EGU2020-17480
https://doi.org/10.5194/egusphere-egu2020-17480
EGU General Assembly 2020

Ocean carbon storage and release over a glacial cycle

James Rae[1], Alan Foreman[2], Jessica Crumpton-Banks[1], Andrea Burke[1], Christopher Charles[2], and Jess Adkins[3]

[1]University of St Andrews, Earth and Environmental Sciences, St Andrews, United Kingdom of Great Britain and Northern Ireland (jwbr@st-andrews.ac.uk)

[2]Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA 92093

[3]Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA, 91125

Perhaps the most important feedback to orbital climate change is CO_2 storage in the deep ocean. By regulating atmospheric CO_2, ocean carbon storage synchronizes glacial climate in both hemispheres, and drives the full magnitude of glacial-interglacial climate change. However few data exist that directly track the deep ocean's carbon chemistry over a glacial cycle. Here, we present geochemical reconstructions of deep ocean circulation, redox, and carbon chemistry from sediment cores making up a detailed depth profile in the South Atlantic, alongside a record of Southern Ocean surface water CO_2, spanning the last glacial cycle. These data indicate that initial glacial CO_2 drawdown is associated with a major increase in surface ocean pH in the Antarctic Zone of the Southern Ocean, cooling at depth, enhanced deep ocean stratification, and carbon storage. Deep ocean carbon storage and deep stratification are further enhanced when CO_2 falls at the onset of Marine Isotope Stage 4, and are also pronounced during the LGM, illustrating a link between orbital scale climate stages and deep ocean carbon. However our data also illustrate non-linear feedbacks to orbital forcing during glacial terminations, which show abrupt decreases in pH in Southern Ocean surface and subsurface waters, as CO_2 is rapidly expelled from the deep ocean at the end of the last ice age.