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Climate and carbon cycle coupling during the late Paleocene and early Eocene: Inferences from high-resolution stable isotope records

James C. Zachos (1), Heather McCarren (1), Brandon Murphy (1), Ursula Röhl (2) and Thomas Westerhold (2)

(1) Earth & Planetary Sciences Department, University of California, Santa Cruz, CA 95064, USA, (2) Centre for Marine Environmental Sciences, Bremen University, Bremen, Germany

The Paleocene-Eocene is marked by secular variations in climate that appear to be strongly coupled to prominent variations in the carbon cycle as inferrred from carbon isotope and other data. Here we use new high-resolution, orbitally-tuned stable isotope records from the South Atlantic to evaluate the nature of coupling on both long and short-time scales. The records were constructed using core samples recovered at Site 1262 on Walvis Ridge during ODP Leg 208. The isotope records, which have a $\sim$3-5 k.y. resolution and are stratigraphically continuous from 53 to 61 Mya., were orbitally tuned to an astronomical model (see Westerhold et al., 2007). The carbon isotope time series shows the well-characterized long-term decline from a late Paleocene maximum (57.4 Ma) to the early Eocene minimum (53.6 Ma). Superimposed on the long-term C-isotope trend are prominent cycles along with several distinct negative excursions including the PETM and ELMO. The largest amplitude cycles have periods of 400 and 100 k.y. and exhibit the highest amplitude oscillations over the late Paleocene and lowest amplitude just after the PETM. The carbon isotope minima generally correspond with minima in carbonate content and oxygen isotopes implying increased input of isotopically depleted (reduced) carbon, lower ocean pH, and greenhouse induced global warming, not unlike what occurs during the PETM and ELMO though on a smaller scale. These patterns imply enhanced coupling between the carbon cycle and climate throughout this period, possibly involving exchange of carbon with a large reduced carbon reservoir (e.g., methane hydrate capacitor of Dickens (2003)). Several

possible mechanisms for this coupling are discussed.