Geophysical Research Abstracts
Vol. 18, EGU2016-4069, 2016
EGU General Assembly 2016

Trends, Rhythms, and Aberrations in Global Climate during the Cenozoic: The Interplay between Tectonic and Orbital forcing (Milutin Milankovic Medal Lecture)

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Prior to the mid-nineties much of our understanding of early Neogene and Paleogene climate was based on relatively low-resolution reconstructions. As a consequence, under-sampled periodic climate variability appeared as noise in global records (i.e. stacks), limiting our ability to fully evaluate mechanisms of past climate change. Efforts to address this limitation began in earnest with Ocean Drilling Program Leg 154, one of the first to successfully recover high-quality stratigraphically complete and relatively expanded successions of Paleogene pelagic sediments, allowing for astronomical tuning and the development of detailed paleoclimatic records extending back into the Oligocene. The strategies implemented during this Leg to locate, recover, and tune Paleogene sequences were adapted by subsequent ODP/IODP expeditions, ultimately contributing to the development of high-resolution astronomically-tuned climate records extending back to the Cretaceous. The collective contributions of these expeditions provided the necessary framework for characterizing climate variability on orbital time scales throughout the Cenozoic, including the major transitions and aberrations, the Oligocene-Miocene (O/M), Eocene-Oligocene Transition (EOT), and the Paleocene-Eocene Thermal Maximum (PETM). In this presentation I will review the most recent advances in reconstructing past climates on orbital time scales, and how these advances are altering our understanding of the triggering mechanisms for these major climate transitions, and discuss how the interplay between tectonic processes and orbital forcing as well as physical and geochemical feedbacks contributed to drive the more rapid and extreme aberrations.