**Motivation**

The 8.2 ka event is a key test case for simulating the coupled climate response to changes in the Atlantic Meridional Overturning Circulation (AMOC). This event was likely caused by the rapid drainage of Lake Agassiz-Ojibway into the Hudson Bay and Labrador sea around 8,200 years ago. Yet, model simulations of the event that incorporate this forcing generally do not reproduce climate changes as long or severe as those shown by the paleoclimate record at 8.2 ka.

**Oceanic Response**

- **Annual sea surface salinity anomalies**
  - Lab_Lake+Ice vs. CTL: significant changes in the Labrador Sea (Lab) and more in the Lake+Ice experiment compared to the corresponding control experiment.
  - Coast_Lake+Ice vs. CTL: similar pattern to Lab_Lake+Ice, with a more realistic simulation of the Labrador coast and the St. Lawrence River.

- **AMOC and sea ice area**
  - Freshwater transport to connection areas (thick black lines) is greater in the Lab than in the COAST experiments, and greater in the Lake+Ice than in the Lake experiments.
  - The Lab_Lake+Ice experiment yields the best match with sea surface salinity reconstructed from proxies (colored circles).

- **AMOC reduction and sea ice expansion are significantly greater in the Lab_Lake+Ice experiment compared to the other experiments.**

**Atmospheric Response**

- **Annual 2-meter temperature anomalies**
  - Lab_Lake+Ice vs. CTL: cooling in the Northern Hemisphere is larger and more statistically significant (stippling) in Lab_Lake+Ice than in the corresponding control experiment.
  - Both experiments capture the general pattern of temperature change recorded by proxies, but the Lab_Lake+Ice experiment matches the magnitude of change better.

- **Proxy anomalies**
  - Only the Lab_Lake+Ice experiment matches the duration of extratropical cooling that is observed from proxies (e.g., GRIP ice core; Thomas et al. 2007).
  - Both experiments capture the observed duration of precipitation changes in the tropics (e.g., Yarnal 1975).

**Simulations**

- **We completed four experiments of the 8.2 ka event using the Community Climate System Model, version 3.**
- The ocean model has only slightly coarser resolution (~0.3 degrees in latitude) and is coupled to the control simulation and the CCSM3 pre-industrial simulation, and their comparison to proxy anomalies. The most robust patterns, including warm anomalies in the East Greenland current and cool anomalies in the Labrador Sea, are captured by the model (Wagner et al. 2013).
- **Simulation forcings**
  - Simulation name: Lab_Lake, COAST_Lake, COAST_Lake+Ice, Control
  - Freshwater forcing rate and duration: 2.5 Sv x 1 year, 2.5 Sv x 99 years, 2.5 Sv x 1 year
  - Forcing location: Labrador Sea, Labrador coast
  - Length of simulation: 250 yrs

**Conclusions**

- **In the Lab_Lake+Ice experiment, we reconcile previous model-data mismatches by applying a larger revised freshwater flux as recently reconstructed from sea level and ocean geochemical records.**
- **The 8.2 ka event was forced by a volume of freshwater approximately 6 times greater than that of Lake Agassiz alone, implying a lower sensitivity of the coupled climate system to freshwater forcing.**

- **The more realistic geographic placement of freshwater forcing in the Coast experiments yields worse model-data agreement.**

**References**

- Li et al. (2012) Quaternary Science Reviews 51: 159-179.

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