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A LIGHTNING PHOTOGRAPHY SPECIAL
How Best to Photograph Lightning
Thunderstorms in the 18th Century: Part 1
Whirlwind report for Poland in 2010





The International Journal of Meteorology

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THUNDERSTORMS IN NORTHERN ENGLAND, 1750 - 1799: PART 1: THUNDERSTORM CHARACTERISTICS

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"1789 will long be remembered not only for an insurrection in France, but also for an insurrection in the elements - The heavy and long-continued showers, with the tremendous bursts of thunder, and the expansive and vivid flashes of lightning must have impressed even the lightest mind with the most serious apprehensions." (*Leeds Mercury*, 28 July 1789.)

Abstract: a wide range of sources has been examined in an attempt to understand the history and impact of thunderstorms and associated phenomena in northern England during the latter half of the 18th century. Despite certain shortcomings, the information gathered offers a fairly detailed picture of the incidence of the storms and their effects on society and the environment. The evidence points to an impact greater than that of present-day thunderstorms in northern England.

Keywords: Thunderstorms, lightning, floods, hail, tornadoes; northern England; Manchester; Sheffield; Scottish Border; 1750-1799; society impact; environment impact.

INTRODUCTION

Any study of 18th Century thunderstorms and their impact in Britain has to contend with two very different situations. On the one hand, people were more likely to record thunderstorms than run-of-the-mill weather, not least because of a public interest in less common weather events (Golinski 2003). In contrast, some thunderstorms were probably missed by those who wished to record them, given the patchy nature of their occurrence and the small number of observers at the time. This raises the question of whether or not it will be possible to build up what seems to be an accurate picture of thunderstorms and their effects on society and the environment in northern England for the period 1750 to 1799.

In an effort to address this question, a wide variety of sources has been consulted, though it has been found that easily the most helpful of these are personal diaries and newspapers. A particularly concentrated body of weather data exists in the diary of John Poole from near Manchester. This survives from January 1774 to June 1778 and mentions 89 thunderstorms. Also valuable is the Liverpool diary of William Hutchinson, which runs from January 1768 to August 1793. It records weather on a continuous, daily basis and has over 90 references to thunderstorms. This is somewhat more than John Holt's record, which is also from the Liverpool area. Spanning the years 1791-1799 and, therefore, briefly overlapping Hutchinson's diary, this notes thunderstorms on 77 days (*Gentleman's Magazine (GM)*, 1791-1799). A far longer period (1742-1781) is covered by the diary of George Williamson from near Appleby, though this has rather intermittent weather data. It consequently manages only 55 references to thunderstorms in the second half of the 18th century. Even so, this is more than the 47 such references in the diary of Isaac Fletcher from near Cockermouth, which covers the years 1756-1781 (Winchester 1994). Another valuable weather diary originated with Jonathan Dalton at Kendal. This essentially spans the years 1793-1809, but, despite being a continuous, daily record, it has only 29 references to 18th Century thunderstorms.

To these diaries can be added the book, "*Meteorological observations and essays*", written by Jonathan's famous brother, John, which lists 46 days with thunderstorms at Kendal and Keswick in the five years 1788-1792 (Dalton 1793; see also Crosthwaite 1787-1792).

Newspapers are doubly useful, as they often record the dates of thunderstorms together with their impact on society and the environment. Two Leeds papers have been the mainstay for this type of source. As available on microfilm, they first become useful during 1755 in the case of the *Intelligencer (LI)* and in 1769 for the *Mercury (LM)*. They record thunderstorms and their impacts in northern England on around 170 days during the second half of the 18th Century. This information was augmented initially by data from the *Cumberland Pacquet (CP)*. Microfilms for this cover the years 1774-1799, but not 1780 and 1784, which were missing from the sets examined. These note thunderstorms on 91 days. Also consulted were the *Manchester Mercury (MM)* (1752-1770) and the *York Courant (YC)* (1750-1769, though there were no microfilms for 1757, 1758 and 1759). Together, these identified only 23 days with thunderstorms, of which two-thirds are known from other sources. Extending the survey of these papers to 1799 was, therefore, not thought to justify the money and time needed to purchase and search the relevant microfilms. In contrast, all volumes of the *GM* between 1750 and 1799 were examined as these were conveniently available in a local library. Again, however, only a modest 47 thunderstorm days were identified. Finally, the relevant volumes of the *Annual Register (AR)* (ie. 1758-1799) and the *Times Digital Archive (TDA)* (ie. 1785-1799) were studied, but each yielded less than ten thunderstorm days for northern England.

NATURE OF THE THUNDERSTORM DATA

There were 642 days between 1750 and 1799 when thunderstorms are known to have occurred in northern England. This total gives an average of almost 13 a year. In reality, however, the data point more strongly to variability as the chief attribute of these and other timescales. Hence, the number of thunderstorm days recorded per decade was, perhaps not surprisingly, much lower during the 1750s and 1760s (ie. 52 and 68 respectively) than in the 1790s (187). Less expected was the finding that the total for the 1770s (180) is distinctly higher than that for the 1780s (155).

This decadal pattern is reflected in the picture of annual thunderstorm variability (Figure 1). Hence, totals of less than ten thunderstorm days a year are overwhelmingly clustered before 1767, though there is no year without at least one day when a thunderstorm has been identified (Table 1). Between 1750 and 1766 there was an average of 4.5 thunderstorm days per annum, whereas this figure rises to 17 for the period 1767-1799. Extremes of year-to-year variability are provided by annual totals ranging from one thunderstorm day in 1753 to 36 in 1775. Between 1750 and 1766 only 1756 had a markedly greater than average number of thunderstorm days (14 have been identified). From 1767 to 1799 there were 18 years when this figure was exceeded, in some cases (1775 and 1789) by between two and three times. Yet, this same period also recorded years when the number of thunderstorm days was well below average, most notably 1769 (9), 1771 (2), 1773 (8), 1784 (8), 1786 (9) and 1793 (7). In contrast to these and earlier low thunderstorm totals, there was a set of high annual values in the 1770s, particularly 1775 (36), 1776 (29) and 1777 (25).

Years with <10 thunderstorm days in north England.	1750, 1751, 1752, 1753, 1754, 1755, 1757, 1758, 1759, 1760, 1761, 1762, 1763, 1764, 1765, 1766, 1769, 1771, 1773, 1784, 1786, 1793.
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Table 1. Years when less than ten thunderstorm days have been identified in north England.

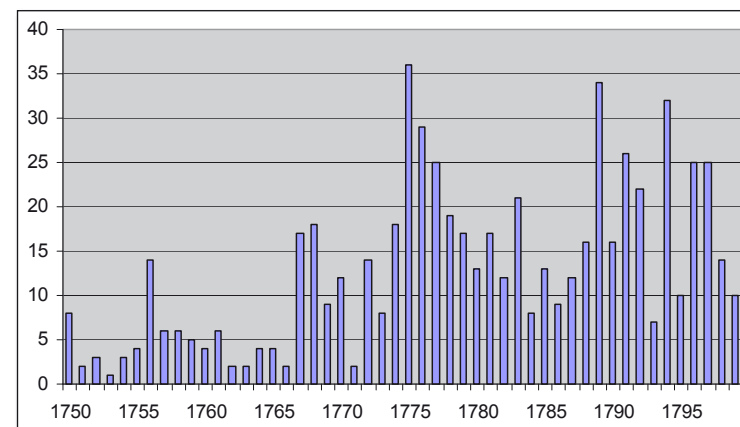


Figure 1 Annual totals of days with thunderstorms in northern England, 1750-1799. N=642.

At times, adjacent years have experienced markedly different numbers of thunderstorm days. This was especially so with 1755 (4) and 1756 (14), 1766 (2) and 1767 (17), 1771 (2) and 1772 (14), 1774 (18) and 1775 (36), 1788 (16) and 1789 (34), and 1793 (7) and 1794 (32).

Monthly averages also show pronounced variability. As expected, they record a thunderstorm peak in summer (Figure 2). If the six months April to September are defined as the summer half of the year, then these experienced 79 % of the 642 thunderstorm days identified, while October-March (the winter half of the year) had 21 %. The months of the year with the highest numbers of thunderstorm days were June, July and August, which had 16.3 %, 21.1 % and 16.3 % respectively of the total: November, December, January, February and March, each with less than 5 % of the total, had the fewest thunderstorm days. The year recording the highest number of months with thunderstorms was 1791 (10), followed by 1794 (9), then 1767, 1775, 1776, 1777, 1792 and 1798 (each with 8). Of the 16 years registering three months or less with thunderstorms (Table 2), only three (1771, 1773 and 1781) were after 1766. The individual months with the highest numbers of thunderstorm days were July 1789 (10), August 1775 (9) and the five months June 1756, July 1776, June 1781, June 1789 and October 1796 (each with 8).

Years registering three months or fewer with thunder in north England	1750, 1751, 1752, 1753, 1754, 1755, 1758, 1759, 1760, 1762, 1763, 1765, 1766, 1771, 1773, 1781.
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Table 2. Years registering three months or fewer with thunderstorms in north England.

The longest uninterrupted sequences of days with thunderstorms in northern England were 1-5 August 1775, 25-29 June 1778, 19-23 July 1789 and 9-13 October 1796. From the months of June, July and August, only the 14th June and the 31st July did not have at least one year between 1750 and 1799 when there was a thunderstorm. The most thundery period was between the 15th and the 24th July, during which there were 69 thunderstorm days over the half century. However, the individual days that registered the highest number of years with thunderstorms (ie. nine) were the 17th and 27th June and the 16th July.

On present evidence, comments about the spatial aspects of thunderstorms in northern England between 1750 and 1799 are likely to be less meaningful than the preceding remarks about variations over time. This is chiefly because surviving observations of the period are sparsely and haphazardly distributed and no doubt failed to record a number of thunderstorms. Therefore, unlike modern accounts, which identify, for example, relatively high thunderstorm activity in Greater Manchester, the data collected during the present research do not permit spatial variations to be discussed with confidence. All that can be highlighted at present are a few days when there were several reports of thunderstorms in northern England. The most important were 10 April 1774, 14 July 1775, 27 June 1789, 15 August 1791 and 12 January 1796 (each with six thunderstorm reports), together with 20 June 1789, 22 June 1790, 16 July 1792, 5 June 1795, 30 July 1797 (seven reports), 21 September 1775, 1 August 1797 and 18 August 1797 (eight reports) and 5 July 1776 (nine reports). On these days, thunderstorms were apparently widespread throughout northern England.

The *precise* characteristics of thunderstorms were seldom noted by observers in northern England. Many reports appeared content to indulge in well-worn and often exaggerated descriptions of storms: adjectives like 'dreadful', 'terrible' and 'violent' or phrases such as 'the worst in the memory of man' were all too readily used. Occasionally, however, approximate times were given for the beginning and end of a storm (eg. almost continuous lightning was reported at Leeds between 7 and 12 pm on 15 August 1791: *LM*, 23 August 1791). Equally, a few people introduced a note of precision by stating that there were only one or two flashes or thunderclaps during a storm. Some precision also occurs in the writings of John Dalton. During a storm in the Kendal area on 16 August 1788 he observed "20 or 30 flashes and reports... in about half an hour", while in another, on 20 June 1789, he counted "35 peals in 3/4 of an hour." (Dalton, 1793). Likewise, on 5 September 1775, John Poole observed lightning two and three times a minute for nearly two hours (Poole, 1774-1778), while John Holt used his "seconds-watch" to count on two occasions "20 flashes in 30 seconds" on 29 July 1797 (*GM*, 1797).

Observers have described "balls of fire" in northern England on 18 days between 1750 and 1799. Most reports simply noted their existence and impact (damage, deaths, etc). A few, however, gave more interesting details. For example, the *Leeds Intelligencer (LI)* (14 May 1771) described how lightning entered a house at Bradford "like a blazing torch, in a triangular form". This presumably refers to the conical shape that ball lightning sometimes assumes. Equally fascinating was the report that on 10 July 1783, near Leeds, "several balls of fire were seen to strike on the ground, and after running upon it some time, burst into small balls, which again sprung into the air, and then vanished" (*LM* 15 July 1783) (cf. Anon, 1983).

INTERPRETING THE DATA

The information collected for the first one-third of the half century studied (i.e. up to 1766) gives annual totals of thunderstorm days that are usually much smaller than those for the remaining two-thirds (Figure 1). It is suspected that this strongly reflects the availability of data, in which case the record before 1767 must be treated with caution, while that after 1766 may be regarded as giving a picture that is closer to reality. Support for this view comes from work on thunderstorms which occurred in northern England between 1700 and 1749. This has so far identified only 120 thunderstorm days, a total which is obviously much below that known for the later decades of the century.

It is not however, entirely clear why the thunderstorm data collected should become more abundant after 1766.

Perhaps, observing the weather became caught up in those changing and more positive attitudes towards landscape, which led to the Romantic revolution. Significantly, Roberts (2001) has pointed out that these new attitudes showed a marked growth in the late 1760s. This, therefore, coincided with the time when information on thunderstorms in northern England becomes more abundant. A further influence may have been the very harsh January of 1767, which could have sharpened peoples' awareness of the importance of the weather. Another possibility considered was that thunderstorm totals were boosted by Hutchinson's detailed Liverpool record, which started in 1768. The figures, however, show that this made only a small contribution to the improved record of thunderstorm days after 1766.

Although the thunderstorm details identified for the years 1750 to 1799 may not give a complete picture of reality, it is worth mentioning that the more recently-consulted sources have tended to confirm, rather than augment the thunderstorm days already known. For example, of the seven thunderstorm days which the preacher, John Wesley, recorded during his travels in northern England (Curnock, 1960), only one had not been previously identified from other sources.

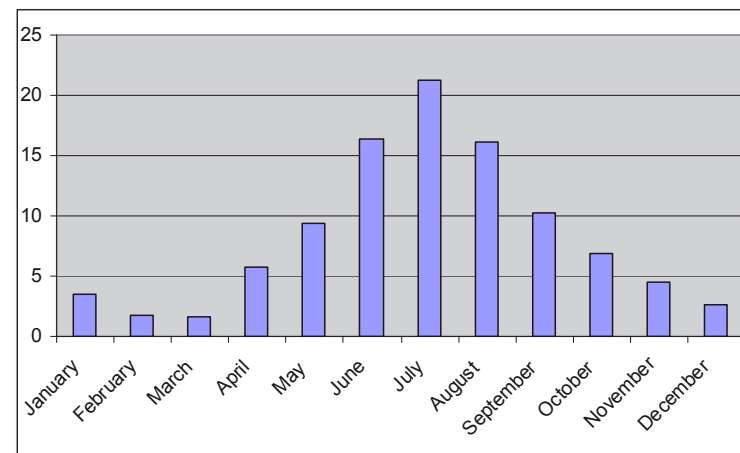


Figure 2 Monthly frequencies of thunderstorms in northern England, 1750-1799 (expressed as percentages). N=642.

Even though the information collected becomes more abundant after 1766, it still presents difficulties of interpretation as sources come and go. Thus, in 1771, the very low number of two thunderstorm days coincides with a gap in the diary of George Williamson. On the other hand, Hutchinson and Fletcher, together with the *LI* and *Mercury*, cover the year. There are, then, grounds for suspecting that 1771 was a year of minimal thunderstorm activity in northern England. Similarly, it could be thought that the identification of only seven thunderstorm days for 1793 must somehow reflect the fact that eight months of Jonathan Dalton's daily record at Kendal are missing. Yet, this is a year covered by the Leeds newspapers, the *CP* and by Holt's daily observations from Walton. In addition, for almost two-thirds of the year, Hutchinson was compiling daily weather reports at Liverpool. It may therefore be that, like 1771, it really was a year with few thunderstorms in northern England. By contrast, there are high annual totals of thunderstorm days in the 1770s that largely coincide with the years covered by the diary of John Poole. Although he was observing in an area of relatively high thunderstorm activity, the amount he records is, perhaps, surprising.

In this context, it must be appreciated that Poole compiled one of the most detailed weather diaries of any 18th Century observer in northern England, with lengthy descriptive entries that often note several changes of weather in a 24-hour period (he even reported on weather during the night). It may, however, be that Poole has at times confused lightning with the Aurora Borealis, a problem occasionally mentioned in the newspapers (e.g. *MM*, 27 January 1767). The reliability of Poole's observations can to some extent be assessed by comparing them with those of his contemporaries. Thus, of the 89 thunderstorm days he recorded in the years 1774-8 barely 43 % were noted as such by other observers. Because this is a rather low percentage, it may be best to await further investigations before passing a final judgement on Poole's thunderstorm record.

Unusually thundery weather has also been claimed for much of the June-August period of 1783. This has been linked to the state of the atmosphere during the eruption of the Laki fissure in Iceland. It was said by contemporary writers in northern England to be hot and sultry, with a hazy sky and more thunder and lightning than ever remembered, both locally and in other parts of Europe (Hutton 1754-1812; Chipchase 1779 et seq; Robinson 1779-95; *LM*, 29 July 1783; *CP*, 2 September 1783; Hutchinson, 1797). Yet, in some respects at least, the thunderstorms of 1783 do not appear to have been exceptional. Indeed, if one ranks in order of magnitude the number of days each year when thunderstorms were recorded in northern England during the second half of the 18th Century, 1783 only achieves tenth place. Likewise, although northern England had seven thunderstorm days in both July and August 1783, there were seven months between 1750 and 1799 (June 1756, August 1775, July 1776, June 1781, June 1789, July 1789 and October 1796) that recorded eight or more thunderstorm days. Interestingly, four of these (August 1775, July 1776, June 1789 and July 1789) were adjacent to a month which had at least five days with thunder. Again, the fairly widespread thundery activity in northern England on the 10/11 July, the 2 and 19 August 1783 is not exceptional within its half-century context. Finally, the more severe storms of 1783 appear to have lasted under four hours and descriptions of their intensity are no more colourful than for storms in other years. Present evidence, therefore, suggests that 1783 was not an exceptional year for thunderstorm activity in northern England within the period 1750-1799.

Indeed, as mentioned above, several years appear to have been more thundery than 1783. Of these, 1775 and 1789 head the list, with 36 and 34 thunderstorm days respectively (as against 21 in 1783). The totals for 1775 and 1789 are derived from nine and eight sources respectively. One of those for 1775 is, however, John Poole, who furnishes over one-third of the thunderstorm days identified. Given previous comments about his diary, it would be premature to claim that 1775 was the most thundery year in northern England during the second half of the 18th Century. Perhaps that accolade will eventually go to 1789?

PHENOMENA ASSOCIATED WITH THUNDERSTORMS

Rain, hail and tornadoes were all associated with thunderstorms in northern England during the second half of the 18th Century. Unfortunately, the virtual lack of measured amounts of thunderstorm rain makes it difficult to assess intensity and significance. One of the few attempts at precision has again come from John Dalton (1793). He noted that on 4 June 1791 over 1 and a half inches of rain mixed with hail fell in three quarters of an hour during a thunderstorm at Kendal, but that for much of the time the rain was only moderate. Although flooding can be a proxy for the intensity of thunderstorm rain, confusion may arise when use of the word 'flood' could simply indicate a raised water level. An example of the difficulties of interpretation is the claim that Beetham, north of Lancaster, had 17 "great Floods" between 10 May and 25 December 1792 (Hutton, 1754-1812).

Despite this type of problem, available evidence clearly suggests that only a few (perhaps around 6 %) of the 642 thunderstorm days so far identified experienced true floods. These were chiefly within the months June-August. Probably the most important occurred on several days in July 1768 and on 8 June 1775, 23 July 1777 and 26 August 1792 (*AR*, *GM* 1768; *MM* 26 July 1768, 2 August 1768; *LI* 26 July 1768; *LM* 13 June 1775; *LI* 29 July 1777; *CP* 5 August 1777; *LM* 1 September 1792; and, Oates and Navickas, 2006).

Hail is known to have fallen in northern England on 665 days between 1750 and 1799. As expected, the data show a winter peak, whereby 57.3 % of days with hail were during the October - March period. Even so, April was the month which recorded by far the highest incidence of days with hail (nearly 15 % of the total), whereas July, August and September registered the lowest totals, though they had comparatively high proportions of days when the hail was associated with thunder. For example, August recorded the lowest number of hail days (16) during the half century studied, but had nine with thunder. April, by contrast, despite having 98 hail days, managed only 10 with thunder. Over the period 1750-1799, a total of 133 days have been identified when there was both hail and thunder. Two-thirds of these were between April and September.

Observers in northern England have variously described the larger forms of hail as being the size of pigeons' eggs (Ismay 1722-1766), as big as marbles (Poole 1774-8) and nearly the size of almonds (*LI*; *CP* 29 July 1783). Some of the largest recorded had a circumference of five to six inches and fell near Newcastle during a storm on 20 July 1767 (*LI* 28 July 1767). Stones of almost five inches circumference were noted after a storm in the Stockton area on 2 August 1783 (Chipchase, 1779 et seq; *LM*, *LI*, *CP*, 12 August 1783). A few observers recorded the depth of thunderstorm hail. This reached a maximum of 15 inches (noted by Poole on 16 July 1775). Almost as deep were the 12-14 inches that fell during a storm at Haydon Bridge on 20 June 1768 (*LI*, 12 July 1768). That hail can accumulate quickly is evidenced by a storm on 29 September 1789, when the streets of Whitehaven were covered to a depth of four inches in 1.5 minutes (*CP*, 7 October 1789; *LI*, 13 October 1789). There are also occasional remarks on how long the hail lay – sometimes (e.g. the storm of 27 July 1775 near Alnwick), stones remained unmelted after 24 hours (*LI*, *LM*, 8 August 1775). Similarly, hail which fell over the Leeds area between 5 and 6 pm on 20 June 1772 survived the next morning as irregular lumps of ice "as big as a common football" (*LI*, 23 June 1772).

Occasionally, during the years 1750-1799, tornadoes and related features developed in northern England at or around the same time as thunderstorms. South of Kendal, in an estuarine location near Milnthorpe, a waterspout was observed on 13 August 1775 (Hutton 1754-1812). Although this report does not mention thunderstorms, the day appears to have been unsettled, with thunder being noted in the Manchester area (Poole 1774-1778).

Again, prior to a thunderstorm near Barnard Castle on 15 August 1770 a whirlwind was reported (*LM*, 11 September 1770), while during a storm on 23 June 1792 near the Cheviot "an inverted whitish cone" was seen (*LM*, 7 July 1792). On 27 August 1790 and 18 June 1798 there were clouds in the Craven district of Yorkshire that resembled serpents (*LM*, 14 September 1790; *LI*, 2 July 1798).

(Part 2 will be continued in a near future issue of IJMet)

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SOLAR PILLARS OF FIRE PART 4: MAGNETIC ANOMALIES CONTROL TROPICAL CYCLONE DIRECTION

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Abstract: Hurricanes perform arcs of loops at a particular location east of the United States. It is reported that these hurricane antics are a result of changing weather troughs. It is suspected the hurricane antics are due to a magnetic feature on the floor of the ocean.

Keywords: Hurricane, Tropical Cyclone, Magnetic Anomaly.

INTRODUCTION

The National Hurricane Archive has provided an explanation of the changing direction of Hurricane Felix 1995 when it was located due east of the Outer Banks: "The split in the trough resulted in increased ridging over the western Atlantic that appeared to be strong enough to drive Felix into the eastern United States. However, a small weakness remained between 70 and 75 °W as indicated by Air Force and NOAA reconnaissance data on the 16th. Felix turned northward into the weakness and almost stalled late on the 16th. It then moved slowly northeastward on 17 August. A second westerly trough failed to pick up the storm on 18-19 August, and Felix performed an anticyclonic loop offshore as the trough bypassed the tropical cyclone. The hurricane accelerated northward on 20 August and northeastward on 21 August in response to a third trough."



Figure 1. Best Track of Hurricane Josephine 1984.

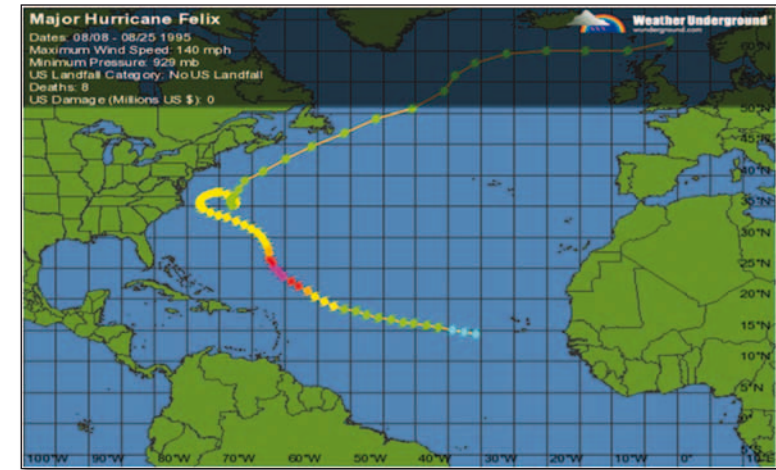


Figure 2. Best track of Hurricane Felix 1995.

This motion for Hurricane Felix 2005 is shown in Figure 2. The problem is that there is another hurricane that exhibit this looping motion at the location 72 to 73.5W and 35+N. It is possible that changing troughs are causing the noted hurricane motions for Josephine 1984 (Figure 1) in the same location in the Atlantic Ocean as Felix 2005. However, one could bet on much better odds that the hurricane antics are being caused by magnetic anomalies on the ocean floor.

Negative magnetic anomalies indicate a decrease in the earth magnetic field at the location of the anomaly. A portion of the World Magnetic Anomaly Map is shown as Figure 3. It would be instructive for the reader to plot the portions of the identical arcs of the hurricane's paths on Figure 3.

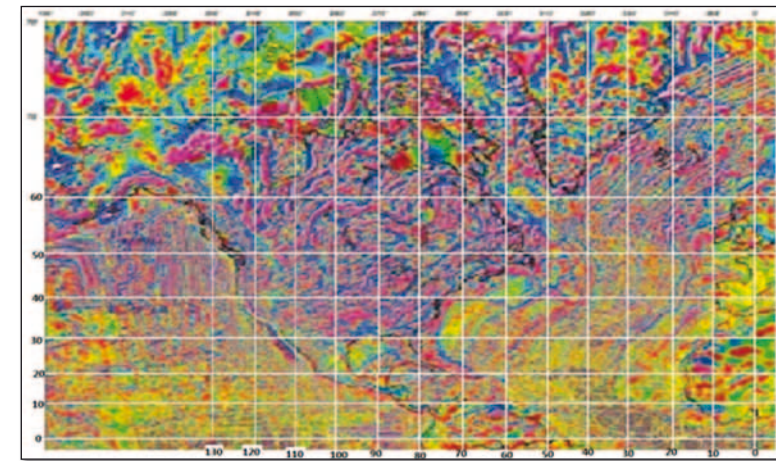


Figure 3. Sector of World Magnetic Anomaly Map (Red = Positive Magnetic Anomaly Blue = Negative Magnetic Anomaly).

The noted path of the hurricanes off the outer banks contains a trough of negative magnetic anomalies surrounded by positive magnetic anomalies and the stated hurricanes are tracking the negative magnetic anomalies.

CONCLUSION

The electro-magnetic hurricane model previously reported proposes a hurricane is positive ions revolving in a magnetic field (Sokeland, 2006). The proposed hurricane model would have a positive magnetic pole (field direction downward) in the eyewall of the hurricane that extends to the outer ionic ring of the hurricane. The magnetic field of a blue negative magnetic anomaly would be upward in the northern hemisphere. The magnetic field of the negative magnetic anomaly produces a negative magnetic pole. The direction of the negative magnetic anomaly's magnetic field is upward in the northern hemisphere. Unlike magnetic poles produce a force of attraction between them in the same way unlike electrical charges attract each other. As a result, the hurricane will track the path of the negative magnetic anomaly. The hurricanes noted have identical paths and are obeying the magnetic laws of Physics and therefore the electro-magnetic model for a hurricane is correct.

ACKNOWLEDGEMENTS

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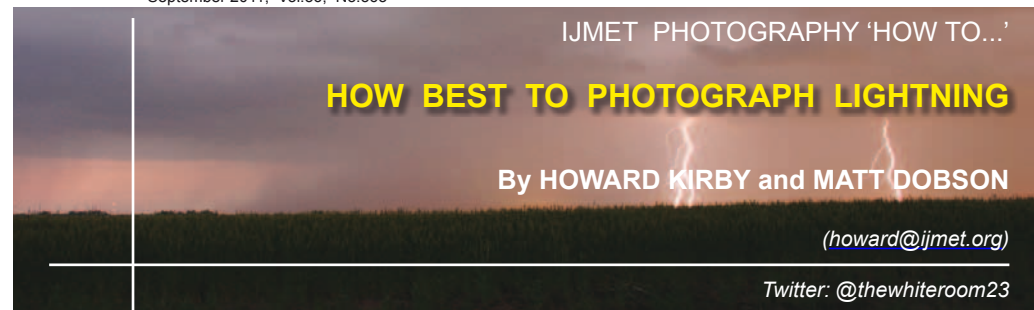
The author dedicates this work to his daughter, Sherri Sokeland Kaiser.

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About the author: William Sokeland is a retired consultant engineer and worked on real time mission support assignment to NASA on the Skylab refrigeration system. He studied at General Motors Institute, Purdue University, and University of Florida before becoming a visiting Professor at University of Evansville, Indiana.

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Taking photographs of lightning can be a highly rewarding type of photography, producing spectacular images that catch nature at its most ferocious. It is most successfully carried out at night but it is also possible during the day, especially when using a novel piece of technology (discussed below) that you can attach to some cameras. While lightning photography can be very exciting and allows the photographer to capture the beauty of these powerful electrical discharges, it must be stressed that lightning is deadly. Standing in exposed parts of the countryside with metal camera equipment obviously increases your chances of being struck. Therefore it is important to minimise this risk by avoiding being the tallest object in an open area and also not standing near isolated trees or on exposed hill tops. Always ensure you have quick access to a safe environment such as a house or car if necessary.

How can you estimate how close lightning is? The number of seconds between the lightning flash and subsequent thunder, divided by five gives the approximate distance of the lightning discharge from the observer in miles (divide by three for distance in Kilometres).

Below are our Top Ten Tips for Lightning Photography:

TOP TEN TIPS:

1. Monitor the weather forecast closely in the days and hours leading up to potential thunderstorm events: This is not just a case of watching the forecast on the TV. There is plenty of free weather forecast information available on the internet, along with subscription sites that give you access to high resolution forecast charts and also rainfall radar and lightning strike (sferic) observations. Accessing this information can quickly help you to find where thunderstorms are tracking and how intense the lightning activity is. Additionally, weather forums such as the excellent www.ukweatherworld.co.uk include links to a huge range of weather forecast and monitoring sites, while providing discussion threads regarding thunderstorm forecasts and reports, and of course the TORRO forum.

2.Track thunderstorms remotely: The latest smartphones, tablets, laptops and netbooks offer access to fairly high speed internet while on the move, at a pretty reasonable cost. This is in addition to free WiFi hotspots that are becoming more numerous. It is therefore possible to track thunderstorm movements in near real-time while out on a lightning photography mission! This significantly improves your chances of intercepting a storm and saves you time and petrol if the storms begin to die out before you reach them.

3. Become aware of when thunderstorms are most likely: With a little time invested researching and some practice, you will soon be able to distinguish which weather patterns are most likely to bring thunderstorms to your local area.

In the UK, the nature of its climate means that thunderstorm frequency and intensity vary quite markedly from region to region and also season to season. For example, Scotland experiences relatively few storms in summer but has more in autumn and winter as big showers sweep in over the relatively warm seas. Over central and eastern England, most storms occur in the spring and summer months when temperatures are highest and instability greatest. On average, East Anglia and southeast England experience the greatest number of thunderstorm days per year - around 14 to 16 days at any one location. These areas are also most at risk from the larger and often more severe thunderstorms that develop at the end of a summer heatwave for example. Slow moving storms that produce frequent lightning obviously offer the photographer a greater opportunity to capture a lightning image.

4. Find a good vantage point to watch the storm approach: Once you have identified that thunderstorms are heading your way or likely to develop imminently, the next thing to do is find yourself a vantage point to watch the storm from. Ideally, a horizon free from obstructions with a wide view of the sky towards the direction of the storm is what you are looking for. A view out to sea or over a sweeping landscape is ideal, with a hillside or raised area of land providing an even better vantage point. For a more artistic and original scene, you could try including some well placed features in your composition, such as a house, trees, the coastline or even an offshore wind farm!

5. Be aware of the storm's motion to maximise your chances of capturing a lightning strike: To improve the chance of capturing a lightning strike on camera, to lessen the time that you will stand in heavy rain and to increase your safety, you need to be positioned so that the storm tracks across your field of view rather than straight towards you! Therefore, if a storm is moving from southwest to northeast, you want to be positioned on its southeastern side. This location is also ideal (compared to the northwestern side) for looking into what is usually the most active part of the storm. It also allows you more freedom to continue to follow the storm for additional lightning shots as new cells most frequently develop to the right of a storm's track. You can increase your chances of obtaining a good picture further by closely monitoring the parts of the storm that are producing lightning and timing the interval between the flashes. There might be just one active storm cell or maybe more than one. Each cell will be active for perhaps 10-20 minutes before it decays and a new one develops.

6. Camera and lens choice: Although any camera can be used to take photographs of lightning, the task is made much simpler if you use one that gives you full control over the exposure settings (known as manual mode or M). Digital SLRs are ideal as most also offer a BULB setting in manual mode. This allows you to leave the shutter open for as long as you want, providing total flexibility for the exposure. Regarding lens choice, a standard zoom lens with a focal length of 18-55 mm will be ideal. A wide minimum aperture/fast lens is not especially important, as you will discover in the next section. An ultra wide lens can be an excellent secondary lens for capturing stunning anvil crawler lightning that flashes across huge portions of the sky, while a telephoto lens is useful for picking out a gathering storm on the horizon.

7. Camera settings: At night, it is best to disable the autofocus (as it does not work in the dark) on your lens and use manual focus and set it to infinity (to make sure the image will be sharp front to back). At dusk/dawn it can be useful to use autofocus to set the focus initially, but is often better to switch to manual focus once 'locked on'. The probability of recording a lightning flash is increased if a narrow aperture is used as this extends the exposure time. However, during daylight hours this still only gives you a small window of opportunity before the photograph becomes overexposed and blown out.

Therefore, lightning photography is most successful when carried out during dawn, dusk and particularly overnight. The shutter can be left open for longer periods at night and closed once any lightning actually flashes. However, be aware that digital noise may begin to creep into the picture at very long exposures (more than 1 or 2 minutes) so it is still good practise to keep shutting and re-opening the shutter at fairly regular intervals. To minimise image noise and for highest picture quality, keep the ISO at the lowest setting (normally 50 or 100). However, there are some exceptions. If lightning at night is especially distant or faint then it is worth widening the lens aperture and perhaps upping the ISO slightly until you are happy with the exposure of the images.

8. Neutral Density Filter: For extending exposure times, more especially when taking lightning photographs during daylight, it is worth purchasing at least one neutral density filter for your lens. These work to reduce the amount of light passing through your lens onto the sensor/film and therefore increase the time you can leave the shutter open before the image overexposes. Stack several filters on top of each other to increase this effect, but image quality will reduce somewhat as you add more. Good quality filters (such as from Hoya or Lee) do not produce a colour cast on your photographs.

9. Three legged friend: A tripod (or at second best any other stable platform to rest your camera like a bean bag, wall or car roof) is an indispensable photographic accessory as far as lightning photography is concerned. When using long shutter speeds there is no other way to ensure shake-free shots. Set the tripod up with a weight (camera bag or rucksack) hanging from the hook on the base of the central column to increase stability. Thunderstorms tend to produce gusty conditions as they approach which can shake or even blow over a poorly secured or lightweight tripod. Try not to use the extender column for extra height as this increases the risk of camera shake. Use a cable-release to fire the shutter (many of these allow you to slide a switch to hold the shutter open in BULB mode too) and avoid touching the camera when making an exposure. If rain sets in, attach your camera's lens hood and hang a heavy duty plastic carrier bag or old rain jacket over the rest of the lens and camera body so that you can keep shooting for as long as possible without ruining your equipment.

10. Digital Darkroom: Once you have completed your lightning photography trip and are back in the comfort of your home, there are a number of image corrections and tricks that you can do with PC software. Firstly, it is worth checking your photographs for signs of digital image noise. A fair proportion of your lightning shots are likely to contain areas of dark tones which will show up noise more easily, if it is present. Thankfully, the latest digital SLRs produce far less noise and most image editing software will do a good job at reducing/removing this problem. A trick worth trying if you have captured successive photos of lightning without recomposing is to combine these exposures using the layers function in your imaging software. Altering the image opacity and then 'flattening' the image will allow the individual lightning bolts to show through, giving the appearance of a very active thunderstorm over the landscape!

An additional note about the use of Lightning Triggers.

If you are using an SLR or digital SLR and are keen to capture daytime lightning without resorting to grabbing a frame from a video you may want to use a Lightning Trigger (LT). A quick internet search would return several websites with these devices for sale. This novel piece of technology is able to detect lightning up to around 20 miles away in daylight and basically takes the photo for you, once you have set up the camera. It sits on the hot shoe of your SLR and a cable connects it to the shutter release socket. So once you have found a suitable and safe location set your camera on a tripod, focus manually on infinity, or auto focus to infinity.

Then set to manual or focus lock, set single exposure and choose shutter priority mode. Pick a shutter speed slower than around 1/20 sec to ensure the entire lightning stroke is captured. The LT utilised the camera's light meter to alter the aperture accordingly for each shot. If the ambient light is too high you may want to add a Neutral Density or Polarizing filter to your lens which will enable a couple more stops down on the aperture as previously discussed. If you are able to select mirror lock-up this will also reduce any delay in shutter release and reduce any camera shake. All you have to do then is stand back, enjoy the show and wait for the results.

One last tip: Make sure all batteries are fully charged before you go out!

The results of lightning photography can be exceptionally dramatic and rewarding. Of course do please do share your results with us at *IJMet* and stay safe!

Safe shooting – Matt and Howard, *IJMet* photography team.



Image above © Samantha Hall USA storm chasing (2005)

Background Title Image: © Samantha Hall USA storm chasing (2005).

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DAYS WITH THUNDERSTORMS, TORNADOES, WATERSPOUTS AND FUNNEL CLOUDS IN POLAND IN 2010

By LESZEK KOLENDOWICZ

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Abstract: This report analyses the occurrence of days with thunderstorms, tornadoes and funnel clouds in Poland during 2010. The number of days with thunderstorms was analysed with respect to their frequency in individual months, seasons of the year and the year as a whole and compared to the corresponding average values from the period between the years 1951-2010. Occurrences of tornadoes in 2010 were analysed taking into account their intensity and the resulting material damage, followed by a description of the accompanying weather conditions.

Keywords: Thunder, thunderstorm, tornado, waterspout, funnel cloud, Poland, 2010.

DAYS WITH THUNDERSTORMS IN 2010

The number of days with thunderstorms in Poland in 2010 was analysed on the basis of data from 29 weather stations of the IMGW (Institute of Meteorology and Water Management) (Figure 1). The resulting information on the frequency of thunderstorm days was then compared against the mean values for the 60-year period from 1951 to 2010, for the same territory. The data from before 1981 were taken from the Weather Yearbooks and Precipitation Yearbooks of the IMGW, whereas the later data were taken from the NOAA NCDD website (<http://www7.ncdc.noaa.gov/CDO/cdo>).

On average, one weather station recorded 21.6 days with thunderstorms in 2010, which is below the long-term (1961-2010) average (23.5). The greatest number of thunderstorm days occurred in the summer period, both in 2010 and during the last 50 years. It has been noted that storm activity in the summer of 2010 was slightly greater than in the long-term (by less than 1 day). In the remaining seasons of 2010, there were fewer thunderstorm days than on average in the years 1951 to 2010. Particularly remarkable was the winter season, with no thunderstorm days in 2010. Both in 2010 and in the average year of the 60-year period, spring was the season with the second largest number of storm days, after summer. The autumn typically has fewer storm days than the two preceding seasons, whereas winter has either no thunderstorm days at all (2010), or very few of them (1951 to 2010). An analysis of the frequency of days with thunderstorms in each individual month shows that in 2010 the greatest number of such days occurred in August (7.4 days on average), whereas in the 60-year period – in July (5.4). In the spring period, thunderstorm days are the most frequent in May, whereas in the autumn – in September. December is the has the lowest frequency of thunderstorm days in Poland (see Tables 1 and 2).

An analysis of the annual spatial distribution of thunderstorm days (both in 2010 and in the long-term) shows that thunderstorm activity grows from the northwest to the southeast part of the country. In the average year of the 60-year period, there are fewer than 15 thunderstorm days on the northwestern coast of the Baltic sea, as compared to over 30 such days in the southeastern part of the country (Figure 2b). Both in the northwest and in the northeast, there were fewer thunderstorm days in 2010 than the 1951-2010 average (below 5 and below 15, respectively) (Figure 2a).

	months												spring	summer	autumn	winter	year	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII						
Aleksandrowice	0	0	0	0	0	8	3	9	6	0	0	0	0	8	18	0	0	26
Białystok	0	0	0	1	4	5	8	9	0	0	0	0	0	5	22	0	0	27
Chojnice	0	0	0	4	2	6	9	0	0	0	0	0	0	4	17	0	0	21
Częstochowa	0	0	0	2	5	2	5	6	1	0	0	0	0	7	13	1	0	21
Elbląg	0	0	0	1	3	4	5	10	0	0	0	0	0	4	19	0	0	23
Gdańsk	0	0	0	1	2	4	9	0	0	1	0	0	0	1	15	1	0	17
Gorzów Wielkopolski	0	0	0	0	0	0	1	4	0	0	0	0	0	0	5	0	0	5
Kasproy Wierch	0	0	0	0	5	4	10	5	0	0	0	0	0	5	19	0	0	24
Kielce	0	0	0	0	8	4	8	7	0	0	0	0	0	8	19	0	0	27
Kłodzko	0	0	0	1	5	4	6	7	0	0	0	0	0	6	17	0	0	23
Koszalin	0	0	0	1	3	1	5	0	0	0	0	0	0	1	9	0	0	10
Kraków	0	0	0	1	7	6	7	8	0	0	0	0	0	8	21	0	0	29
Lesko	0	0	0	3	8	5	8	8	0	0	0	0	0	11	21	0	0	32
Lublin	0	0	0	0	9	4	8	7	1	0	0	0	0	9	19	1	0	29
Łeba	0	0	0	0	1	2	4	8	2	0	0	0	0	1	14	2	0	17
Łódź	0	0	0	1	3	3	9	5	0	0	0	0	0	4	17	0	0	21
Mława	0	0	0	0	7	4	6	11	0	0	0	0	0	7	21	0	0	28
Nowy Sącz	0	0	0	1	5	5	10	7	0	0	0	0	0	6	22	0	0	28
Płock	0	0	0	1	5	3	6	11	1	0	0	0	0	6	20	1	0	27
Poznań	0	0	0	0	4	2	4	10	1	0	0	0	0	4	16	1	0	21
Rzeszów	0	0	0	1	6	4	7	7	0	0	0	0	0	7	18	0	0	25
Sandomierz	0	0	0	0	8	3	8	6	0	0	0	0	0	8	17	0	0	25
Suwałki	0	0	0	0	1	1	6	7	0	0	0	0	0	1	14	0	0	15
Śnieżka	0	0	0	0	1	1	6	7	0	0	0	0	0	1	14	0	0	15
Świnoujście	0	0	0	0	0	2	1	3	0	0	0	0	0	0	6	0	0	6
Toruń	0	0	0	0	2	2	5	7	0	0	0	0	0	2	14	0	0	16
Ustka	0	0	0	0	1	2	3	4	2	0	0	0	0	1	9	2	0	12
Warszawa	0	0	0	3	7	4	6	10	0	0	0	0	0	10	20	0	0	30
Wrocław	0	0	0	1	5	4	6	11	0	0	0	0	0	6	21	0	0	27
average station	0,0	0,0	0,0	0,6	4,3	3,1	6,0	7,4	0,3	0,0	0,0	0,0	0,0	4,9	16,4	0,3	0,0	21,6

Table.1 The number of days with thunderstorms in particular meteorological stations during the year 2010 in Poland.

	months												spring	summer	autumn	winter	year	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII						
Aleksandrowice	0,1	0,1	0,4	1,3	5,1	6,3	6,0	5,2	1,6	0,3	0,2	0,0	0,0	6,8	17,5	2,0	0,2	26,5
Białystok	0,0	0,1	0,3	1,0	4,3	5,5	5,9	4,8	1,6	0,2	0,1	0,0	0,0	5,6	16,1	1,9	0,1	23,7
Chojnice	0,0	0,0	0,1	1,0	3,9	5,0	5,2	4,0	1,4	0,3	0,1	0,0	0,0	5,0	14,2	1,8	0,1	21,1
Częstochowa	0,1	0,1	0,3	1,0	3,8	4,8	4,9	3,6	0,8	0,2	0,1	0,1	0,1	5,0	13,3	1,0	0,2	19,5
Elbląg	0,1	0,1	0,2	1,0	3,8	5,2	5,9	5,1	2,1	0,5	0,1	0,0	0,0	5,0	16,2	2,7	0,2	23,9
Gdańsk	0,0	0,1	0,1	0,6	2,5	3,3	3,6	2,9	1,0	0,2	0,1	0,0	0,0	3,2	9,8	1,3	0,1	14,3
Gorzów Wielkopolski	0,1	0,2	0,3	0,9	3,7	4,3	5,1	3,8	1,5	0,2	0,1	0,0	0,0	4,8	13,3	1,7	0,3	20,0
Kasproy Wierch	0,1	0,1	0,1	1,6	6,1	7,9	7,6	6,3	1,9	0,3	0,1	0,1	0,1	7,7	21,9	2,3	0,1	32,2
Kielce	0,1	0,1	0,3	1,5	5,2	6,3	6,7	5,5	1,7	0,2	0,0	0,0	0,0	7,0	18,4	1,9	0,2	27,5
Kłodzko	0,1	0,0	0,2	1,1	5,0	6,5	6,6	5,0	1,5	0,3	0,1	0,1	0,1	6,3	18,1	1,8	0,2	26,3
Koszalin	0,1	0,1	0,2	0,9	3,6	4,1	5,2	4,3	2,3	0,8	0,3	0,1	0,1	4,7	13,6	3,3	0,2	21,8
Kraków	0,3	0,2	0,4	1,3	4,9	6,0	6,1	4,6	1,7	0,3	0,1	0,1	0,1	6,6	16,7	2,1	0,6	25,9
Lesko	0,1	0,1	0,4	1,9	6,3	7,6	7,9	6,3	2,1	0,4	0,1	0,0	0,0	8,6	21,8	2,5	0,2	33,1
Lublin	0,0	0,1	0,3	1,4	5,1	6,2	7,0	5,1	1,6	0,2	0,0	0,1	0,1	6,7	18,2	1,8	0,2	26,9
Łeba	0,0	0,0	0,1	0,9	3,1	3,7	4,9	4,4	2,4	1,1	0,4	0,1	0,1	4,0	13,0	3,9	0,1	21,0
Łódź	0,1	0,1	0,2	1,1	3,8	4,8	6,0	4,2	1,3	0,3	0,0	0,0	0,0	5,2	14,9	1,6	0,3	21,9
Mława	0,0	0,0	0,1	1,4	3,9	4,7	5,7	4,2	1,4	0,3	0,0	0,0	0,0	5,3	14,6	1,8	0,1	21,7
Nowy Sącz	0,1	0,0	0,1	1,4	5,4	6,9	6,9	5,8	1,6	0,2	0,1	0,0	0,0	6,9	19,5	1,8	0,1	28,3
Płock	0,1	0,1	0,2	1,2	4,2	5,0	5,8	4,5	1,3	0,2	0,0	0,0	0,0	5,5	15,2	1,5	0,2	22,4
Poznań	0,0	0,1	0,2	0,9	3,7	4,8	5,1	4,2	1,4	0,3	0,1	0,0	0,0	4,9	14,1	1,7	0,1	20,8
Rzeszów	0,1	0,0	0,3	1,5	5,1	6,2	7,2	5,6	1,7	0,3	0,1	0,1	0,1	6,9	18,9	2,1	0,1	28,1
Sandomierz	0,1	0,1	0,3	1,1	4,7	5,5	6,5	4,5	1,6	0,3	0,1	0,0	0,0	6,1	16,5	1,9	0,2	24,6
Suwałki	0,0	0,0	0,1	1,2	3,6	5,2	5,5	4,0	1,4	0,2	0,0	0,0	0,0	5,0	14,7	1,6	0,0	21,3
Śnieżka	0,1	0,1	0,3	1,1	4,6	5,8	5,7	5,2	1,5	0,2	0,1	0,1	0,1	5,9	16,7	1,7	0,1	24,4
Świnoujście	0,0	0,0	0,2	0,6	2,7	3,1	3,7	2,7	1,5	0,3	0,1	0,0	0,0	3,4	9,5	1,8	0,1	14,9
Toruń	0,0	0,0	0,1	1,1	4,1	4,8	5,5	4,1	1,5	0,2	0,1	0,0	0,0	5,4	14,5	1,7	0,1	21,6
Ustka	0,0	0,0	0,1	0,7	2,3	2,6	3,6	3,1	1,9	0,7	0,4	0,0	0,0	3,1	9,3	3,0	0,1	15,4
Warszawa	0,1	0,2	0,5	1,6	4,9	5,8	6,5	5,3	1,6	0,4	0,2	0,0	0,0	6,9	17,5	2,2	0,3	26,9
Wrocław	0,1	0,1	0,4	1,3	4,7	6,0	6,1	5,1	1,6	0,3	0,0	0,1	0,1	6,4	17,1	1,9	0,2	25,5
average station	0,1	0,1	0,2	1,2	4,3	5,3	5,8	4,6	1,6	0,3	0,1	0,0	0,0	5,6	15,7	2,0	0,2	23,5

Table.2 The average number of days with thunderstorm in particular meteorological stations in the period 1951-2010 in Poland.

In the remaining parts of the country, the number of thunderstorm days in 2010 was similar to the long-term average.



Figure 1. Location of meteorological stations.

TORNADOES, WATERSPOUTS AND FUNNEL CLOUDS IN 2010

In 2010, there were 9 days with tornadoes and four days with waterspouts recorded in Poland. Tornadoes occurred on four May days (7, 18, 24 and 25), two June days (10 and 12) and three August days (7, 12 and 27). Waterspouts took place twice in August (19 and 28) and twice in September (1 and 2) (Figure 3). Funnel clouds were observed on 12 occasions in 2010: three times in May (18, 20 and 30), twice in July (4 and 5), five times in August (2, 15, 16, 17 and 18) and twice in September (1 and 9) (Figure 4).

The records on the occurrences of tornadoes, waterspouts and funnel clouds was taken from the Polish storm spotters website ("Polscy Łowcy Burz SKYWARN POLSKA" - <http://lowcyburz.pl>). The weather maps showing weather conditions on the above dates come from the Daily Weather Bulletin of the IMGW from 2010.

TORNADOES

Late in the afternoon on 7 May 2010, a whirlwind accompanied by intense rainfall hit the town of Sępopol in Warmińsko-Mazurskie region. The tornado broke hundreds of trees in the town, caused roof damage to numerous buildings, and the accompanying rainfall resulted in flooding basements and garages in most buildings. The damage indicates that the scale of the phenomenon was T2 in the TORRO scale (F1 in the Fujita scale). On the day of the tornado Poland was in the centre of a low pressure area with weather fronts separating warm maritime polar air in the east from a similar mass of air advecting from the northwest. The low pressure system moved northeastwards during the day. The weather was cloudy but clearing. There was some rainfall and thunderstorms with intense precipitation (rain and hail). The maximum temperatures ranged from 6 °C on the Baltic coast to 22 °C in the northeastern part of Poland. The tornado occurred in a storm cloud forming in the cool weather front connected with the central part of the low pressure area separating the two masses of air, differing significantly in terms of temperature. The wind was weak to moderate to gusty and variable during storms (Figure 5).

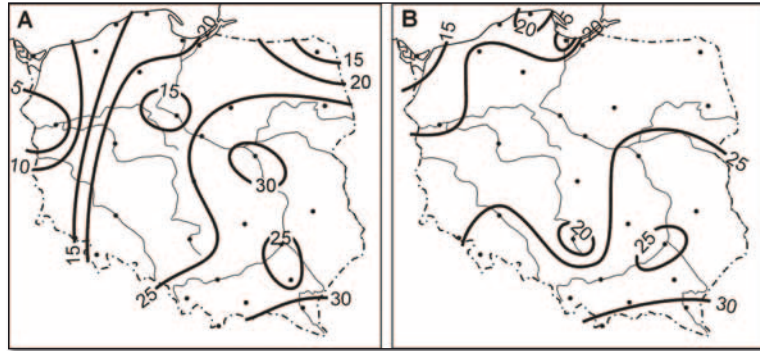


Figure 2. The annual distribution of thunderstorm days in 2010 (A) and the average number of days with thunderstorms during the period of years 1951-2010 (B).

In the afternoon on 18 May 2010, a whirlwind hit five villages, namely: Pobondzie, Potopy, Rowele, Marianka and Kadaryszki, again in Warmińsko-Mazurskie region. A total of 16 farm buildings and seven houses were damaged; a number of trees and electric pylons were broken as well. Despite considerable damage, there were no casualties. The damage caused by the whirlwind was three times greater than in the previous case. The intensity of the tornado was T3 (F2). On the analysed day, Poland was dominated by local low pressure areas persisting over Ukraine or forming over its northeastern part. Cloudiness was total to high. There were rain and drizzle activities, and thunderstorms in the north and the east of the country. A warm weather front hovering over the north and the east of Poland separated the masses of warm maritime polar air covering the northeastern part of the country from the masses of maritime polar air. The wind was westerly and northwesterly, weak to moderate, and periodically strong and gusty (up to 18 m/s). The whirlwind was associated with thunderstorm clouds forming in the central part of the low pressure area over the northeastern part of the country (Figure 6).

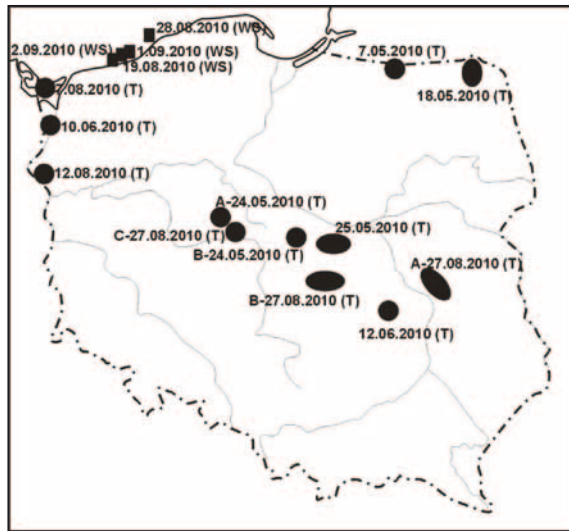


Figure 3. Location of tornadoes (circles and ellipses) and waterspouts (squares) observed in Poland in 2010.

On 24 May 2010 at around 1900 hrs a whirlwind was observed near the village of Skurbaczewo (A in Figure 3), 24 km north of the town of Słupca in Wielkopolskie region. The whirlwind passed over buildings, apparently causing no damage. Its intensity was likely to be T0 (F0). On the same day at 2000 hrs a whirlwind passed over the town of Kutno (B in Figure 3) in Łódzkie region, breaking over ten trees in the town. No damage was recorded to buildings or power infrastructure. The intensity of the whirlwind could be estimated at T1 (F0).

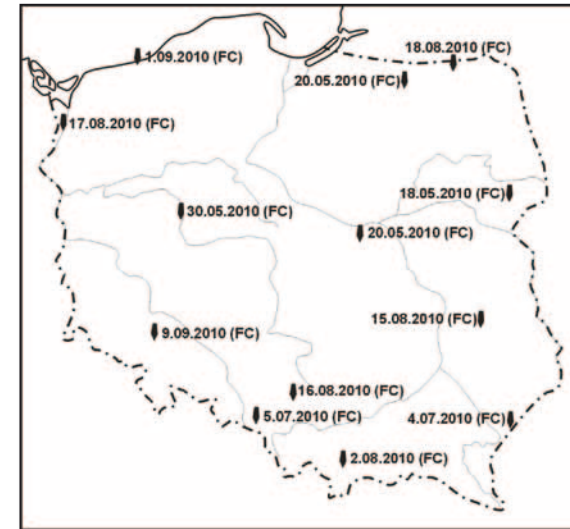


Figure 4. Location of tornadoes funnel cloud observed in Poland in 2010.

On the analysed day, Poland was under direct influence of a cool weather front moving from the north to the south of the country. The weather was cloudy but clearing considerably. Nearly all of the country experienced some shower activities and/or thunderstorms. The maximum temperature ranged from 11 °C on the coast to 21 °C in the southwestern part of the country. The wind was weak to moderate, periodically turning to fairly strong and gusty (up to 20 m/s, westerly). The tornadoes occurred in storm clouds forming on the quickly moving cool front (Figure 7, A and B).

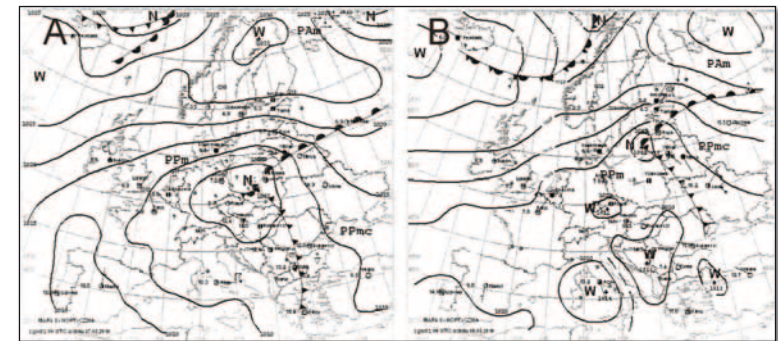


Figure 5. Synoptic map of 7 May 2010 at 00 UTC (A) and 8 May 2010 at 00 UTC (B), according to *Codzienny Biuletyn Meteorologiczny IMGW*.

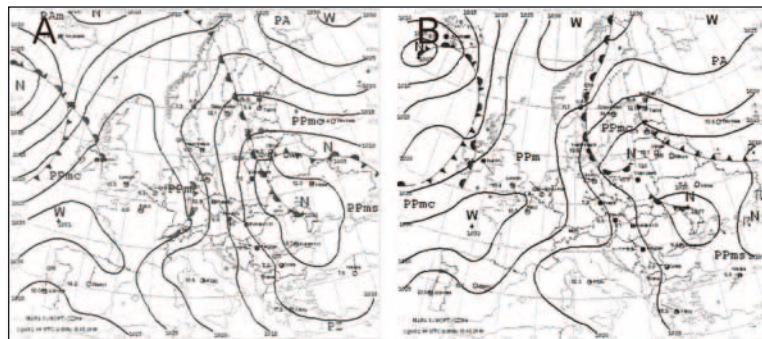


Figure 6. Synoptic map of 18 May 2010 at 00 UTC (A) and 19 May 2010 at 00 UTC (B), according to *Codzienny Biuletyn Meteorologiczny IMGW*.

In the afternoon on 25 May 2010, a whirlwind appeared over the town of Sochaczew, and specifically in the area of its Trojanów district (Mazowieckie region). It caused damage to several farm buildings. On the same day, another whirlwind appeared in the village of Bedlno near Kutno (Wielkopolskie region), where it ripped the roof of the local fire station. Both whirlwinds seem to be T2 (F1). The weather on the 25th May was very similar to the weather on the day before. Also in this case the tornado formed in storm clouds on a quickly moving cool front (Figure 7, B and C).

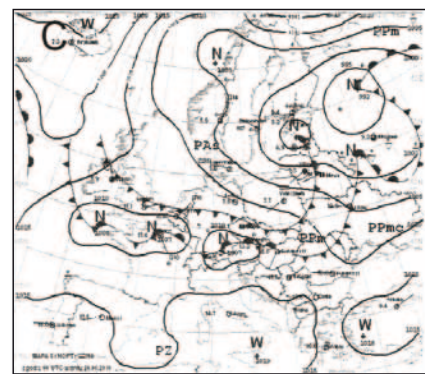
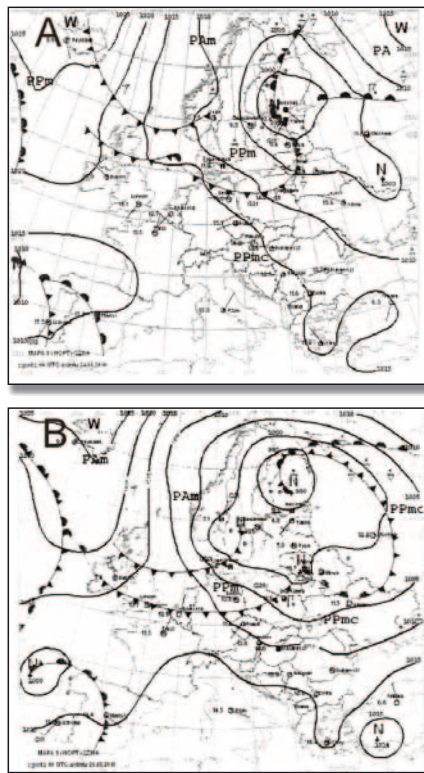


Figure 7. Synoptic map of 25 May 2010 at 00 UTC (A), 26 May 2010 at 00 UTC (B) and 27 May 2010 at 00 UTC (C), according to *Codzienny Biuletyn Meteorologiczny IMGW*.

In the afternoon of 10 June 2010 a whirlwind passed over the town of Gryfino (Zachodniopomorskie region), breaking trees and thus causing damage to cars parked near them. The intensity of the whirlwind is believed to be T1 (F0). On that day, a larger share of the territory of Poland (except for its northern extreme) was influenced by a mass of tropical air. One of the arms of the cool front extended to the western border of Poland. The cloudiness was low to moderate to high in the north, with some showers and thunderstorms. The maximum temperatures ranged from 18 °C in the north to 33 °C in the south of Poland. The wind was weak, only locally moderate and gusty, southerly and southeasterly. The tornado seen on that day was associated with a thunderstorm cloud forming as a result of a cool front and its effect on the warm tropical air mass (Figure 8, A and B).

On 12 June 2010, a whirlwind appeared over Skaryszew near the city of Radom. No major damage was caused. The accompanying wind broke tree branches. The whirlwind's intensity was T0 (F0). On that day, Poland was under the influence of cool and occluded weather fronts, quickly moving from the northwest to the southeast of the country. The fronts separated tropical air masses from maritime polar air. Cloudiness was low to moderate, and to high at times. Shower activities were accompanied by thunderstorms (some of them violent and accompanied with hail). The maximum temperatures ranged from 18 °C in the north to 33 °C in the south of Poland. The wind was usually southwesterly, weak to moderate, turning strong and gusty (up to 22 m/s) during storms. The tornado was associated with storm clouds forming on a cool weather front (Figure 8, C and D).

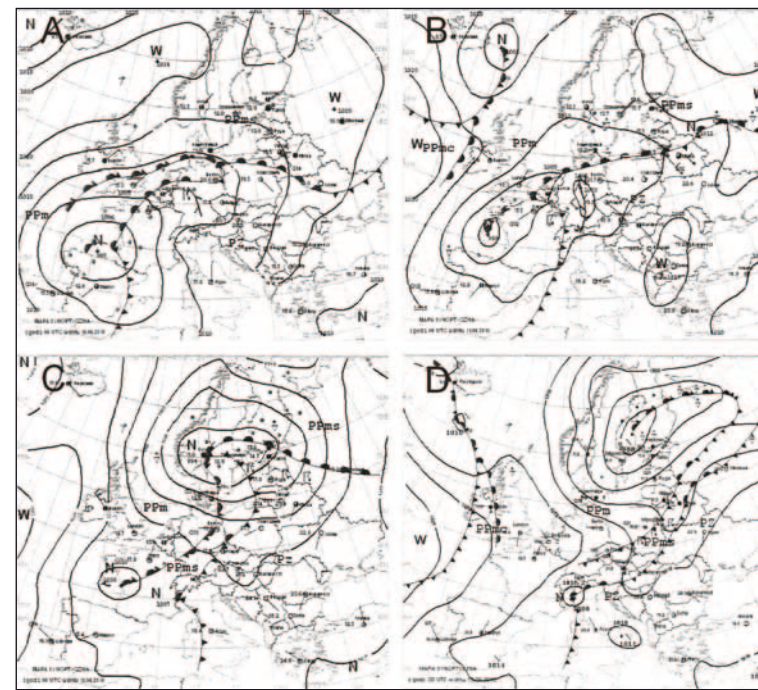


Figure 8. Synoptic map of 10 June 2010 at 00 UTC (A), 11 June 2010 at 00 UTC (B), 12 June 2010 at 00 UTC (C) and 13 June 2010 at 00 UTC (D), according to *Codzienny Biuletyn Meteorologiczny IMGW*.

In the afternoon on 7 August 2010, a whirlwind appeared in Świnoujście (Zachodniopomorskie region). No damage was recorded. The whirlwind's intensity was T0 (F0). On that day, a cool weather front moved over Poland, separating wet and warm masses of equatorial air from old maritime polar air. Cloudiness was low to moderate, and high at times. Local shower activity was observed and thunderstorms were recorded in the north, west and centre of Poland. The maximum temperatures ranged from 18 °C in the west to 28 °C in the east of the country. Westerly and southerly wind was weak to moderate, turning fairly strong and gusty (up to 15 m/s) during storms. The tornado was associated with storm clouds forming on a quickly moving cool weather front (Figure 9).

On 12 August 2010, a T0 (F0) tornado passed over Mieszkowice in Zachodniopomorskie region, causing no major damage. On that day Poland was under the influence of a wet and warm mass of equatorial air. From above Germany, a cool weather front moved towards the western part of Poland, resulting in a secondary weather front. This interference caused the formation of storm clouds and – consequently – a tornado in the warm and wet mass of tropical air (Figure 10).

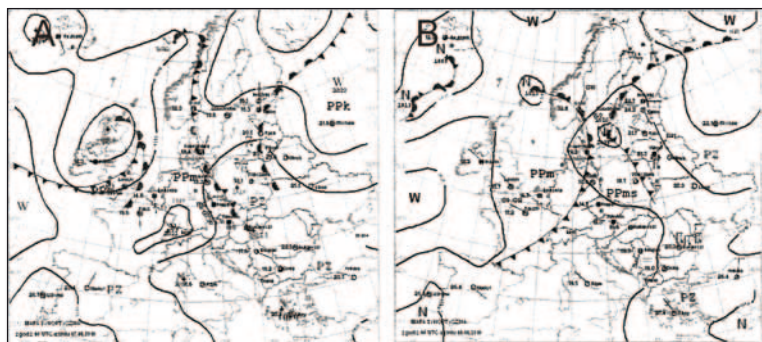


Figure 9. Synoptic map of 7 August 2010 at 00 UTC (A) and 8 August 2010 at 00 UTC (B), according to *Codzienny Biuletyn Meteorologiczny IMGW*.

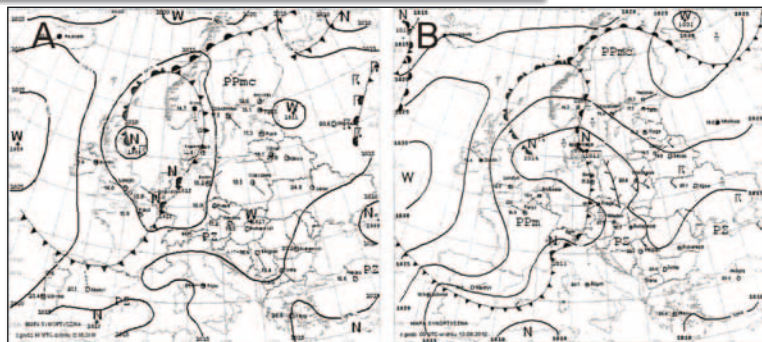


Figure 10. Synoptic map of 12 August 2010 at 00 UTC (A) and 13 August 2010 at 00 UTC (B), according to *Codzienny Biuletyn Meteorologiczny IMGW*.

On 27 August 2010, whirlwinds passed over Łódzkie, Mazowieckie and Lubelskie regions. In Wola Rębkowska in Mazowieckie (A in Figure 3), roofs were ripped and 20 houses were seriously damaged. Power lines were broken. The damage is indicative of an intensity of T3 (F1). In Lubelskie, a T1 (F0) tornado passed in the afternoon over the villages of Swaty and Brzeziny near the town of Ryki (A in Figure 3). Broken trees caused damage to the overhead equipment of the Warsaw – Dęblin railway line. In Łódzkie the whirlwind ripped and/or damaged several roofs in the villages of Regnów Nowy, Annosław and Podskarbie Królewskie (B in Figure.3). The intensity is believed to be T1 (F0). At around 1500 hrs in Wielkopolskie region, (district of Słupca, municipality of Łądek – C in Figure 3) a whirlwind destroyed several roofs of residential buildings.

Additionally, it broke trees and electric pylons. Its intensity is believed to be T1 (F0).

On the analysed day, the weather situation was typical of violent storms and powerful tornadoes in Europe (Kolendowicz, 2006; Walkner, 1992). From the south, very warm and wet tropical air came in, in the form of a low pressure area whose central part was located over northern Germany. Simultaneously, the pace of the low pressure area with a cool front challenging the tropical air mass was very high. In just 24 hours the front moved from central Germany to Moscow in western Russia (Figure 11). These powerful (by Polish standards) tornadoes developed out of storm clouds formed on a very fast-paced cool weather front, in a warm and wet mass of tropical air.

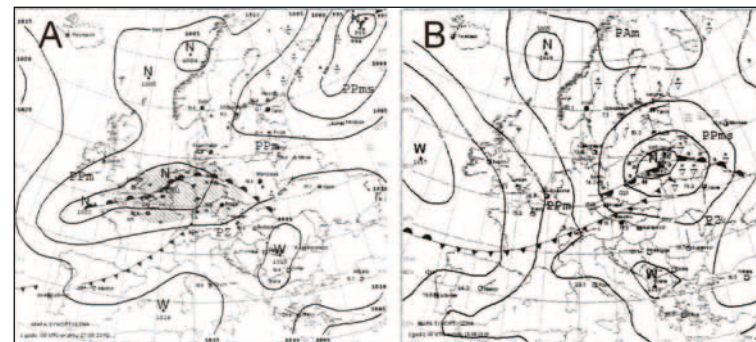


Figure 11. Synoptic map of 27 August 2010 at 00 UTC (A) and 28 August 2010 at 00 UTC (B), according to *Codzienny Biuletyn Meteorologiczny IMGW*.

WATERSPOUTS

As already mentioned, waterspouts were recorded on four occasions in 2010. All of them were seen from the shore above the waters of the Baltic sea and they caused no damage to property.

On the 19th August waterspouts were seen in the area of Sianorzęty. The waterspout developed out of a Cb cloud, forming in the mass of maritime polar air coming to Poland from the west, behind an occluded weather front. The weather associated with the incoming air from above the North Sea was characteristic for cloudy but clearing sky and some shower activities in the north of Poland. Thunderstorms occurred locally. On the coast, wind was westerly and south westerly, occasionally strong, rising to 15 m/s in gusts. The maximum temperature ranged from 17.7 °C to nearly 21 °C (Figure 12).

On the 28th August, another waterspout was observed near Darłówko. The phenomenon was associated with a storm cloud formed in a uniform mass of old maritime polar air. On the day in question the Baltic coast in Poland was dominated by cloudy but clearing weather, with occasional rains, some of them intense. The maximum temperature was approximately 18 °C. Wind was north westerly, moderate to strong, gusty (Figure 11b).

On 1st September at around midday another waterspout was observed near Gaški. The storm clouds giving rise to the waterspout were formed in a mass of maritime polar air coming in behind a warm front from the west. The Baltic coast in Poland was dominated by low to moderate cloudiness, with some local shower activity. The maximum temperature was approximately 18 °C. Wind was northerly and westerly, weak and moderate, occasionally strong and gusty, up to 18 m/s (Figure 13a).

On the 2nd September at around 0940 hrs a waterspout was observed near Kołobrzeg. It developed from storm clouds forming in the frontal part of a cool weather front moving from the north to the south of Poland.

On that day, the sky was moderately cloudy, with some shower activities and storms. The maximum temperature on the coast was approximately 17 °C. Wind was northerly and north-westerly, weak and moderate, occasionally strong and gusty, up to 18 m/s (Figure 13b).

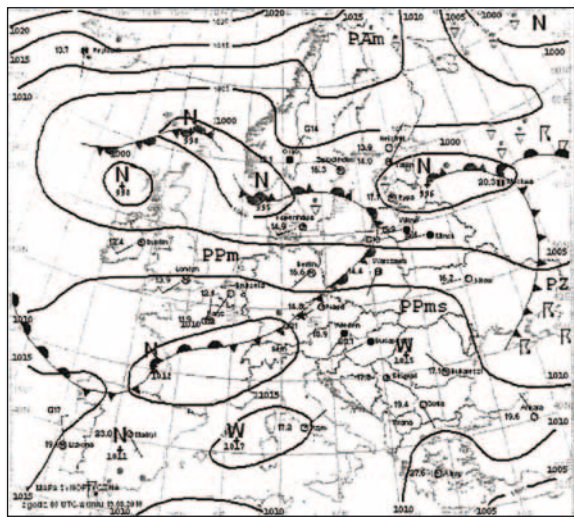


Figure 12. Synoptic map of 19 August 2010 at 00 UTC, according to *Codzienny Biuletyn Meteorologiczny IMGW*.

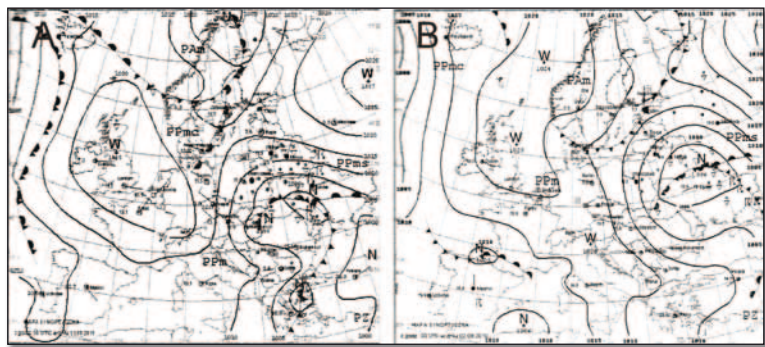


Figure 13. Synoptic map of 1 September 2010 at 00 UTC (A) and 2 September 2010 at 00 UTC (B), according to *Codzienny Biuletyn Meteorologiczny IMGW*.

FUNNEL CLOUDS

On 18th May, a funnel cloud was seen near Bielsk Podlaski. It formed out of clouds associated with an occluded front persisting over the eastern part of Poland.

On the 20th May, a funnel cloud was seen in the area of Sochaczew near Warsaw and in the area of Kętrzyn in the Mazury Lake District. The phenomenon was a consequence of a cool weather front moving in from the northeast over Poland. The front separated warm maritime polar air from a mass of continental maritime air.

On the 30th May, a funnel cloud was recorded over the city of Poznań. It was formed in clouds associated with a fast-moving cool weather front shifting from the west to the east of the country.

On the 4th July between 1250 and 1315 hrs funnel clouds were seen near the village of Kalników in Podkarpackie region.

They were formed in a uniform mass of maritime polar air, following a cool weather front which moved over Poland the day before.

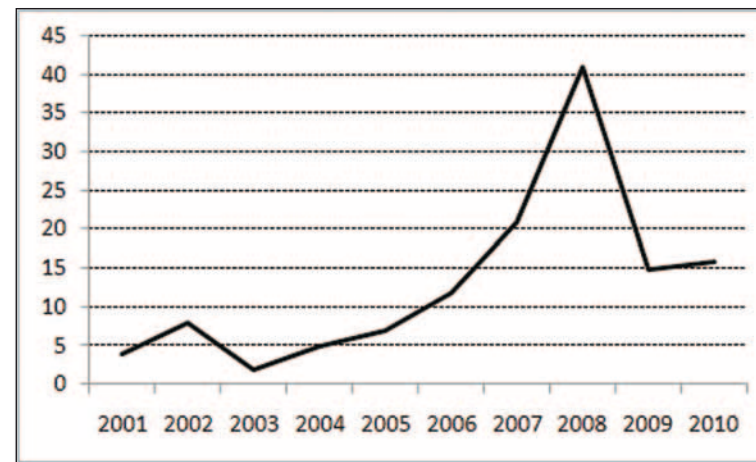


Figure 14. The number of tornadoes and waterspouts recorded in Poland in the years 2001 to 2010.

On the 5th July, another funnel cloud was seen near the town of Żory in Silesia region. It developed from clouds forming a fast-moving cool weather front shifting from the west to the east of the country.

On the 2nd August at 1829 hrs a funnel cloud was seen near Nowy Targ in Podkarpackie region. It developed from clouds forming in a secondary weather front in a mass of old maritime polar air.

On the 15th August, the phenomenon in question was seen in Bełżyce in southeastern Poland. It was associated with storm clouds forming in a uniform mass of tropical air.

On the 16th August at around 1600 hrs funnel clouds were seen in Katowice; on the 17th August at around 1130 hrs in Szczecin and on the 16th August – in the area of Gołdap in Mazury region. All of them were formed of storm clouds in cool and occluded weather fronts.

On the 1st September at 1600 hrs a funnel cloud was seen in Kołobrzeg. It was formed on an occluded weather front moving into Poland from the north.

On the 9th September at 1900 hrs a funnel cloud was seen in the area of Mount Ślęza. It developed from storm clouds formed in a uniform mass of old polar air.

CONCLUSIONS

An analysis of thunderstorm activity in Poland in 2010 indicates that the frequency of days with thunderstorms was lower than the average value for the period 1951 to 2010. However, a higher frequency of thunderstorm days in the summer period should be noticed, and so should the lack of storm days in winter, as well as a smaller number of such days in spring and in the autumn.

In 2010, documented tornadoes and water spouts occurred on 13 days in the summer period from May to September. The most intense tornadoes occurred during weather conditions conducive to a high intensity of both tornadoes and thunderstorms (Kurz, 1985 1986; Kolendowicz, 2006, 2007; Walkner, 1992).

Funnel clouds were documented on 12 occasions, also from May to September.

Data on tornadoes and waterspouts recorded in Poland in the years 2001 to 2010 on the basis of photographs, films or accounts of reliable eye-witnesses are presented in Figure 14. The mean value for the said period is 13.1 days per year, which is why the year 2010 – with 16 tornadoes and waterspouts – was characteristic for a greater frequency of these phenomena than during the previous 10 years. Some doubts may be caused by a relatively small number of data for the years 2001 to 2005, which may lower the mean value. The existing data base is being continually expanded and supplemented, and so is the number of persons taking interest in tornadoes, also due to considerable damage and threat caused by both phenomena. Therefore, one should assume that the data for the years 2006 to 2010 are more reliable and that the frequency of tornadoes and waterspouts has not been subject to any statistically significant variations over the analyzed period.

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TORRO TORNADO DIVISION REPORT: September-December 2010

By PAUL R. BROWN and G. TERENCE MEADEN

This was a rather quiet period for whirlwind activity. September 2010 had anticyclonic spells in the first and last weeks, but cyclonic or westerly types in the middle; just one waterspout and two funnel clouds were reported. In October winds were often from between southwest and northwest, but there was an easterly spell in the second week; there were two probable tornadoes, one waterspout, and two funnel clouds. November had a cyclonic westerly pattern until mid-month, but very cold northeasterly winds dominated the last 10 days; there was one tornado (definite), three waterspouts, and three funnel clouds. December 2010 was an exceptionally cold month with north and east winds for much of the time; one waterspout and one tornado (definite) were reported; and there was a funnel cloud in the Irish Republic.

ws2010Sep07 *Brixham, Devon (50° 23' N 3° 31' W, SX 9255)*

The *Herald Express* of the 9th September published photographs taken by Mr Ali King from Paignton showing a broad vertical funnel cloud over Brixham; the time was about 1800 GMT, and although contact with the surface is not visible in the picture, it seems likely that the vortex would have disturbed the sea surface. At 1800 GMT a complex area of low pressure covered the British Isles, with main centre, 987 mb, off northwest Ireland. Scattered showers, locally heavy, affected many areas (although the funnel cloud does not appear to have been associated with any of them).

FC2010Sep11? *Offshore Harwich, Essex (c 51° 56' N 1° 16' E, TM 2531)*

Ms Georgina Cleminson wrote to us on the 26th September to say she had seen a large funnel cloud over the sea from Harwich 'about two weeks ago'. She described it as "very defined and dark, but didn't go down more than a third of the way to the water". Of the implied dates circa 11-13th, the 11th is the most likely meteorologically, when a cold front moved slowly east across the area in the afternoon (the 12th had a ridge of high pressure, while on the 13th a warm front was moving east).

FC2010Sep17 *Alderney (Airport), Channel Islands (c 49° 43' N 2° 12' W)*

A funnel cloud was reported in the vicinity in the 1050 GMT Alderney METAR. At 1200 GMT a northwesterly airstream covered the British Isles between a low, 989 mb, over Scandinavia and a high, 1023 mb, near western Ireland. Many places had a dry day, but scattered showers affect the west and north (and the English Channel).

Wind2010Sep24? *Milton of Ogil, Glen Ogle, Angus (56° 44' N 2° 53' W, NO 459612)*

According to the *Courier* of the 28th September a wooden hut at the Mountains Animal Sanctuary was destroyed by a suspected 'mini-tornado'. Ms Kerry Hill of the sanctuary said: "It's not as if it's just been old and blown over — it's completely destroyed and has been left in little bits all over the field". The hut was used as a shelter by horses, but they were unharmed. There is, however, insufficient evidence for us to record this as a tornado. The date was only given as 'the end of last week', which suggests the 24th or 25th September. A northerly airstream covered the area on both those days; there were showers on the former date, but the latter was mostly dry.

tn2010Oct06 *Leigh, Lancashire (53° 30' N 2° 31' N, SD 657006)*

This was first reported to the editor, Samantha Hall, by a Mrs Sager, who described a line of roof damage suggestive of a tornado, which happened at about 0430 GMT, and which sounded like 'a helicopter'. Further details appeared in the Leigh Journal of the 13th October, which gave the locations as The Avenue, Hope Street, Irvine Street, and Abbey Street; at one house the roof tiles had been piled up 'like a pyramid'. Ms Hall later visited the scene and made enquiries, which led her to conclude that this probably was a tornado. Force perhaps T1. At 0600 GMT an unstable westerly airstream covered the British Isles, associated with a large low, 964 mb, near Iceland; a shower trough was moving east over England, having recently cleared Lancashire. There was a band of showers, heavy and prolonged in places, on the trough, and further scattered showers behind it.

FC2010Oct17 *Manston, Kent (c 51° 20' N 1° 21' E, TR 3365)*

A funnel cloud was reported 'in the vicinity' from Manston Airfield in the 0920 GMT METAR. At 1200 GMT a ridge of high pressure extended across southern Britain from a high, 1033 mb, in mid-Atlantic, while fronts were moving east across the north. Despite the high pressure, the official analyses showed a shower trough near the coast of Kent throughout the day, and a few light showers were reported from the coastal stations.

WS2010Oct20 *Offshore Sheringham, Norfolk (c 53° 00' N 1° 12' E, TG 1550)*

The *Eastern Daily Press* (23rd October) published a photograph of this waterspout taken by Mr Brian Farrow from Sheringham; the time was 1015 GMT and the spout was estimated as 3-5 miles (5-8 km) offshore. The visible funnel extends about halfway from the cloudbase, beneath which there is a rising cloud of spray from the sea surface. At 1200 GMT a northwesterly airstream covered the British Isles between a low, 995 mb, over the Baltic and a high, 1028 mb, west of Ireland. Most inland areas had a dry day, but showers affected northwest-facing coasts in the east and west (as well as northwest Scotland). We thank Chris Warner of TORRO for drawing this to our attention.

tn2010Oct23 *Bagnum, near Ringwood, Hampshire (50° 49' N 1° 45' W, SU 174028)*

The *Bournemouth Daily Echo* and *Southern Daily Echo* of the 25th October both reported this as a 'mini-tornado' that caused a tree to fall on a parked van at Bagnum Riding Stables. The occupant of the van, Mr Adrian Hunneyball, said: "... It was quite a nice bright day, and then all of a sudden it just clouded over, the wind picked up and this mini tornado came through. There were leaves swirling up in the air and branches were starting to fall on the van. Then, crash, this tree came down on the windscreen". He was not hurt in the accident. The time was about 1130 GMT, and it was said to have lasted 30 seconds. At 1200 GMT a deepening low, 993 mb, was moving away east across the North Sea. Its cold front had cleared the south in the morning, but was followed by minor shower troughs, one of which was over central southern England at this time. There were showers, locally thundery, in many parts of England and Wales, especially near the troughs.

FC2010Oct23 *Offshore Dover, Kent (c 51° 07' N 1° 20' E, TR 3340)*

Photographs of this funnel cloud appeared on The Weather Outlook forum (photographer's name not known); they show a thin, contorted, funnel reaching a good third of the way to the sea surface. The time was early afternoon.

ld2010Oct28 *Alum Bay, Isle of Wight (50° 40' N 1° 35' W, SZ 3085)*

The *Isle of Wight County Press* of the 6th November reported that a 'mini-tornado' had blown stones and small rocks through an upper-deck window of an open-topped bus travelling between Alum Bay and The Needles.

One passenger was slightly injured by broken glass. The exact time was not stated, but it was in the afternoon. While it seems that some sort of whirlwind would be necessary to levitate stones to the top of a double-decker bus, it is impossible to say for certain what this was. At 1200 GMT a moderate southwesterly airstream covered the British Isles ahead of a low, 974 mb, well to the west of Ireland. The airmass was of maritime Tropical type in the south, but not particularly moist, having layers of medium and upper cloud, and patchy stratus on the coast evolving into shallow cumulus inland.

q2010Nov11 *Higham Ferrers, Northamptonshire (52° 19' N 0° 36' W, SP 955688)*

This was reported in the *Northants Evening Telegraph* of the 12th November, where it was stated that during a 'freak storm' that moved across the county a large branch fell from a tree in Meadow Close and damaged a conservatory in Vine Hill Close. This was attributed to a 'mini-tornado', but the account gives no evidence for more than a squall. The time was about 1400 GMT.

At 1200 GMT a very deep depression of 948 mb was approaching the Hebrides, and by 1800 GMT it was over north Scotland, 951 mb; its cold swept across England in the afternoon, accompanied by a broken band of squally showers and isolated thunderstorms, and there were further showers behind it. Both the reports for this day appear to have been associated with the front.

TN2010Nov11 *Ipswich, Suffolk (52° 04' N 1° 08' E, TM 143455)*

The *Evening Star* (Ipswich) published a brief account of this on the 12th November followed by a longer report the next day. The 'suspected mini-tornado' affected Quentin Close and Bramford Lane at about 1430 GMT, when roofs were damaged and falling debris caused subsidiary damage. According to Ms Gillian Sillett: "I saw part of a roof lift off, twirl round in mid-air and then all this asphalt blew across the road, smashing into my car with a loud bang". There was also an unconfirmed (and unlikely) report of a car having been overturned. Force T2-3. The grid reference is for Quentin Close; Bramford Lane is a few hundred metres to the northeast.

FCs2010Nov15 *Ronaldsway, Isle of Man (54° 05' N 4° 38' W, SC 2868)*

Recent funnel clouds were reported in the METARs from Ronaldsway Airport at 1520 and 1550 GMT.

At 1200 GMT a weak westerly pattern covered most of Britain between a small high, 1015 mb, over southeast England and a small low, 1005 mb, near the Hebrides; a shower trough was moving very slowly east across the Irish Sea. There were showers near this trough, and near the low in the northwest, but most other parts were dry.

WS2010Nov15/I *South Stack, Anglesey (c 53° 18' N 4° 42' W, SH 2082)*

WS2010Nov15/II *Skerries, Anglesey (c 53° 25' N 4° 37' W, SH 2694)*

These two waterspouts were seen by the crew of an RAF helicopter flying near Anglesey. The one near South Stack Lighthouse was seen at 1140 GMT, and film of it was shown by the BBC - a well-formed spout reaching from cloudbase to sea; the other one was seen off the Skerries about 40 minutes earlier. An account was published in the *Liverpool Daily Post* (17th November).

FC2010Nov16 *Brook, Isle of Wight (50° 39' N 1° 28' W, SZ 3883)*

Mrs Barbara Close contacted us in respect of this funnel cloud, which she saw at 1450 GMT. Her photograph of it was published in the *Isle of Wight County Press* (17th November), which shows the funnel just off the coast and reaching a third of the way to the sea.

It lasted about 10 minutes, and the weather was dry but cloudy. Other pictures taken by Mr Mark O'Sullivan and Mr Simon Johnson were published on a Ventnor news internet site. At 1200 GMT a southerly airstream was developing over the British Isles ahead of a low, 976 mb, west of Ireland. Rain was spreading into Ireland, but most other areas had a dry day.

FC2010Nov28 *Alderney, Channel Islands (49° 43' N 2° 12' W)*

A funnel cloud was reported in the 1620 GMT METAR from Alderney. There was a sleet shower at the time. At 1200 GMT a complex easterly pattern covered the British Isles; there were minor low centres, 1003-1005 mb, over East Anglia, the Irish Sea, and off the Brest Peninsula, and several minor shower troughs within the pattern. Many inland parts were dry but very cold (with sub-zero temperatures), but there were wintry showers, thundery at times, over the sea, some of which moved inland.

ws2010Nov29 *Falmouth Bay, Cornwall (c 50° 08' N 5° 04' W, SW 8130)*

The *Falmouth Packet* of the 29th November published an anonymous photograph of a funnel cloud over the bay taken during the morning. The visible funnel appears to reach about a third of the way to the sea surface. At 1200 GMT a cold easterly airstream continued to affect all areas. There were further snow showers, sometimes accompanied by thunder, near exposed coasts (including west Cornwall), but sheltered parts were mainly dry.

WSs2010Dec18 *offshore Brighton, West Sussex (c 50° 46' N 0° 15' W, TV 2498)*

Dr Nick Douthwaite wrote to us in respect of a display of 'multiple concurrent waterspouts' that he saw several miles off the coast of Brighton at 1030 GMT. They were in view for 10-15 minutes. Shoreham Airport reported funnel cloud(s) in the vicinity in the 1050 GMT METAR, and since Shoreham is in West Sussex we have assigned the report to this county (rather than to East Sussex, which Brighton is in). Dr Douthwaite gave the weather at the time as 'snow storm'.

At 1200 GMT a complex area of low pressure covered the British Isles within a very cold Arctic airmass; there were small low centres of 989-990 mb over the Home Counties, the Irish Sea, and west of Ireland. Snow showers or longer periods of snow occurred in the south, and there was thunder locally in coastal areas.

TN2010Dec18 *Eastbourne, East Sussex (50° 47' N 0° 17' E to 50° 48' N 0° 19' E, TQ 615008 to TQ 634027)*

The *Eastbourne Herald* of the 22nd December reported this under the headline 'Roofs damaged as tornado strikes'. In Badlesmere Road (TQ 615008) tiles were removed from roofs and a heavy wheelbarrow was blown a distance of 15 feet, while in Kipling Walk (TQ 634027) a garage roof was reported to have been carried into a neighbouring garden, and the roof of a house lifted; the tornado was also said to have affected Hereford Court (TQ 630024). No time of day was stated at any of these locations, but since all three lie on a line of 2.7 km from southwest to northeast, we assume that a single tornado was involved, although the press report spoke of 'mini-tornadoes' (in the plural). Force probably T2. There was hail and thunder at the time, which would imply a time of about 1100 GMT, when a minor trough was moving through the area.

Whirlwind in the Irish Republic

FC2010Dec01 *Wicklow, County Wicklow (c 52° 59' N 6° 04' W, T 3094)*

A correspondent (name unknown) to the UKWeatherworld internet forum photographed this funnel cloud from about three miles north of Wicklow at 1210 GMT.

It was seen moving west to the south of the observer, and was in sight for about five minutes. The photographs show a slender slanting funnel reaching about halfway to the (snow-covered) ground. At 1200 GMT a very cold northeasterly airstream covered the British Isles between a low, 993 mb, over the Adriatic and a high, 1034 mb, over south Norway. There were frequent snow showers (locally thundery) over, and inland from, eastern coasts of both Britain and Ireland.

Annual totals for 2010

The number of known tornadoes in the British Isles in 2010 was 22 (a rather low figure). Of these, 21 were in the United Kingdom and, provisionally, one in the Irish Republic (but we await Dr John Tyrrell's summary for the final Irish totals). In addition, there were 12 reports of waterspouts that did not reach land (all from the UK or Channel Islands). There were 53 reports of funnel clouds not reaching the surface in the United Kingdom, plus another five (provisionally) in the Irish Republic (58 in total). The total number of days in the British Isles for which tornadoes, waterspouts, or funnel clouds are known is 56. Twenty land devils, one water devil, and three eddy whirlwinds were also reported during the year.

Amendment to report for September 1999 (published in J.Meteorology, U.K. vol. 26, pp. 343-351)

WS-TN1999Sep23/IV *West Wittering, West Sussex (50° 46' N 0° 54' W to 50° 47' N 0° 53' W, SZ 778975 to SZ 786982)*

Mr Storm Dunlop recently contacted us about this via Jonathan Webb of TORRO, and it turned out that one of the witnesses mentioned in the original report, Mr Crisp, is a friend of Mr Dunlop. He was therefore able to obtain a map of the tornado's track from the time it reached land, as a result of which we can now give a more precise grid reference than before. It came ashore near the south end of Berry Barn Lane at SZ 778975 and followed a northeasterly track to a position just east of West Wittering at SZ 786982, giving a track length over land of 1.1 km. He also confirmed that the time was 0850 GMT, about which there had previously been some uncertainty.

ACKNOWLEDGEMENTS

TORRO is extremely grateful to all the members and other correspondents who have provided information on the whirlwinds of 2010, especially those who carried out site investigations; without their enthusiasm it would be impossible to produce these reports. Further observations of any of the cases mentioned in the 2010 summaries will be very welcome, as will details of any previously unreported cases.



BOOK REVIEWS

By PETER ROGERS

THE POCKET WEATHER FORECASTER; HOW TO IDENTIFY CLOUDS AND THE WEATHER THEY FORETELL. By Dr. Simon Keeling ISBN 978-0-9556280-1-6 (2008) published by *The Weather School, The Weather Centre, Wombourne, South Staffordshire, WV5 0LT* pp84 pb £11.99.

This compact landscape paperback reproduces some excellent colour photographs of most of the recognised cloud types, on the right-hand page, with a very short text on the facing page indicating what weather the illustrated cloud-type is likely to produce. I did find these to be rather “thin”, but the photographs are all excellent and well-reproduced. However, there are so many books of clouds on the market, that, despite the undoubted pedigree of the author, I fear that this book may struggle to maintain market share, and I would suggest that any second edition should “beef up” the text.

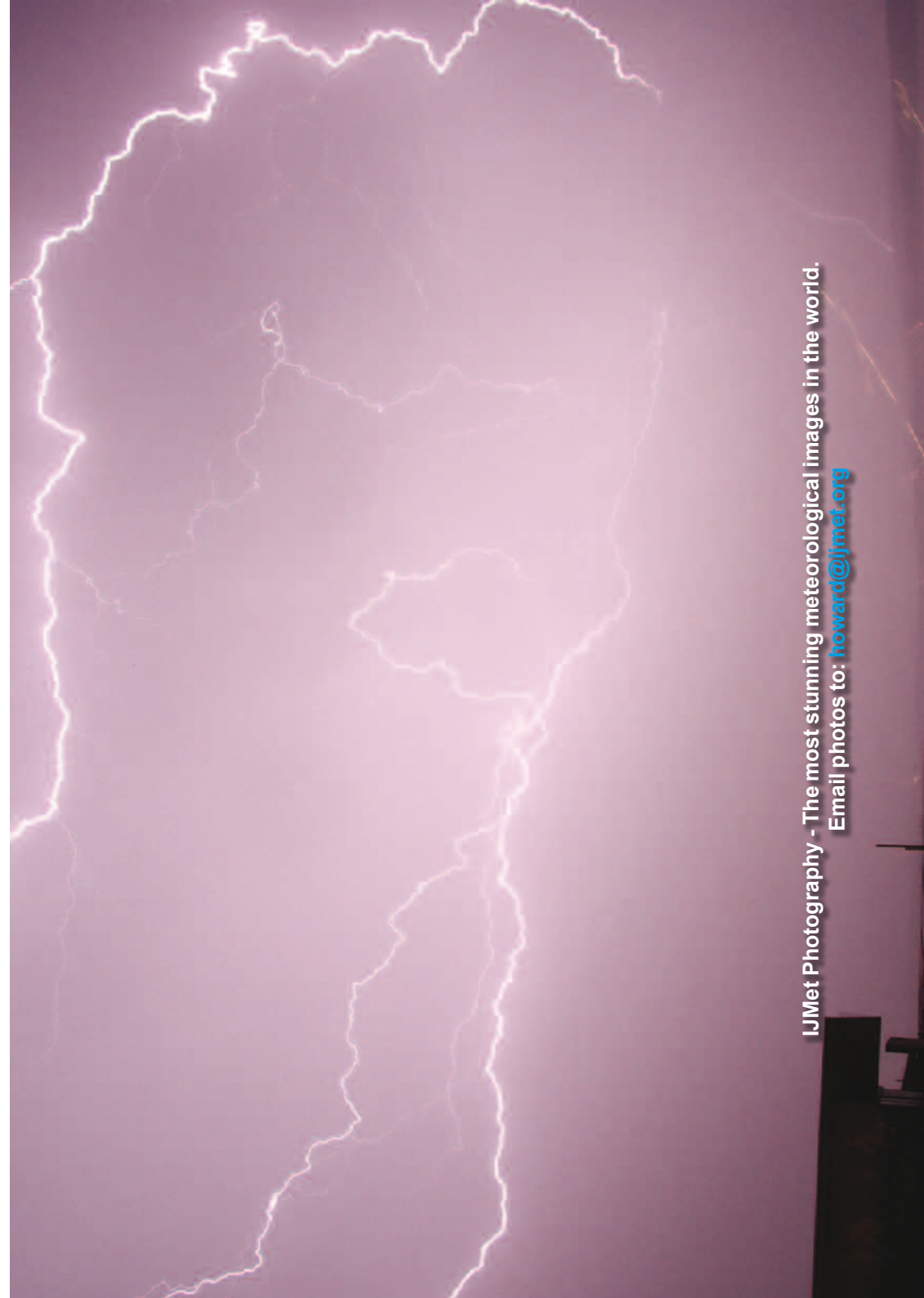
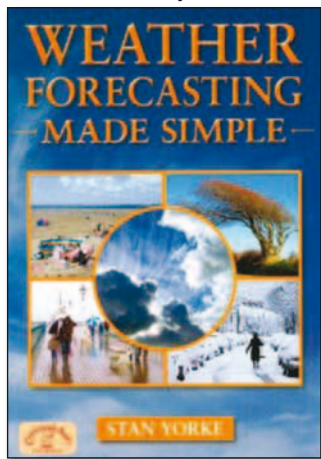
WEATHER FORECASTING MADE SIMPLE by Stan Yorke ISBN 978 1 84674 197 5 (2010) *Countryside Books, 3 Catherine Road, Newbury Berkshire* pp64 pb £5.99.

This small book has two Sections, *The Weather* and *Forecasting*. The former has four sub-sections, ranging from “*Basic Rules*” to “*How our Weather Moves*”, while the latter covers “*The Met Office and TV Forecasts*”, “*Unusual Clouds and Effects*”, “*Past Extremes*” and “*The Future*”. There is also a *Bibliography* and *List of Websites*, and a one-page Index. It is extremely well produced, with excellent colour photographs and good captions. One photograph I particularly liked was of Flood Marks on the Wall of Worcester Cathedral, showing that the area had been flooded in 1670, 1770, 1947, 1886, 2007, 2000 and 1924. The author does not pull any punches. Thus in the chapter on The Met Office and TV forecasts, he says:

“How do we get the most from the television service?....

The next step is to excuse the awful politically correct approach that demands that every area is mentioned by name. Even Scotland was redrawn larger on the weather map a few years ago in response to complaints that it was being neglected in the forecasts. This wastes so much time which would be better used for the forecasters to qualify and expand their predictions.”

Incredibly, this book retails at £5.99, and this coupled with the refreshing approach of the author, and the excellent photographs and diagrams and maps makes this unbeatable value. Buy two copies immediately: one for yourself, and one to give away as a present. Christmas is coming!



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