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Investigating the impact of Lake Agassiz drainage routes on the 8.2 ka cold event with a climate model

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Abstract. The 8.2 ka event is the most prominent abrupt climate change in the Holocene and is often believed to result from catastrophic drainage of proglacial lakes Agassiz and Ojibway (LAO) that routed through the Hudson Bay and the Labrador Sea into the North Atlantic Ocean, and perturbed Atlantic meridional overturning circulation (MOC). One key assumption of this triggering mechanism is that the LAO freshwater drainage was dispersed over the Labrador Sea. Recent data, however, show no evidence of lowered $\delta^{18}O$ values, indicative of low salinity, from the open Labrador Sea around 8.2 ka. Instead, negative $\delta^{18}O$ anomalies are found close to the east coast of North America, extending as far south as Cape Hatteras, North Carolina, suggesting that the freshwater drainage may have been confined to a long stretch of continental shelf before fully mixing with North Atlantic Ocean water. Here we conduct a sensitivity study that examines the effects of a southerly drainage route on the 8.2 ka event with the ECBilt-CLIO-VECODE model. Hosing experiments of four routing scenarios, where freshwater was introduced to the Labrador Sea in the northerly route and to three different locations along the southerly route, were performed to investigate the routing effects on model responses. The modeling results show that a southerly drainage route is possible but generally yields reduced climatic consequences in comparison to those of a northerly route. This finding implies that more freshwater would be required for a southerly route than for a northerly route to produce the same climate anomaly. The implicated large amount of LAO drainage for a southerly routing scenario is in line with a recent geophysical modelling study of gravitational effects on sea-level change associated with the 8.2 ka event, which suggests that the volume of drainage might be larger than previously estimated.

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