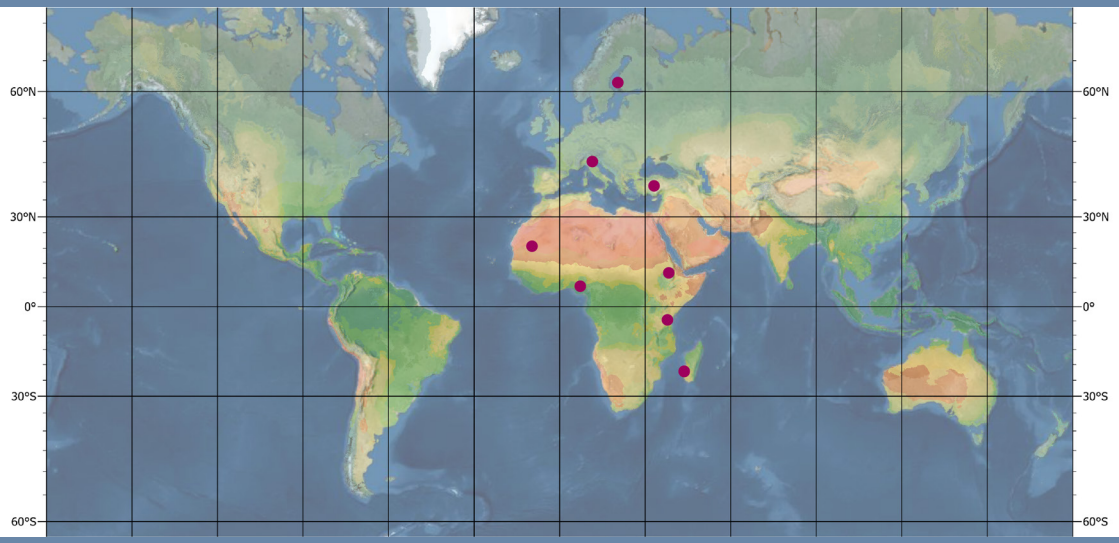
Cross-Cultural and Cross-Latitudinal Responses to Extreme and Unpredictable Weather and Climate Events in the Ancient World

Workshop organised by Ioana A. Dumitru, Rubina Raja, Søren M. Sindbæk and Felix Riede

Aarhus University

30 June 2022



UrbNet
CENTRE FOR URBAN NETWORK EVOLUTIONS

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Outline

As the pace of global climate change is accelerated, questions revolving around the dynamic, long-term relationship between communities and their environment are widely debated across disciplines in the humanities, social, and natural sciences and are increasingly attracting the attention of the general public.

This scholarship is characterized by a Northern Hemisphere bias, with comparatively less focus on reconstructing human responses to paleoclimatic shifts in the Southern Hemisphere. This overreliance on Northern Hemisphere examples is particularly problematic when reconstructions of purportedly global processes are largely based on case studies from northern latitudes.

While sampling case studies across a latitudinal transect (Fig. 1), this workshop seeks to especially highlight the unique challenges encountered by researchers working in the Southern Hemisphere, with comparatively fewer robust datasets, climate archives, and models devoted to understanding community responses to paleoclimatic shifts.

Our primary goal is to explore ways of achieving methodological consistency and robust comparison around models of human responses to extreme or unpredictable climatic shifts. We argue that variability in human responses can best be understood by capturing both geographic and cultural variability. As such, case studies integrated into this workshop will aim for cross-latitudinal and cross-cultural representation by bringing together scholars working from Arctic to Subtropical environments. We will further nuance paleoclimatic models by including multi-scalar perspectives which incorporate datasets that represent responses at different household, community, and societal levels.

Relatedly, we will formulate a set of the affiliated changes correlated with climatic shifts that we would expect to see in the archaeological record. These expectations would take into consideration regional differences as impacted by local socio-political, cultural, and environmental particulars. Furthermore, models would account for the types of fluctuations communities are perennially accommodating without suffering systemic changes. Why does systemic fragmentation or collapse occur when previously the same system was resilient under pressure? We will seek to identify the archaeological proxies associated with changes in social processes such as subsistence strategies, food storage, network structure, mobility, migration, conflict and other relevant correlates of risk management in response to paleoclimatic shifts. A standardized set of expectations around diagnostic archaeological proxies for risk management would also allow us to propose new directions for future research that may fill existing gaps.

This workshop expands the scope of current research being conducted at UrbNet and in the Department of Archaeology and Heritage Studies at Aarhus University, where the impacts of climatic and environmental pressures on the fabric of urban networks, where present, village communities, or other manifestations of socio-political organization are being studied.

Programme - Thursday 30 June

	Session I
8:30 – 9:00	**Welcome and Introductory Remarks** Rubina Raja and Ioana A. Dumitru
9:00 – 9:50	**Volcanic Eruptions, Climatic Shocks and Human Crises in 6th and 17th Centuries CE Finland. Historical Analogue to Prehistoric World?** Heli Huhtamaa
9:50 – 10:10	***Coffee break***
10:10 – 11:00	**The Impact of the 536/540 AD Cluster Volcanic Eruptions on the Central-Eastern Mediterranean** Elena Xoplaki
11:00 – 11:50	**Adaptive Responses to Late Bronze Age Aridity in Central Anatolia** John M. Marston
11:50 – 13:00	***Lunch***
	Session II
13:00 – 13:50	**A Framework for Integrated Flood Risk Governance in Coastal Cities of Sub-Saharan Africa** Olasunkanmi Habeeb Okunola
13:50 – 14:40	**Tending to weather extremes and tempering urban communities in sub-Saharan Africa** Federica Sulas
14:40 – 15:00	***Coffee break***
15:00 – 15:50	**Climatic Shifts and Societal Reorganizations on the Swahili Coast of East Africa** Ioana A. Dumitru
15:50 – 16:20	**End discussion**
16:30	**Departure from UrbNet into town (via taxi)**
17:15	**Speakers' dinner at Restaurant MellemRum**

Note: each talk will be 30 minutes, with 20 minutes of Q&A.

ABSTRACTS

Volcanic Eruptions, Climatic Shocks and Human Crises in 6th and 17th Centuries CE Finland. Historical Analogue to Prehistoric World?

Heli Huhtamaa (Universität Bern)

The 17th century started and ended with devastating famines in Finland (1601–03 and 1695–1697, respectively). In addition, the harvest was destroyed badly in 1641 and people suffered from hunger in the following years. Unexpected cold climatic pulses triggered all of these societal crises. These cold pulses, in turn, are associated with radiative effects of large tropical eruptions (i.e. 1600 Huaynaputina, 1640/1641 Koma-ga-take/Parker, and 1695 unidentified eruptions).

Rich documentary evidence provides detailed material to investigate agricultural, demographic, and economic consequences of these crises with high spatial and temporal precision. By studying these sources, we can find that the societal consequences varied considerably in time, space, and within the society. Whether the volcanic climate events had a strong or weak societal effect, depended on various factors, such as livelihood options, physical and immaterial networks, and institutional practices. These factors influenced societal vulnerability and resilience to cold pulses and the resulting harvest failures.

Yet, the 17th century was not the only period when volcanic cold pulses troubled Finland. Climate reconstruction and model data indicate that the mid-6th century CE was one of the coldest eras over the last two millennia all over the Northern Hemisphere and especially over Finland. As with the 17th century cold pulses, the 6th century event is associated with volcanic eruptions (in 536 and 540 CE). This period is evidenced in the archaeological record with widespread settlement abandonment and population displacement all over the Nordics – expect in Finland! Recent research has concluded that a broad range of livelihood options provided resilience for people to overcome the abrupt climatic shock.

By comparing the societal effects of the 6th and 17th century CE in western Finland, I will demonstrate the complexity of possible causal relationships from a climatic shock to human consequences. For example, to what degree can the detected societal effects be attributed to climatic disturbances, and to what degree can the existing socio-environmental conditions and emerging human actions explain these events? In doing so, I aim to provoke discussion on the challenges and opportunities of using historical examples as analogues to prehistoric events.

The Impact of the 536/540 AD Cluster of Volcanic Eruptions on the Central-Eastern Mediterranean

Elena Xoplaki (presenter) (Justus Liebig University Giessen) and Adam Izdebski (Max Planck Institute for the Science of Human History Jena, Germany and Institute of History Jagiellonian University in Krakow, Poland)

In our talk, we will provide an overview of the immediate (20-30 years) climatic effects of the 536/540 cluster of volcanic eruptions in the Central-Eastern Mediterranean. This cluster of eruptions is often considered the trigger for the so-called Late Antique Little Ice Age. We will use up-to-date palaeoclimate earth system and regional model simulations and the best-dated and highest-resolved proxies available from the area. As a second step, we will look at the highly-resolved pollen records from the same region, trying to identify (possible) responses of vegetation to the 536/540 volcanic eruptions. In particular, we will consider changes in the balance of more- and less-light-demanding plants (as a response to insulation decrease), and changes in olive pollen (as a response to late spring frost destroying olive flowers). In this way, for the first time, we will be able to look into the biophysical impact of the early LALIA phase on the core regions of the Eastern Roman Empire.

Adaptive Responses to Late Bronze Age Aridity in Central Anatolia

John M. Marston (Boston University)

A period of aridity identified in paleoclimatic records from across the eastern Mediterranean around 1200 BCE, known as the "3.2 kya event", has been argued to be one of the major, if not the single primary, cause of the deterioration and "collapse" of Late Bronze Age polities across the region. The extent and impact of this event at both broad and local scales have been debated, but the agency of agricultural specialists in responding to aridity is rarely considered within the grand narrative. Drawing on a recent synthesis of regional archaeobotanical data from central Anatolia and archaeological evidence from several sites therein, I detail flexible agricultural systems that enabled adaptive responses by farmers to deteriorating climate and argue that these successfully mitigated the impact of rapid climate change in an already semi-arid region. Failures of local polities, such as the Hittite state, were more likely political than agricultural in nature, demonstrating the regionally variable social impact of the 3.2 kya event.

A Framework for Integrated Flood Risk Governance in Coastal Cities of Sub-Saharan Africa

Olasunkanmi Habeeb Okunola (University of the Witwatersrand and United Nations University Institute for Environment and Human Security)

In recent years, coastal cities in Africa are experiencing frequent flooding, imposing a heavy burden on vulnerable communities, ecosystems, livelihoods, critical infrastructures, sectors, and systems. This is further compounded by rapid urbanization, rising inequality, and loss of biodiversity, which hamper the progress toward achieving the Sustainable Development Goals (SDGs). Consequently, the succession of these frequent floods has led to devastating direct and indirect impacts on health, social, economic, and financial systems, notably for the most vulnerable in coastal African cities. The 2022 United Nations Intergovernmental Panel on Climate Change (IPCC) working group reports also warned of the imminent increase in the intensity of climate change impacts and the dangers of not acting fast enough. Hence, a paradigm shift in understanding and developing a framework for integrated food risk governance in coastal cities of Sub-Saharan Africa is urgently needed. This is necessary to achieve the ambitious goals of the Sendai Framework to reduce existing and prevent future risks and achieve transitions toward more resilient and sustainable African coastal cities. Multiple methods were adopted to develop the framework including review of literature, laws, policy documents, interviews and stakeholder workshops. The resulting framework consists of three interrelated concepts for appropriate integrative flood risk governance arrangements: institutional interaction; actors' inclusiveness/ relationship, and policy mixes. The three concepts are meant to diagnose integrative flood risk governance. Integrative flood risk governance thus incorporates the institutions, the rules, norms, and regulations that structure interactions and the actors involved, their values, interests, and actions.

Tending to weather extremes and tempering urban communities in sub-Saharan Africa

Federica Sulas (University of Cambridge)

Special reservoirs of biocultural diversity, sub-Saharan African regions are growing too urban and too fast and increasingly vulnerable to extreme climate events according to recent assessments (State of the Tropics 2020; Intergovernmental Panel for Climate Change Sixth Assessment Report 2022). Directly impacting local communities and ecologies, these developments have consequences for global energy and atmospheric circulations too. Mainstream approaches to modelling the impacts of, and responses to, climate extremes in sub-Saharan Africa rely on (palaeo-)rainfall and settlement dynamics in the past and the present: failing or exceeding rainfall as 'the' extreme events, triggering human responses in the form of settlement expansion, contraction, or abandonment. Whilst seemingly effective in modelling 'collapse,' these models fail to explain biocultural persistence through periods of climatic shifts. This is the case of urban traditions developing over centuries amidst shifting rainfall in sub-tropical montane scrubland and savanna biomes. Revising the record from northern Ethiopia and southern Zimbabwe, this paper reflects on the context and scale of urban experiences in these different biomes. Informed by African environmental philosophy, the analysis of biophysical indicators and socioecological practices through time suggests that the impact of and responses to climate shifts are shaped by how communities relate to weather. Whilst conditions and properties differ in time and across space, a focus on weather-community nexus relations over time offers potential to build robust biophysical and socioecological parameters for addressing cross-latitudinal and cultural responses to climate extremes.

Climatic Shifts and Societal Reorganizations on the Swahili Coast of East Africa?

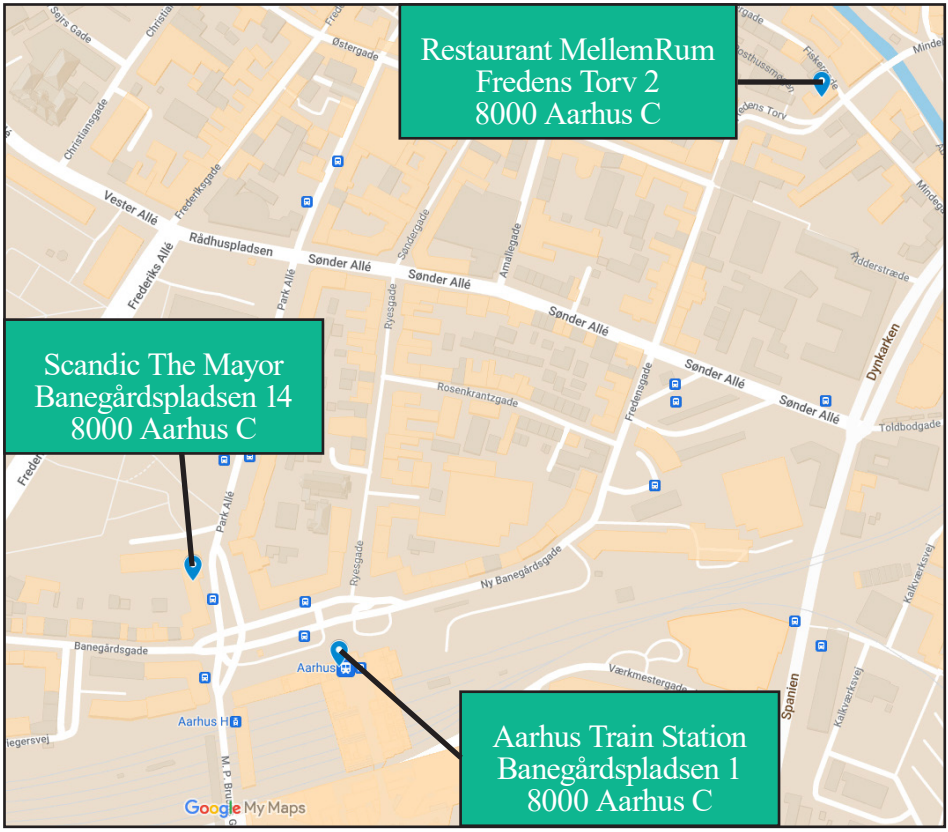
Ioana A. Dumitru (presenter), Søren Munch Kristiansen, Jesper Olsen, Rubina Raja, Søren M. Sindbæk (UrbNet, Aarhus University)

The impacts on the Northern Hemisphere climate of the 536/540 CE cluster of volcanic eruptions are well documented in paleo-climatic archives and Eurasian historical records as is their role in reinforcing dramatic transformations to the established geopolitical order in the Mediterranean Basin and in West Asia. This period also sees a fundamental societal shift occurring in tropical East Africa. Beginning in the late 6th/early 7th centuries, communities of farmers from the arid interior began migrating towards the Indian Ocean Coast initiating a period of rapid settlement expansion that would culminate in the development of the Swahili coastal urban network. We investigate whether the impacts of these eruptions on the tropical East African climate contributed to the timing, scale, and direction of migrations.

Although there is a gap in our understanding of the volcanism-climate system in the Southern Hemisphere, prior work suggests a triggering of the El Niño-Southern Oscillation (ENSO) cycle as a forced response to large tropical volcanic eruptions. Interconnected with other influences including local geographic factors, regional circulation, coastal/marine influences, and remote forcing, the ENSO cycle drives rainfall variability in East Africa. An El Niño-like warming of the equatorial Pacific correlates with a positive Indian Ocean Dipole (IOD) mode that sees warmer SSTs in the western Indian Ocean and increased precipitation in East Africa. However, the region's climate is characterized by high spatial heterogeneity, with sharp transitions between biogeographical regions, resulting in different rainfall patterns within the space of tens of kilometers. For instance, prior work has shown that during an ENSO warm phase, the Lake Victoria region experienced warmer and more humid weather, whereas nearby central Tanzania and eastern Kenya recorded warmer and drier conditions. This same variation is revealed between the coast, characterized by pluvial conditions, and the interior towards the Rift Valley where drought is often recorded.

This pattern is archaeologically meaningful as it relates to the origins of the proto-Swahili peoples. Observational records, climatic simulations, and synthesized paleoclimatic proxy data suggest that by the time this region would have faced the effects of a volcanically-forced ENSO warm phase, it would have been contending with severe drought for over two decades. We, therefore, propose migration towards the coast as a flexible adaptive mechanism in the face of an increasingly untenable environmental setting.

Venues in Aarhus' city centre



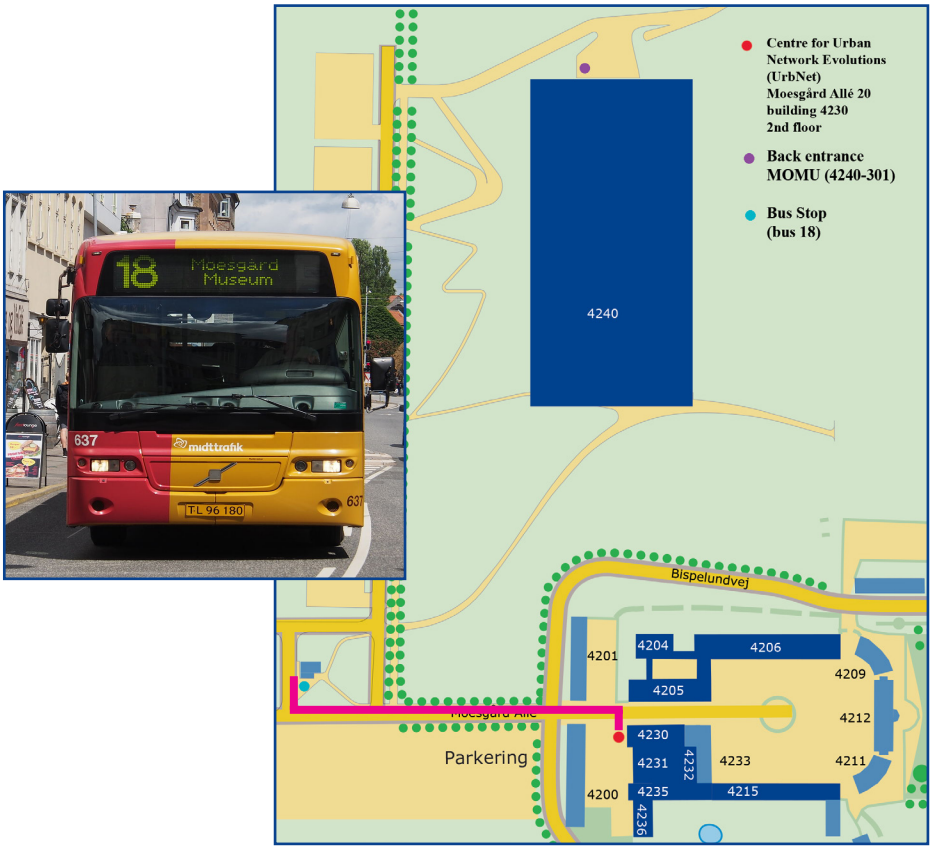
Scan this QR code to open a map with all venues on your smartphone!

Getting to UrbNet/Moesgaard Manor

Centre for Urban Network Evolutions (UrbNet) is located at Moesgaard Manor in Højbjerg, approximately 10 km south of Aarhus city centre.

From downtown Aarhus, you can take **Bus 18**

Bus 18 (see timetable: https://www.midttrafik.dk/media/25732/18_aarhus_bybusser_-_hobitten_b-busser-final-a.pdf) is a yellow city bus, which leaves from Park Allé (next to the hotel) three times an hour (direction: Moesgård Museum). Enter the bus through the back or the middle door and purchase your ticket at the ticket machine (22 DKr in cash). Get off at the bus stop "Moesgård Museum" (end station) - the ride takes approximately 25 min. From there, it is only a 300 m walk to UrbNet (see map below).



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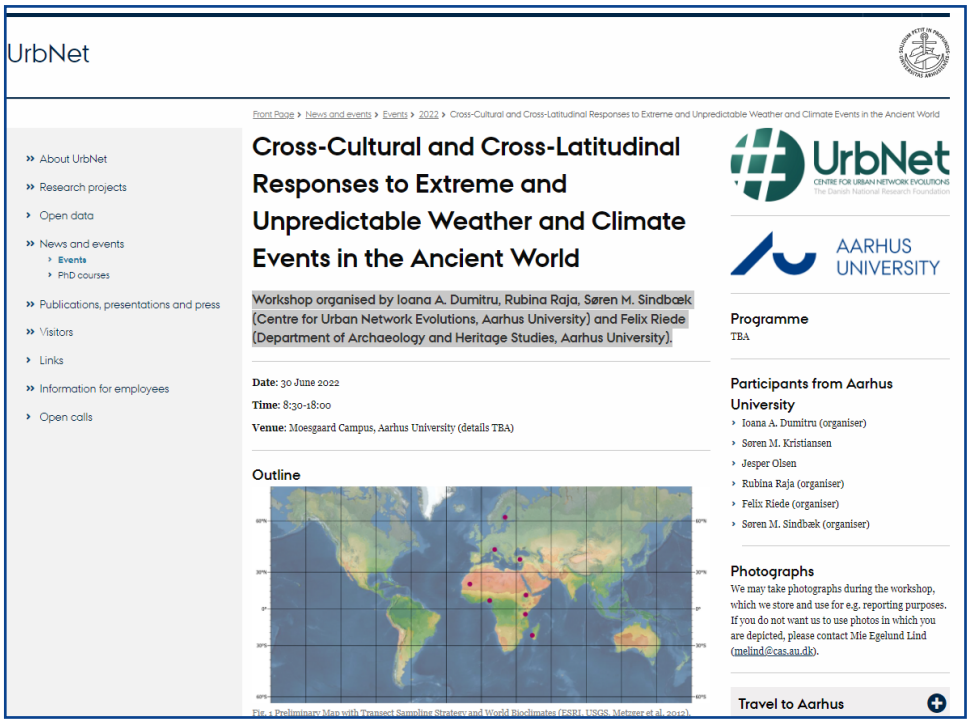
Conference website

https://urbnet.au.dk/news/events/2022/cross-cultural-and-cross-latitudinal-responses-to-extreme-and-unpredictable-weather-and-climate-events-in-the-ancient-world



GDPR

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Book of abstracts

Editors: Ioana A. Dumitru and Mie Egelund Lind

Front cover: Preliminary Map with Transect Sampling Strategy and World Bioclimates (ESRI, USGS, Metzger et al. 2012).