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Dust and Climate – New Perspectives from the Southern Hemisphere

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Dust plays a critical role in Earth' climate system. Dust affects climate, both by altering the radiation budget of the atmosphere and by influencing the efficiency of the ocean's biological pump: The scarcity of iron limits marine export production and carbon uptake in about 25% of the global ocean. Of these, the Southern Ocean is the region where iron fertilization can have the largest effect on Earth's carbon cycle, both in the modern and in the past.

I will present an integrated perspective of Southern Hemisphere dust transport and its potential link to climate on a variety of timescales – from millennial scale climate change events, glacial/interglacial cycles, major climate transitions like the Mid-Pleistocene Transition and the initiation of the Northern Hemisphere Glaciation to million-year trends over the Plio/Pleistocene.

This presentation will feature records from the Southern Ocean, with a particular emphasis on the South Pacific. As the largest Southern Ocean sector, the South Pacific plays a key role in influencing atmosphere-ocean-cryosphere processes on a global scale. However, despite its global importance, reliable sediment records from the South Pacific had been sparse limiting our understanding of its Plio/Pleistocene paleoceanography. Recently drilled sediment cores from IODP Expedition 383 to the Subantarctic Pacific [1] now allow us to fill this gap and evaluate large-scale common climate forcings such as latitudinal shifts of the southern westerlies, regionally enhanced dust mobilization processes and dust impacts on the carbon cycle. Comparing the new reconstructions from the South Pacific with records from the South Atlantic and Antarctic ice cores will provide a comprehensive perspective of dust-climate interactions, and aims to help counteract the bias of our community's understanding of Earth's long-term climate evolution towards the Northern Hemisphere, where the majority of Plio/Pleistocene climate records have historically been developed.

Lamy, F., G. Winckler, C Alvarez Zarikian and Expedition 383 Scientists (2021). Dynamics of the Pacific Antarctic Circumpolar Current (DYNAPACC). Proceedings of the International Ocean Discovery Program, Volume 383. 10.14379/iodp.proc.383.2021