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Determining phase relations of proxy data using the eccentricity-precession pattern

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The phase relation between proxy data and orbital forcing is not always obvious; a link to both precession/insolation maxima or -minima can often be reasoned for.
We present a novel approach to extract the phase relation using solely eccentricity-precession pattern from high quality proxy data. We determine the position of consecutive eccentricity maxima as precisely as possible from a stratigraphic record using both eccentricity filters and the amplitude modulation of precession. This way we obtain both the position of these eccentricity maxima as well as the sedimentation rate between successive maxima with error margins. Combining these results with the precession pattern in the geological record, we can determine whether precession-related patterns relate to precession (or insolation) minima or maxima.
This approach relies on high quality geological data, the assumption of a direct eccentricity and precession response to orbital forcing, and a well defined orbital solution, but avoids the assumption of an instantaneous response to obliquity.
For data with filtered components showing a good fit with the proxy data, this approach yields good results. Using high quality proxy data (color, magnetic susceptibility), we are able to determine the phase relation for equatorial Atlantic Miocene successions of ODP Leg 154.

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