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# HISTORY AND CLIMATE SCIENCE: A COLLABORATIVE RELATIONSHIP FOR THE TWENTY-FIRST CENTURY

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## ABSTRACT

History as a subject for higher education (and beyond) has often been criticized for failing to be relevant to the demands of the twenty-first century. This paper argues that not only is learning from our past a valuable exercise in any time period, but that historical research can provide modern sciences with the much needed data and contextual analysis crucial to understanding many of the problems facing our world today. Based on research from historic archives in the UK and Malaysia, this paper explains how historians are recovering historic data invaluable to modern climate science, and demonstrates just how this data is being used.

**Keywords:** History; Climate; Environment; Data Recovery.

## INTRODUCTION

The utility of History as an educational subject has been consistently attacked for failing to be relevant to the demands of the twenty-first century. Policy makers in education in many countries (the UK for example) have proposed downgrading the place of history in school curriculums, and scaled back funding for pre-modern history in higher education institutions leading, in some cases, to their closure. Elsewhere, especially in newly-industrialized countries - like Malaysia - history is often considered ancillary to the sciences in educational programs. This paper argues that this should not be the case. History (as an academic subject) has moved forward over the past twenty years. Historiography demonstrates that it has been a long time since history was simply the retelling of the stories of eminent politicians, notable battles, or national figures. Historical research is engaged in a process of continual revision, and modern historians rarely work within narrow methodological perimeters, but assiduously push the boundaries of inter-disciplinary working. Today, more than ever, academic historical practice is entirely relevant to current social, cultural and political challenges, and I aim to illustrate this over the course of the following paper.

This paper draws on my own experiences to argue that historical research is crucial in meeting and combatting the challenges of the modern world. One of the biggest trials facing the world's emerging economies today is climate change, and it may seem surprising, but this is an important area where scientists and historians can collaborate. Whilst climate scientists may debate the causes and extent of climate change; few would argue that climate change is not a reality.

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## A COLLABORATIVE RELATIONSHIP BETWEEN HISTORY AND CLIMATE SCIENCE

Our climate is not, and never has been, a stable given; our weather exhibits patterns, anomalies and fluctuations that have an immense impact on our global environment, resources, and people. To appreciate climate change and to prepare for its potential impacts, it is essential to understand long-term change, and what effect this had on our environment. This is where historians can not only provide essential data about past weather, but explain its historic context by exploring the impact of climate change on society. To give an example, one task facing climate scientists is to use advanced modelling techniques to recreate, and explore changes and continuities in our climate over the past millennium. These modelling systems – like the National Oceanic and Atmospheric Administration's (NOAA) Twentieth Century Reanalysis (20CR) project for instance - require vast quantities of global data about marine and terrestrial weather to improve their efficiency. However, there are large geographic and temporal gaps in observational weather records across many regions of the developing world and across the world's oceans; especially prior to the twentieth century.

From the early 1900s most countries in the world had observatories and weather stations at which wind, temperature, pressure, and rainfall were recorded in detail. From the 1920s, many countries also hosted dedicated meteorological departments which collated this material and made their own observations. Much of this data has survived, but – and this is especially the case in developing countries - it is not always available for modern climate scientists to use. Before 1900, the collection of weather data was less certain. From 1850 onwards weather observations of a fairly reliable standard were recorded at stations across the developed world; especially in Europe and the US.[2] Before 1850 there is a dearth of observational data from any region, as there were few systematic methods of collecting and storing such information. Climate scientists compensate for the paucity of instrumental data sources by using natural proxies such as tree-rings or ice-cores, but the evidence from these types of sources can vary in quality, and instrumental data is still required to calibrate proxies for accuracy. In recent years developments in climate modelling simulations have greatly reduced the margin for error, but the inclusion of raw instrumental data remains an essential part of climate modelling, especially in exploring the climatic impact of extreme events like cyclones or volcanic eruptions where there were variances in regional and decadal patterns. Equally, there are large areas of land and sea where existing data is scarce. Accurate climate models are essential for understanding and projecting variability and change in our weather in the future.

As a historian, my task has been to aid in the research and recovery of historic weather observations – especially temperature - across the globe. Scientists have turned to historians because of their subject specific skills in research, critical analysis and palaeography to uncover sources relating to our climatic past. This is not as easy a job as it might sound. The areas in the world which currently experience a dearth of data are often those which restrict access to their archives, where archive material is un-catalogued, or in a state of decay (this especially applies to tropical countries like Indonesia). In some places, data was never recorded, or has been lost. Another major problem is that more than two thirds of our planet is covered in water. How then, can historians acquire the relevant instrumental data needed for scientific purposes?

Instrumental data (temperature, wind, pressure, rainfall) was compiled at a variety of places, including meteorological observatories, but also at hospitals, lighthouses, prisons, and on-board merchant and naval vessels. In the Asia-Pacific region, observational data from a wide variety of sources - including ship's log books - can be found in the records of meteorological observatories in Mauritius, Hong Kong and Australia. Since man first set sail our world's oceans h~~ave been~~ navigated, surveyed and mapped, with varying degrees of success and accuracy. From

[2] Brohan, P., Kennedy, J., Harris, I., Tett, S. F. B., and Jones, P. D., 'Uncertainty Estimates in Regional and Global Observed Temperature Changes: a new dataset from 1850, Journal of Geophysical Research, 111, D12 106, doi:10.1029/2005JD006548, 2006.

at least the sixteenth century, these voyages were recorded in log books and captain's journals, many of which have survived through the ages. Sixteenth-and seventeenth century log books often took the form of fantastic travel narratives, and thus they have to be treated with caution as reliable sources, but by the late eighteenth and early nineteenth centuries, log keeping had become far more guided, formulaic and scientific. What all the log books have in common however, is a shared understanding of the importance of documenting the ship's position and the weather. This information was essential to early navigators. Thus, even during the 1600s, marine log keepers assiduously documented their ship's position (as far as it could be accurately determined in the days before the eighteenth-century invention of the chronometer), wind force and direction, and described the weather on a daily basis. These records are a unique resource for exploring everyday weather conditions (as well as storms and unusual events), but it lies scattered across the world's archives, and back rooms. Often it takes a historian to unearth the raw instrumental data, decipher the several centuries' old handwriting, and clarify the data in light of its historic context.

For example, observations of wind force and the general state of the weather were both subjective. Before the nineteenth-century invention of cup and pressure tube anemometers, wind force could only be estimated. These estimates were taken by experienced officers on board ship who deduced the readings by observing the state of the sea, and stress placed on the ship and its sails. Arguably, these estimates were not precision readings in the modern sense, but they tend to follow consistent patterns. Wind direction on the other hand was taken with the help of a compass, in conjunction with extraneous observations, such as the movement of wind driven waves.[3]

From the 1800s, as science progressed, so too did the accuracy and reliability of weather observations. William Dampier, for example, devoted many studies to the behavior of the wind, and Edmund Halley studied the earth's magnetic field from the decks of the Paramore in the South Atlantic.[4] Instruments for recording the weather became more advanced: the Sympiesometer for example (a mercury thermometer and barometer), was invented in the early nineteenth century and used on the 1818 Arctic expedition, and of course, the problem of longitude was finally resolved by John Harrison after nearly thirty years of development in 1759. On English East India Company ships (EEIC), the sub-daily recording of pressure and temperature became a requirement from the late eighteenth century under the direction of the Company's Chief Hydrographer, Alexander Dalrymple.[5] Dalrymple also began a process of collating and storing the old logbooks to study navigation, and it is he who we have to thank for the systematic collation of all the EEIC's shipping records. From 1808, the measurement of wind force was standardized by the creation of the Beaufort Scale - as devised by the Royal Navy's Admiral Francis Beaufort - though not adopted as customary practice till much later.

Thus, into the nineteenth and early-twentieth centuries, we find that logbooks – and the instrumental data contained within them - became more formulaic with less room for narrative flair. The adoption of standardized printed pages and strict rules about what to record during a voyage certainly makes for less interesting reading. Nevertheless, the scientific accuracy of observational data is markedly improved. British naval survey vessels for example, carried a marine barometer, aneroid barometer, barograph, hydrometer, wet and dry bulb thermometer, and a

thermometer for recording sea temperature as standard, and ordinary naval ships carried a fair share of the above.[6]

Over the past twenty years or so, there has been increasing interest in using the logbooks of both sailing and steam vessels as sources of information about our past climate. Inspired by the work of people like Syukuro Manabe (who encouraged interest in observational data taken on Japanese naval fleets); large organizations like The National Oceanic and Atmospheric Administration (NOAA) in the US, the MET Office Hadley Centre in the UK, and

[3] Wheeler, et al., CLIWOC, p. 12-13.

[4] My thanks to Dr Clive Wilkinson of the Climatic Research Unit (CRU) at the University of East Anglia (UEA) for providing this information from his current research on marine science.

[5] Ibid., p. 14.

[6] Wilkinson, C., British Logbooks in UK Archives in the 20th Century A survey of the range, selection and suitability of British logbooks and related documents for climatic research (NOAA, 2009), p. 31.

smaller volunteer groups including the International Data Rescue Organization (IEEDRO) have joined together in promoting and supporting global initiatives to draw together comprehensive databases of early instrumental observations. Much of the footwork of this research has been completed by historians. These results of such collaborations can be seen in the International Comprehensive Ocean-Atmosphere Data Set (ICOADS, US) and the Climatological Database for the World's Oceans (CLIWOC, UK), amongst others.

With the success of these databases, many new projects have been funded with the purpose of collating, imaging, digitizing, and – most importantly - making public, the data available in historic logbooks and journals.[7] With the search perimeters being on a global scale, it is not unsurprising that several hundred thousand logbooks have already been uncovered in countries all over the world. Most remarkable, is the survival rate of pre-1850 logbooks which are termed 'pre-instrumental', yet still contain usable observations.[8] Just to give an example, a survey of EEIC logbooks held at the British Library in London completed during 2009, uncovered over nine-hundred logbooks with usable observational data including temperature, pressure, and wind direction documented on a daily and sometimes sub- daily basis. Usable logs were identified by a historian, and the data was imaged and has been digitized and included in ICOADS. The result of this project was the creation 273,000 new weather records for the period 1789 to 1834.[9]

Building from the premise of these successful projects, the aim is to recover data from less well researched regions, including Southeast Asia: an area where there is a dearth of data, especially before the 1940s. There is printed data available in a variety of journals and newspapers in Southeast Asia, including, for example, the Penang Gazette, which is yet to be collated in any systematic, or global way. There are many primary marine data sources, like for example, those left from the Dutch colonial period in Indonesia now being studied by the Digitisasi Data Historis (DiDaH) project. Early investigations in Malaysia have also unearthed a substantial wealth of instrumental data for the pre-WWII period held – but as yet, un-catalogued, or imaged – at the Malaysian MET department. Under the umbrella of the UK MET Office Hadley Centre's Atmospheric Circulation Reconstructions over the Earth (ACRE) initiative, and UKM, I hope to facilitate interest in and further research on this underexplored area, with the ultimate aim of making this data widely available to the scientific community, academics, and the general public.

## CONCLUSION

The impact of historic climate research is immense. It brings together institutions and academics from across the social sciences, sciences and humanities on a global scale, and captures masses of contextual material and data that such disciplines need, but can rarely access in such quantities. In making this material available publically, it can be employed to its greatest benefit by policy makers and scientists to help predict, and manage the challenge of climate change.

[7] Example include: The CORRAL Project http://www.corral.org.uk/; OldWeather http://www.oldweather.org/; or ARCDoc - http://arcdoc.wordpress.com/

[8] Casale, R., Herrera, R. G., Koek, F., Können, G., Rosario-Prieto, M., Wheeler, D., and Wilkinson, C., CLIWOC: Climatological Database for the World's Oceans, 1750-1850 (Luxembourg: European Community Publication,
2006), p. 6.

[9]Brohan, P., Allan, R., Freeman, E., Wheeler, D., Wilkinson, C., and Williamson, F., eds., 'Constraining the
temperature history of the past millennium using early instrumental observations', Climate of the Past Journal, 8 (2012), pp. 1653-1685, 1654.

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