

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)

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 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 subvention 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 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 Serbia 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 postdoctoral 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 Bayesian Networks. Within the McGill project her main role – in collaboration with Pablo Arroyo – involves work on mapping of human-environment interactions via Bayesian statistical, probabilistic model networks which are visualised on traditional maps.

Netsanet Kassa Alamirew, James Hamilton and Melissa Lazenby – graduate students working on

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 Colorado), 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 timeframes. 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 decolonisation, 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 subprojects, each run by a regional collaborator, looking at Canada, 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 17th to 19th century maps in the Americas, the Pacific and the Indian Ocean.

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 dropdown boxes, restricting answers to a number of predefined 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 a 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>). 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 1801/1809 supervolcano, 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 Bayesian 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 the

x 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) supercomputer 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 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 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-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 ~~optimal~~, 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 constraints on 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 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 ~~barriers~~ to the study of discrete 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 1633 and 1638 produced no dramatic response but was marked by a slight cooling over India and 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

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-frame. 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 pursuit of funding and the refinement 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-year phase and the all round enthusiasm for the leveraging of the McGill proposal into applications to other bodies.