

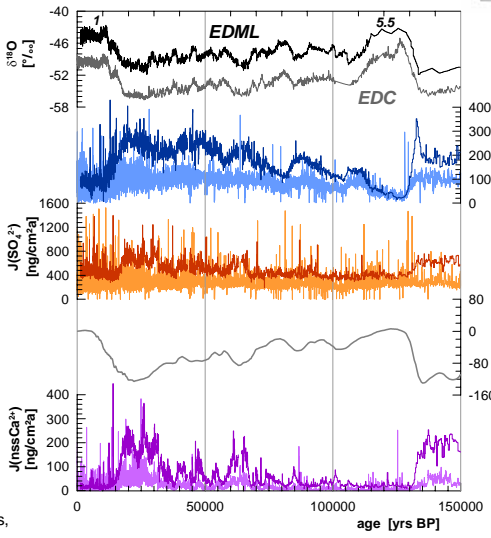
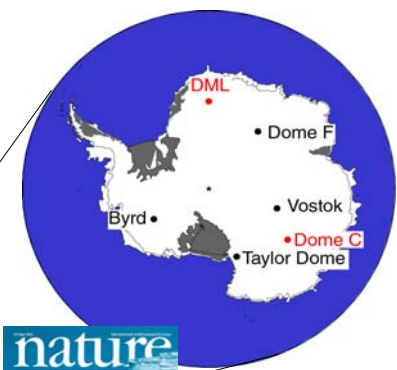
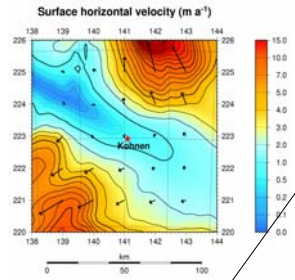
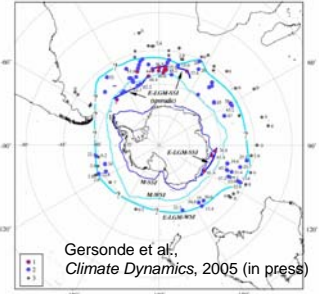
RESPIC – Paleoclimatic changes in the global carbon cycle



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DEKLIM project RESPIC (young scientist Research group on Earth climate System reconstructions on Polar Ice Cores)
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Summary: The goal of RESPIC is the quantification of changes in the global carbon cycle (GCC) in the past. To this end relevant boundary conditions for the GCC have been reconstructed from the new EPICA ice cores and changes in carbon fluxes have been quantified using the new GCC-model BICYCLE. Ice core aerosol records show substantial changes in mineral dust, thus iron input, to the Southern Ocean (SO) parallel to changes in sea level. In contrast, changes in marine biogenic sulfur do not point to a substantial increase in marine sulfur productivity in parallel to a potential iron fertilisation. Sea ice coverage as revealed in sea salt aerosol doubles for glacial conditions connected to higher SO stratification and reduced gas exchange. In line, BICYCLE reveals a strong effect of SO mixing and carbonate sedimentation/dissolution on atmospheric CO₂ while the influence of iron fertilisation is limited to about 20 ppmv. New quantitative information on carbon fluxes can be derived from novell high-precision δ¹³C₂ measurements developed within RESPIC which show 0.5 ‰ higher levels during warm marine isotope stage (MIS) 5.5 compared to the penultimate glacial.



Sea salt fluxes at EDML and EDC are 2-3 times higher in the glacial than in the Holocene pointing to a two fold increase in sea ice formation. During MIS 5.5 winter sea ice is significantly reduced in line with 2-4 °C warmer temperatures. The mineral dust flux in the glacial is up to 12 times higher with highest fluxes during sea level low stands. However, biogenic sulfur fluxes are not (EDC) or only 30 % (EDML) higher.

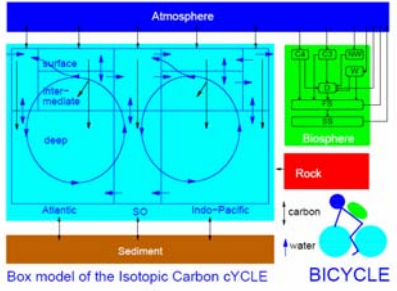
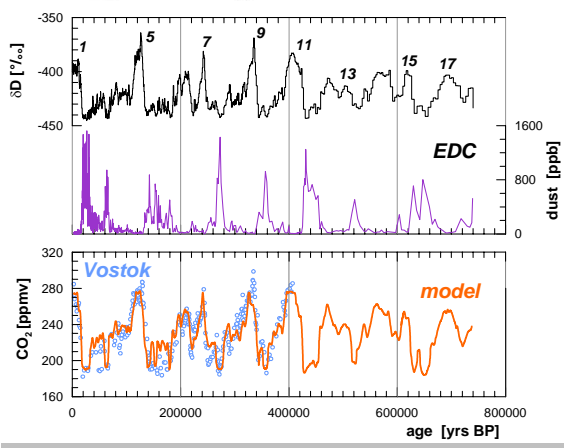


EPICA community members, *Nature*, 429, 2004

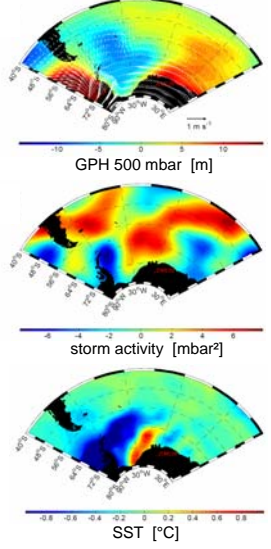
FORUM

The EPICA Challenge to the Earth System Modeling Community

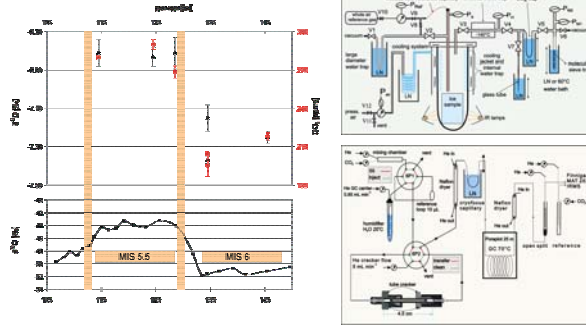
Wolff et al., *EOS*, 85, 38, 2004



Meteorological up-scaling studies of aerosol records using NCEP/NCAR reanalysis data show a strong influence of the Antarctic Dipole Pattern and the Antarctic Circumpolar Wave on aerosol transport onto DML.



Based on input data from marine and ice core proxy records, BICYCLE is for the first time able to quantitatively explain the transient glacial/interglacial CO₂ change recorded in the Vostok ice core. The first 4 glacial cycles in the EDC record, however, are characterised by reduced CO₂ amplitudes. Major factors are SO deep stratification, carbonate sedimentation(dissolution) and to lesser extent marine export productivity.



The new sublimation GCMS technique allows for 100 % extraction efficiency. Only 30 g of ice are required (compared to 200-1000 g with conventional techniques) for combined δ¹³C and CO₂ measurements. An unprecedented accuracy for δ¹³C of 0.05 ‰ is achieved which is a prerequisite to constrain carbon fluxes.



Paleoclimate Research German Climate Research Programme

