Collapse of the former Barents Sea Ice Sheet: an analogue for a future West Antarctica

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Project description:

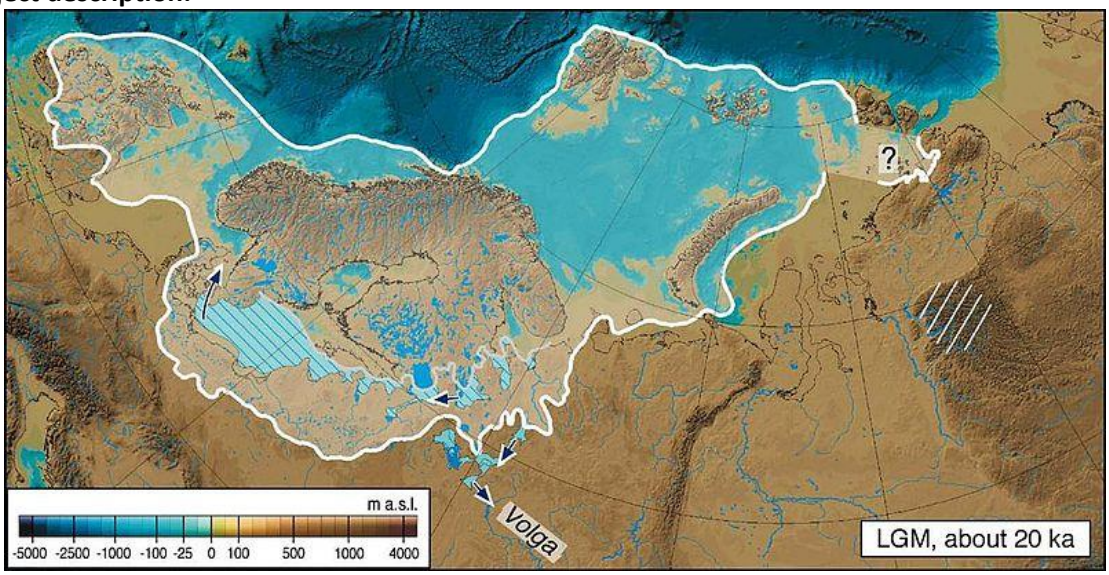

Figure 1. Map indicating the extent of the Scandinavian and Barents Sea ice sheets during the Last Glacial Maximum. The Barents Sea ice sheet occupied the large shelf sea with present-day water depths up to 600 m.

The Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) identifies the loss of the marine sectors of the Antarctic ice sheet through the process of Marine Ice Sheet Instability (MISI) as the major uncertainty in projecting future sea level over the remainder of the 21st century. While models of the ice sheet have developed enormously over the last five years, they cannot be adequately tested using contemporary observations because of the short duration of the available record (primarily from satellite imagery of the last few decades) compared to the likely duration of MISI between centuries and millennia.
This lack of test data hampers the development of models capable of simulating the MISI and therefore the credibility of the projections of future sea-level made by these models.

The marine-based former Barents Sea ice sheet (BSIS), which has been studied extensively over the past 30 years, is the best available analogue to the West Antarctic ice sheet (WAIS) and occupied the present-day Arctic shelf sea (Figure 1). The BSIS occupied a similar area to the WAIS (1.4 compared to 2.0 million square kilometres) but is shallower (water depths up to 600m compared to well over a kilometre for WAIS after isostatic rebound is taken into account). The retreat chronology and size of the former ice sheet is relatively well known from a variety of data sources including seafloor and terrestrial glacial landforms and sea-level records from the area (Ingólfsson and Landvik 2013).

The project will simulate the growth and decay of BSIS using the advanced ice-flow models BISICLES (Cornford et al. 2013), which is one of a new-generation of models specifically designed to accurately simulate grounding-line retreat and the MISI.

References:

Cornford, SL, et al. (2013) Adaptive mesh, finite volume modelling of marine ice sheets, Journal of Computational Physics 232, 529–549.

Ingólfsson, O., and J.Y. Landvik (2013) The Svalbard - Barents Sea ice-sheet: Historical, current and future perspectives, Quaternary Science Reviews 64, 33-60.