THE HISTORICAL STUDY OF CLIMATE:
A REPORT ON THE WORK OF THE CLIMATE RESEARCH UNIT AT THE
UNIVERSITY OF EAST ANGLIA

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In the past few years many parts of the world have experienced relatively unusual weather patterns, entailing in certain areas serious economic and social consequences. The need to explain them and assess their significance has resulted in a marked quickening of interest in climatological research.1 Many lines of inquiry are being pursued, but certainly a very important aspect of current work is the investigation of climatic history. For environmental scientists, the eventual fruit of this palaeoclimatological research will be a firmer knowledge of the range of variation to which the climate has been subject and an increased understanding of the processes of change; but the results should also be of considerable interest to historians. A much more detailed knowledge of both long and short-term climatic variations will help towards an understanding of harvest fluctuations and of the problems of arable farming generally; of the vicissitudes of animal husbandry; of dislocations of the many industrial activities which until relatively modern times were highly sensitive to weather; of transport and communication difficulties; and of the incidence of disease.2 In fine, the study of climate in past time will aid and enrich the study of economic and social history and of historical demography; and the purpose of this note, in reporting briefly on research in progress at the Climatic Research Unit at the University of East Anglia, is to arouse the interest and request the assistance of readers of Local Population Studies.

Attempts to study the weather which our ancestors experienced are by no means new, but in recent years research techniques have rapidly become more sophisticated. Where records of accurate instrumental observations exist, the problem of reconstructing the history of climate is relatively straightforward; but since such records, even in the most favoured areas extend back no further than the second half of the seventeenth century and cannot be said to have a really satisfactory beginning until after 1700,3 their testimony has to be supplemented with a variety of other forms of data.
Of these supplementary sources of information, many do not rely on written evidence at all, for certain natural phenomena embody a ‘record’ of biological, chemical, or physical processes which provide indirect or ‘proxy’ data on the weather of the past. By analysing the remains of pollen deposited on lake beds and in peat bogs, for example, it is possible to determine which types of plants and trees flourished in successive periods, and hence draw valuable conclusions, albeit in broad terms, about the course of climatic change in the remote pre-historic past. Again, the thickness of the growth-rings in the trunks of certain trees in some measure reflects the state of the weather; and an analysis of tree-ring patterns in carefully selected timber, whether recently felled or long dead, can provide the basis for extended series of data on climatic fluctuations. By the use of these and similar sources of information, it is to some extent possible to reconstruct the climate record for areas of the world and periods of time for which conventional historical data are entirely lacking.¹

Written sources, however, undoubtedly extend the scope of information available and offer means of checking the chronological accuracy of series based entirely on the natural record. In the first place, their testimony can furnish further series of ‘proxy’ data: records of the date at which grapes were harvested in certain areas of Europe in successive years, for example, provide indirect evidence of temperature fluctuations.² In addition, however, historical sources of many types make explicit reference to the state of the weather or to such directly related phenomena as the freezing of lakes and rivers. It is in the exploitation of this kind of data that a team of climatologists and historians at the University of East Anglia, assembled under the guidance of Professor H. H. Lamb and directed by Dr. T. M. L. Wigley, is making its greatest contribution to climatological research.

To be sure, many previous researchers have used materials of this type and indeed, there exist a number of substantial compilations of historical weather data derived from such sources.³ Unfortunately, many of these works are in various ways defective.⁴ They are, in general, marked by an uncritical approach to the sources, and accordingly include much spurious or inaccurately dated material; and they are often based on a relatively narrow range of documents. The team at East Anglia, by contrast, is committed to a rigorous system of source criticism, and the use of as wide a range of materials as is possible within a reasonable time-limit.

What, in fact, are the sources available and how are they to be used? By way of illustration, these points may be answered with reference to England, though the unit’s interests naturally range more widely. For the mediaeval period, the extensive corpus of chronicles and annals provides a rich vein of material, though its working requires care. Only sources which provide a contemporary or near-contemporary account of the events they purport to describe are admissible, and even these must be further tested for the possible presence of various forms of bias. Again, a rigorous handling of problems of chronology, which inevitably spring from the fact that a variety of different calendars and methods of reckoning the year were in use, is naturally of fundamental importance. The application of
these rules involves the discarding of much information which at first sight appears relevant; but there remains, nevertheless, a considerable body of valuable data. Chronicles, however, are not the only source of evidence on mediaeval weather. Titow has shown that manorial account rolls can yield a surprising amount of relevant information, and new material of this type is being exploited by a member of the unit.

It is unfortunate that manorial accounts yield little information for the period after 1450. Chronicles and annals, likewise, cease to be such an important source after that date, though certain London chronicles and analogous compilations for provincial towns do contain valuable data for the sixteenth and even the seventeenth centuries, as do certain printed histories, such as the works of John Stow. On the other hand, a multitude of other materials becomes available. Diaries furnish a mass of information; few, it is true, can match the importance of the record kept by the meticulous Ralph Josselin in the middle years of the seventeenth century, but a great many include, in varying proportions, some relevant material. Valuable data are embedded in the various series of state papers. Contemporary correspondence, especially newsletters like those written by John Chamberlain in the early seventeenth century, provide another major source; while information can also be found in the writings of astrologers like Simon Forman. Certain parish registers, such as that belonging to the parish of Beeston-next-Mileham in Norfolk, contain useful observations; while further examples of documents similar to the draft register of Rolleston in Nottinghamshire for the period 1588-1615, which the incumbent used to record (among other things) valuable descriptions of the weather, may yet come to light.

The information which may be derived from such sources appears, at first sight, extremely heterogeneous, but may be classified under a small number of headings. **Meteorological descriptors** are simply qualitative descriptions of the weather: 'extremity of cold', 'perpetual weeping weather', and so on. Sometimes, valuable indications of wind direction are included. The most useful kind of description (in the absence of regular and accurate daily observations) are those which relate to some extended period of time, such as weeks or months; but even notices of isolated weather events can in some circumstances be significant. **Hydrometeorological descriptors** include remarks on the state of the ground, lakes and rivers: typical examples are 'extreme foul ways and great floods', 'the ways as dusty as they be usually at midsummer', 'above Westminster the Thames is quite frozen over'. **Oceanographic descriptors** are notices about the state of the sea, including observations of storm floods, sea ice and icebergs. In practice, the recording of climatic events is often associated with references to other phenomena, and these form an important class of ancillary data. The most common types of supplementary information are references to the state of the harvest, the commodity prices, or to other agricultural matters, and comments on the incidence of disease; but many other human activities more or less dependent on the weather are sometimes touched on.

Clearly, such materials involve many problems of interpretation. A large proportion of observations, for example, are relative, determined with
reference to the observer's subjective idea of what constitutes the norm. It is plain that notions of normality were often very imprecise, and such phrases as 'the greatest... that hath been known in the memory of any man living' occur so often as to suggest that memories were exceedingly short. The precise duration of any set of phenomena was often left unclear: dates were frequently 'rounded off' by reference to important saints' days, while it is often no easy task to decide exactly what time-span a particular writer had in mind when he used words like 'summer' and 'winter'. Nevertheless, when substantial quantities of data are available and when the materials are handled with a sensitive appreciation of their limitations, a coherent record can be constructed. If carefully evaluated data drawn from a wide geographical area are plotted on maps, it is possible to sketch in, with reasonable accuracy, the main outlines of atmospheric circulation patterns in particular years. When many such maps have been produced, there will emerge a remarkably detailed history of the weather. This, indeed, is the aim of one of the unit's major current projects, funded since 1974 by the Rockefeller Foundation and now well advanced. The final result will be the production of a continuous time-series of seasonal weather maps for the North Atlantic-European portions of the northern hemisphere from the year 1000 to the late nineteenth century.

By way of conclusion, two years of English weather will be illustrated in some detail, in order to indicate the kinds of data at present available in the unit's files and to explain in what ways assistance would be welcomed. The two years are from December 1572 to November 1573, and the corresponding period from 1610 to 1611. It is clear that the winter of 1572-3 and the succeeding spring were exceptionally cold: Stow made the point for England generally and local commentators were in accord. Thus a chronicler of Shrewsbury recorded that:

"the winter and spring time was very long, cold, hard and dry, so that it was very far in the month of May before any leaf or blossom appeared upon any tree..."

while an observer in Liverpool noted long winter snows and a

"very great drought for want of rain from mid-Lent [i.e. the end of February] till Whitsunday [10 May]."

Similarly, Bishop Parkhurst of Norwich wrote from Ludham in Norfolk on 20 January 1573,

"Frost and snow have continued these eight weeks, with barely a break the whole time. But at last they have disappeared;"

and on 30 June:

"Here we had perpetual winter from the beginning of November until Whitsun, for only the coldest winds those from the east and the north, blew throughout this time; indeed the warm ones, the west and the south, never or rarely."

By the end of June, however, the weather appears to have been more normal, and Parkhurst expressed a hope that in spite of the late spring the crops would do reasonably well. But again the climate proved fickle: the harvest season, which in Norfolk did not begin before late August (Old Style Calendar) was 'very wet and rainy; there was hardly a fine day during the whole harvest' and the yield was bad. According to the
Shrewsbury chronicler, October was also very wet, and rye could not be sown; but November was mild and fair, as was to be much of the succeeding winter.\textsuperscript{35}

The winter of 1610-11 was mainly mild and wet. The Venetian ambassador in London described it as a period of 'great damp'. The parish register of Beeston-next-Mileham recorded a season characterized by 'a great fall of rain and water' from mid-October 1610 to mid-February 1611, and there were reports of flooding.\textsuperscript{36} This predominantly wet period was followed by a long period of drought in the spring. The west-country diarist Walter Yonge, for example, described 'such a dry spring this year as never was before seen or heard of',\textsuperscript{27} while the register of Beeston-next-Mileham added the information that the dry period was characterized by east and north winds. But the drought did not continue throughout the summer. Dr Richard Napier, writing at Great Linford, Bucks, recorded a number of falls of rain, some of them heavy, in June, July and August;\textsuperscript{38} while there were several reports that the dry period had been 'relieved' by rain at the end of May or the beginning of June.\textsuperscript{39} By late September, in any event, a cold, wet, windy autumn had set in, and there was snow and frost around Michaelmas and, to judge from Napier's diary, a further spell of frost in mid-November.\textsuperscript{30}

These summaries do not exhaust the English weather data for these two years at present in the unit's files, but they certainly contain the main items of information. There is clearly a need for more local accounts of the weather of these and other years to cover the possibility of regional variations, and readers of Local Population Studies are invited to supply them. The bulk of our data comes from published sources, but there must be considerable quantities of valuable material hidden away in manuscript collections throughout the country. We should be very grateful indeed if readers would communicate any relevant data which they may come across, for any period before the late nineteenth century, or alert us of the existence of important material. All contributions will, of course, be properly acknowledged when the work is written up for publication.

Anyone who has data which he is willing to share, or would like further details about the work of the unit, should contact Dr M. J. Ingram, Climatic Research Unit, School of Environmental Sciences, The University of East Anglia, Norwich NR4 7TJ.

NOTES
3. For example, the longest homogeneous temperature series is the 'central England' record established by Manley; it extends back to 1659, but the pre-1720 data are presented as less reliable than the rest: G. Manley, 'Central England temperatures: monthly means 1659-1973', Quarterly Journal Royal Meteorological Society, 100, 1974, pp. 389-405.
4. The various scientific techniques available for the reconstruction of climate are reviewed in H. H. Lamb, *Climate: Past, Present, and Future*, vol. 2, pp. 52-243.


7. Certain compilations, especially the most recent, maintain a very high standard of comprehensiveness and accuracy: e.g., M.K.E. Gottschalk, *Stomvloeden en Rivieroverstromingen in Nederland*, 2 vols. 1971-5.


10. The Calendar of State Papers Venetian is especially useful.


13. The register remains with the incumbent of the parish.


15. It is not possible to discuss here the methods used for reconstructing circulation patterns from the available data, and the ways in which the validity and reliability of these methods may be tested; the solution of the various theoretical and technical problems is naturally an important aspect of the unit’s work.

16. Atmospheric circulation maps basically show the distribution of high and low pressure areas, from which wind patterns, etc., may be deduced.

17. Other projects are also in progress: for example, an attempt to establish the existence, and investigate the nature, of periods of general warming and cooling of the earth in the last three thousand years.


22. Ibid. p. 75.

23. Ibid. p. 84.


