Geophysical Research Abstracts
Vol. 17, EGU2015-9819, 2015
EGU General Assembly 2015

Stratigraphic significance and global distribution of the δ^{13}C Suess effect during the Anthropocene

André Paul and Stefan Mulitza

University of Bremen, MARUM - Center for Marine Environmental Sciences, Department of Geosciences, Bremen, Germany (apaul@marum.de)

The Anthropocene is the proposed term for the present geological epoch (from the time of the Industrial Revolution onwards), during which human influence significantly impacts the environment. We argue that the burning of isotopically light fossil fuel that causes the so-called "δ^{13}C Suess effect" leaves such a strong imprint on marine sediments that it may serve to define the onset of this geological epoch, at least since the so-called "Great Acceleration", i.e., the second half of the 20$^{\text{th}}$ century.

Sediment data with high temporal resolution from the recent past indeed reveal a trend that corresponds to a negative carbon isotope excursion of the order of one permil, comparable to carbon isotope excursions in the deep past that define stratigraphic boundaries such as the Paleocene–Eocene Thermal Maximum (PETM). A global carbon cycle model based on the MIT general circulation model (MITgcm), fitted with carbon isotopes ^{13}C and ^{14}C and forced with observed changes in the atmospheric carbon dioxide partial pressure and carbon isotopic ratio ^{13}C/^{12}C, allows to investigate the temporal evolution and three-dimensional structure of the anomaly.

We show the carbon isotopic ratios of fossil shells of benthic foraminifera ($\delta^{13}C_c$) from two ocean sediment cores GeoB6008 (31° N) und GeoB9501 (17° N) over the Anthropocene (mainly the 20$^{\text{th}}$ century). The decrease in $\delta^{13}C_c$ at 31° N is about 0.8 permil; off Mauretania (at 17° N in the shadow zone of the subtropical gyre) it still amounts to about 0.4 permil. While the magnitude of the change in the global carbon cycle model is similar, the difference is smaller: The decrease in the model is around 0.9 permil near the location of the northern core and around 0.8 permil near the location of the southern core. The smaller difference of only about 0.1 permil points to a bias in the simulated as opposed to the observed ventilation of the thermocline.

We further use a carbon cycle multi-box model to extrapolate this change in $\delta^{13}C_c$ to the future. Our data and models highlight the role of the North Atlantic Ocean for the uptake and storage of anthropogenic carbon and offer a link between proxy and instrumental records from the recent past.