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A megasplice of globally distributed benthic $\delta^{18}O$ records exposes the different astronomical rhythms of the last 35 million years.

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Compilations of worldwide benthic $\delta^{18}O$ records (e.g. Cramer et al., 2009; Zachos et al., 2001; Zachos et al., 2008) led to a significant improvement of our understanding of changing ocean circulation characteristics in the Cenozoic. However, in these compilations, different isotopic records are accumulated and individual astronomical cycles are not always clearly recognizable. Here, we present a benthic $\delta^{18}O$ megasplice for the last 35 Ma that results from the splicing of a dozen globally distributed high-resolution isotope records (>11000 measurements). We carefully correlated these isotope records in their overlapping parts, and slightly revised the original astronomical age models where necessary. The result is a megasplice in which individual astronomical cycles are clearly delineated throughout the last 35 Ma. Benthic $\delta^{18}O$ records from the deep ocean can be regarded as resembling globally averaged temperature and ice-volume conditions. Nevertheless, an important disadvantage of the megasplice consists of the fact that data from single sites do not reflect whole ocean conditions. We account for possible local effects by presenting different versions of the megasplice, each version consisting of a different combination of records.

Subsequently, the imprint of astronomical climate forcing in the megasplice is displayed in a novel way. We display the response of benthic $\delta^{18}O$ to obliquity and eccentricity-modulated precession for 800-kyr wide time-windows. The $\delta^{18}O$ response in function of obliquity and $e * sin(\omega)$ allows for an assessment of the relative strength of obliquity and precession. A similar display in function of $e * sin(\omega)$ and $e * cos(\omega)$ should be read as a polar plot of which the azimuth represents the longitude of the perihelion and the distance from the pole represents eccentricity. The month during which the Earth reaches perihelion is indicated at the corresponding azimuth. This novel way of visualizing the astronomical imprint allows us to visualize non-trivial dependencies of climate on the phase and amplitude of astronomical parameters. The megasplice allows for a countless amount of comparisons of the climate's response to astronomical forcing between different time slices. For example, a comparison of the response before and after the Oligocene-Miocene transition shows that it was predominantly the northern hemisphere that drove global climate during the Oligocene, and the southern hemisphere during the Miocene.

References

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