



Abstract ID : 49

## The 1610 CO<sub>2</sub> drop: Natural, Anthropogenic or Artefact?

### Content

We present new measurements of carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>) in the Skytrain ice core, with gas ages dated around 1610 AD. The aim of these measurements is to improve our understanding of why there are small but significant difference between measured CO<sub>2</sub> at that time in previous ice core records.

A pronounced feature of the Law Dome record (accumulation 60 cm ice eq. yr; gas age distribution 8 years,) is a rapid decrease in CO<sub>2</sub> of ~10 ppm over 50 years leading into the Little Ice Age (LIA), with a distinct minimum at 1610. The cause of this decrease is much debated, with complex carbon cycle feedbacks often invoked. However, other ice cores do not show the same event. The West Antarctic Ice Sheet (WAIS) divide record (accumulation 22 cm ice eq. yr; gas age distribution 19 years) shows a steadier decline in CO<sub>2</sub> of approximately 6 ppm over the same period, with the record also ~2-3 ppm higher than Law Dome CO<sub>2</sub> values throughout 900-1800 CE. The new Skytrain CO<sub>2</sub> record (accumulation 14 cm ice eq. yr; gas age distribution 23 yrs) also does not show the distinct CO<sub>2</sub> low at 1610, showing instead a steadier CO<sub>2</sub> decrease of ~7 ppm. Absolute CO<sub>2</sub> values sit between the offset WAIS and Law Dome records. Age distribution analysis alongside continuous CH<sub>4</sub> measurements through the period suggest that the lack of a distinct CO<sub>2</sub> low in both Skytrain and WAIS at 1610 is not due to greater smoothing of the records when compared to Law Dome. We present these findings with a goal of improving our understanding on several questions: (1) What is the true amplitude of CO<sub>2</sub> change leading into the Little Ice Age, and what drove this change? (2) Does one of the ice core records suffer from contamination? (3) Is our understanding of gas smoothing processes in these ice cores accurate?

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**Track Classification:** Biogeochemical Cycles in the Earth system – data and models