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High-resolution measurements of δ13C-CH4 reveal heavy anomalies during enhanced CH4 emissions associated with Heinrich Events

Content

Past abrupt millennial scale changes in atmospheric methane (CH4) are linked to similarly dramatic changes in Northern Hemisphere climate known as Dansgaard-Oeschger (DO) Events. Abrupt centennial scale CH4 variability has recently been linked to Heinrich Events (HE), which were periods of intense iceberg discharge into the North Atlantic that disrupted ocean circulation and inflicted changes to climate globally (Rhodes et al., 2015). The changes to the CH4 budget that drove these CH4 pulses can be more quantitatively constrained through the measurement and interpretation of CH4 stable isotopes at high resolution. Because major CH4 source types (microbial, geologic and biomass burning) have unique isotopic signatures, variability in the atmospheric signature could be driven by changes in the contribution of these sources to the total budget.
Lee et al (2017) reported a 1‰ heavy anomaly in δ13C-CH4 that coincided with the CH4 pulse associated with HE 4. We now report a very similar feature for the pulse associated with HE 1 and plan similar measurements for the HE 5 CH4 event. These observations suggests that a 13C-enriched CH4 source, such as biomass burning, played an important role in the increased emissions associated with HE's. Enhanced biomass burning emissions could explain the isotopic excursion and increased CH4 emissions and is supported by synchronous evidence of extreme drying in Northern Hemisphere tropical regions due to the southerly displacement of tropical rain belts. Proposed increases in wetland CH4 emissions due to rainfall intensification across the southern tropics may have also played a role, notably in the elevated baseline CH4 following the HE 4 CH4 pulse and δ13C-CH4 excursion.

References:

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