

A proxy compatible model for the YD and the subsequent greening of the Sahara

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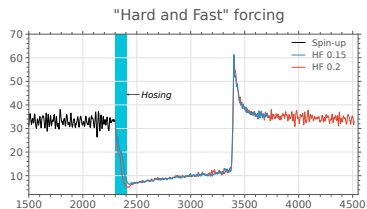
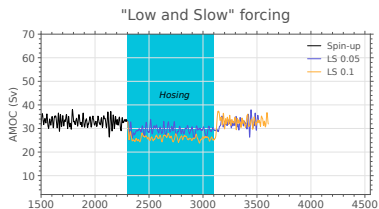
Department of Physics

- The Younger Dryas was a rapid return to glacial conditions which occurred at approximately 12.8 ka to 11.5 ka.
- Known to be caused by a release of fresh water from pro glacial lakes into the Arctic Ocean^[1]
- Outflow of freshwater subdued/shutdown the Atlantic Meridional Overturning Circulation for a millennium

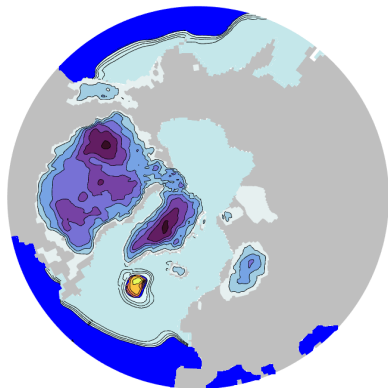


- Love et al. (2021)^[2] summarized numerous prior modelling attempts
- Identified three key areas of improvement
- Forcing Strength, Forcing Location, Boundary Conditions
- Many models apply overly strong forcing to the North Atlantic with LGM boundary conditions.
- Not only is forcing too strong, total water volume is incompatible with Sea Level records
- LGM boundary conditions deviate significantly from those at YD time
- Sea levels are significantly higher, and ice coverage much more limited

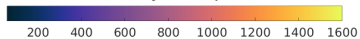




- Fig 1: AMOC recovers at end of hosing
- Fig 2: AMOC stays collapsed after forcing ends

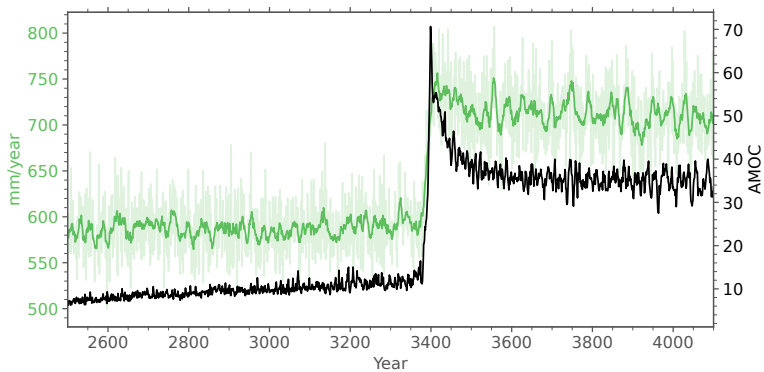


Mixed Layer Depth (m)



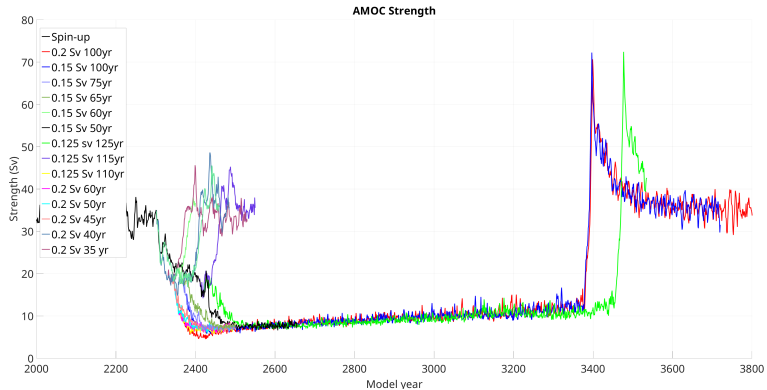
Sea Ice Percent





- Model of YD produced using reasonable freshwater forcing. less than a meter of ESL.
- Accurate trace gasses, orbital parameters and orography used
- LSM set to LGM, but this is unlikely to matter.
- Clear evidence of on and off states in AMOC
- 1000 year natural duration of shutdown.
- Suggests possible Greening of the Sahara on recovery, especially with land surface feedbacks^[3].





- [1] L. Tarasov and W. Peltier, "Arctic freshwater forcing of the younger dryas cold reversal," *Nature*, vol. 435, no. 7042, pp. 662–665, 2005.
- [2] R. Love, H. J. Andres, A. Condron, and L. Tarasov, "Freshwater routing in eddy-permitting simulations of the last deglacial: the impact of realistic freshwater discharge," *Climate of the Past*, vol. 17, no. 6, pp. 2327–2341, 2021.
- [3] D. Chandan and W. R. Peltier, "African humid period precipitation sustained by robust vegetation, soil, and lake feedbacks," *Geophysical Research Letters*, vol. 47, no. 21, p. e2020GL088728, 2020.

