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Massive subtropical icebergs and freshwater forcing of climate

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High resolution seafloor mapping shows incredible evidence that massive (>300m thick) icebergs drifted more than 5,000 km along the United States continental margin to southern Florida during the last deglaciation. Here we discuss how the discovery of icebergs in this location highlights a previously unknown ocean circulation pathway capable of transporting icebergs and meltwater from the Northern Hemisphere ice sheets directly to the subtropical North Atlantic. This pathway questions the classical idea that freshwater forcing from meltwater floods and icebergs occurred primarily over the subpolar North Atlantic (50N - 70N), with little penetration to subtropical latitudes, south of 40N.

Using a sophisticated, high-resolution (1/6 deg.) ocean model, capable of resolving the circulation of the coastal ocean in detail, we show that icebergs off the coast of Florida likely calved from ice streams in the Gulf of St Lawrence and Hudson Bay. We find that icebergs can only drift south of Cape Hatteras, and overcome the northward flow of the Gulf Stream, when they are entrained in a narrow, southward-flowing, coastal meltwater flood originating from the Laurentide Ice Sheet. This cold meltwater increases iceberg survival in the warm subtropics and flows in the opposite direction to the Gulf Stream along the coast, allowing icebergs to drift to southern Florida in less than 4 months. We conclude that during the last deglaciation, icebergs drifted south in massive meltwater floods that delivered freshwater to the subtropical North Atlantic. Our findings have important implications for understanding how changes in freshwater forcing triggered past abrupt climate change.