High latitude temperature evolution across the Last Interglacial: new data synthesis and model-data comparison

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Résumé

The Last Interglacial (LIG, 129-116 thousand of years, ka) represents a test bed for climate model feedbacks in warmer-than-present high latitude regions. However, mainly because aligning different palaeoclimatic archives and from different parts of the world is not trivial, a spatio-temporal picture of LIG temperature changes is difficult to obtain.
Here, we have selected 47 polar ice core and sub-polar marine sediment records and developed a strategy to align them onto the recent AICC2012 ice core chronology. We provide the first compilation of high-latitude temperature changes across the LIG associated with a coherent temporal framework built between ice core and marine sediment records. Our new data synthesis highlights non-synchronous maximum temperature changes between the two hemispheres with the Southern Ocean and Antarctica records showing an early warming compared to North Atlantic records. We also observe warmer than present-day conditions

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that occur for a longer time period in southern high latitudes than in northern high latitudes. Finally, the amplitude of temperature changes at high northern latitudes is larger compared to high southern latitude temperature changes recorded at the onset and the demise of the LIG.

We have also compiled four data-based time slices with temperature anomalies (compared to present- day conditions) at 115 ka, 120 ka, 125 ka and 130 ka and quantitatively estimated temperature uncertainties that include relative dating errors. This provides an improved benchmark for performing more robust model-data comparison. The surface temperature simulated by two General Circulation Models (CCSM3 and HadCM3) for 130 ka and 125 ka is compared to the corresponding time slice data synthesis. This comparison shows that the models predict warmer than present conditions earlier than documented in the North Atlantic, while neither model is able to produce the reconstructed early Southern Ocean and Antarctic warming. Our results highlight the importance of producing a sequence of time slices rather than one single time slice averaging the LIG climate conditions.