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Millennial-scale climate change and the chronology of events : new input from high-resolution CH_4 records

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Rapid climatic variability over the last glacial is recorded in Greenland and Antarctic ice cores through fast and large-amplitude variations of the methane atmospheric mixing ratio. Here we will present the status of the high-resolution CH_4 record jointly obtained by LGGE and Bern on the Dome C ice core, focussing on the last four climatic cycles and on the common structure observed with the Vostok CH_4 record (Delmotte et al., 2004). The scientific interest of such record is twofold :

- Firstly, the frequency of CH_4 variations, their speed and amplitude and their phasing with Antarctic climate is of direct climatic relevance as such record represents the only proxy of North Atlantic climate shifts recorded in ice before Marine Isotopic Stage (MIS) 5e. We will compare and discuss this variability over the previous glacial periods and the Terminations.
- Secondly, because the Dome C and Vostok CH_4 records must be synchronous, they provide a test of the consistency of climatic parameterization used as inputs for the densification model simulating the trapping of gases in ice and thus the delta-age between the gas and the surrounding ice. Indeed temperature and accumulation rate changes are poorly constrained parameters on the Antarctic

plateau. In addition to the close-off density and the thinning function of annual layers, they directly affect the delta-depth (and thus delta-age) of contemporaneous events in the gas and in the ice.

After (1) matching events of ash layer, dust content water isotopes and the ^{10}Be peak, and (2) using a firn densification model including heat diffusion to deduce the age of the gas, we construct a Vostok gas chronology based on the Dome C ice timescale. We will present and discuss the different sets of parameters tested and we will evaluate their consistency with existing glaciological constraints based on an inverse method (Parrenin et al., 2001).

References:

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