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Hudson valley floods an unlikely trigger for Inter-Allerød Cold Period (IACP) cooling 13,300 years ago

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It has long been hypothesized that periodic meltwater input from a retreating Laurentide Ice Sheet (LIS) inhibited North Atlantic deep water (NADW) formation, weakened the strength of the Atlantic Meridional Overturning Circulation (AMOC), and triggered several cold periods in the North Atlantic region during the last deglaciation (21-8ka yrs BP). Since the establishment of this hypothesis more than thirty years ago, geomorphic and chronologic evidence of meltwater flows from the LIS have been shown to roughly coincide with centennial-to-millennial scale cool periods (e.g., Younger Dryas, the 8.2 ka event).

Here, we use realizations of the MITgcm ocean model to investigate the possibility that meltwater discharge from the Hudson River, New York City, USA ~13,300 yrs BP triggered the Inter-Allerød Cold Period (IACP). Using estimates of flood volumes, we assess the sensitivity of AMOC to both short duration (1 month), and long duration (1 year) flood events. We also evaluate the impact of successive flood events on AMOC to determine if sequential floods impact AMOC differently than a single flood event. Finally, we also assess whether the continuous background flux of meltwater from the paleo-Hudson River played role in 'pre-conditioning' the AMOC to weaken in response to short duration outburst floods.

We find that in all of our experiments, regardless of flood magnitude, duration, reoccurrence interval (frequency) or background meltwater flux, there is no significant weakening of the AMOC. This limited impact suggests that although the Hudson Valley floods occurred near the beginning of the IACP, they are unlikely the sole driver. Additional modeling experiments are needed to determine if the combination of multiple drainage pathways from the LIS could have been a trigger and/or contributor to the IACP.

Our results have significant implications for determining whether other isolated deglacial flood events triggered periods of climatic cooling: for example, the millennial-length Younger Dryas cooling is thought to have been triggered by a flood only 3-times larger than the one from the Hudson River, which again questions the role short-lived outburst floods played in triggering centennial to millennial scale climate cooling.