INTIMATE: INTegrating Ice core, MArine and TErrestrial records (60,000 to 8000 years ago)

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INTIMATE aims at developing common protocols and methods to reconstruct abrupt and extreme climate change across the full range of environments (ice, marine and terrestrial) over the period 60,000 to 8,000 years ago. The aim is to better understand the mechanisms and impact of change, and thereby reduce the uncertainty of future prediction.
It is crucial that independent records of abrupt climate change across Europe are generated and robustly compared to test for leads/lags in the climate system and the interaction between different climate forcing mechanisms. Doing so will critically underpin our ability to model future climate change and ecosystem response. The main objectives of INTIMATE are thus to standardize methodologies, incorporate reconstructions within climate models, and facilitate interdisciplinary science collaborations.
Currently, 15 countries are participating in this action, the research is focused in 4 Working Groups that are closely cooperating. If you are interested in participating, please contact the project chair Dr. Sune Olander Rasmussen (olander@gfy.ku.dk), or one of the Working Group chairs.

WG 1 - Dating and Chronological Modeling
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Precise correlation between high precision palaeoclimate archives over the last 60 000 years is critical to gain a better understanding of the exact timing and, hence, mechanisms of past climate change. The abrupt climatic changes in this time-frame occur at millennial to centennial scales and developing and integrating independent chronologies with this level of resolution is a core goal of INTIMATE.
One key issue is building on the improvements in radiocarbon dating and radiocarbon calibration. To most effectively compare datasets through this period this Action will exploit the latest radiocarbon datasets such as the developing Lake Suigetsu terrestrial calibration curve. Chronological control will be augmented by new varved sequences in Europe and Asia, time-parallel marker horizons in the form of pan-European tephra, Greenland ice core reconstructions, speleothem data and geomagnetic excursions. Protocols for the development and application of these methods and their interpretation (including Bayesian modelling using the software programme OxCal) will be developed, and the outcomes of this will be used to help INTIMATE members develop precise and accurate chronological models during COST workshops and other meetings.

WG 2 - Quantification of Past Climate
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The period between 60,000 to 8000 years ago is dominated by significant climatological contrasts; from the highly variable climate of the Dansgaard-Oeschger (D-O) events and the consistently cold millennia of the Last Glacial Maximum (LGM) through to dramatic climatic changes at the glacial termination to mild and stable interglacial conditions in the Holocene (see oxygen isotope record, NGRIP dating group 2008).
Records from studies of multifarious archives of past climate, e.g. ice cores, tree rings, or marine or lacustrine sediments provide valuable information on how local or regional climate conditions changed and – in some cases – how local ecosystems responded to the changes. Palaeoclimate reconstructions have until recently been based on proxy data (in particular pollen) described on a qualitative basis. Although such an approach has some value in providing a general scheme of events, there are inherent problems including the interpretation of proxy data, disentangling different climate signals, temporal sensitivity of proxies to climatic change and the value of qualitative terms.
While the individual records are valuable for the understanding of our climate, the study of the integrated records paves the way for a deeper understanding of the processes and feedbacks active in the climate system. For example, when records from neighbouring locations are precisely compared, it is possible to identify possible leads and lags between the records and to set up time lines of events for past periods of climate change. Time lines like these are of paramount importance for the understanding of the dynamics of the climate system because they are the starting points for making hypotheses about not only the dynamics, but the mechanisms, of past climate change, and allow for testing of these hypotheses, adding to our understanding of the ice-sea-atmosphere interactions and feedbacks during periods of abrupt and extreme change.

NGRIP dating group, 2008.

WG 3 - Modelling Mechanisms of Past Change
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This WG will optimize methodologies to evaluate model simulations with the aid of suitable palaeodata. Model-data comparisons are considered a challenge because the characteristics of model output and palaeodata are very different and many sources of uncertainty exist. Climate is represented at different spatial scales: local in proxy records, several hundred kilometres or more in models. Further, the registered variability in proxies is only partly caused by climatic variations, so that it is necessary to isolate the climatic signal using statistical methods and to represent the non-climatic residuals by a suitable stochastic model. Finally, the responses of the proxies to the local or large-scale climate may be non-invertible.

The activities will be focused on:
1. Transient simulations of the last termination using coupled atmosphere-ocean-vegetation models with dynamical ice-sheets.
2. Compilation of forcings for transient simulations, which require high quality data-sets with information on the forcing.
3. Evaluation of experiments with comparison to high-quality climate reconstructions from key locations, in different environments. The simulations can be employed to establish the key locations.
4. Exploring downscaling techniques to bridge the difference in spatial scales between proxy records and climate models.
5. Evaluating different forward modelling efforts, where appropriate process-based (physical, biological, chemical) or empirical models are driven by climate model output to simulate a proxy value or time series, which is then compared with the actual proxy data.
6. Assessing the potential of data assimilation to improve model-data comparisons.
7. Carbon cycle modelling, to provide important new insights on the role of carbon cycle feedbacks during past changes.

WG 4 - Climate Impacts
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This WG will integrate the impacts of climate changes 60,000 to 8000 years ago on biota in the European region. The biota will range from biomes through ecosystems to individual species and will include both the terrestrial and the marine realms.
Vegetation and faunal changes (including migration) have long been recognized in terrestrial and marine records throughout the region. An attempt to synthesise them in time and space will be made in this COST Action.
The development of a North Atlantic-wide database will identify spatial and temporal changes through 60,000 to 8000 years ago. This will ultimately lead to a quantification of climate thresholds applicable to climate sensitive species/genera. The chronology from WG1 will be indispensable here.
Furthermore, this WG will explore the relationship between identified genetic changes, including extinction and migration, and significant climate changes in the North Atlantic region.
In practice, this WG will bring together specialists working on individual taxa and assemblages, including plants, important microfauna, and larger mammals, including humans. The integration of existing databases with the high-resolution palaeoclimate chronologies and models being developed and integrated in the other WGs.
Eventually we will then be able to compare the best data-sets of flora and fauna with the integrated palaeoclimate and model reconstructions.

INTIMATE is recognized and supported by INQUA an has existed since 1995, but the activity has increased recently as INTIMATE was established as a European Union-funded COST Action (ES0907). Within the framework of the INTIMATE COST action (2010-2014) several international workshops will be organised focusing on the different Working Groups topics and overall aims. For the INTIMATE COST action a number of grants for Short Term Scientific Missions (STSMs) are available.

For more information on the INTIMATE project or to join, visit http://cost-es0907.geoenvi.org/