Geophysical Research Abstracts
Vol. 15, EGU2013-9492, 2013
EGU General Assembly 2013

Persistent linkage between long-term eccentricity cycles in Antarctic ice volume and changes in the global carbon cycle during the Pliocene and Pleistocene

Bas de Boer (1), Lucas Lourens (2), and Roderik van de Wal (1)

(1) Utrecht University, Institute for Marine and Atmospheric research Utrecht, Physics and Astronomy, Utrecht, Netherlands, (2) Utrecht University, Depertment of Earth Sciences, Faculty of Geosciences, Utrecht, Netherlands

The imprint of the 400,000 and 100,000 year cycles on high-resolution deep sea carbon (δ^{13}C) and oxygen (δ^{18}O) records have been found in the Oligocene to Middle Miocene time interval, when global climate change was under the influence of the waxing and waning of Antarctic ice sheet. In contrast, the long-eccentricity signal is absent in the Pleistocene ice-age records, while oceanic carbon isotope records do reveal long-term changes in the global carbon reservoir. Here we have simulated global ice volume over the past 5 million years (Myr) using a coupled system of four 3-D ice-sheet-shelf models, comprising the glaciations on Eurasia, North America, Greenland and Antarctica, thereby explicitly calculating all ice-volume contributions. With an inverse approach ice volume and temperature are derived from the global mean LR04 benthic δ^{18}O record. Although the LR04 stack does not reflect a strong signal in the 400-kyr long-eccentricity cycles, the simulated Antarctic ice sheet reflects a strong 400-kyr signal throughout the Plio-Pleistocene. Evidently, the long-term eccentricity bound changes in the Antarctic ice sheet co-vary with the planktonic foraminifera δ^{13}C record of the Mediterranean over the past 5 Myr and with the benthic stacked δ^{13}C record of ODP Leg 154 (Ceara Rise) sites in the equatorial Atlantic between 5 and 1.5 Myr ago. This suggests a persistent linkage between eccentricity-paced Antarctic ice sheet fluctuations and changes in the carbon cycle throughout the late Cenozoic icehouse world.