his time there he fell out with the Director of the Irish service over workloads, and returned to England at the end of 1944, earlier than planned. Showing notable generosity of spirit the Office welcomed him back and gave him postings to forecast offices calculated not to trouble his conscience, first to RAF Gloucester, then briefly to Hurn Airport (which was serving as a temporary London Airport), and then to Prestwick. Soon after arriving at Prestwick, however, a circular came round to him and a few others inviting applications for the position of forecaster on a Norwegian whaling ship (the *Balaena*) bound for the Antarctic in the Southern summer of 1946-47. The ship needed a forecaster because it was to carry spotter aeroplanes to search for whales from the air. Lamb applied and got the job. From our viewpoint in the twenty-first century it seems appalling that he should have allowed himself to become involved in something as despicable as whaling; but sixty years ago the notion of conservation was far less developed than it is now. (Just as Lamb was leaving for the Antarctic his father died suddenly, and as the result of their earlier rift he found himself left out of the will.)

The voyage was of mixed success. The aeroplanes had been imposed on the ship's captain against his will, and he did all he could to thwart their use, including putting obstacles in the way of Lamb's forecasting and observing duties. Nonetheless, Lamb made the best of an awkward situation, and acquired a good deal of useful knowledge about the meteorology of the Southern Ocean; and on returning home he was allowed twelve months in the Marine Division free of other duties to write up his work, which was published as a Geophysical Memoir *Meteorological results of the Balaena expedition 1946-47.*

By now Lamb was in his thirties and still a single man. There had naturally been amorous relationships but little is known about them. Then in 1947 on holiday in Scotland he met by chance the Milligan family and their daughter Moira, also on holiday in the same village. One thing led to another, and six months later he and Moira began a long and happy marriage during which two daughters and a son were produced.

After his paper on the *Balaena* voyage was complete Lamb was moved to the Forecasting Research Division to work on long-range weather forecasting. He was given the task of devising a classification system to describe each day's weather over the whole Northern Hemisphere; but realising the impracticability of this he secretly set to work on producing a system covering just the British Isles. The outcome was one of the most important series in the study of climate: the Lamb Daily Weather Types, which now runs from 1861 to the present. This led on to a related paper called *Types and Spells of Weather around the Year.*

Early in 1951 he returned to operational forecasting in a posting to RAF Germany at Bad Eilsen for a couple of years, and then to Malta. Lamb did not take to the Mediterranean, neither its climate nor its landscape, and the Mediterranean people did not seem to take to him; but he still managed to write a paper on the sea breezes of the island while he was there. Then in 1954 he came back to England; and when his

[4] A colleague of his at Foynes was a namesake of mine, with whom I have once or twice been confused, but Lamb's Paul Brown (an expert in marine climatology) died prematurely as long ago as 1961.

intended job in the Meteorological Office Library fell through he was placed 'temporarily' in the Climatological Division.

By the mid-fifties Lamb had been nearly twenty years a meteorologist, most of the time on day-to-day forecasting, but also spending spells in research. His path now took a much more definite turn towards research and for the next ten years he led a charmed life. He was set down among the meteorological archives at Harrow where he found himself in a treasure trove of old records, and was allowed to do more or less as he chose. During this time his output was enormous. He revised his Daily Weather Type classifications (later published in a Geophysical Memoir as *British Isles Weather Types*), wrote another Geophysical Memoir on *Tornadoes in England*, produced maps of average barometric pressure over the North Atlantic and Europe back to the eighteenth century, devised a method of deducing temperature and rainfall anomalies across Europe from historical manuscripts back to mediaeval times, created his Dust Veil Index for calculating the effect of volcanic eruptions on the atmosphere (published by the Royal Society as *Volcanic Dust in the Atmosphere*), wrote scores of papers for a wide range of scientific journals (some of them in foreign languages), wrote a revised edition of the book *The English Climate* (first written by C. E. P. Brooks), produced another book *The Changing Climate* (a collection of some of his published papers), besides beginning work on his *magnum opus*, the two-volume *Climate: present, past and future*. By the 1960s his name had become widely known and respected, not just in meteorology and climatology, but in the wider scientific community. In fact, he was so much in demand to write papers and speak at conferences that he found it increasingly difficult to get any work done. In recognition of his achievements he was awarded the rare distinction of special merit promotion within the Meteorological Office, i.e. promotion to high grade but without the administrative responsibilities that would normally accompany it. It was during these years that he began to propound his thesis, now taken for granted but then a heterodox view, that climate is not static but undergoes continual, often important, variations.

All this happened under Sir Graham Sutton as Director-General – a man who appreciated pure as much as applied research. Changes were afoot, however. In 1965 Sutton retired to be succeeded by a much younger man, Dr B. J. Mason, whose attitude to research was more businesslike – it had to pay its way. Lamb's position by now was too strong to be in danger from this 'new broom' sweeping through the Office, but he did begin to feel that his work was no longer valued as it had been. He was still several years away from the Civil Service retirement age of 60 so he began to consider what he might do. In 1967 his friend and fellow climatologist, Professor Gordon Manley, was due to retire from his post at Lancaster University, and Manley very much hoped Lamb would fill his shoes; but having paid a visit to the area Lamb decided it was not for him (too much administrative work and the climate too cloudy, not to mention the inferior social life up north compared with fashionable Guildford where he was living). Meanwhile, through the good offices of Sutton (now head of the Natural Environment Research Council), Lamb had been promised funding to establish a research facility for climate – if he could find a home for it. During this period he met by chance the man who was organising a new School of Environmental Sciences in the University of East Anglia at Norwich; and the result of this encounter was that four years later, in 1971, at the age of 58, Lamb took the bold step of leaving the comfortable security of the Meteorological Office for the unfamiliar world of academia to establish the Climatic Research Unit, where he became Professor Lamb.

CLIMATIC RESEARCH UNIT AND RETIREMENT

On arrival at Norwich he must have wondered if he had not made a ghastly mistake. From the start the Unit was seriously short of funds, no staff could be employed other than Lamb himself, and he for only three years. Research was restricted to what paying clients wanted and there was little opportunity for Lamb to pursue his personal research. The future looked unpromising until in 1974 a note about it appeared in the journal *Nature*. This finally sparked interest from major funding institutions, and from then on the situation steadily improved until by the time of Lamb's retirement in 1978 the Unit was fully staffed and its reputation growing. Today, 40 years on, it is respected as one of the leading climatological institutions of the world. Under its new director, Tom Wigley, however, the Unit's research began to take a different course, and while Lamb accepted the inevitability of this, it remained a source of disappointment to him that poring over historical documents was no longer considered a worthy cause. It was a firm principle of Lamb's that climatic prediction must be founded on knowledge of the past, a requirement which he felt was being ignored as too laborious and slow for the computer age.

During his years at the Climatic Research Unit and on through retirement (as Professor Emeritus) Lamb continued his output of scientific papers and wrote five more books: the second (huge) volume of *Climate: present, past and future; Climate, History and the Modern World; Weather, Climate and Human Affairs; Historic Storms of the North Sea, British Isles and Northwest Europe; and finally his autobiography Through all the Changing Scenes of Life*[5] (which he almost left too late, barely putting the finishing touches to it ere that old man with the scythe was swishing at his heels). He was gracious enough to serve on the Editorial Board of the present journal for a number of years. He was an insomniac much of his life, which must have facilitated the lucubration necessary to achieve his great output, in all of which Lamb displayed his gift for writing fluently and clearly in good grammatical English. Furthermore, unlike today's scientists, for whom calculations on a computer are often the be all and end all of their research, Lamb's wide learning in the social as much as the physical sciences gave him a more rounded view, enabling him always to relate his research to the human predicament: it was never just figures on paper. Among the awards he received were the two highest that can be conferred on a British meteorologist: the L. G. Groves Memorial Prize and the Symons Gold Medal.

Hubert Lamb died on 28 June 1997[6], but in spite of his early misgivings about being able to maintain the reputation of the family name he did so admirably. It lives on, not only through his own prolific writings and especially in his daily weather catalogue, but now his son, Norman Lamb, is (at the time of writing) a minister in the Conservative-Liberal Coalition government. His character according to those who knew him was that of a modest, unassuming, man who also had a determination to stick to his principles and beliefs, but always doing so in a friendly and courteous manner.

[5] For any readers who cannot quite remember, the title is from the hymn of the same name, itself a quotation from Psalm 34 (Brady & Tate New Version).

[6] By a rather grim coincidence Lamb and his two great counterparts in Germany and America, Hermann Flohn and Jerome Namias, all died within a few months of each other.

ISSN 1748-2992