CRC806

- Our Way to Europe -

Book of Abstracts
and
Workshop Information

Workshop on

Paleoclimate Modeling and Aeolian Dust as Climate Proxy

13 - 14 November 2014
University of Cologne

Welcome to Cologne

CRC806 – Our Way to Europe – is a Collaborative Research Centre supported by the DFG (German Research Foundation) for study on the history of early human migration from Africa to Europe (for more information go to http://www.sfb806.uni-koeln.de). One of the objectives of the CRC is, based on paleoclimate modeling and paleoclimate proxies, to understand how paleoclimate changed and how paleoclimate and environmental conditions impacted on the movement of Homo sapiens. The purpose of the workshop is to provide colleagues of similar interests with a platform for the exchange of ideas. The tentative topics we suggest to discuss include

- frontiers of (regional) paleoclimate and paleodust modeling
- overview, value and uncertainties of paleoclimate proxies
- collaboration among groups and individuals on paleoclimate studies

In this workshop, we wish to bring together colleagues with different backgrounds on a list of topics related to paleoclimate modeling, proxies, reconstructions, etc. Overview talks and discussions will be combined to achieve the workshop objectives.

We look forward to this exciting workshop in Cologne.

The organizers,

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Workshop program

Thursday, 13 November 2014

09:15 **Yihui Ding** (China Meteorological Administration, China)
Long-term variations of the Afro-Asian monsoon and its links to climate change

09:50 **Karl-Heinz Wyrwoll** (University of Western Australia, Australia)
The paleoclimatology of the last 25 000 years of the northern Australian summer monsoon: from proxies to models

10:25 Coffee Break

10:50 **Martin Claussen** (Max-Planck-Institute for Meteorology, Germany)
Abrupt climate change in African Quaternary climate: concepts and modeling

11:25 **Tim Brücher** (Max-Planck-Institute for Meteorology, Germany)
Paleoclimate modeling: understanding past fire activity

12:00 Lunch

13:45 **Zhongshi Zhang** (Bjerknes Centre for Climate Research, Bergen, Norway)
Aridification of the Sahara desert caused by Tethys Sea shrinkage during Late Miocene

14:20 **Nicholas Webb** (USDA-ARS Jornada Experimental Range, USA)
Representing historical and future land surface conditions: contemporary insights from Australia

14:55 Coffee Break

15:20 **Adrian Chappell** (CSIRO Land and Water, Australia)
A reduced complexity estimate of aerodynamic properties for land surface models

15:55 General Discussion chaired by **Andreas Hense** & **Michael Staubwasser**

18:00 Workshop Dinner

Friday, 14 November 2014

09:15 **Stefan Kröpelin** (University of Cologne, Germany)

Holocene Climate Change in the Sahara: Control of the planet's largest source of dust

09:50 **Andreas Fink** (Karlsruhe Institute of Technology, Germany)

The importance of representing deep convection for modeling recent and paleo-climates of North Africa

10:25 Coffee Break

10:50 **Finn Viehberg** (University of Cologne, Germany)

Aquatic species succession hindcast the evolution of ecosystems in the Sahara

11:25 **Jan-Berend Stuut** (Royal Netherlands Institute for Sea Research, Netherlands)

Saharan dust from a marine perspective: inferences from the marine sediment archive and observations of modern dust

12:00 Lunch

13:30 **Slobodan Nickovic** (Institute of Physics, Belgrade, Serbia)

Can present-day dust models help to better reconstruct paleo-climatic conditions?

14:05 **Gilles Bergametti** (LISA, France)

Present Saharan and Sahelian dust deposition: extreme events and temporal scales of variability

14:40 Coffee Break

15:00 **Christoph Raible** (University of Bern, Switzerland)

North Atlantic atmospheric circulation changes during glacial and interglacial times

15:35 **Jörg Matschullat** (Technical University Mining Academy Freiberg, Germany)

Aerosol–climate interactions and paleoclimatology – challenging the impossible?

16:10 General Discussion chaired by **Martin Melles** & **Frank Lehmkuhl**

16:45 Farewell drinks/snacks

Abstracts of invited talks

Long-term variations of the Afro-Asian monsoon and its links to climate change

Ding Yihui
National Climate Center, China Meteorological Administration, 100081,Beijing

Abstract:
The present paper includes four parts (1) The Afro-Asian monsoon region and dynamics of the Asian summer monsoon; (2) the dominate modes of the Afro-Asian summer monsoon variability and its links to climate change; (3) present change in the Asian summer monsoon: a weakening monsoon system and (4) conclusions: toward increasing monsoon precipitation and weakening monsoon circulation in a warmer climate.

1. The conclusions are as follows: The African –Asian monsoon system has two leading modes: strong monsoon mode (EOF 1) and weakening monsoon mode (EOF 2). The strong monsoon mode is characterized by: (1) further northern position of the whole ITCZ than the normal; (2) accompanying the northern shift of the ITCZ, the major rainfall belt moves substantially northward as well, extended from North African across central Asia and the Tibetan Plateau down to North China and Northeast China; (3) a warm and humid climate prevails in most of NH African and Asian areas; (4) the strong monsoon broadly corresponds to EOF1 while weak monsoon corresponds to EOF2. The present-day monsoon, mainly following EOF2, is at weakening stage, with a marked inter-decadal variability and (5) the driving forces of the African-Asian-interglacial monsoon system during the glacial period are the insolation forcing the induced by eccentricity – modulated processional cycles, which produces out of phase inter-hemispheric temperature and pressure response and rainfall variability. Generally, the warm climate periods correspond to strong monsoon, while cold periods correspond to weak monsoon. But also possibly, the strong or enhanced monsoon can occur in cold periods with decreasing ice volume, with combined northern and southern pulling or driving.

2. In the future, the East Asian summer monsoon will continue to enhance and the precipitation amount in North China will significantly increase, whereas the South Asian monsoon will continue to weaken, with precipitation patterns to change considerably.

The paleoclimatology of the last 25 000 years of the northern Australian summer monsoon: from proxies to models

Karl-Heinz Wyrwoll[1], Fiona McRobie[1], Thomas Stemler[2], Guangshan Chen[3] and Rhawn Denniston[4]

[1]*School of Earth and Environment, The University of Western Australia*

[2]*School of Mathematics and Statistics, The University of Western Australia*

[3]*Nelson Institute, Center for Climatic Research, University of Wisconsin-Madison*

[4]*Department of Geology, Cornell College, Iowa*

Abstract:

The development of stable isotope speleothem stratigraphies from the summer monsoon region of northwestern Australia and a high resolution paleoflood record has revealed the general trends of monsoon activity over the last c. 25 000 years and highlighted specific millennial-scale events during that time. The presentation will outline the record of monsoon events, as presently known and place these within the context of the dynamics that controlled monsoon activity as revealed by AOGCM experiments. Some emphasis will be placed on connections with Northern Hemisphere drivers, evaluating connections in the context of complex network theory and ascertaining stratigraphic trends through metric space analysis.

Abrupt climate change in African Quaternary Climate: concepts and modelling

Martin Claussen
Max-Planck-Institute of Meteorology and University Hamburg, Germany

Abstract:
Pronounced changes in African climate, specifically during the transitions between glacials and interglacials, have been found in paleo-climatic archives. Some geological records suggest abrupt climate shifts others, more gradual transitions. Here, we present an overview of theory and numerical climate system simulations aiming at understanding these changes. African climate and vegetation shifts were likely induced by large changes in ice masses, ocean circulation and monsoon dynamics, which, in turn, were triggered by variations in the Earth orbit around the sun and subsequent alteration of meridional insolation gradients. It is shown that abrupt change, or 'tipping, could result from a strong feedback between vegetation and climate at different times at different locations. Moreover, strong feedback in one region can lead to 'induced tipping' in other, seemingly stable regions. However, the diversity of plants can affect the strength of biogeophysical feedback. Regions rich in plant diversity may stabilize the system leading to more gradual transitions. As alternative hypothesis, abrupt changes may also emerge from intrinsic threshold behavior of hydrological systems and ecosystems.

Paleoclimate modeling: understanding past fire activity

Tim Brücher
Max-Planck-Institute of Meteorology and University Hamburg, Germany

Abstract:
Fire is an important process that affects climate through changes in CO_2 emissions, albedo, and aerosols (Ward et al., 2012). Fire-history reconstructions from charcoal accumulations in sediment have indicated that biomass burning has increased since the last glacial maximum (Power et al., 2008; Marlon et al., 2013). Recent comparisons with transient climate model output suggest that this increase in global fire activity is linked primarily to variations in temperature and secondarily to variations in precipitation (Daniau et al., 2012).

In this study we address the question, "What is the best way to compare global fire model output with charcoal records?". This is important because (i) the fire model provides quantitative information about burned area and fire-related emissions of CO_2, whereas charcoal-based paleofire data only provide information about relative changes in biomass burning for specific regions and time periods; and (ii) the model can be used to relate trends in charcoal to trends in quantitative changes in burned area or fire carbon emissions. Charcoal records are reported as Z-scores (Power et al., 2008), which is a non-linear power transformation of charcoal influxes. Therefore it is questionable, if for example a 2-fold increase in the standardized charcoal reconstruction reflect a 2-, 200-fold, or any other increase in area burned? Here, we test (i) how well the model can reproduce the reconstructions by applying the same metric and (ii) how far the statistic of model output is affected by applying that metric.

From a modelling perspective, this study helps to validate the capability of a model to simulate past fire activity. In addition, given that the fire model is not tuned by the charcoal data, the overall agreement (on hemispheric scales) illustrates the ability to reconstruct broad changes in paleofire activity from syntheses of paleofire records in the Global Charcoal Database. Even regions which are sparsely covered by reconstructions correlate positively with the model results, pointing to the importance and increased confidence of using both data and models together to provide more complete spatial coverage of past fire activity.

Aridification of the Sahara desert caused by Tethys Sea shrinkage during Late Miocene

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[4]*Institut de Physique du Globe de Strasbourg (UMR 7516), École et Observatoire des Sciences de la Terre, CNRS and Université de Strasbourg, 1 rue Blessig, 67084 Strasbourg Cedex, France.*
[5]*Bjerknes Centre for Climate Research, Geophysical Institute, University of Bergen, Allégaten 70, 5007 Bergen, Norway.*

Abstract:
It is widely believed that the Sahara desert is no more than ~2–3 million years (Myr) old, with geological evidence showing a remarkable aridification of north Africa at the onset of the Quaternary ice ages. Before that time, North African aridity was mainly controlled by the African summer monsoon (ASM), which oscillated with Earth's orbital precession cycles. Afterwards, the Northern Hemisphere glaciation added an ice volume forcing on the ASM, which additionally oscillated with glacial–interglacial cycles. These findings led to the idea that the Sahara desert came into existence when the Northern Hemisphere glaciated ~2–3 Myr ago. The later discovery, however, of aeolian dune deposits ~7 Myr old suggested a much older age, although this interpretation is hotly challenged and there is no clear mechanism for aridification around this time. Here we use climate model simulations to identify the Tortonian stage (~7–11 Myr ago) of the Late Miocene epoch as the pivotal period for triggering North African aridity and creating the Sahara desert. Through a set of experiments with the Norwegian Earth System Model and the Community Atmosphere Model, we demonstrate that the African summer monsoon was drastically weakened by the Tethys Sea shrinkage during the Tortonian, allowing arid, desert conditions to expand across North Africa. Not only did the Tethys shrinkage alter the mean climate of the region, it also enhanced the sensitivity of the African monsoon to orbital forcing, which subsequently became the major driver of Sahara extent fluctuations. These important climatic changes probably caused the shifts in Asian and African flora and fauna observed during the same period, with possible links to the emergence of early hominins in North Africa.

Representing historical and future land surface conditions: contemporary insights from Australia

Nicholas Webb
USDA-ARS Jornada Experimental Range, MSC 3JER, NMSU, Las Cruces, NM, USA

Abstract:
Predicting land surface changes, particularly vegetation growth and the response of plant communities to disturbance and climate change, presents many challenges for understanding past and future environmental conditions. Evaluating the application of land surface models to address contemporary environmental questions can provide insights that can be used to inform paleo-environmental reconstructions. For example, by demonstrating the nature of environmental responses to disturbances and climatic change and, more specifically, by enabling identification of key variables that underpin the magnitude and direction of vegetation change. Here, I will describe the application of the GRASP and AussieGRASS model suite to simulate climate-soil-plant-management dynamics in the Australian rangelands. I will focus on two applications of the models. First, to evaluate the spatiotemporal dynamics of dust source erodibility in western Queensland, and second to evaluate projected climate change impacts on tropical and semi-arid pasture systems. Findings and lessons learned from the model applications will be synthesized to provide recommendations for representing similar processes in paleo-environmental reconstructions.

A reduced complexity estimate of aerodynamic properties for land surface models

Adrian Chappell
CSIRO Land & Water Flagship, Australia

Abstract:
Wind erosion and dust emission models are essential to estimate the lateral and vertical atmospheric fluxes of carbon and nutrients between terrestrial and marine ecosystems and reduce uncertainty of radiative forcing for climate models. Wind erosion models approximate turbulent transfer of momentum by surface roughness elements using roughness density (lateral cover or the frontal area index) and derivations for other influential aerodynamic properties (APs). Estimation of APs over large areas (regions etc.) and for past and future environments is difficult. Classes of cover and vegetation type are frequently derived from satellite remote sensing or in the case of bare surfaces, approximated using geometry. These approaches create surface discontinuities between classes and exclude heterogeneity due to mixtures of different surface types and canopies. Consequently, there is a need to reduce the uncertainty associated with the estimation of APs and develop a holistic approach common for all scales in space and time and mixtures of roughness types. We developed a reduced complexity approach to representing APs using normalised albedo ($N\omega$). We demonstrate how $N\omega$ reduces / removes the confounding spectral influences of colour and moisture etc. to reveal surface structure. We show how $N\omega$ can be retrieved from the Moderate Resolution Imaging Spectroradiometer (MODIS) to estimate aerodynamic properties around Australia prone to wind erosion and dust emission.

Land surface modelling offers a potential platform to develop the relationship between land cover / land use and dust emission for paleoclimate modelling and the use of aeolian dust as a climate proxy. However, land surface models are not typically coupled to dust emission schemes, do not have feedback mechanisms to change over time the soil characteristics and influence land use / cover dynamics. Coupling a wind erosion scheme to an LSM will develop the feedback mechanism, which more realistically represents soil erosion dynamics. Extant radiation components of LSMs dynamically provide the normalised albedo $N\omega$ to estimate APs. Consequently, the development of LSMs using this reduced complexity approach to wind erosion modelling will likely improve the feedback between fluxes of air, water and material.

Holocene Climate Change in the Sahara: Control of the planet's largest source of dust

Stefan Kröpelin
Institute of Prehistoric Archaeology - African Archaeology, University of Cologne, Germany

Abstract:
Desiccation of the Sahara since the middle Holocene has eradicated all but a few natural archives recording its transition from a "green Sahara" to the present hyperarid desert. Our continuous 6000-year paleoenvironmental reconstruction from northern Chad shows progressive drying of the regional terrestrial ecosystem in response to weakening insolation forcing of the African monsoon and abrupt hydrological change in the local aquatic ecosystem controlled by site-specific thresholds. Strong reductions in tropical trees and then Sahelian grassland cover allowed large-scale dust mobilization from 4300 calendar years before the present (cal yr B.P.). Today's desert ecosystem and regional wind regime were established around 2700 cal yr B.P. This gradual rather than abrupt termination of the African Humid Period in the eastern Sahara suggests a relatively weak biogeophysical feedback on climate.

(Abstract taken from: **Kröpelin S**., Verschuren D., Lézine A.-M., Eggermont H., Cocquyt C., Francus P., Cazet J.-P., Fagot M., Rumes B., Russell J. M., Darius F., Conley D. J., Schuster M., Suchodoletz H. v., Engstrom D. R. (2008). Climate-Driven Ecosystem Succession in the Sahara: The Past 6000 Years. Science **320**: 765-768.)

The importance of representing deep convection for modeling recent and paleo-climates of North Africa

Andreas H. Fink
Institute for Meteorology and Climate Research, Karlsruhe Institute of Technology, Karlsruhe, Germany

Abstract:
From the dynamical point of view, the West African Monsoon is more complex compared to other monsoon systems of the Earth. This is, amongst other aspects, related to the frequent occurrence of so-called Mesoscale Convective Systems (MCSs), that once triggered, are self-sustaining, large, and intense precipitation systems. However, a proper simulation of these MCSs is only possible with convection-permitting models (i.e. moist convection is not parameterized) at a horizontal resolution of 3 km or less.

Results from recent research are shown that demonstrates that parameterizing the moist convection leads to considerable errors in the WAM rainfall climatology. This is related to errors in the diurnal cycle of MCS-related convection and ensuing errors in the moisture advection towards the Saharan heat low. The cold-pool outflows, known as haboobs, that are associated with these MCSs are also ventilating and moistening the Sahara and are responsible for about 40% of dust uplift in the boreal summer season. While runs with parameterized and explicit convection may not so much differ in terms of net dust uplift, the uplift occurs in the former simulations for wrong physical reasons. Another typical difference is that with explicit convection, there is a negative “soil moisture-convection triggering” feedback, i.e., new MCSs are initiated over drier soils. Almost all global and regional climate models show a positive feedback.

It is argued that the common practice of tuning coarse resolution models to the present climate cannot resolve the above-mentioned problems in the WAM region. It is especially precarious to apply these models to paleo-climate situations with strongly different sea surface temperature and radiative forcing. Rather two approaches should be pursued to gain new insights into the WAM variability and its causes for present and past climates: (a) To implement computationally inexpensive ways to simulate the effects of cold-pool outflows or (b) to conduct computationally costly time-slice integrations at convection-permitting resolutions.

Aquatic species succession hindcast the evolution of ecosystems in the Sahara

Finn Viehberg
Institute of Geology und Mineralogy, University of Cologne, Germany

Abstract:
Lakes start to exist by forming basins or depressions that are formed and eventually filled with water. Its time of existence is defined by the rate of sedimentation. During this time the diversity of biotic life depends on and is characterised by the local hydrological situation and the property of the chemical and physical parameters of the host water. The species inventory is also restricted by their ecological tolerance and their ability of dispersal. Comparing several Holocene sediment archives in the Sahara, the fossil assemblage of aquatic invertebrates is often a combination of holarctic and afrotropical species which are at it ecological and geographical limits. This is the reason why the interpretation and inference of paleoenvironmental conditions needs special attention. The low species diversity and the lack of modern analogues are the main difficulties when hindcasting quantitative changes, which are necessary for model input.

Saharan dust from a marine perspective: inferences from the marine sediment archive and observations of modern dust

Jan-Berend W. Stuut[1,2]
[1]*NIOZ – Royal Netherlands Institute for Sea Research, Texel, NL-1797SZ, Netherlands*
[2]*MARUM – Center for Marine Environmental Sciences, Bremen, D-28359, Germany*

Abstract:

On a geological time scale the seasonal/monsoonal precipitation in sub-Saharan Africa has shifted zonally, causing abrupt and persistent droughts whenever the summer rains were concentrated further South than at present. These wet-dry alternations are recorded in the marine sediment archive where aeolian dust and fluvial mud are deposited depending on the environmental conditions on land. In addition to the natural variability, land-use plays an active role in the mobilisation of soils as well.

In this talk I will give some examples of studies carried out on deep-sea sediments retrieved off NW Africa with the aim to reconstruct paleo-environmental conditions in the source area(s) of Saharan dust. The proxies I will present are bulk-chemical composition, Sr/Nd isotopes, and particle-size distribution of the terrigenous sediment fraction. The derived aridity records from sediment cores off Mauritania have varying temporal resolution throughout the Late Quaternary.

In addition, I will attempt to ground-truth the inferences made from the sediment archive with modern data from sediment traps that have collected dust over the past few decades and ongoing. The combination of proxies and modern observations offers the unique opportunity to study in high detail the natural versus anthropogenic dust production and transport, as well as their marine environmental effects.

Can present-day dust models help to better reconstruct paleo-climatic conditions?

Slobodan Nickovic
Institute of Physics, Belgrade, Serbia

Abstract:
After two decades from first developments, atmospheric dust models used today for research and operational dust forecasting are capable to describe major components of the emission/transport/deposition of dust with acceptable accuracy. Dust as important factor for paleo, current or future climate interacts with the atmosphere through complex feedback mechanisms, including dust-radiation, dust-cloud, dust-ocean etc. relations. Dust mineralogy plays an important role in most of feedback interactions and it is already incorporated in some dust models. If present-day models should be used in paleo-climate studies, their certain components have to be modified for this specific research. The most probable critical issue will be specification of sources (soil/land cover features) corresponded to paleo periods. In the Workshop, details on the Dust Regional Atmospheric Model (DREAM) and incorporated interactions with the atmosphere will be presented.

Present Saharan and Sahelian dust deposition: extreme events and temporal scales of variability

Gilles Bergametti, B. Marticorena, J.L. Rajot, J. Vincent, B. Laurent, R. Losno, B. Chatenet, A. De Roubaix, E. Bon Nguyen, S. Chevaillier et al.
LISA, Laboratoire Interuniversitaire des Systèmes Atmosphériques, UMR CNRS 7583 - Université Paris Est Créteil- Université Paris Diderot, IPSL, Créteil, France

Abstract:
During transport, dust particles are subjected to deposition processes that strongly affect their atmospheric lifetime and their radiative and geochemical impacts. Dust particles are removed from the atmosphere either by dry deposition (mainly controlled by sedimentation, impaction and diffusion) or by wet removal in or below clouds, all these processes being strongly size dependent. Theoretical models have been developed to describe these processes and parameterizations have been derived in order to represent as precisely as possible the deposition of dust in 3D models. However, direct measurements, especially for dry deposition, are difficult to perform. Consequently dust deposition data sets are sparse, limiting our capability to test the accuracy of the simulations of the dust deposition and thus to really constrain the dust mass budget simulated by these models. Thus, improving our knowledge of the dust deposition is today a key issue for a better understanding of the dust cycle and its impacts.

The presentation will focus on results derived from some new data sets of dust deposition measurements performed in the Sahel and the Mediterranean Basin. These data will be discussed in terms of variability of the present dust deposition at different time scales. Especially, it will be shown that intense dust emissions combined with very efficient deposition events lead to very high deposition fluxes that can represent a large part of the annual deposition flux. Such high dust deposition events can be considered in terms of frequency as “extreme events” and this should be kept in mind when using dust archives to reconstruct past climates.

North Atlantic atmospheric circulation changes during glacial and interglacial times

Christoph Raible
University of Bern, Switzerland

Abstract:
The climate during past glacial and interglacial times is of great interest. On the one hand glacial times are a testbed of a state, which is fundamentally different, compared to today. On the other hand interglacial like the Eemian are thought to be an analog of todays and potentially the future situation. Therefore, over the last decades periods like the Last Glacial Maximum (LGM) round 21 thousand years before the present were extensively studied. Still the proxy data remain sparse ion particularly when going further back in time.

Thus, one way to overcome these limitations and to gain process understanding is the use of climate models. This is especially important for the atmosphere as processes and the dynamics are dominant on shorter time scales, which are hardly recorded by current proxy data. The results presented will focus on the changes of the atmospheric dynamics in the North Atlantic during glacial and inter glacial times. Different aspects of the dynamics are considered ranging from weather type patterns (Hofer et al. 2012a) over storm track characteristics (Hofer et al. 2012b) to variations in the North Atlantic eddy-driven jet stream (Merz et al. 2014), which manifests itself as prevailing westerly winds in the lower troposphere. Characteristics of this jet (Woollings et al. 2014) and the associated North Atlantic Oscillation (Raible et al. 2014) could change implying that the stationarity assumption important in proxy reconstructions is questioned.
Overall the presentation will give an overview of the current state of knowledge on atmospheric circulation changes with implication on how proxy archive interpretation could be affected.

Related References:

Hofer, D., C. C. Raible, N. Merz, A. Dehnert, and J. Kuhlemann, 2012a: Simulated winter circulation types in the North Atlantic and European region for preindustrial and glacial conditions, Geophys. Res. Lett.,39, L15805.

Hofer, D., C. C. Raible, A. Dehnert, and J. Kuhlemann, 2012b: The impact of different glacial boundary conditions on atmospheric dynamics and precipitation in the North Atlantic region, Climate of the Past, 8, 935-949.

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Raible, C. C., F. Lehner, J. F. Gonzalez-Rouco, and L. Fernandez-Donado, 2014: Changing correlation structures of the Northern Hemisphere atmospheric circulation from 1000 to 2100 AD, Climate of the Past, 10, 537-550.

Woollings, T., C. Franzke, D. Hodson, B. Dong, E. Barnes, C. C. Raible and J. Pinto, 2014: Contrasting interannual and multidecadal NAO variability. Climate Dynamics, in press.

Aerosol–climate interactions and paleoclimatology – challenging the impossible?

Jörg Matschullat
TU Bergakademie Freiberg, Interdisziplinäres Ökologisches Zentrum, Brennhausgasse 14, 09599 Freiberg

Abstract *(withdrawn)*:
Two hypotheses stand behind this presentation: 1) That High-Resolution Paleoclimatology is educated guesswork and 2) That to reconstruct aerosol behaviour of the past is as difficult as projecting future aerosol conduct. These hypotheses keep in mind that the overarching questions to be tackled is a reconstruction of boundary conditions for the great human migrations in the Quaternary and mainly in the Holocene.

While we seem somewhat capable of reconstructing paleoclimatological constellations for various world regions and different geological times, the related accuracy and precision often leaves lots to be desired – if our attempt aims at reconstructing such constellations in an information network for e.g., human migration and behaviour within the past two million years – and even more so for the past 10,000 years. To this respect, paleoclimatology suffers from similar restrictions as geology as a science with limited time (and spatial) resolutions, if hypothesis are to be corroborated by testable facts and true evidence.

There is little doubt that atmospheric chemistry influences climate and that this includes aerosol behaviour. As a feedback process, climatological conditions do exert boundary conditions to aerosol behaviour. Yet, aerosol generation derives from various independent sources and their source strength is all but linear or in a steady state. This fact seriously inhibits reliable projections of aerosol behaviour in the (even near) future and thus, it appears only logical that similar constraints apply for any attempt to reconstruct past conditions.

How to overcome such a deadlock? From my perspective, very many more studies are needed on various spatial (and temporal) scales to first obtain much more in-depth experience with aerosol behaviour and its specific time-slice and location-related likely dynamics. Such studies will have to be concerted actions, similar to the recent DFG-supported SAMUM-project (http://samum.tropos.de).