Geophysical Research Abstracts, Vol. 7, 02397, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02397

Proposing a mechanistic understanding of atmospheric CO_2 during the last 740,000 years

P. Köhler and H. Fischer

Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany
(pkoehler@awi-bremerhaven.de)

Paleo-climate records in ice cores revealed high variability in temperature, atmospheric dust content and CO_2. The longest CO_2 record from the Antarctic ice core of the Vostok station went back in time as far as about 410 kyr BP showing a switch of glacials and interglacials in all those parameters approximately every 100 kyr during the last four glacial cycles with CO_2 varying between 180–280 parts ppmv. New measurements of dust and the isotopic temperature proxy deuterium of the EPICA Dome C ice core covered the last 740 kyr, however, revealed glacial cycles of reduced temperature amplitude. These new archives offer the possibility to propose atmospheric CO_2 for the pre-Vostok time span as called for in the EPICA challenge. Here, we contribute to this challenge using a box model of the isotopic carbon cycle (Köhler et al., submitted to GBC) based on process understanding previously derived for Termination I and show that major features of the Vostok period are reproduced while prior to Vostok our model predicts significantly smaller amplitudes in CO_2 variations.

While most processes which impact on CO_2 were reduced in their magnitude during the terminations of the pre-Vostok period, the absolute contribution of iron fertilisation changed only slightly. Thus, the relative importance of biological and biogeochemical processes is enhanced (approximately doubling their relative share) in the pre-Vostok period. The contribution of physical processes (SST, sea level, sea ice) to the CO_2 rise during terminations stayed always below 25%, while ocean circulation contributed up to 75% during the Vostok era but less than 50% before.