

Dynamics of the Pacific Antarctic Circumpolar Current over the past five million years (IODP Expedition 383 - DYNAPACC)

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Our community's understanding of Earth's long-term climate evolution suffers a bias towards the Northern Hemisphere, where the majority of Plio-Pleistocene climate records have been developed. Although more recent efforts by the International Ocean Discovery Program (IODP) have sought to increase the number of long-term sedimentary records from the Southern Hemisphere, there remains an enormous gap in paleoclimate data from the South Pacific, representing the largest surface area and volume fraction of the Southern Ocean and therefore holding the largest capacity for carbon storage in the deep ocean. IODP Expedition 383 set out to fill this South Pacific data gap with the goal to improve our ability to understand global changes in ocean-atmosphere-ice sheet dynamics and carbon cycling during past climatic transitions.

The Southern Ocean exerts a critical control on atmospheric CO₂ variations, changes in global ocean circulation, as well as the growth and decay of the Antarctic ice sheets across past glacial/interglacial cycles and longer time-scales. To a large part, the underlying physical and biogeochemical processes are associated with the dynamics of the Antarctic Circumpolar Current (ACC) and the southern westerly wind belt, affecting climate on a global scale. Here, we document changes in ACC dynamics from a suite of IODP and RV Polarstern sediment cores across the Central South Pacific covering the past five million years.

We present results of a suite of complementary biological and geochemical tracers to reconstruct Plio-Pleistocene atmosphere-ocean changes, focusing on the dynamics of the Antarctic Circumpolar Current and the frontal positions. Time-scales include the Pliocene, the intensification of Northern Hemisphere Glaciation, the Mid-Pleistocene Transition and middle and late Pleistocene Glacial/Interglacial cycles.