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Atmospheric CO₂ and d13C-CO₂ reconstruction of the Little Ice Age from Antarctic ice cores.

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The decrease of atmospheric CO₂ concentration recorded in Antarctic ice around 1600 AD is one of the most significant atmospheric changes to have occurred during the last millennia, before the onset of the industrial period. Together with the temperature decrease, the CO₂ drop has been used to derive the sensitivity of carbon stores to climate. However, the cause of it is still under debate because models are not yet able to reproduce either its magnitude, or its timing. Here we present new measurements of the CO₂ concentration decrease recorded in an ice core from a medium accumulation rate site in Antarctica (DML). We show that the new record is compatible (differences <2 ppm) with the CO₂ record from the high accumulation rate DSS site on Law Dome (East Antarctica), when the different age distributions are taken into account. We have also measured the d13C-CO₂ change in DML ice, filling a gap around 1600 AD in the DSS d13C record. We use a double deconvolution of the CO₂ and d13C records together to provide quantitative evidence that the CO₂ decrease was caused by a change in the net flux to the terrestrial biosphere. Finally, we provide a new interpretation of a published record showing increasing atmospheric carbonyl sulphide during the CO₂ decrease, suggesting that cooler LIA climate affected terrestrial biospheric fluxes. Altogether our findings support the hypothesis that reduced soil heterotrophic respiration is likely to have given the most significant contribution to the LIA CO₂ decrease implying a positive CO₂-climate feedback.