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Ice core perspectives on past changes in the global carbon cycle

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Preindustrial changes in the global carbon cycle on time scales of centuries and millennia are primarily controlled by changes in the ocean and secondarily by changes in the terrestrial biosphere, while the atmospheric CO_2 load measured in Antarctic ice cores only passively responds to these changes.Nevertheless, latest progress in high-precision and high-resolution ice core records of atmospheric CO_2 and especially of its carbon isotopic signature (Schmitt et al., 2012) allows for an integrated view into past global carbon cycle changes and the responsible processes over the last glacial/interglacial cycle. Moreover, novel ice core proxies are currently developed that provide independent information on other parameters in the earth system that affect the global carbon cycle in the past. This presentation attempts to provide an overview of the latest results gleaned from ice cores, which allow to- constrain the processes leading to CO_2 changes in the course of the Holocene, identify the factors leading to glacial/interglacial change in atmospheric CO_2, study the balance of the global carbon cycle on even longer time scales, provide independent information on weathering changes and its feedback to the global carbon cycle over the last 800,000 yr. In combination with paleoceanographic and carbon cycle model results this helps to quantitatively constrain carbon cycle changes over the last 8 glacial cycles. However, no ice core record exists to date that could assess the role of the global carbon cycle in the Mid-Pleistocene Transition, i.e. during the shift from the so called "40,000 yr world" to the well-known 100,000 yr glacial/interglacial cycles encountered over the last about 900,000 yr (Elderfield et al., 2012). To find a suitable site and drill an ice core that covers this transition will be a major effort within the ice core community for the coming decade.

References:
Elderfield et al. (2012), *Science*, 337, 704-709.
Schmitt et al, (2012), *Science*, 336, 711-714.