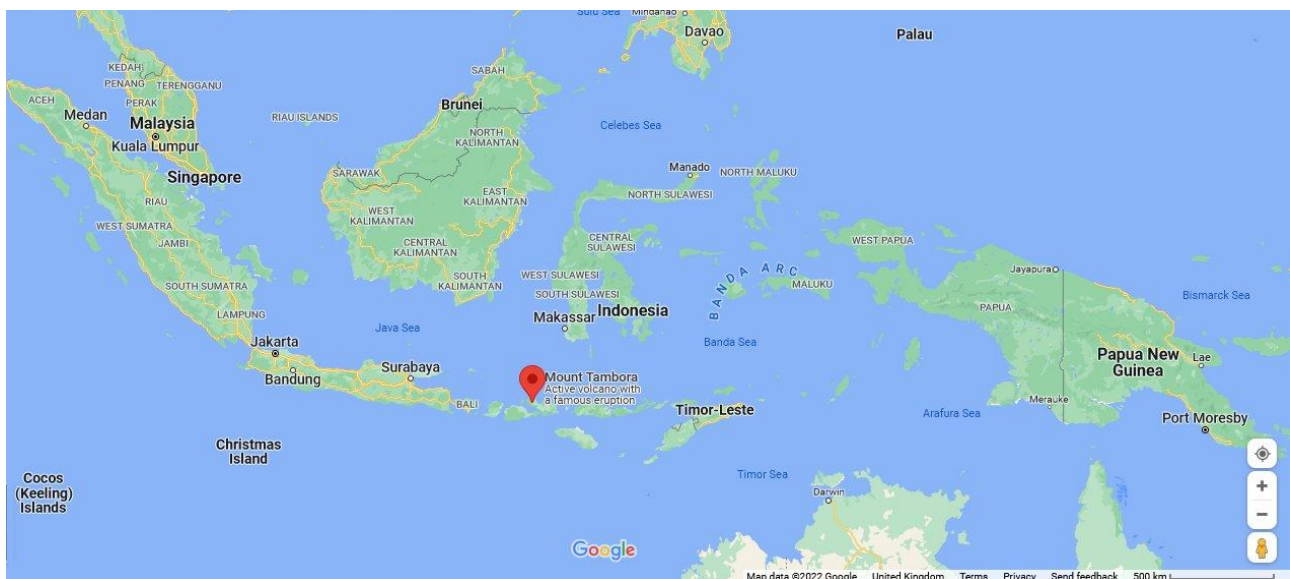


Did “the year without a summer” affect Kildwick ?

Introduction

In early April 1815 people across the Indonesian archipelago, covering thousands of square kilometres, started to hear rumblings and small explosions. Strangely, everyone seemed to think that the source of these disturbances was nearby: on the island of Java, indigenous people thought there was an earthquake; Europeans thought there was a large sea battle being fought just over the horizon and called out the militia.

Both groups were wrong. What they were hearing was the re-awakening of Mount Tambora, a volcano on the island of Sumbawa, about 1000 kilometres away, which had been dormant for several hundred years.



Indonesian archipelago, showing the site of Mount Tambora
From Google maps

A little after 7pm on the evening of April 10th things escalated when Tambora quite literally “blew its top”. The explosion reduced the height of the mountain from 4300 metres to just 2850 metres and left a caldera measuring over six kilometres across and 600 to 700 metres deep.



The caldera of Mount Tambora
From New York Times online

The eruption was the largest and most devastating observed in recorded history. 150 cubic kilometres of material was ejected in just a few days – enough to cover the whole of Britain up to knee-deep in volcanic dust and rock. All life in a radius of 20km from Tambora was eradicated and solid material settled across Indonesia.

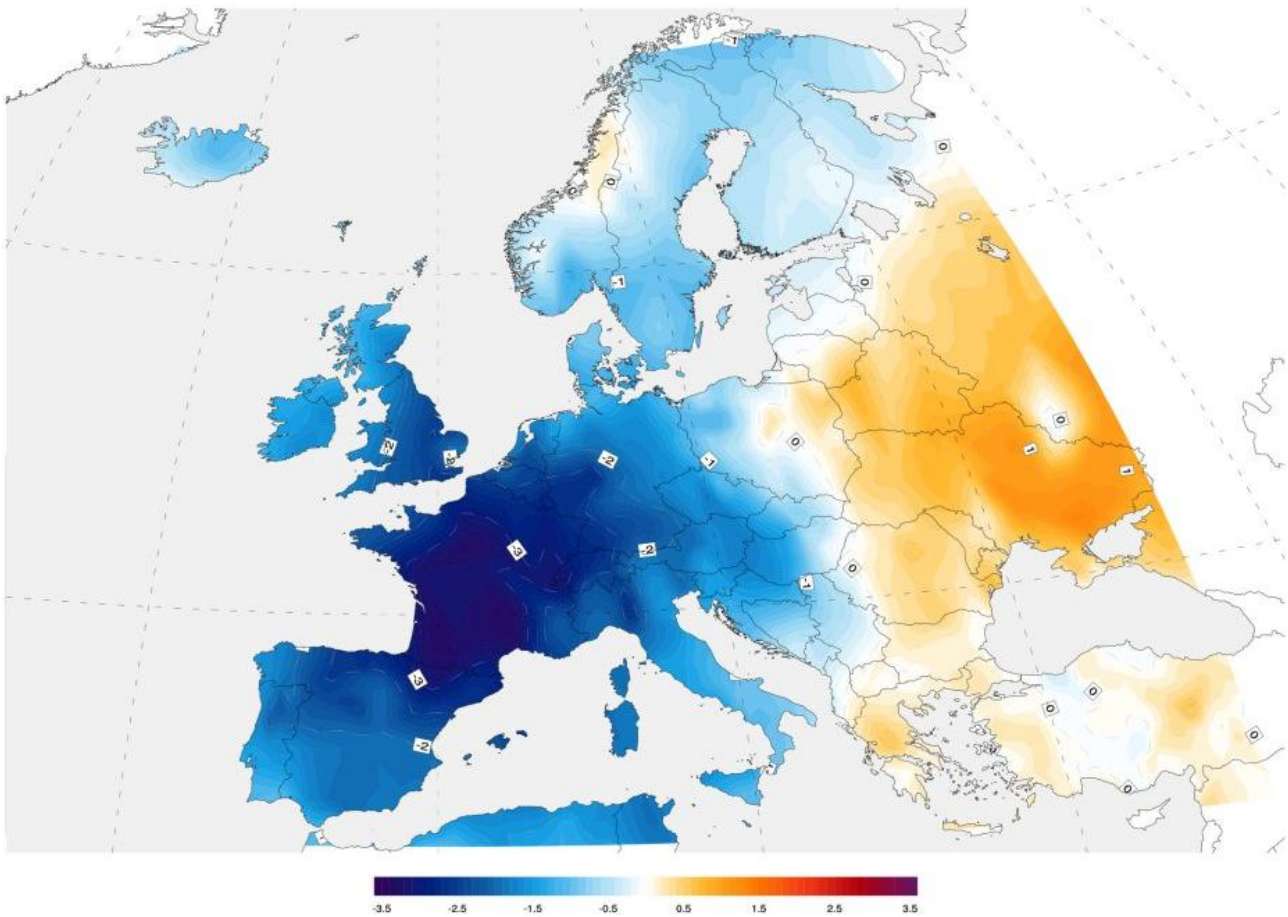


The pattern of solid deposits across Indonesia following the Mount Tambora eruption
From Wikipedia

Smaller particles were propelled up into the stratosphere where dust entered the global weather systems, causing a blanketing effect which would have taken up to 5 or 6 years to be fully removed from the atmosphere. Sulphur was converted into dilute sulphuric acid- resulting in acid rain.

The aftermath of Tambora – the year without a summer

The Mount Tambora explosion is thought to have had a significant impact on the weather around the world for several years. In 1816 the average global temperature decreased by 3°C and it stayed below normal for a number of years afterwards.



The impact of the Mount Tambora explosion on European temperatures in 1816
From University Corporation for Atmospheric Research

In 1815 most of Europe had a good harvest, but the following year saw cold and rain throughout the spring across the continent, with the growing season much reduced. In central Europe unseasonal frosts occurred in June, July and August, along with falls of orange/brown snow. The poor harvest resulted in a widespread famine.

In Britain the summer of 1816 was one of the most unseasonable known (see Appendix), and the July of that year is still the coldest in the Central England Temperature series (extending back to 1659). The cold weather caused a very bad harvest, but the serious famine that affected Europe was mitigated by the existence of a better-developed trade network which allowed increased imports of grain from the US. In 1818, Britain imported more food than in any previous year. Despite these imports the price of bread more than doubled between 1817 and 1818.

The years after the Tambora eruption also saw a significant increase in emigration from Britain to the US, as well as a movement of populations westward within the US (where year 1816 was colloquially referred to as “Eighteen hundred and frozen to death”).

Can the impact of 1816 be detected in Kildwick parish records ?

If 1816 and the years that followed had poor harvests, might this be reflected in an increased number of deaths occurring in a particular area ?

Work done on transcribing the baptism, marriage and burial records of Kildwick parish, carried out over a number of years by Josie Walsh provides a valuable dataset which allows us to examine this question.

Burials totals 1802 to 1820

The 1634 burials recorded in the Kildwick parish records between 1802 and 1820 were examined and the totals for each year tabulated (below). Each of the 19 years was ranked based on the number of deaths.

Year	Total	Rank
1802	54	19
1803	102	4
1804	77	14
1805	60	18
1806	67	17
1807	84	11
1808	70	16
1809	89	9
1810	97	6
1811	119	1
1812	95	7
1813	71	15
1814	89	9
1815	78	12
1816	95	7
1817	103	3
1818	107	2
1819	99	5
1820	78	13

Table showing the annual numbers of burials in Kildwick parish between 1802 and 1820

The “Tambora effect”, if indeed there was one, did not result in a significant number of excess deaths in the parish in the years following 1815. Indeed the year with the highest number of deaths (1811) was prior to the Tambora eruption.

However, it is noteworthy that four of the seven highest death tolls in the period examined occurred between 1816 and 1819, when any effects of the Tambora eruption might be expected to have had their impact.

Burials for each month 1802 to 1820

The table on the following page shows the same data split out to show the number of deaths in each month.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1802	2	9	6	4	9	2	4	0	4	4	4	6
1803	9	8	16	11	20	12	6	2	6	4	0	8
1804	6	0	11	8	8	3	11	6	9	3	2	10
1805	8	8	5	7	4	5	5	3	2	5	3	5
1806	7	4	7	11	5	4	5	6	6	4	5	3
1807	7	2	9	8	16	9	11	3	5	4	6	4
1808	8	6	9	6	8	6	5	6	2	4	5	5
1809	8	2	5	14	6	6	12	7	3	10	6	10
1810	6	10	6	5	11	8	9	9	7	9	11	6
1811	12	14	18	10	16	7	10	6	3	10	3	10
1812	11	8	10	12	8	8	3	5	8	7	4	11
1813	5	13	5	7	8	4	4	6	3	7	6	3
1814	13	10	5	8	9	8	4	7	6	4	9	6
1815	9	11	4	7	5	6	6	6	4	9	4	7
1816	9	4	7	10	10	12	8	7	10	8	6	4
1817	7	4	6	10	8	8	10	9	13	10	8	10
1818	16	13	9	8	9	6	7	9	2	10	6	12
1819	12	9	13	12	12	8	10	8	2	3	2	8
1820	5	11	11	9	10	5	2	3	1	6	6	9
Av.	8.42	7.68	8.53	8.79	9.58	6.68	6.95	5.68	5.05	6.37	5.05	7.21

Table showing the monthly numbers of burials in Kildwick parish between 1802 and 1820

In this table, periods when the number of deaths exceeds the average for a run of three months or more – i.e. when there was an extended period of higher than average mortality – are highlighted in yellow. Clearly there was an extended period, beginning in April 1816, when the death rate was higher than usual.

Indeed if one also includes the isolated above average mortality in April 1817 (shown in green) and the months from April to July 1818, when the death rate was below but very close to the average (shown in pale blue), then the period April 1816 to August 1819 shows a noticeable below average mortality in just six out of 41 months.

Burials by age group

The final table (overleaf) shows the numbers of burials recorded for each age group over the period 1813 to 1820 – 720 deaths in total. (This date range was selected as prior to 1813 the recording of the age of the deceased in the Kildwick registers was rather irregular.)

Here the highlighting shows where, for a given age group, the number of deaths was above average for two or more years. The following points are noteworthy:

- The number of deaths in the age range 0 to 10, which was always high, shows an above average rate between 1815 and 1817, with a distinct uptick in 1816 and 1817.
- Deaths in the age range 11 to 40 was elevated in the period 1817 to 1819.

	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-	unknown
1813	19	8	7	7	5	11	3	8	3	
1814	22	7	7	8	4	9	11	13	8	
1815	26	7	6	2	10	3	15	6	3	
1816	33	6	8	8	4	10	7	14	5	
1817	37	9	16	12	9	6	6	6	2	
1818	22	15	14	11	9	7	15	8	6	
1819	26	8	14	7	6	6	12	14	6	
1820	22	6	6	4	10	7	7	9	6	1
Avg	23.5	7.25	8.875	6.5	6.5	6	9.125	8.75	4.5	

Table showing the annual numbers of burials in Kildwick parish for each age group in the period between 1813 and 1820

Conclusions

The years 1816 to 1819 saw a noteworthy increase in the number of deaths in Kildwick parish when compared to the average for the period 1802 to 1820. This increase coincides with the years following the eruption of Mount Tambora.

But correlation is not causation. Just because two things happen at the same time does not necessarily mean that one causes the other. For example, the rise in violent crime in the 1950s in the USA matches almost perfectly rising sales of refrigerators. However no one would suggest that ice cubes can make people murderous.

What is *certain* is that from 1816 to 1819 the British weather was unseasonable, resulting in poor harvests and possibly an enhanced death rate in Kildwick parish; and although the Tambora eruption *may* have played some part in this, this cannot be proved. And even if it played some part, other factors may also have been involved to a greater or lesser extent.

In their 2016 article "Situating 1816, the 'year without summer', in the UK", Lucy Veale and Georgina Endfield suggested that "... the summer of 1816 [must be] set against the wider weather and cultural contexts of the 1810s" and that "... summer 1816 was characterised by unusual and extreme weather events [but] it also took place within a sequence of years that were similarly replete with anomalous and challenging weather conditions".

It is also important to be very clear that the excess deaths seen in Kildwick parish between 1816 and 1819 do not pass the strict requirements for a statistically significant event (defined as $>\pm 2\times SD$). The usual annual mortality figures show such variation from one year to the next that any one of those in the period 1816 to 1819 might have occurred purely by chance.

What is noteworthy, however, is the prevalence of above average deaths in that period; suggesting that there is perhaps a cause (or perhaps more than one, and perhaps including the Tambora explosion) underlying this anomaly.

Appendix - Contemporary newspaper reports (1816 / 1817)

The poor weather and bad harvest of 1816 are attested in a number of newspaper reports from the time.

THE WEATHER.

The oldest man living does not recollect such unseasonable weather as we have lately experienced. But this is the case not only in England, but in the most mild and salubrious parts of France, and every other part of the Continent. A letter from Bourdeaux (of the 15th June) says:—"We really do not know here where we are. We sit with our doors and windows closed and fire burning as in the middle of winter. It is cold as in October, and the sky is dark and rainy; violent winds, accompanied with heavy rain and hail, rage round our country houses; the low grounds are under water: if we have one tolerable warm day, several cold and rainy ones like the preceding, are to follow. The oldest people in the country do not recollect such a summer. Vegetation suffers, particularly the vines. The time of the blossom should be past, and they have not yet begun to blossom. This is a bad prospect for the vintage, as the grapes cannot possibly ripen."

Cambridge Chronicle - 12th July 1816

THE WEATHER.

The continuance of the present very unseasonable weather has been attended with the most baneful effects in various parts of the country. Such an inclement summer is scarcely remembered by the oldest inhabitant of London or its environs. The hay towards the southern counties has been so much injured by the incessant rains, that the only alternative left to the proprietor is to convert it into dung for manure. The clover likewise has sustained equal damage with the hay, and has been made the same use of. This unexpected visitation from Heaven, added to the severe distress to which the country is otherwise reduced, has infused into the minds of the people generally the greatest apprehension and alarm. It is now to be feared, that not only the clover and hay will experience the ill effects of the weather, but that the corn will also be seriously injured by the heavy rains which have fallen. Should the present wet weather continue, the corn will inevitably be laid, and the effects of such a calamity and at such a time cannot be otherwise than ruinous to the farmers, and even to the people at large. The weather, it would seem, is not unseasonable in this country only; for we find that in Sweden and many other parts it has been equally unfavourable. In different parts of Sweden prayers are offered up in the churches daily for a favourable change. We may add, that the weather continues bad all over the Continent. The situation of America is also extraordinary in this respect.

St James' Chronicle – 20th July 1816

Unseasonable as the weather has been, we cannot help thinking that the following paragraph must originate in mistake:—"Snow in harvest is no common occurrence, but it is a fact that it occurred here yesterday, as witnessed by several persons in the town."—*Lewes Journal*.

Belfast Evening Mail – reporting on the Lewes Journal. 4th September 1816

Monthly Agricultural Report for October.—

The long continuance of rainy weather has been severely felt in the Eastern and Northern districts, where a considerable breadth of Oats and Barley, and even Wheat, that were cut in the early part of the month, still remain spearing on the land. The white crops in the fens of Cambridge and Lincolnshire have rotted on the ground. The forward sown Peas have been well got in, but the Beans in most parts, are still in the field. The Wheats along the Kent and Essex coasts, coming earlier to the sickle, have in general been well harvested, and are found to rise as well as those of last year.—Clover Seed is likely to rise badly, from the irregularity of the crops, and the unseasonable weather for getting it up. The Turnips are in many counties going off, particularly the Swedes, from the extreme wetness of the weather. The Cole Seed plants are good; and the grass-land seed is abundant every where. Potatoes are found a short crop, and except on very dry soils, are defective in quality. Wheat sowing is pretty generally commenced, but is not likely to be closed on this side Christmas, from the great extent of Bean eddishes, the last of which still remains uncarted; the seed got in early upon fallowed lands, have planted freely from the moistness of the season. The Meat markets have been well supplied through the month, particularly those of Smithfield, St. Ives, and Norwich, where prime Beef and Mutton have found a brisk demand within the last fortnight, at an advance in price. Lean Stock continues dull on sale, particularly for Scotch and Welsh runts, the droves of which are more numerous at this season than usual. Sheep and Hoggets are somewhat dearer, arising from the start which the Wool trade has recently experienced both in long and short fleeces.

The weather was also “strange” early in 1817.

It is an extraordinary fact that two oxen died, on Friday week, while at plough, in consequence of the unseasonable warmth of the weather.— One of them was the property of Mr. S. Foster, of Knapp, and the other of Mr. Wood, near Exeter.

Leicester Chronicle – 22nd February 1817

Sources

“1816, the Year Without a Summer” episode of “In Our Time”, BBC Radio 4
(<https://www.bbc.co.uk/sounds/play/b077j4yv>)

1815 eruption of Mount Tambora. Wikipedia
(https://en.wikipedia.org/wiki/1815_eruption_of_Mount_Tambora)

Mount Tambora. Wikipedia (https://en.wikipedia.org/wiki/Mount_Tambora)

“A Volcanic Eruption That Reverberates 200 Years Later” article in New York Times, 25/8/2015
(<https://www.nytimes.com/2015/08/25/science/mount-tambora-volcano-eruption-1815.html>)

“The Deadliest Volcanic Eruption in History” from <https://www.history.com/news/the-deadliest-volcanic-eruption-in-history>

“Mount Tambora and the Year Without a Summer” by UCAR Center for Science Education
(<https://scied.ucar.edu/learning-zone/how-climate-works/mount-tambora-and-year-without-summer>)

“Situating 1816, the ‘year without summer’, in the UK” by Lucy Veale and Georgina H Endfield; published in The Geographical Journal, 2016,