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North and South: Equal melting from each hemisphere raised ice age sea levels

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The gargantuan volumes of meltwater that boosted sea levels during the most recent round of ice ages derived equally from ice sheets in the Northern and Southern Hemispheres, according to new simulations of ocean currents.

Between 65,000 and 35,000 years ago, the planet's climate was much colder and more variable than it is now. For example, global average temperatures warmed significantly at least four times, melting land-based ice sheets and raising sea levels by dozens of meters before cooling set in again, says Mark Siddall, an oceanographer at the University of Bern in Switzerland.

Many scientists assumed that most of the meltwater released in the 30,000-year period came from ice sheets in the Northern Hemisphere. During the cold times, ice masses could readily spread across continental land areas, thereby storing water as ice at heights above sea level.

That seemed an unlikely scenario for the Southern Hemisphere, where Antarctica is surrounded by ocean. Growing ice sheets on that small land mass would simply flow off the edge of the continent.

Siddall and his colleagues used a computer model of ocean currents to analyze various meltwater scenarios during an average, theoretical warming spell in which sea level rose about 30 m over about 1,500 years.

According to the model, if all the fresh water came from ice sheets in the Northern Hemisphere, the salt- and temperature-based circulation that drives ocean currents would shut down. Also, sea-surface temperatures in the North Atlantic would drop much below those indicated by oxygen isotopes in surface plankton that lived in that era. That mismatch renders the north-only scenario unlikely, the researchers argue.

On the other hand, if all of the meltwater came from Antarctica, it would have changed a current that runs northward along the floor of the Atlantic Ocean. The model predicts ocean temperatures that disagree with those inferred from that era's deep-sea plankton. So, a strictly southern source of the meltwater also seems improbable.

Among the scenarios analyzed by Siddall and his colleagues, the one in which half the fresh water comes from Antarctica produces ocean temperatures that most closely correspond to the temperatures indicated by fossil plankton. The researchers, who report their findings in the Aug. 26 *Nature*, suggest that Antarctica wasn't a stable reservoir of glacial ice.

Results of the study are "interesting," says Wallace S. Broecker of the Lamont-Doherty Earth Observatory in Palisades, N.Y. However, he's reserving judgment on the theory until the researchers can show that their model simulates climatic effects of meltwater at the end of the last ice age, about 10,000 years ago. Scientists know more about that period than about the era simulated in the current analysis, he notes.

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Further Readings:

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