



Glacial Inceptions: Past and Future (Alfred Wegener Medal Lecture)

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Determining the causes and mechanisms of glacial inceptions during the past half million years has challenged scores of climate theoreticians and modellers. After introducing the basic Milankovitch theory of glaciation, I will review a number of earlier modelling studies on past glacial inceptions which have employed high-resolution GCMs or EMICs (Earth system Models of Intermediate Complexity). The latter class of climate models has been developed over the past two decades in order to investigate the many interactions and feedbacks among the geophysical and biospheric components of the Earth system over long time-scales.

Following an overview of various EMICs from Europe and North America, including the McGill Paleoclimate Model (MPM), I will present some recent simulations of the last glacial inception (LGI) in response to orbital (Milankovitch) and radiative (atmospheric CO₂) forcing. Special attention will be given to determining the relative roles of the ocean thermohaline circulation, freshwater fluxes, orography, cryospheric processes and vegetation dynamics during the inception phase.

The lecture will conclude with a discussion on the (possible) occurrence of the next glacial period. To address this issue, which has been inspired by recent Berger-Loutre papers with titles like "An exceptionally long interglacial ahead?", I shall present EMIC simulations of the climate for the next 100 kyr which are forced by a various prescribed atmospheric CO₂ levels, as well as insolation changes. The influence of a near-term global warming scenario on glacial inception will also be examined.

Finally, the recent simulations of glacial inceptions in the Potsdam (PIK) EMIC which includes an interactive carbon cycle will be described. It is not inconceivable that due to human activities, the current interglacial will last for at least another half million

years.

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