

THREE HUNDRED YEARS OF WEATHER EXTREMES FROM
THE ANNALS OF CONNACHT
FRANCIS LUDLOW

This paper provides a preliminary investigation into the considerable body of evidence relating to weather extremes and natural hazards reported in the native Irish annals, described by the noted Gaelic scholar, Brian Ó Cuív, as “the most copious and reliable native sources for the history of Ireland.”¹ It will focus on the years covered by one particular set, currently known as *The Annals of Connacht*, the surviving text of which runs, with some gaps, from AD 1224 to 1544.

This investigation takes place against the background of current global climate change and alongside negative impacts of weather extremes and natural hazards, from which the human and economic losses have grown, worldwide, in recent decades.² Ireland is not immune from these issues, and there is considerable concern over the effect of climate change on many social and economic sectors, including energy supply and agriculture.³ Possible increases in the frequency and intensity of weather extremes arising from global warming,⁴ such as flooding, windstorms and drought, and the resulting consequences for human society, are currently areas of major international research.

One particular objective is to compile reliable records of past climate variations.⁵ Only with such records can we determine to what extent current global increases in temperature⁶ arise from natural causes, such as increased input of solar energy, or from human-made factors, such as the release of greenhouse gases after the Industrial Revolution, AD 1700. These studies address the “Late-Holocene,” a period covering the past three thousand years but, prior to the 1970s, paleo-climatologists were more concerned with the very distant past, on much larger timescales, with the cycles of great ice ages. Indeed, the prevailing view was that climate was relatively unchanging on scales measured by the span of a thousand years, or by the average human lifetime.⁷

However, with mounting evidence of significant climate variations across Europe and other parts of the world in recent decades, centuries and millennia, alongside evidence of present global warming, these views have altered. Records of variables such as temperature and precipitation over the last thousand years are especially significant, since within this timeframe, several notable climate shifts are identified or proposed, such as those centred predominantly on Europe and the Northern Hemisphere, including the “Medieval Warm Period” (MWP, AD 900-1300)⁸ and “Little Ice Age” (LIA, AD 1350-1850).⁹ These natural climate changes invite comparison with current climate trends in Ireland,¹⁰ and are at least partially influenced by human activities.

Further important considerations are apparent regional variations in the timing and intensity of climate shifts and changes. There is growing awareness that events like the MWP and LIA were not truly global in character, varying widely across regions even within North West Europe.¹¹ Researchers are now looking for detailed and accurate reconstructions of variables (such as temperature and precipitation) at as fine a level as possible (either yearly or monthly) in as many regions as records can be developed, in order to gain a definitive picture of the Earth's past climate. Variables other than those discussed above are important. Since one of the main issues related to impacts of global warming concerns possible increasing extreme weather, long records of extreme events are needed to understand how their frequency and intensity relate to more general climate trends.

The Irish annals have the potential to provide a long and detailed record of extreme events in Ireland, alongside information on their effects on contemporary Irish society.

Documentary Sources of Climate Information

There are many sources of information relating to Earth's past climate. Many are natural archives, including sedimentary records, ice cores, and tree rings—the annual growth widths of which respond to weather conditions—and it is now common for researchers to combine sources, capitalising on the strengths of each, and compensating for weaknesses.¹² In addition to natural archives, information may be gleaned from endless varieties of documentary sources, including those preceding the development of dedicated meteorological instruments to measure weather variables (around AD 1750, Europe). The available information can be categorised under three general headings.¹³

1. Continuous Observations or Direct Seasonal Descriptions

Sources with intentional, systematic observations of weather at timescales varying from hourly to weekly are most useful for reconstructing quantitative climate variables, such as precipitation, temperature, wind speed, and wind direction. Similarly, descriptive seasonal accounts that have continuity and uniformity across the years are helpful.¹⁴ If coverage is sufficient, it is even possible to reconstruct accurate atmospheric pressure maps on a regional scale.¹⁵ The sources providing the best information are dedicated weather diaries, in which the author's intention, often from scientific curiosity, was to systematically record each day's or week's weather using pre-defined descriptive terms.¹⁶ Europe is well covered with such sources;¹⁷ the first known is Walter Merle's diary at Oxford from AD 1337 to 1344.¹⁸ The earliest Irish weather diary is that kept for the Duke of Ormond, by John Kevan, AD 1682 to 1683,¹⁹ but Ireland is not as well documented as continental Europe.

2. Parameteorological Phenomena

Parameteorological phenomena refer to once-off unusual weather events or anomalies,

including wind storms, flooding,²⁰ extreme frosts, and snow. Though not as definitive for tracking general shifts in climate as continuous data, records of extremes, where notable changes in frequencies occur, can serve to highlight shifts in underlying climate regimes. Where reconstructions of changes in general climate variables (such as average yearly temperatures) exist, data on weather extreme frequencies can be correlated to see how return periods vary in response to underlying climate changes. Finally, reports of extremes are often accompanied by descriptions of their effects on society, useful analogues for possible future impacts. Reports of parameteorological phenomena are found in monastic annals and town chronicles, essentially yearly listings of events considered important by the compilers of these sources. Europe is well supplied with these, often dating from the eighth century AD.²¹

3. Indirect and Phenological Indicators

Use may be made of data indirectly relating to weather conditions, or from which conditions may be inferred. Such indirect evidence includes reports of harvest failures, found in annals and chronicles, often linked to poor weather conditions. Less directly, records of prices of agricultural produce (like grain) vary according to supply, linked to growing conditions and weather.²² Such information is furnished by manorial account rolls,²³ more common in the rest of Europe than in Ireland.²⁴ Other factors, with more tenuous climate-links, but still useful, include famine and disease reports. Finally, phenology is the study of the lifecycle stages of plants and animals,²⁵ which respond to environmental and climate changes. Examples include dates of the flowering or fruiting of plants and trees. Many valuable sources exist in Europe and Asia, including records of timing and yields of grapes in vineyards.²⁶ Once the relationship between a particular species and its environment is established, changes evident in such information will often parallel climate.

Bias and Reliability

The historical sources employed for reconstructing climate must be assessed for bias and reliability, taking into account the context in which they were written.²⁷ The necessity for this is best illuminated by examples.

Much can be learned from Dag Retsö's study on weather information within archived sixteenth-century Swedish correspondence letters.²⁸ A letter from the Swedish Bishop Mats of Strängnäs reports notable icy conditions in AD 1518, such that travel was difficult. Yet studies of the Bishop's politics indicate motives for exaggerating his report, to excuse himself from the Regent Sten Sture's request to travel to Stockholm. Another widely known example, showing the need for critical reading, is provided by reports of flooding, severe enough to damage medieval and early modern stone bridges. A study of bridge-building in these periods shows they were prone to destruction; built narrower and lower, they allowed flood debris to pile up and overcome the bridge with its weight. Thus, we should not instinctively equate such floods with those capable of destroying modern bridges.

To use documentary evidence properly, consideration must be given to bias and reliability. Even with sources deemed reliable, information should be read with broad knowledge of contemporary conditions. In terms of the Irish annals, it has been shown,²⁹ using *The Annals of the Four Masters*³⁰ as case study, that there is significant information of the types categorised above. Here, the information yielded by *The Annals of Connacht*³¹ will be examined and the initial results presented.

The Irish Annals

The Irish annals are yearly listings of both ecclesiastical and secular events deemed notable by the compilers, originally recorded in monastic communities. These annals focused mainly on Ireland, with occasional mentions of international events. Owing to their abundance and general reliability,³² demonstrable by comparing reported events between texts,³³ or to independent evidence,³⁴ the annals are among the most important sources for Irish history.³⁵ It has been argued that these sources run reliably from AD 650³⁶ to 1600 when the spread of English settlement and custom resulted in the dissolution of their centres of recording, adversely affecting the Irish historians responsible for their compilation.³⁷

It is thought that, similar to European sources,³⁸ the tradition of keeping annals began with short notices penned in the margins of Easter tables,³⁹ from which the changing religious feast-date of Easter⁴⁰ was calculated. Certainly, much of the first genuine historical material in the Irish annals pertaining to the origins of Christianity in Ireland, before the proper recording of annals, AD 650, likely came from notices in Easter tables. The model for the actual annals, however, probably came from annals and chronicles already compiled in Europe,⁴¹ the tradition of which dates to Roman times. Indeed, several sources of international material used in earlier portions of the Irish annals are visible,⁴² such as the *Irish World Chronicle*, with material of international interest integrated into several surviving texts.

Aside from international reports (such as obituaries of popes), much early material comprises a pre-Christian “history” of Ireland.⁴³ For examples, see *The Annals of Inisfallen*⁴⁴ and *The Annals of Tigernach*.⁴⁵ Given there were no Irish written histories or records to draw upon before Christianity’s arrival in the fifth-century AD, this material is considered unreliable.⁴⁶ It represents an attempt by later annalists to integrate Biblical and Classical history with Irish history by combining it with Irish oral traditions, myth and hereditary *King Lists*. One source of such material, likely available to many annalists, were various versions of *Lebor Gabála* (the *Book of Settlement*),⁴⁷ originally composed in the eleventh century from speculations and pseudo-historical deductions developed in preceding centuries, concerning “events” in Ireland’s distant past.

The inclusion in various annals of this “history”, was probably motivated by the desire to construct a long, acceptable national identity for Ireland,⁴⁸ and to reinforce Ireland’s Christianisation by placing its history alongside, and in the context of, Biblical events. Its inclusion was probably also motivated by tendencies towards

placing value and authority in longer histories, drawing on older established sources.⁴⁹ In fact, the survival of many Irish annals, through the traditional, generally faithful⁵⁰ copying and recopying of older material, first in monastic scriptoria,⁵¹ and later in Bardic schools,⁵² owes much to the fact that a compilation's authority and value could be enhanced by back-dating it. Influences from continental annals and chronicles, often extended back from the time of composition,⁵³ probably also played a part.

That the annals were seen, by their compilers or superiors, as a useful vehicle for providing Ireland with a "suitable" national identity, indicates the high status in which they, and the keeping of Irish history, were held. The same reasons, however, open up the annalistic record to manipulation for political reasons, even after proper contemporaneous recording of events began, AD 650. Such issues will be discussed in a later section.

In general, after the seventh century, the reliable content of the annals ranges from notices of battles, sackings of religious settlements and the obits of notable persons, to lengthy narratives of events, more common later on, and often exhibiting characteristics of on-the-spot reporting.⁵⁴ Also included are natural phenomena, e.g. comets, aurorae, unusual and extreme weather, harvest reports and disease. The first centre of contemporary recording of Irish⁵⁵ events is thought to have been the monastery on Iona, an island off Scotland's west coast, where the *Iona Chronicle* was produced during the seventh and eighth centuries.⁵⁶

From the eighth century, other indigenous annals that borrowed or inherited materials from other regions, were being compiled in monastic schools and scriptoria around Ireland.⁵⁷ During the tenth century, it is proposed that a *Chronicle of Ireland*,⁵⁸ the basis of all our remaining Irish annals,⁵⁹ was synthesised from available local and regional chronicles. The incentive for this may have been the destruction caused by Viking incursions,⁶⁰ and the Irish desire to preserve historical records. By the eleventh century a change had begun, due to shifting ecclesiastical and political influences from abroad, that would see the keeping of Irish annals switch from the great monastic schools to the Bardic lay schools of professional, hereditary historians and learned classes.⁶¹

It is to such a class that we owe the existence of *The Annals of Connacht*.

The Annals of Connacht

The Annals of Connacht (henceforth *AC*), as they are now known to most scholars,⁶² come from the original Irish vellum manuscript kept in the library of the Royal Irish Academy,⁶³ edited and translated by Alexander Freeman, and published by the Dublin Institute for Advanced Studies, 1944.⁶⁴ The text, or what remains of it, runs from AD 1224-1544,⁶⁵ a considerable period, covering many important events in Ireland. However, the record is not complete for the full three hundred and twenty years. There are three breaks in the manuscript, and indeed, three predominant scribes, but these gaps, AD 1378-84, 1393-98 and 1427-32, fall into the domain of the main

scribe, denoted by Freeman as Scribe A.

It is tempting to associate these gaps with contemporary events the annals relate. There is mention of plague at the time of the first hiatus, and Freeman felt that deficient source material available to Scribe A, writing much later, rather than missing leaves in our copy of *AC*, is to blame for the lacunae. This does not detract from possibilities of contemporary circumstances affecting the recording of the source annals for *AC*, in this case plague. But without evidence, this is speculation. In any case, the gaps are relatively small, though there are also instances of sparse text,⁶⁶ having comparatively few yearly entries. However, *AC* generally provides one of the most important records for the period for the western half of Ireland, and indeed, after historical recording switched from monasteries to the bardic schools, the province of Connacht played a vital role.⁶⁷

The passages of sparse text are interspersed with more thorough records, for which explanations have been offered. Certainly, in *AC*'s earlier periods, source material was probably less abundant, perhaps reflecting that as time progressed older accounts had less chance of surviving, or surviving fully intact through scribal copying.⁶⁸ But a distinction is needed. Even where *AC*'s text is more detailed in terms of the number of reports, there is another early trend from AD 1224 to 1250, wherein certain individual reports depart from the traditional, terse, annalistic entry, and demonstrate a more engaging, readable form, concerning a sort of narrative prose, across the years of "the war of the Gael and the Gall," essentially an account of Irish encounters with "foreign" settlers and forces.

Aubrey Gwynn proposes that this marked the beginnings of an Irish narrative prose style, inspired by influences from continental historical narratives.⁶⁹ Critics objected that this departure from traditional entries was an indigenous development within the monastic schools of Connacht. Barry O'Dwyer regards it as a last flourish before the keeping of such histories, and the involvement they implied with the world beyond the religious enclosure, became unfashionable, partly due to religious reform movements from the continent.⁷⁰ Thereafter, the keeping of annals and histories fell to the growing class of lay historians. These changes in *AC* anticipate times when the copyists could add their own, contemporary entries.

And so it is with *AC*, whose scribes combined earlier sources, some of which may be identified, including the peculiar narrative entries discussed above, before coming to their own times, when it is possible they made contemporary entries.⁷¹ Three main scribes, with some occasional, small-scale contributors, were involved in compiling *AC*.⁷² Scribe A composed the majority, until 1468, and in his work the three gaps occur.⁷³ He was also, in terms of writing style, the most traditional and medieval, paying most attention to the old chronological apparatus⁷⁴ used in earlier sources, before the full introduction of the *Anno Domini* dating system. Scribe B covered 1468 to 1478, and Scribe C 1479 to 1544, in a less formal hand, perhaps most representative of the change from monastic schools to lay, bardic schools.

The identities of the scribes are not known, and various suggestions have

raised debate.⁷⁵ This is a fascinating aspect of *AC*, but there is not the scope here to review the debate. It suffices to say the scribes were either from the hereditary family of historians known as the Ó Maoilchonaire, or from the Ó Duibhghennáins, though collaboration between these is not altogether impossible.⁷⁶ Depending upon which argument is believed, it is possible that Scribe A was writing in the later fifteenth century, and the others during the sixteenth. The location of the compilation of *AC* is unknown, but suggestions of where its source material was compiled are available, including the Abbey of Cong, or the Monasteries of Boyle or Holy Trinity,⁷⁷ all in present-day Connacht. The first hundred years of *AC* provide quite a narrow focus on Connacht, though this broadens out as the years proceed. It is probably fair to say *AC* preserves a relatively good record of events in the province for the period covered. With this in mind, some examples of climate information discussed above will now be presented.

Weather and Related Information from *AC*

Strictly speaking, there are no continuous observations of weather in the annals. Unremarkable weather was not reported. However, there are many observations of several months duration, commenting on the character and severity of notable seasons, such as the examples below:

1. “A very hot summer this year.” (AD 1263, p. 141)⁷⁸
2. “The cattle and winter grass of Ireland suffered much from frost and snow, which lasted from the end of the first fortnight in Winter into Spring.” (AD 1339, p. 283)

The most common annalistic weather reports are extreme events, or para-meteorological phenomena. Because of their unusual nature they are also commonly found in records, such as personal diaries,⁷⁹ where the main motivation for writing has little to do with weather, simply because of the spectacle value. However, as is discussed later, the annalists had several motives for recording such phenomena, making them more sensitive recorders of these events. Examples are presented below:

3. “A great wind this year, which wrecked churches and houses and sank many ships and boats.” (AD 1363, p. 326)
4. “Showers of hail fell each side of Beltaine, with lightning and thunders, destroying much blossom and beans and fruits in all parts of Ireland where they fell. One of these showers, in the east, had stones two or three inches long, which made large wounds on the people they struck ... There was another, in the north, which did much damage in Moylburg and at the monastery of Boyle; and a boat could have floated over the floor of the great church of the monks, as we have heard from the folk of that place.” (AD 1471, p. 555)⁸⁰

The final category, discussed earlier, concerned indirect and phenological evidence. All such information has potential for use as a marker of weather, but several assumptions must first be made, and justified. In Example 5, a famine report, the causal factor is not explicitly stated. This situation may have arisen from poor, weather-related growing conditions. However, there are other possible reasons,⁸¹ including deliberate “scorched earth” policies employed by warring Irish factions, whereby crops in an enemy’s territory were systematically destroyed.

5. “Great famine this year throughout Ireland.” (AD 1317, p. 250)

In other cases, the annalists may themselves make a link to weather (see example 6). Thus, we can more comfortably use the report in analysing climate. But where no link is provided, and in absence of any corroborative evidence, we cannot assume the report is indicative of weather conditions. Examples 7, 8, and 9 hint at the range of available indirect and phenological information.

6. “Much thunder and lightning this year, whereby much of the fruit and produce of all Ireland was ruined, and the corn grew up white and blind.” (AD 1328, p. 263)

7. “A very tranquil year, with a great plenty of acorns and of milk and of all other good things.” (AD 1254, p. 111)

8. “An abundant nut-crop this year; the summer and autumn very dry and all the crops very early.” (AD 1471, p. 555)

9. “This was a pestilential, unhealthy year, wherein there were many diseases, as for instance the plague was very widespread, and smallpox, the flux and the leuctal sickness in great excess.” (AD 1536, p. 689).

Motivation and Bias in the Annals

Before considering what the weather information from *AC* tells us, we must evaluate the reliability of the reports. This partly involves an overall source-assessment, for obvious, pervasive bias. Since the annalists were human, some bias can be expected. One way of illuminating this issue is by examining general motives for recording of the annals. Then, even if the source is deemed reliable overall, each particular entry of interest must also be scrutinised.⁸²

There is no doubt that the Irish annals are one of the most important sources of Irish history, and compared to similar European sources, Ireland is well-endowed.⁸³ Great dependence has generally been placed in their contents by later historians. Indeed, even contemporaries of the annalists in twelfth-century England held our annals in great esteem,⁸⁴ and Ireland is often credited with keeping the spirit of scholarship alive during the European Dark Ages, along with preserving important texts.⁸⁵ However, the evidence in the annals should not simply be taken at face value.⁸⁶

We have discussed the reliability of entries in various annals before AD 650, and indicated motives for presenting as fact what the annalists must have realised was

of dubious reliability. But after the advent of contemporaneous recording, subjectivity might still enter the record through a particular annalist's (or his superior's) views on what was worth recording, and how to phrase it.⁸⁷ This is only natural, and does not mean all annalists were deliberately, or consciously, presenting biased records. Even today, it may be impossible to ask historians to put aside any bias before writing.⁸⁸ But it means the annals must be approached with caution.

Difficulties are compounded because our remaining annals are copies of copies. But that later annalists would continue to copy pre-Christian material of doubtful factual value, and perhaps of less relevance,⁸⁹ highlights their general respect for the value of earlier sources. It shows their compliance with the old antiquarian tradition of which their work formed part,⁹¹ even when sources crossed from monastic to bardic scholars.⁹¹ But, because considerable weight was placed in the content of the annals, where they might be used as evidence of kinship or hereditary rights, there were motives for deliberately tampering with the record. One well-known case is the alliance between the Uí Néill, a secular noble family in Ulster and Leinster, and the Armagh religious centre around the ninth century. Here some rewriting of available annals occurred, to put greater emphasis on the role of Armagh and the Uí Néill in Irish history, who were vying for secular and ecclesiastical political domination.⁹²

Despite this, John Kelleher proposed that most entries would not have been targets for manipulation, being irrelevant to the revisionist's goals.⁹³ Indeed, the integrity of weather reports may have been assured thorough preservation, supposing that the best way to hide a lie is by making it as close to the truth as possible. So, what of the general purpose of the annals? This discussion indicates they were functional but valued documents useful for enhancing reputations or reinforcing a claim to hereditary privileges and titles. But the overall goal of recording was to preserve a history of the locale where a set of annals was maintained, and later syntheses to preserve regional or national history.

Surely few would argue the wealth of minor detail was simply fabricated. Take the following minor report of very local interest from *AC* under AD 1246: "a whale was stranded in Carbury ... which brought great relief and joy to the countryside." To sum up, perhaps Friar John Clyn's words, recording his annals⁹⁴ during the fourteenth century, capture the spirit of the annalistic endeavor: "and I, Brother John Clyn of the Friars Minor in Kilkenny have written in this book the notable events which befell in my time ... so that notable deeds shall not perish with time, and be lost from the memory of future generations."⁹⁵

Motivations for Recording of Weather Extremes and Related Events

Assuming the overall goal of keeping annals was to preserve important events, someone still decided what was important, probably focusing on his or her own area. This, and the tendency to preserve what was already in older texts, even if irrelevant to a copyist's locale, explains why remarkably local notes are preserved (such as obituaries of minor officials) from individual areas, where a compilation was once

maintained.⁹⁶ Apart from overall motivation, entries of a particular category seem to have specific factors motivating their inclusion.

So, what of weather extremes and related events? Some insight is gained from Daniel McCarthy and Aidan Breen's study of the numerous reports of celestial phenomena, including aurorae and comets.⁹⁷ It seems clear these were seen as portents, or signs, and were often interpreted by the clergy as divine messages, perhaps comments upon contemporary events.⁹⁸ It was common for such phenomena to be interpreted as signs of the coming of the Biblical "Last Days," widely expected to occur on the first millennium,⁹⁹ and associated with natural phenomena (like comets) in the Bible. In the annals, the volume and accuracy¹⁰⁰ of reports is such that they indicate systematic observation of celestial events in Ireland until around AD 1133, when the volume of reports declines.¹⁰¹

Similarly, destructive weather and disease were considered portents,¹⁰² and were occasionally described,¹⁰³ and possibly exaggerated, using apocalyptic language. Nor were the annalists beyond associating events and weather conditions with God's anger, thus betraying their views on certain events and people, such as in the entry under AD 1400: "the sons of Sir David [Burke] made a great raid on Niall Mor O hUicinn; and God punished them for it that very night, for many of them perished from the cold of the night."¹⁰⁴ Here the report of a "cold" night might be exaggerated, or fabricated, and cannot be taken as fully reliable. Weather reports of questionable reliability are, however, rare, and their number do not suffer decline as does celestial phenomena.

Perhaps celestial phenomena were no longer relevant, particularly after the uneventful passing of the first millennium,¹⁰⁵ or due to the passing of chronicling from clergymen to lay historians less concerned with portents.¹⁰⁶ Or perhaps the fading of the old systems of dating and chronology,¹⁰⁷ requiring observation of the sky to track lunar and solar phases, in favour of the simpler AD system, was to blame. Whichever cause, weather reports do not suffer this fate, indicating another motive for their inclusion. And this can be seen in damage reports, such as that under AD 1373: "a very great wind this year, which wrecked many churches."¹⁰⁸

Thus, violent natural events may have been included purely from economic and social costs they imposed upon the people. If the clergy's stone buildings could be damaged by a great windstorm, what of weaker housing? What of the crops of the common folk, or forests,¹⁰⁹ often reported as destroyed by harsh weather? The annalists are here telling us why they recorded such events, and once one is aware of possible exaggerations, the annals provide us with reliable evidence of weather extremes and related events, perhaps amounting to the longest such record for any European country.

Initial Results and Discussion

In the following analysis, unreliable reports are removed. As discussed, assessing reliability is a complex process, but a methodological approach tailored to weather information in Irish annalistic record is in development, intended to be applicable to

similar European sources. The ensuing discussion is based on only one text, *AC*, and thus has relatively few reports to draw upon, yet some preliminary comments are worthwhile.

Basic trends in annalistic entries concerning severe weather from *The Annals of the Four Masters* have been published,¹¹⁰ covering AD 600-1600, derived from seventy-seven reliable entries. Both these and the data from *AC* presented below reaffirm that the pre-1970s notion of assuming a constant climate for planning human activity has been rightly discredited. The practice, based upon as little as thirty years of data, of estimating probabilities of extremes via expected “return-periods” (a particular grade of storm expected every fifty years), also appears to be unreliable. The annals show periods experiencing marked increases in extremes, with others experiencing markedly few. Thus, longer time-periods are needed to calculate return-periods properly in a given climate regime.

In *AC*, a total of 41 reliable entries concern extreme phenomena. From AD 1224-1544, Figure 1 shows notable variations in the frequency of these entries. Extremes do not occur evenly through time. It should be noted that Figure 1 does not include indirect entries, but does include entries concerning flooding or drought, reports of which are taken as sufficient evidence in Ireland to infer underlying weather conditions (that is, severe flooding indicates precipitation).¹¹¹ Future work will examine the indirect evidence in the annals.

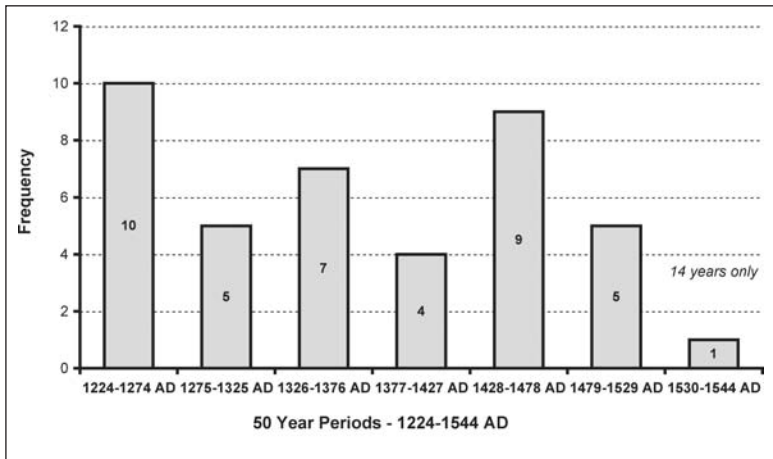


Figure 1 Annalistic Entries Concerning Extremes (*AC*)

Figure 1 represents discrete entries directly referring to “severe” weather and, clearly, the occurrence of extreme events exhibits significant variations through time, ranging from four events at the lowest to ten at the highest. In terms of analysing changes in the climate behind these events, better use of the data is made by separating entries reporting different phenomena (such as drought and flooding),

which arise from very different underlying weather conditions.¹¹² It should also be noted that single entries may report several phenomena, like wind and snow. Separating these allows increased quantities of data for analysis. Both divisions¹¹³ are used in the following graphs. The range of reported phenomena includes windstorms, floods, heat or drought, hail, lightning, snow, ice and frost, including unspecific “terrible weather” reports. Figure 2 represents a division into entries concerning frost, snow, ice, or cold weather, all related to temperature, with heat, drought or reports of “dry” weather stacked on top, and Figure 3 into those reporting windstorms.

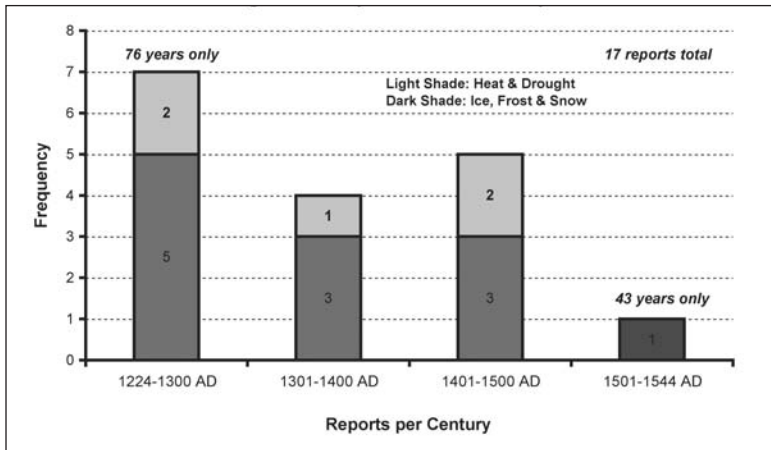


Figure 2 Temperature Related Reports

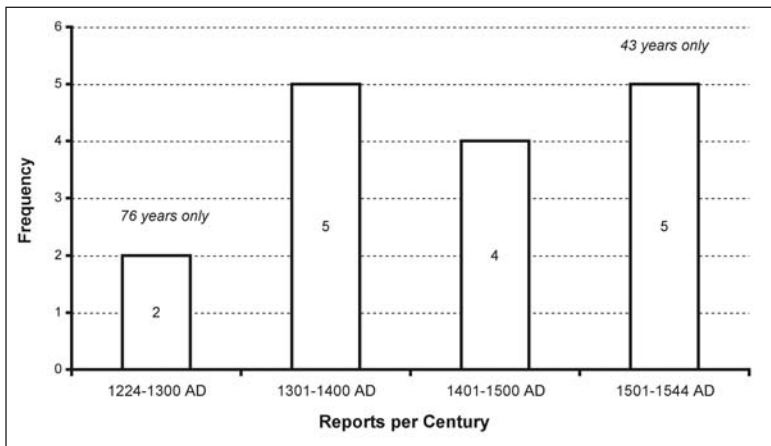


Figure 3 Reported Windstorms Per Century

Variations through time are again evident in Figures 2 and 3. Furthermore, patterns between phenomena also vary. Figure 2 shows more frequent occurrence of extreme cold weather than storms (Figure 3) in the period AD 1224-1300, whereas the period AD 1501-1544 exhibits more storminess, despite covering only 43 years, and little extreme cold weather, showing that what society might regard as “bad” weather are not necessarily related phenomena in a climatic sense. Also of interest are apparently contradictory trends between phenomena which one might more sensibly consider related. Figure 2 shows that extremes of drought and heat (which on the basis of this evidence are rarer than cold extremes in Ireland) do not really decrease in frequency even as reported cold events increase. Though the numbers are too few to make broad comments, they do serve to emphasize the complexity of the climate system and the large degree of variability that may occur by natural climate means alone. Also evident is that periods of increased extreme cold weather, for example, do not necessarily imply that the climate was consistently colder, as the reports of drought and heat illustrate.

Can anything be said with this evidence of supposed climate phases such as the “Little Ice Age” and its occurrence in Ireland? With evidence from AC only, it is premature to attempt definitive comments. Again, however, plenty of variability in extreme weather events is apparent, and other sources of data from Europe agree with AC in showing that even within overall consistent climate trends (such as cooling), contradictory short-run variations are to be expected.¹¹⁴ So too are regional variations. Thus, an important point to remember is that Ireland should not be expected to have experienced the same intensities or timing of trends as elsewhere in Europe, and the temptation to look for convenient trends fitting nicely with other regions should be avoided.

Indeed, the longer record from *The Annals of the Four Masters* supports the notion of regional variation in the timing of a dual-phase LIA as indicated by weather extremes,¹¹⁵ with this Irish evidence not matching the usual date of the first phase of the LIA (AD 1350). But the instinctive search for broadly similar climate trends across regions may be almost over as scientists realise the complexities of the global climate system mean that differing trends between regions may not only be expected, but may be related, with one region, for example, experiencing above average precipitation, associated with another experiencing drought.¹¹⁶ Episodes such as the LIA and MWP, once seen as large-scale, even global, trends, are now being reconsidered, their usefulness in describing the Earth’s past climate being questioned.¹¹⁷

Conclusions

With annals of such high quality and quantity,¹¹⁸ and considering the use made of similar European and Asian sources, it is surprising that the climate information in the Irish annals has not before been systematically exploited. Great potential now exists for extending our record of weather extremes back to AD 600, one of the longest in Europe. Being situated in the path of the main westerly storm tracks

developing in the North Atlantic Ocean,¹¹⁹ Ireland may perhaps be expected to have shown more sensitivity in the past to climate changes than other North West European areas. By examining past trends in Ireland's crucial geographical location, useful lessons may be learned regarding the occurrence of future extremes in Europe, and their possible regional patterns and extent, as anthropogenic influences impact upon the global climate system.

In 1972 Kathleen Hughes remarked upon how little known the Irish annals were outside of Ireland, and suggested we were not making enough fuss over what is an amazing historical and cultural resource. Future work aims to extend and develop the analysis of climate information presented here to all the available Irish and Anglo-Irish annals, and compare trends to other sources of climate information in Ireland as they are developed. It is certainly high time that these remarkable national resources are given the credit they deserve. They still have much to teach us.

NOTES

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²David Easterling, Gerald Meehl, Camille Parmesan, Stanley Changnon, Thomas Karl, and Linda Mearns, "Climate Extremes: Observations, Modeling, and Impacts," *Science* 289 (2000): 2068-74.

³Brendan McWilliams, "Implications for Ireland of Climate Change—An Overview," in *Climate Variation and Climate Change in Ireland*, ed. John Feehan (Dublin: Environmental Institute, University College Dublin, 1994), pp. 64-73.

⁴Thomas Karl, "Overview," *Climatic Change* 42 (1999): 1-2.

⁵Mike Hulme, "Global Warming," *Progress in Physical Geography* 24, no. 4 (2000): 591-599.

⁶IPCC, *Climate Change 2001: Synthesis Report* (Cambridge, UK and New York, USA: Cambridge University Press, 2001).

⁷Peter Lamb, "The Climate Revolution: A Perspective," *Climatic Change* 54 (2002): 1-9. See Frank Chambers and Sally Brain, "Paradigm shifts in late-Holocene climatology?" *The Holocene* 12, no. 2 (2002): 239-249.

⁸Andrew Goudie, "Medieval Climatic Optimum," in *Encyclopaedia of Global Change—Environmental Change and Human Society—Vol. 2*, ed. Andrew Goudie (NY: Oxford University Press, 2002): pp. 63-64.

⁹Jean Grove, "The Initiation of the 'Little Ice Age' in Regions round the North Atlantic," *Climatic Change* 48 (2001): 53-82.

¹⁰Laura McElwain and John Sweeney, "Climate change in Ireland—Recent Trends in Temperature and Precipitation," *Irish Geography* 36, no. 2 (2004): 97-111.

- ¹¹Malcolm Hughes and Henry Diaz, “Was There a ‘Medieval Warm Period,’ and If So, Where and When?” *Climatic Change* 26 (1994): 109-142. See Peter Jones and Keith Briffa, “The ‘Little Ice Age’: Local and Global Perspectives,” *Climatic Change* 48 (2001): 5-8.
- ¹²Michael Mann, “The Value of Multiple Proxies,” *Science* 297 (2002): 1481-1482.
- ¹³Hubert Lamb, *Climate, History and the Modern World*, 2nd ed. (NY: Routledge, 1995).
- ¹⁴Christian Pfister, Rudolf Brázdil, and Mariano Barriendos, “Reconstructing Past Climate and Natural Disasters in Europe Using Documentary Evidence,” *PAGES News* 10, no. 3 (2002): 6-8.
- ¹⁵Jucundus Jacobeit, Heinz Wanner, Gerhard Koslowski, and Martin Gudd, “European Surface Pressure Patterns for Months with Outstanding Climatic Anomalies During the Sixteenth Century,” *Climatic Change* 43 (1999): 201-221.
- ¹⁶Pfister et al., “Reconstructing Past Climate,” 6-8.
- ¹⁷Christian Pfister, Rudolf Brázdil, Rudiger Glaser, Anita Bokwa, Franz Holawe, Danuta Limanowka, Oldrich Kotyza, Jan Munzar, Lajoz Rácz, Elisabeth Strömmer, and Gabriella Schwarz-Zanetti, “Daily Weather Observations in Sixteenth-Century Europe,” *Climatic Change* 43 (1999): 111-150.
- ¹⁸Robert Henson, *The Rough Guide to Weather* (London: Rough Guides Ltd., 2002).
- ¹⁹Kilian Rohan, *The Climate of Ireland*, 2nd ed. (Dublin: Stationary Office, 1986).
- ²⁰Strictly, flooding and drought reports are “proxy” evidence, not referring *directly* to weather; other factors may be involved, for example, new crops requiring more moisture. For this paper, they are included in parameteorological phenomena.
- ²¹H. Lamb, *Climate, History and the Modern World*.
- ²²Emanuel Le Roy Ladurie, *Times of Feast, Times of Famine: A History of Climate Since the Year 1000* (NY: Doubleday, 1972).
- ²³Manorial Account Rolls or Extents are administrative documents detailing the running of feudal estates.
- ²⁴See Mark Hennessy, “Manorial Organisation in Early Thirteenth Century Tipperary” *Irish Geography* 29, no. 2 (1996): 116-125. These have not yet been surveyed for use as a source of climate information.
- ²⁵John Whittow, *The Penguin Dictionary of Physical Geography* (London: Penguin Books, 1984).
- ²⁶H. Lamb, *Climate, History and the Modern World*.
- ²⁷Astrid Ogilive and Graham Farmer, “Documenting the Medieval Climate,” in *Climates of the British Isles*, eds. Mike Hulme and Elaine Barrow (London: Routledge, 1997), pp. 112-133.
- ²⁸Dag Retsö, “A Contribution to the History of European Winters: Some Climatological Proxy Data from Early-Sixteenth Century Swedish Documentary Sources,” *Climatic Change* 52 (2002): 137-173.
- ²⁹Francis Ludlow, “A Surprisingly Useful Source of Information about Ireland’s Past Climate—The Irish Annals,” *Geographical Viewpoint* 33 (2005).

³⁰John O'Donovan, *Annala Rioghachta Eireann: Annals of the Kingdom of Ireland by the Four Masters, From the Earliest Period to the Year 1616* (Dublin: Hodges and Smith, 1851).

³¹Alexander Martin Freeman, *The Annals of Connacht* (Dublin: Dublin Institute for Advanced Studies, 1944).

³²Francis Martin, "Foreword," in *The Medieval Irish Annals*, by Gearoid Mac Niocaill (Dublin: Dublin Historical Association, 1975), pp. 5-10.

³³Gearoid Mac Niocaill, *The Medieval Irish Annals* (Dublin: Dublin Historical Association, 1975).

³⁴Daniel McCarthy, "The Chronology of the Irish Annals," *Proceedings of the Royal Irish Academy* 98 C (1998): 203-255.

³⁵Emmett O'Byrne, *War, Politics and the Irish of Leinster, 1156-1606* (Dublin: Four Courts Press, 2003).

³⁶Alfred Smyth, "The Earliest Irish Annals: Their First Contemporary Entries and Earliest Centres of Recording," *Proceedings of the Royal Irish Academy* 72, C (1972): 1-48.

³⁷Katherine Simms, "Bardic Schools, Learned Families," in *Medieval Ireland: An Encyclopedia*, ed. Sean Duffy (NY: Routledge, 2005), pp. 35-37.

³⁸Dianne Tillotson, *Histories, Chronicles & Annals* (2 March 2005). Accessed 16 January 2006, available from

<http://medievalwriting.50megs.com/word/chronicle.htm>

³⁹Dáibhí O'Croinin, "Early Irish Annals from Easter Tables: A Case Restated," *Peritia* 2 (1983): 74-86.

⁴⁰Miriam Davis, "Festivals and Holidays," in *Encyclopedia of Medieval Literature*, eds. Robert Lambdin and Laura Lambdin (London: Fitzroy Dearborn Publisher, 2000), pp. 188-196.

⁴¹Léon van der Essen, "Chronicles," in *The Catholic Encyclopedia—Vol. 1*, eds. Charles Herbermann, Edward Pace, Condé Pallen, Thomas Shahan, and John Wynne (NY: Appleton, 1907). Accessed 3 January 2006, available from <http://www.newadvent.org/cathen/01531b.htm>.

⁴²Daniel McCarthy, "The Chronology and Sources of the Early Irish Annals," *Early Medieval Europe* 10, no. 3 (2001): 323-341.

⁴³Thomas O'Rahilly, *Early Irish History and Mythology* (Dublin: Dublin Institute for Advanced Studies, 1946).

⁴⁴Sean Mac Airt, *The Annals of Inisfallen* (Dublin: Dublin Institute for Advanced Studies, 1951).

⁴⁵Whitley Stokes, *The Annals of Tigernach* (Felinfach: Llanerch, 1993).

⁴⁶Though some have argued for its historical value. See Richard Warner, "The Prehistoric Irish Annals: Fable or History?" *Archaeology Ireland* 4, no. 1 (1990): 30-33. Also see Mike Baillie, *Exodus to Arthur—Catastrophic Encounters with Comets* (London: B. T. Batsford, 1999).

- ⁴⁷John Carey, "Lebor Gabála," in *The Oxford Companion to Irish History*, 2nd ed., ed. Sean Connolly (Oxford: Oxford University Press, 2002), p. 325.
- ⁴⁸Kenneth Nicholls, "Introduction," in *The Annals of Ireland by the Four Masters*, ed. John O'Donovan (Dublin: De Burca Rare Books, 1990), pp. 1-3.
- ⁴⁹Tillotson, *Histories*. See Patrick O'Madden, "Kilronan," *The Journal of Ardagh and Clonmacnoise Antiquarian Society* 2, no. 9 (1943): 54-58.
- ⁵⁰Paul Walsh, "The Book of Fenagh," *The Irish Ecclesiastical Record* 55 (1940): 561-581.
- ⁵¹Francis Byrne, "Introduction," in *The Irish Hand*, ed. Timothy O'Neill (Portlaoise: The Dolmen Press Ltd., 1984), pp. 11-27. See Kathleen Hughes, *Early Christian Ireland: Introduction to the Sources* (London: Hodder and Stoughton, 1972).
- ⁵²Walsh, "The Book of Fenagh," 561-581.
- ⁵³van der Essen, "Chronicles."
- ⁵⁴Ó Cuív, "The Irish Language."
- ⁵⁵Primarily Ulster and Scottish events.
- ⁵⁶See John Bannerman, "Notes on the Scottish Entries in the Early Irish Annals," *Scottish Gaelic Studies* 11 (1968): 149-170. Also see Hughes, *Early Christian Ireland*. This chronicle and other early compilations are not extant today, but they may be traced within our surviving annals.
- ⁵⁷Smyth, "The Earliest Irish Annals," 1-48.
- ⁵⁸Hughes, *Early Christian Ireland*.
- ⁵⁹There is, however, another tradition of annalistic recording in Ireland, the so-called "Anglo-Norman" annals. See Bernadette Williams, "The Kilkenny Chronicle," in *Colony and Frontier in Medieval Ireland*, eds. Terence Barry, Robin Frame, and Katherine Simms (London: The Hambledon Press, 1995): 75-95. Also see Bernadette Williams, "The Dominican Annals of Dublin," in *Medieval Dublin II*, ed. Sean Duffy (Dublin: Four Courts Press, 2001), pp. 142-168.
- ⁶⁰For conflicting views, see Hughes, *Early Christian Ireland*. Also see Colm Etchingham, *Viking Raids on Irish Church Settlements in the Ninth Century: A Reconsideration of the Annals* (Maynooth: St. Patrick's College, Department of Old and Middle Irish, 1996).
- ⁶¹Katherine Simms, "Ollamh," in *The Oxford Companion to Irish History*, 2nd ed., ed. Sean Connolly (Oxford: Oxford University Press, 2002), p. 429. See also Katherine Simms, "Bardic Schools," 35-37.
- ⁶²At least since 1818. See Freeman, *Annals of Connacht*.
- ⁶³The original is classified as MS. Stowe C III. I.
- ⁶⁴Part of AC was published in 1871 to fill gaps in William Hennessy's edition of the *Annals of Loch Cé* (London: Longman, 1871), a closely related text. However, Hennessy's *Annals of Connacht* were based on inferior and later copies of AC. Freeman published part of the text from the good Stowe MS in *Revue Celtique* between 1933-35, but the text printed and translated in 1944 by the Dublin Institute for Advanced Studies is the only full set of these annals. See Aubrey Gwynn,

“Review,” *Studies—An Irish Quarterly Review* 33 (1944): 416-419.

⁶⁵One extra entry exists, for 1562.

⁶⁶AD 1479–1510.

⁶⁷Simms, “Bardic Schools,” 35-37.

⁶⁸The *Annals of Inisfallen* incorporates an early Munster chronicle, significantly abbreviated in copying, with the original no longer extant. See Hughes, *Early Christian Ireland*.

⁶⁹Aubrey Gwynn, “The *Annals of Connacht* and the Abbey of Cong,” *Journal of the Galway Archaeological and Historical Society* 27 (1956-57): 1-9.

⁷⁰Barry O’Dwyer, “The Annals of Connacht and Loch Cé and the Monasteries of Boyle and Holy Trinity,” *Proceedings of the Royal Irish Academy* 72 C (1972): 4-22.

⁷¹See AC, p. 635, AD 1519 for what Freeman, footnote 6, believes to be contemporary.

⁷²Freeman, *Annals of Connacht*.

⁷³Indicating that older sources were less likely to survive intact.

⁷⁴Daniel McCarthy, “The Chronology and Sources of the Early Irish Annals,” *Early Medieval Europe* 10, no. 3 (2001): 323-341 for details of such.

⁷⁵See Freeman, *Annals*. Also see Aubrey Gwynn, “Review,” 1-9, John Brady, “Review,” *Irish Ecclesiastical Record* 65 (1945): 64-65, and Gerard Murphy, “Review,” *Eigse* 6 (1948-52): 80-82.

⁷⁶Paul Walsh, “The Annals of Loch Cé,” *The Irish Ecclesiastical Record* 56 (1940): 113-122.

⁷⁷Gwynn, “Review,” 416-419. See O’Dwyer, “The Annals of Connacht,” 4-22.

⁷⁸All pages are those of Freeman’s edition.

⁷⁹For Irish examples, see Melosina Lenox-Conyngham, “Some Kilkenny Diaries,” *Old Kilkenny Review* 47 (1995): 63-76.

⁸⁰The phrase “as we have heard from the folk of that place” shows the annalists’ willingness to record news from other areas, on the authority of whomever reported to them, and it is possible that this is a contemporary recording, placed into the text during the compilation of AC. Otherwise, it indicates the annalists’ willingness to copy the words of the earlier sources verbatim, important in assessing the integrity of their work, and shows they had more than one source before them for this period, several reporting the event.

⁸¹Ludlow, “A Surprisingly Useful Source.”

⁸²Francis Ludlow, “Interpretation of Celestial and Environmental Phenomena in the Irish Annals,” *Atlas* 10 (2005): 48-60.

⁸³Martin, “Foreword,” 5-10.

⁸⁴Richard Sharpe, “Were the Irish Annals Known to a Twelfth-Century Northumbrian Writer?” *Peritia* 2 (1983): 137-139.

⁸⁵Thomas Cahill, *How the Irish Saved Civilization* (London: Hodder and Stoughton, 1995).

⁸⁶One issue of reliability not covered concerns the chronological accuracy of reported events, which became distorted through accidental (and sometimes deliberate) scribal error, especially in the first millennium AD. Excellent work has rectified many such

dating errors in the Irish annals. See Daniel McCarthy, "Irish Chronicles and their Chronology," (21 March 2005). Accessed 1 October 2005, available from www.cs.tcd.ie/Dan.McCarthy/chronology/synchronisms/annals-chron.htm Fourth Edition

⁸⁷And also scribal copying errors, though these can sometimes be picked out and are not as pervasive as some commentators have stated. See Walsh, "The Book of Fenagh," 561-581.

⁸⁸David Wishart, "The Selectivity of Historical Representation," *Journal of Historical Geography* 23, no. 2 (1997): 111-118.

⁸⁹In terms of its use in forging a national identity and reinforcing the Christianisation of Ireland.

⁹⁰Ó Cuív, "The Irish Language."

⁹¹Walsh, "The Book of Fenagh," 561-81.

⁹²See John Kelleher, "Early Irish History and Pseudo-History," *Studia Hibernica* 3 (1963): 113-127.

⁹³Ibid.

⁹⁴Richard Butler, *Annals of Ireland by Friar John Clyn and Thady Dowling, Chancellor of Leighlin* (Dublin: Irish Archaeological Society, 1849), p. 87. Though Clyn was of the Anglo-Norman tradition, given the similarities between the two traditions, and the reticence of the Irish annalists in leaving personal remarks, it is taken that the motivations of compilation are sufficiently similar.

⁹⁵Translation from Maria Kelly, *A History of the Black Death in Ireland* (UK and US: Tempus, 2001), p. 47.

⁹⁶This does not mean that *no* editing occurred, or that every entry was preserved in later copies. But that apparently minor reports are preserved is testament to the general faithfulness of scribal copying. However, an example of less-thorough copying is seen when comparing *AC* to *The Annals of Loch Cé*, a related but inferior text.

⁹⁷Daniel McCarthy and Aiden Breen, "Astronomical Observations in the Irish Annals and their Motivation," *Peritia* 11 (1997): 1-43.

⁹⁸See *AC*, AD 1537, p. 703, for an example.

⁹⁹Michael Frassetto, *The Year 1000: Religious and Social Response to the Turning of the First Millennium* (London: Palgrave Macmillan, 2002).

¹⁰⁰Judged by retro-calculations and independent records.

¹⁰¹McCarthy and Breen, "Astronomical Observation," 1-43.

¹⁰²Ibid.

¹⁰³The Black Death was often seen as God's punishment of humanity's sins. See William Naphy and Andrew Spicer, *The Black Death: A History of Plagues, 1345-1730* (Stroud: Tempus, 2000).

¹⁰⁴*AC*, AD 1400, p. 377.

¹⁰⁵Ludlow, "Interpretation," 48-60.

¹⁰⁶But see *AC*, p. 703, 1537 AD for a late entry concerning "signs" which, given its date, was more likely recorded in a bardic school than a monastic school. It should

also be noted that there existed some cross over between the two traditions; a person could be cleric *and* bardic historian. For example, AC, p. 343, AD 1373.

¹⁰⁷McCarthy, “The Chronology.”

¹⁰⁸AC, AD 1373, p. 343.

¹⁰⁹Considered as valuable resources. See Fergus Kelly, “Trees in early Ireland,” *Irish Forestry* 56, no. 1 (1999): 39-57.

¹¹⁰Ludlow, “A Surprisingly Useful Source.”

¹¹¹Rohan, *The Climate of Ireland*.

¹¹²Henson, *The Rough Guide to Weather*.

¹¹³That is, division per entry and, where applicable, division per reported phenomena per entry.

¹¹⁴Karl, “Overview,” 1-2.

¹¹⁵Ludlow, “A Surprisingly Useful Source of Information.” Very provisionally, the evidence may point to an earlier first phase LIA.

¹¹⁶For examples, see H. Lamb, *Climate, History and the Modern World*, despite his efforts to identify coherent trends between regions.

¹¹⁷Hughes and Diaz, “Was there a ‘Medieval Warm Period.’” Also see Peter Jones and Keith Briffa.

¹¹⁸Martin, *The Medieval Irish Annals*, 5-10.

¹¹⁹John Sweeney, “Ireland,” in *Regional Climates of the British Isles*, eds. Dennis Wheeler and Julian Mayes (London: Routledge, 1997). See John Sweeney, “A Three-Century Storm Climatology for Dublin 1715-2000,” *Irish Geography* 33, no.1 (2000): 1-14.