CENTRE FOR ICE AND CLIMATE

Our vision is to contribute to the knowledge of climate variations and global warming by producing new and innovative ice core data and use them for climate research through modelling

Centre of Excellence ends

After 10 years, the centre of excellence is coming to an end. Observations and interpretation models have been succesfully integrated and we have reached our goal – to increase knowledge on the past climate with special focus on the warm periods in the past. New grants offer new opportunites related to the study of abrupt climate change during the glacial (focus of the ERC Synergy project Ice2Ice) and understanding ice streams and improving estimates of future sea level rise (focus of the AP Møller grant for EGRIP and the VILLUM Investigator project IceFlow). We celebrated the end of ten succesfull years on March 31st, 2017, and we are looking forward to the new challenges.

Bromine – a new and promising proxy for sea ice

The extent of first-year sea ice in the Arctic has been reconstructed by a new method of Bromine measurements in ice cores. It has thus been possible to find a parameter that informs on sea ice production, which has been difficult to reconstruct.

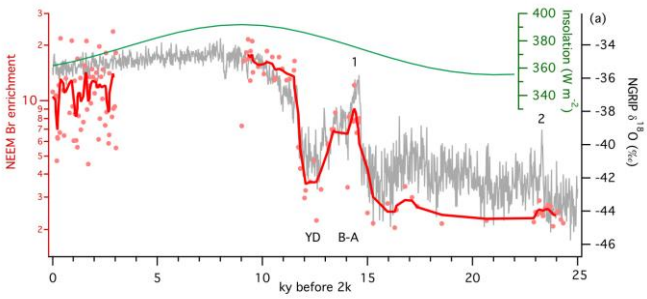

Figure 1. Measurements of Bromine enrichment (red) compared to the climate record ($\delta^{18}O$ – an indirect measure of temperature) from NEEM for the last 25,000 years (Spolaor et al., Scientific Reports 6, 33925, 2016).

Figure 1 shows how the Bromine enrichment correlates with the past temperatures. There was more first-year sea ice during the climatic maximum 9,000 years before present where temperatures were 2-3°C higher than at present (1950-1980). During the glacial period, the Bromine enrichment was lower, indicating more multi-year sea ice. The clear correlation between first-year sea ice and temperature informs that multi-year sea ice is likely to give way to first-year sea ice as the Arctic keeps warming.

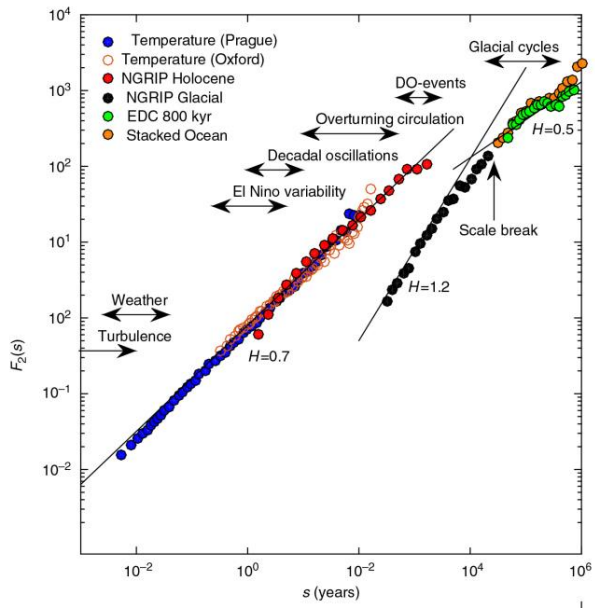

Figure 2. Fractal spectrum of past climate for different time periods (Shao and Ditlevsen, Nature Communications 7, 10951, 2016).

Variability of the climate

Scale analysis of the varibility of the past climate reveals that the Hurst exponent H is 0.7 during interglacial climate (blue and red points on Figure 2) and 1.2 during glacial climate (black points). This remarkable shift of the noise helps characterize the climate system and might give us an early warning beforethe occurrence of abrupt climate shifts. The results demonstrate excellently the integration of observations and models which has been a key objective of the Centre for Ice and Climate.

Thanks to the DNRC

The ten years of research into the warm climate periods of the past – including the drilling and analysis of the NEEM ice core and the development of interpretive models – have been fantastic. Many thanks to the Danish National Research Council!