The iGlass Consortium - Using interglacials to assess future sea-level scenarios

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I. The iGlass consortium

The iGlass consortium brings together scientist from different fields to look at the past and future developments of global sea-level. Together with the academic and non-academic partners the projections for plausible future sea-level change should be improved and brought to the target community.
The major aims are to quantify the sea-level variations in past interglacials and to investigate relationships between the global ice volumes and the climatological control processes.
For this the consortium members use four main steps to reach these aims:

1. Acqusition of new relative sea-level data
2. Modelling of the isostatic effects
3. Synthesis of paleoclimatic data and modelling of interactions between climate and ice sheets
4. Synthesis and modelling of future sea level change

Members:
University of Southampton/National Oceanography Centre
University of York
University of Oxford
Durham University
University of Bristol
National Oceanography Centre Liverpool
British Antarctic Survey

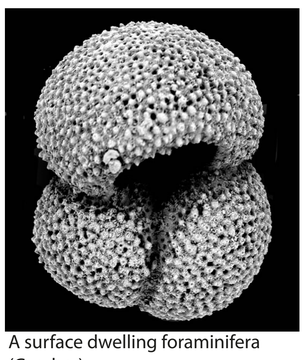
Partners:
academic: University of Ottawa, Australian National University
non-academic: UKCIP, Environmental Agency, Willis Ltd

Alex Thomas (University of Edinburgh) investigating cave deposits

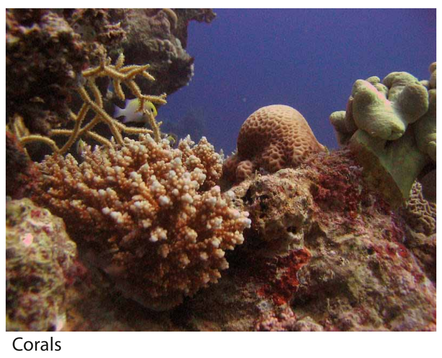
Natasha Barlow and Antony Long (University of Durham) coring estuarine deposits

II. Aquisition of new and old Data

An important part of the project is the aquisition of new paleoclimatic sea-level indicators. New sea-level information are gathered from the UK, Bermuda, Sardinia and the Red Sea. The used archives are sediments from estuarine environments, corals and foraminifera gathered from marine sediment cores and speleotherms from cave depositions.
Furthermore, it is the aim to collect and quality assure already published datasets from these fields. All of the data is used, to compile a global synthesis of sea-level indicators of the times of the last interglacials.

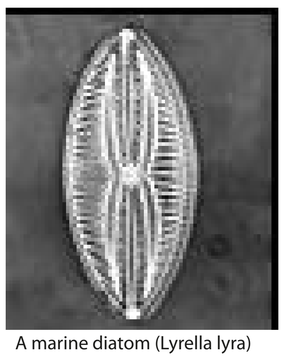


A surface dwelling foraminifera (G. ruber)



Corals

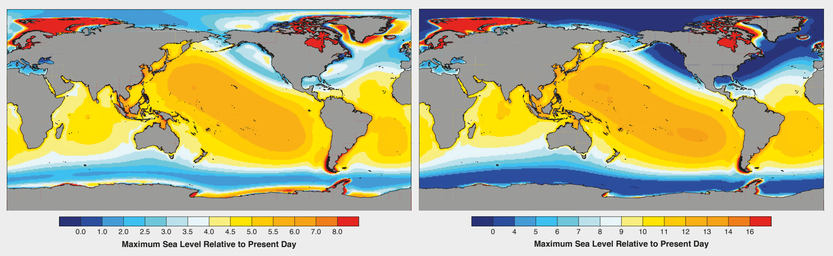
Marine Sediment core from the Red Sea



A marine diatom (Lyrella lyra)

III. GIA modelling

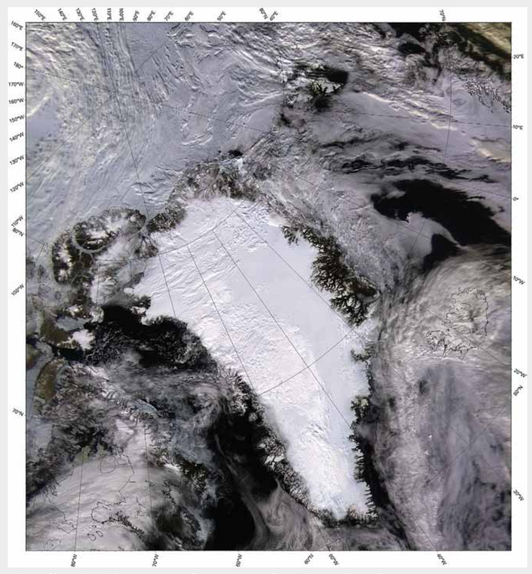
To analyse the sea level on longer time scales, the response of the earth and oceans to the developing ice sheets has to be considered. This process is called glacial isostatic adjustment (GIA). It shows how crustal deformation and changes to gravity affect sea-level.



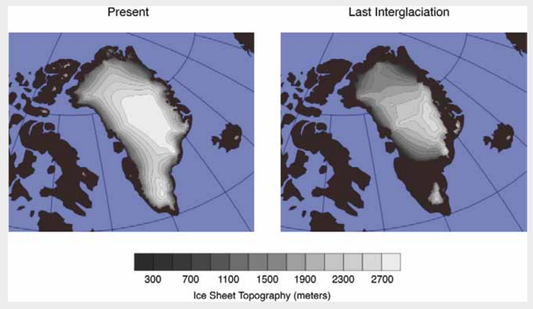
Maximum Sea-level relative to today during the Last Interglacial (118-130 kyr) for two different ice models. The transition between blue and red is approximately the global mean value for the each model run.

IV. Modelling of ice sheets

To model the Greenland and Antarctic ice sheets during the past interglacials, climate parameters are collected and used. These parameters are gained from proxy information contained in ice cores and marine sediments.
A main aim is to model the ice sheets during the last five interglacials at the Marine Isotope Stages (MIS) 1 (~11 kyr BP), 5e (~130 kyr BP), 7 (~244 kyr BP), 9 (~334 kyr BP) and 11 (~427 kyr BP).



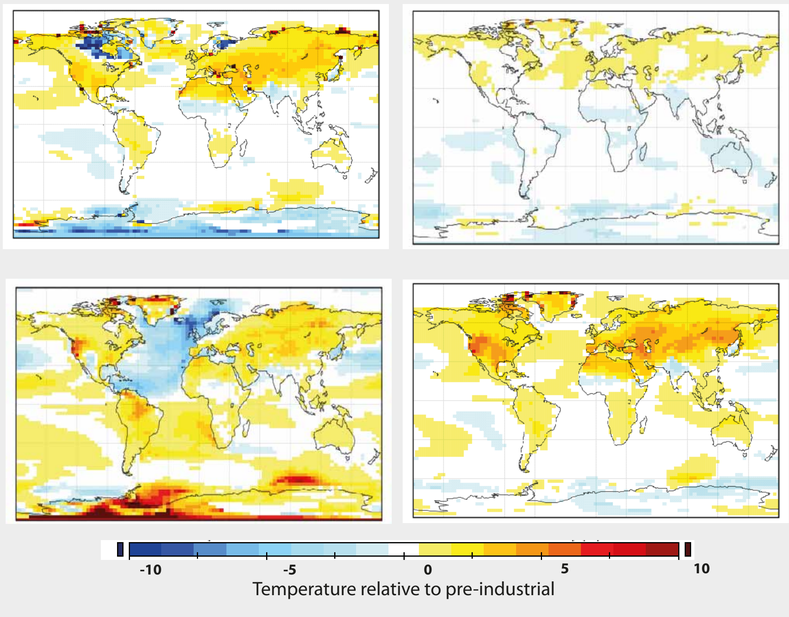
Satellite (GIS) image of present day Greenland



Model experiments by Otto-Bliesner et al (2006) of present day and Last Interglacial ice extent at Greenland

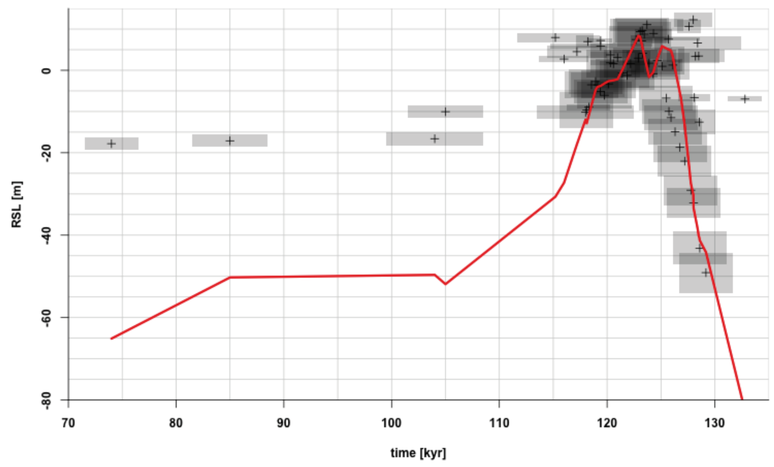
V. Synthesis and modelling the future

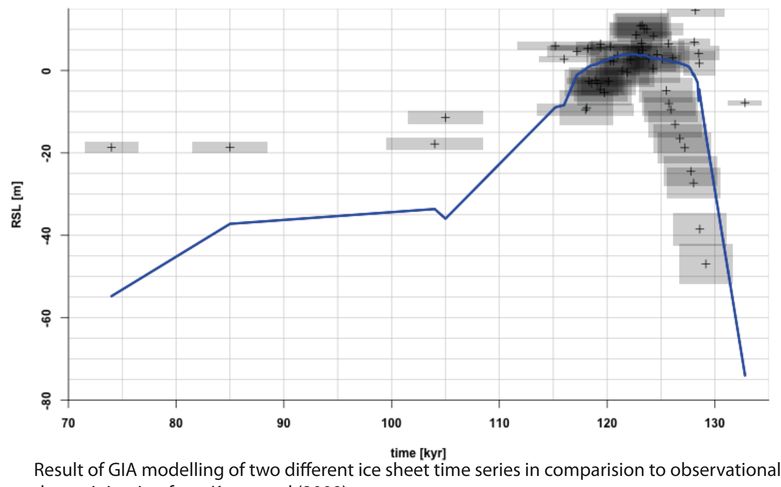
The information gained from the analysis of the paleodata and the modelling experiments will be used to model the potential future developments of the sea-level. A basis for the future climate forcings will be the scenarios and projections by the IPCC. An aim is to estimate an extreme scenario of mean sea-level in the upcomming centuries.



VI. Contributions of NOC Liverpool

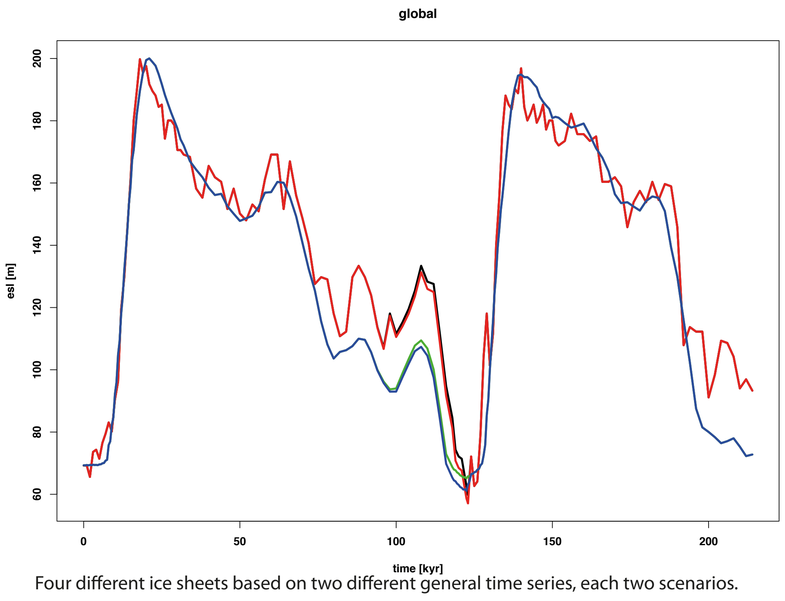
The NOC Liverpool contribution is the GIA modelling component of the project. These modelling results will be connected statistically to the sea-level observations during the last interglacials.





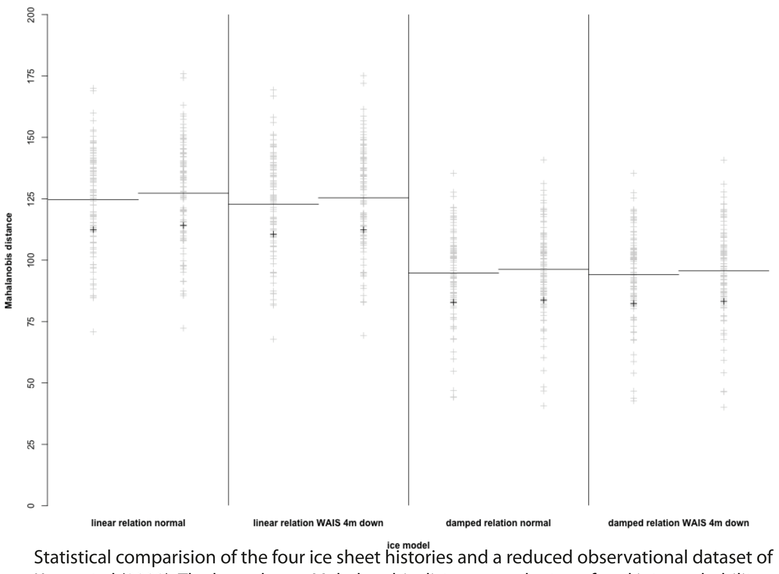
Result of GIA modelling of two different ice sheet time series in comparision to observational data originating from Kopp et al (2009).

With the help of GIA models a given global ice sheet configuration is used to calculate the local sea-levels over the globe. The results depend not only on the ice-sheets, but also on the parameterised reaction on glaciation and deglaciation reaction of the earth.



Four different ice sheets based on two different general time series, each two scenarios.

A main focus is the influence of the different ice-sheets on the sea-level variations during the last Interglacial. With an ensemble approach, different ice sheet configurations are calculated and compared statistically to the available observations. An aim is to identify the main source for the sea-level rise during the interglacials.



Statistical comparision of the four ice sheet histories and a reduced observational dataset of Kopp et al (2009). The here shown Mahalanobis distance can be transfered into probability statements

Literature:
Kopp et al. (2009), Nature, 462, 863-867
Otto-Bliesner et al (2006), Science, 311, 1751-1753

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