



Synchronous abrupt and transient fluctuations of carbon dioxide and radiocarbon at the onset of the Younger Dryas

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Just before the onset of the Younger Dryas (YD) cold event, several stomatal proxy-based records of atmospheric CO₂ concentration (pCO₂) show a sharp increase of 50-100 ppm, followed by a rapid decrease of similar magnitude. We suggest that this fluctuation occurred due to a major ocean flushing event. Simulations with the GENIE earth system model indicate that changes in ocean ventilation, perhaps related to the hypothesis of the glacial ocean as a thermobaric capacitor, can produce such large multi-decadal timescale fluctuations in pCO₂. Our argument is supported by the IntCal13 radiocarbon ($\Delta^{14}\text{C}$) record, which documents decreasing $\Delta^{14}\text{C}$ right before the YD onset when pCO₂ peaks, consistent with a source of "old" CO₂ from the deep ocean. We further suggest that rapid transient decadal to centennial scale fluctuations in pCO₂ may have remained undetected so far in ice cores. Future terrestrial pCO₂ records could potentially show that similar large transient fluctuations of pCO₂ have occurred at other times in the past.