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Stomatal proxy record of CO_2 concentrations during the Last Termination demonstrates dynamic climate behaviour and an important role for CO_2.

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We present a new stomatal proxy-based record of CO_2 concentrations spanning Greenland Interstadial 1 (Allerød pollen zone, GI-1a to 1c), Greenland Stadial 1 (Younger Dryas pollen zone, GS-1) and the first part of the Holocene (Preboreal pollen zone). The calibrated atmospheric CO_2 concentrations are based on Betula nana (dwarf birch) leaves from a fossil lake sedimentary sequence in south-eastern Sweden. The stomatal proxy method relies on the inverse relationship between stomatal density on plant leaves and atmospheric CO_2 concentrations to reconstruct variations in past CO_2 concentrations.

The record presented here demonstrates that the overall pattern of CO_2 evolution during this period was dynamic, with significant abrupt fluctuations in CO_2 concentration when the climate moved from interstadial to stadial state and vice versa. The cooling at the GI-1/GS-1 transition was preceded by an abrupt warming, and the warming at the GS-1/Holocene transition was preceded by an abrupt cooling. This scenario is in contrast to CO_2 records reconstructed from air bubbles trapped in ice, which indicate a gradual increase in concentrations, but largely in alignment with previously published stomatal proxy-based CO_2 records. A new loss-on-ignition chemical record (used here as a proxy for temperature), from the same locality, lends independent support to the CO_2 record.