Minutes of the meeting held at

University of Sussex

on 12th of December 2014

to discuss the status and progress of the McGill University, Indian Ocean World Centre, climate history project, and in particular the role of the group based at Sussex.

Present:

From McGill;

Pablo Arroyo (Pablo.Arroyo@McGill.ca)
Margaret Kalacska (Margaret.Kalacska@McGill.ca)

From Sussex;

Netsanet Kassa Alamirew (N.Alamirew@sussex.ac.uk)
Rob Allan (allarob@googlemail.com)
Vinita Damodaran (V.Damodaran@sussex.ac.uk)
Mick Frogley (M.R.Frogley@sussex.ac.uk)
James Hamilton (J.E.Hamilton@sussex.ac.uk)
Rob Iliffe (R.Iliffe@sussex.ac.uk)
Dominic Kniveton (D.R.Kniveton@sussex.ac.uk)
Melissa Lazenby (M.Lazenby@sussex.ac.uk)
Yi Wang (Yi.Wang@sussex.ac.uk)
Anna Winterbottom (A.E.Winterbottom@sussex.ac.uk)

After an introduction from Dr Vinita Damodaran, in which she extended particular welcome to the visiting guests from McGill, the proposed format of the day's meeting was outlined. The meeting would include talks from Rob Allan on his project on global reconstruction of historical climate; ACRE, Pablo Arroyo and Margaret Kalacska on the McGill's Indian Ocean World project and Yi Wang, Mick Frogley and Dominic Kniveton on their role in that project. In the afternoon, an open session would provide an opportunity for discussion, sharing and clarification of foci, methodologies and approaches, from the scale of individual work packages to the overall trajectory of the project.

Preceding the first presentation, those present introduced themselves, their academic background and their role in the project.

Rob Allan described the beginnings of his academic career in Australia working on climate research at CSIRO (Commonwealth Scientific and Industrial Research Organisation) in Melbourne, where his primary focus was ENSO. Since coming to the UK Hadley centre – the climate research section of the Met Office – some 14 years ago, his focus has been on historical climate reconstruction. The culmination of this work is ACRE (Atmospheric Climate Reconstruction over the Earth), which he has run for the last seven years. Within the McGill project his role is the co-direction of a survey collecting and assessing the usability of documentary evidence on the climate of the C17th in India.

Vinita Damodaran – P.I. on the sub-section of the McGill project being carried out at Sussex – spoke of her background in the environmental history of India, including work on the impact of El Nino. She described her role as director of the CWEH (Centre for World and Environmental History)

at Sussex, which runs a number of networks, perhaps most notably in this context, the AHRC funded network for Collaborative research on the Botanical and Environmental History of the Indian Ocean, 1600 to 1900. A network which brings together over 120 scholars from all over the world, working on various aspects of environmental history in the region, and institutions such as Kew Gardens, The British Library, Jawaharlal Nehru University, the Indian Museum, the India National Archive and the Forest Research Institute of Dehra Dun. Other notable projects run through the centre include a collaboration with Kew Gardens on the Indian correspondence of Joseph Hooker.

Mick Frogley mapped his route through geology and earth sciences to his current position in the geography department at Sussex, where his focus is climate change and paleoclimatology in the quaternary, with a particular focus on the use of lake sediments as a means of reconstructing climate. Geographically he described a shift in focus from the eastern Mediterranean to South America, and now to East Africa and the greater Indian Ocean region. Within the McGill project, he noted his direction of a project collecting paleoclimate sources on the Indian Ocean.

Yi Wang outlined his academic history, including a PhD at McGill and post-doctoral research at the Centre for Climate Research at the University of Wisconsin- Madison. Since 2012 he has worked at Sussex, lecturing and researching in climate change and earth sciences. He described his particular expertise in climate modelling, as well work on impacts of climate variation and extreme weather events at a more subjective level.

Pablo Arroyo – a tropical ecologist by training and research focus – described his position as academic director of the Geographic Information Centre at McGill and his role in the McGill project. A role including academic output looking at the mapping and visualisation of human-climate interactions in the Indian Ocean region (in collaboration with Margaret Kalacska), as well as a more centralising role, helping to coordinate between different groups working on various aspects of the wider project.

Margaret Kalacska – also a tropical ecologist – described a background in remote sensing as it pertains to environmental and ecological issues, as well as work on information visualisation and Beyesian Networks. Within the McGill project her main role – in collaboration with Pablo Arroyo – involves work on mapping of human-environment interactions via Beyesian statistical, probabilistic model networks which are visualised on traditional maps.

Netsanet Kassa Alamirew, James Hamilton and Melissa Lazenby – all graduate students working on the project at Sussex – described backgrounds in geography, environmental history, and earth sciences as well as – in the context of the McGill project – their work on data collection and analysis in various sub-projects or work packages.

Anna Winterbottom, described her position as a Research Associate of CWEH Sussex, where she previously taught, as well as her involvement with McGill's Indian Ocean World Centre as a post-doctoral fellow. Here her work has looked at the Casey Wood collection housed at McGill. Her experience working in environmental history in the Indian Ocean region focussing on medical and botanical knowledge among the non-elite was also noted.

Dominic Kniveton, a lecturer in the geography department at Sussex since 2001, described his expertise in modelling and other quantative methodologies. Extensive work on climate, conflict and migration, primarily in East Africa. In relation to the McGill Indian Ocean World Centre he noted his position as leader of work on the climate modelling sub-project.

Presentations

Rob Allan – Met Office, ACRE

The first presentation was given by Rob Allan. He described the formation of the ACRE initiative, primarily as a self-motivated offshoot of his work at the Hadley centre, which soon became his full time focus. From humble beginnings the project has expanded to become a worldwide effort with partners including the University of Southern Queensland, the Met Office Hadley Centre, the US National Oceanic and Atmospheric Administration (NOAA), the Earth Systems Laboratory, the Cooperative institute for Research in Environmental Sciences (University of Colarado), the National Climate Data Centre, the International Environmental Data Rescue Organisation, the University of Sussex and the British Library. The primary aim of the project is to collect historical climate observations from all over the globe and, via reanalysis (the feeding of observations into weather forecasting software as constraining points), reconstruct historical weather patterns. The current aim of the project is to achieve temporal resolution on the scale of minutes based on a 2°x2° global grid. Professor Allan described the particular opportunities for, and difficulties in, achieving this goal in different regions and time-frames. Regional meteorological stations and ship logs were noted as valuable sources of data, while crowd sourcing, very successfully utilised within astronomy by a galaxy categorisation project and in climate studies by the Met Office 'Old Weather' project, is noted as of great potential in digitising huge amounts of data currently constrained to physical archives. The particular challenge facing the project was seen as the recovery of detailed data for regions which, due to periods of conflict or the often massively destructive processes of de-colonisation, have very little in terms of records. The example of Mozambique – which only became independent from Portugal in 1975 – is given as a region where there are effectively no surviving records. Those that do exist are likely to be held in Portugal.

ACRE sub-projects, each run by a regional collaborator, looking at Canada, Africa, Chile, Arctic, Southern Ocean and more recently S.E. Asia, each having dedicated initiatives, are described, while the formation of a network focussing on China is noted as imminent.

Professor Allan then outlined his work and preliminary thoughts on work package 5 of the McGill project, which looks at C17th sources in the Indian Ocean region. Here he outlined three main goals:

- Identifying gaps in documentary and observational records

- Evaluating the potential to compare paleo data with weather observations from Portuguese, Dutch East India Company and English East India Company ships

- Looking at climate model simulations for this period and the potential for evaluating them against documentary and observational data.

Noting the absence of meaningful instrument data for the period in question, the importance of documentary and proxy sources was emphasised. Dairies, ship's logbooks and gazetteers are seen as of particular importance, these are mostly held in colonial centres, London, Lisbon and the Hague. Climate reconstructions made from proxy sources, are also seen to have significant potential. Though these are somewhat scant for the Indian peninsular, there are numerous studies looking at tree-rings in the Tibetan Plateau.

Pablo Arroyo and Margaret Kalacska –McGill Indian Ocean World Centre

The representatives from McGill described their involvement with the project headed by Professor Gwyn Campbell, the director of the IOWC. They spoke of the difficulties faced in bringing together, processing and presenting the massive quantities of data from a huge variety of sources available for the region. In particular, the requirements of data cleaning were highlighted. In this regard it was noted that input forms including drop-down boxes, restricting answers to a number of pre-defined options, had been very effective in producing usable data, while comment sections allowed for the inclusion of more detailed and nuanced information. As an example of the effectiveness of such as system, it was shown that with unrestricted input where categorisation of the type of disaster was unconstrained, some 100 categories emerged, while with restricted input this had been reduced to six.

A particular visualisation of data was shown as an example of what could be achieved (http://iowp.geog.mcgill.ca/user/login?destination=disaster-map). Here data on natural disasters was represented in the form of a map where points marked events, the number and location, as well as the grouping of certain types of disaster could be easily comprehended while clicking on appropriate markers allowed for further investigation. Rob Allan noted the potential in such a model for identification of the mysterious 1808-1809 super-volcano, which, though recorded in ice cores both in the Arctic and Antarctic, could not be geographically located with any more certainty than to say that it had been located in the tropics.

In addition to data on natural disasters, information on migration was also collected and mapped. As a result, the visualisation was able to go some way toward representing the human impact of natural disasters. The possibility of reconstructing impact and even risk to human populations was described via the use of Beyesian probability models. These calculated numerical values for the probability of migration, conflict or famine, given a certain category of natural disaster in a certain region, at a certain time. An example showed how a drought in a region of Madagascar might promote migration and how an ENSO event might produce famine and migration, particularly to Mauritius and the Indian mainland.

Rob Allan noted that natural disasters must be considered in terms of their duration as well as their ‘depth’, for example, a reduction in rainfall over a large region, for an extended period of time, might be far more impactful than a much more extreme drought lasting for a shorter period and restricted to a smaller area. He also noted the importance of considering ‘pull-factors’ in migration calculations, i.e. a period in which climate was very amenable to certain livelihoods in one region might draw people just as powerfully as a degradation of conditions in their home region. Finally, he emphasised the potential for overlaying ACRE data on such a visualisation. It was noted at this point that considerations of climate in the project were somewhat nascent, and that only two climate datasets had thus far been consulted.

Yi Wang

Dr Wang described his work on climate modelling in the Indian Ocean, investigating links between El Nino and the Indian Ocean monsoon. The primary goal of the modelling project was the determination of the possibility of producing massive shifts in the Indian Ocean weather and climate conditions – particularly those features most important to human livelihoods, i.e. the monsoon or trade-winds – by modelling for extreme expressions of El Nino. Three different types of models were run;

- Fully coupled
- Slab oceans

- Proscribed sea-surface temperature

By simulating permanent El Nino conditions, these models sought to inform understanding of the possibility of extreme EL Nino events producing fundamental, epochal changes in the Indian Ocean Climate. The model, which requires huge computing power and utilises the NERSC (National Energy Research Scientific Computing Centre) super-computer housed at Berkeley, was able to show that a strong El Nino expression could produce significant strengthening of the Indian Ocean monsoon.

Margaret Kalacska noted that some migration reports recorded shipping routes, which might enable the reconstruction of trade winds. Dominik Kniveton suggested the prolonged period of El Nino conditions at the end of the 1800s might present a possible test-case for determining such a linkage.

Mick Frogley

Dr Frogley described a survey undertaken to collect together readily available, published work on the reconstruction of the climate of the Indian Ocean region over the last three millennia. He began by noting the seeming lack of work in this region and the focus of large-scale reconstruction projects such as Pages 2k which is rarely on India. Dr Frogley showed a spreadsheet recording 231 records identified as making reference to the greater Indian Ocean region within the last 3,000 years. Records are categorised here by type of proxy: tree-ring, lake sediment etc. location: both descriptive and lat/lon, duration and resolution. Studies based on data with too low a resolution were rejected. Issues surrounding calibration of sources based on carbon dating of samples were described, it was noted that solar activity is reflected in the quantity of different carbon isotopes taken up by living things and that therefore, calibration curves are continually refined and published. The use of different calibration curves therefore needed to be considered in collating data.

The next step in this project would be the identification of particular events or time-periods, this done, the records could be manually sorted and selected for relevance.

Dominic Kniveton

Dr Kniveton spoke on the responses of certain models to the influence of large volcanic eruptions such as Krakatoa (1883), Tambora etc. observing that many models were unlikely to include a driver from volcanic activity. By way of caution he noted that data point constraint-type reconstructions, while of value are essentially the same thing as modern weather forecasts, and therefore of limited accuracy. Further it was noted that such models are at their best only back to the 1970s, beyond this, the reduced quality and coverage of data degrades model's performance. Discussing proxy sources he noted that many include gaps or other irregularities which make trends difficult to spot, such sources were seen as better suited to the study of discreet events.

Dr Kniveton then showed a number of reconstructions of changes in the Indian Ocean climate in the wake of large eruptions located in the Indonesian archipelago. Models produced outputs for both rainfall and temperature, it was seen that such an eruption might lead to a drying in its own region, an increase in precipitation over India and a general cooling over the entire region. Looking at a period of intense volcanic activity which occurred between 1638-1643 produced no dramatic response but was marked by a slight cooling over India an S Africa. Dr Kniveton concluded his talk by signalling his approval for the McGill project's focus on defining probabilities and suggesting the incorporation of threat multipliers, while cautioning against any language or statement which might suggest environmental determinism.

Discussion

Rob Allan began by suggesting a comparison of model and observational data (probably largely from East India Company ships) on the Tambora eruption of 1815. He noted that he himself, in collaboration with Philip Brohan of the Met office and others, had already published on the subject and also that there were opportunities to link up with the Historical Climatology network – run by CWEH at Sussex – within which there was enthusiasm, as well as concrete plans to mark the two hundredth anniversary of the eruption with a conference and perhaps some publications. He observed that historical work on volcanoes often presents interesting challenges as they can go unnoticed in certain records. In the case of Tambora, many more distant observers thought the sound of the eruptions was gun or cannon fire, furthermore he noted that Tambora was widely known by the alternative spelling 'Tamboro' at the time, and can therefore be easily missed in searching digitised records. Such issues might then help explain the difficulty in identifying the mysterious 1809 eruption. Here it is noted that a quirk of regional politics meant that there were unusually few ships in Indonesian waters at the time, therefore further reducing the likelihood of observations having been made.

Dominic Kniveton observed that dessication appeared to be the main common result of major eruptions, and therefore that pattern of dessication in the period immediately following 1809 might be of potential value in locating the eruption

Rob Allan stated that in his feeling that the primary requirement was richer data. He suggested that a list of all sources and some assessment of the confidence to be placed in them should, or could be compiled. Dominic Kniveton spoke on the reliability of models in this regard stating his opinion that they were, in general, fairly poor on issues relating to the monsoon, but better on ENSO and Indian Ocean Dipole. And, Furthermore, that while most models probably considered Tambora, very few were likely to recognise the mid-C17th high-point of volcanic activity.

Margaret Kalacska stated that while in the early days of the McGill Indian Ocean project the quality of data had not been particularly high, the data cleaning operations of the last year had improved things measurably. Pablo Arroyo noted that data quality had become much more of a focus since the project had moved toward working on the impact of specific, discreet events.

Dominic Kniveton suggested that in order to move forward, the primary thing required by the Sussex group was the definition of a temporal window, and, within this window, the identification of specific events. At this point it would become possible to look more deeply at the available data and to assess what could be done. Mass migrations were seen as a particularly interesting topic particularly given the regional concern over the possibility of huge migrations from Bangladesh into Bengal.

Both Rob Allan and Dominic Kniveton question the timeline for the opening of access to data held by the wider McGill project. In response there is reassurance that this will soon be forthcoming but that the concerns of individual groups and scholars have to be navigated. A large publication, authored by Pablo Arroyo should emerge in the next quarter which will include all the data, at which point it becomes officially attributed and such concerns allayed. The complexity of such a task is emphasised as it is noted that the wider project consists of some 9 separate teams including 37 researchers. In 2015 this will be extended as further 4 teams are set up to tackle current geographic omissions. It is also agreed that the issue of data access for the Sussex group be raised with Gwyn Campbell by Vinita Damodaran,

On the subject of data it is noted by both Vinita Damodaran and Anna Winterbottom that the CWEH AHRC funded Network might have an important contribution to make in terms of locating data.

Dominic Kniveton asked for clarification of those questions central to the wider project. It appeared

that this was perhaps not entirely clear at this relatively early stage, it was suggested that a document outlining the current status of the project should be drafted by Prof. Campbell and sent out to the individual groups.

While Pablo Arroyo stated that the project would be question rather than data led, Anna Winterbottom noted her opinion on the importance of knowing what kind of things could be done with the available data. It was decided that, in part the Sussex group would look to supply this knowledge, which would come in the form of surveys like the one produced by Mick's first work package. Further it was stated that the specific research questions should be expected to be arrived at, in part, by the groups doing the groundwork.

Vinita Damodaran suggested that the first phase of the project should aim to produce a published case-study on human-environment interactions in the region, within the chosen time-scale. Dominic Kniveton noted that if the models being built at Sussex can convincingly show that switches in the monsoon are possible or that significant changes can arise from volcanic forcings, then such results can very quickly be published. Likewise the mapping of climate records onto McGill's conflict and migration data would be immediately publishable.

Pablo Arroyo stated at least one publication would be expected per team to help move the project toward the next phase of funding, Dominic Kniveton suggested that the Sussex group could look at gaining match funding from some UK body and that in doing so, the sharing of McGill's original proposal might be a great help. It emerged that both the pursual of funding and the sharing of the proposal had also been suggested by Prof. Campbell. Rob Allan suggested the Newton Fund and Yi Wang the Horizon 20:20 fund as possible avenues.

The meeting was concluded with Pablo Arroyo emphasising the importance of publications to ensuring ongoing funding beyond the current two-year phase and the all round enthusiasm for the levering of the McGill proposal into applications to other bodies.