EGU2020-2844
https://doi.org/10.5194/egusphere-egu2020-2844
EGU General Assembly 2020

Centennial-scale evolution of methane during the penultimate deglaciation

Loïc Schmidely[1], Lucas Silva[1], Christoph Nehrbass-Ahles[2], Juhyeong Han[1], Jinhwa Shin[3], Jochen Schmitt[1], Hubertus Fischer[1], and Thomas Stocker[1]

[1]University of Bern, Physics Institute, Climate and Environmental Physics, Switzerland (loic.schmidely@climate.unibe.ch)
[2]Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ UK
[3]CNRS, Univ. Grenoble-Alpes, Institut des Géosciences de l'Environnement (IGE), Grenoble, France

Small air inclusions in ice cores represent a direct archive of past atmospheric compositions, allowing us to measure the concentration of the three most potent non-condensable Greenhouse Gases (GHG) CO_2, CH_4 and N_2O as far back as 800,000 years before present (kyr BP). These records demonstrate that transitions from glacial to interglacial conditions are accompanied by a substantial net increase of CO_2, CH_4 and N_2O in the atmosphere (Lüthi et al. 2008, Loulergue et al. 2008, Schilt et al. 2010). A sound understanding of the interplay between the reorganization of the climate system and the perturbation of GHG inventories during glacial terminations is partly limited by the temporal resolution of the records derived from ice cores. In fact, with the exception of the last deglaciation (23-9 kyr BP) centennial-scale GHG variability remained uncaptured for precedings glacial terminations.

In this work, we exploit the exceptionally long temporal coverage of the EPICA Dome C (EDC) ice core to reconstruct, for the first time, centennial-scale fluctuations of CH_4 mole fractions from 145 to 125 kyr BP, encompassing the entire penultimate deglaciation (138-128 kyr BP). With a temporal resolution of ~100 years, our new record is now unveiling all climate-driven signals enclosed into the EDC ice core, exploiting the maximum resolution possible at Dome C (). This offers us the opportunity to study the timing and rates of change of CH_4 in unprecedented details.

Preliminary analysis reveals that the deglacial CH_4 rise is a superimposition of gradual millennial-scale increases (~0.01-0.02 ppb/year) and abrupt and partly intermittent centennial-scale events (~80-200 ppb in less than a millennium). We will investigate processes modulating the observed changes in the CH_4 cycle, compare the structure of our record with the CH_4 profile of the last deglaciation (Marcott, 2014) and contrast it with the EDC CO_2 and N_2O records over the penultimate glacial termination now available in similar resolution.