Reconciling ice core CO2 and land-use change following New World-Old World contact

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Ice core records of carbon dioxide (CO2) over the last 2000 years are critical to our understanding of global carbon cycle dynamics on centennial and multidecadal timescales. They also provide context for the unprecedented anthropogenic rise in atmospheric CO2. Yet for some time intervals throughout the period, the true atmospheric history of CO2 remains uncertain. One such example is the decrease in atmospheric CO2 after 1550 CE, for which the timing and magnitude is debated. To resolve this case, we measure CO2 and methane (CH4) in the new Skytrain Ice Rise ice core from 1450 to 1700 CE, presented alongside firn smoothing analysis and land carbon modelling. Our results suggest that a sudden decrease in ice core CO2 around 1610 CE in one widely used record is most likely an artefact of a small number of anomalously low values. Instead, we observe a more gradual decrease in CO2, with our analysis suggesting 0.5 ppm per decade between 1516 and 1670 CE. The resulting inferred land carbon sink of 2.6 PgC per decade agrees with modelled scenarios of large-scale reorganization of land use in the Americas following New World-Old World contact, for which a larger and more rapid CO2 decrease is incompatible.