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# The last deglaciation of the south-eastern sector of the Scandinavian Ice Sheet

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The Scandinavian Ice Sheet was an important component of the global ice sheet system during the Last Glacial Maximum. Nevertheless, the timing of its growth to or retreat from its maximum extent remains poorly constrained, preventing an assessment of the sensitivity of the Scandinavian Ice Sheet to climate change and its contribution to global sea level change. Here we report 115 cosmogenic $^{10}$Be ages on six prominent end moraine belts deposited by the south-eastern Scandinavian Ice Sheet margin. These data, combined with 70 new and existing radiocarbon ages, constrain the timing of three significant ice-margin fluctuations between 25 and 12 kyr BP. These results make this sector of the ice sheet among the best dated of any of the former Pleistocene glaciers and ice sheets. Accordingly, these results allow us to assess the contribution of the ice sheet to the large and often abrupt sea level and climate changes since the Last Glacial Maximum 21,000 years ago. The south-eastern Scandinavian Ice Sheet margin advanced into the Baltic lowland after 24 cal kyr BP and reached its maximum extent after 21 cal kyr BP, indicating a near-synchronous expansion of the western and southern Eurasian Ice Sheet margins during the Last Glacial Maximum. Initial deglaciation at 19.0 $\pm$1.6$^{10}$Be kyr indicates that the Scandinavian Ice Sheet may have been an important source of an abrupt 10-15 m rise in global sea level 19 kyr BP. Subsequent fluctuations of the south-eastern Scandinavian Ice Sheet margin occurred at the same time as changes in North Atlantic climate, demonstrating a high sensitivity

of Scandinavian Ice Sheet surface mass balance to changes in the Atlantic meridional overturning circulation (AMOC). However, our new chronology reveals that the sign of Scandinavian Ice Sheet response to AMOC changes during cold climates was opposite to that during warm climates, reflecting the dependence of ice sheet mass balance on mean climate state. These responses are exactly of the kind that are expected for the Antarctic (cold climate) and Greenland (warm climate) ice sheets as the Earth's surface temperature warms in the coming century, and thus provides a striking validation of such behaviour. Moreover, the slow rate of ice-margin retreat starting at 14.6 $\pm 0.3^{10}$Be kyr suggests that the Scandinavian Ice Sheet was not a significant contributor to global sea level rise in response to Bølling warming.