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Extending the history of atmospheric CH_4 concentrations back to 650 kyr ago

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The EPICA Dome C core gives access to time periods previously inaccessible from ice core records. This is especially interesting since ice cores record also directly the atmospheric composition of the past. We investigate the concentration changes of atmospheric methane between 420 and 650 kyr. This covers the periods of marine isotope stages 16 to 12.

Over the last four glacial cycles the methane concentration follows closely temperature on glacial interglacial time scales, with millennial-scale structure during glacial times which appears unphased with Antarctic temperature. These observed patterns partly hold as well for the time period of MIS 16 to 12, what is interesting since the latter period is characterized by lower interglacial temperatures in Antarctica. It was suggested that the main player on glacial interglacial time scales responsible for the methane concentration variations are variations in the extent and productivity of tropical wetlands.

In the investigated dataset (MIS 16 to 12) rapid CH_4 variations are also present during MIS 12. A clear $\sim$20-kyr periodicity is observed in the signal, notably imprinted during the warmer stage 13. We suggest a different evolution of temperature and climate on millennial scales in the tropics and the northern hemisphere with respect to Antarctica.