

Using dynamic time warping to align geochemical proxy records

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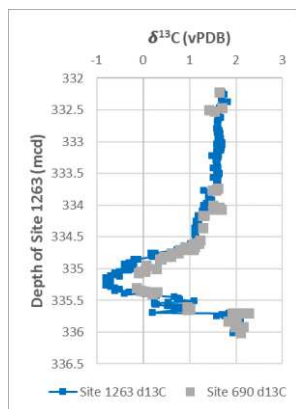
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Dynamic time warping method

Variations in sedimentation rate, bioturbation and dissolution create gaps and distortions in the sedimentary record, establishing a convoluted relationship between depth and time of a geochemical proxy. Dynamic time warping (DTW), a signal processing method used in speech recognition, is used in this study to better understand convoluted records by aligning these records with more complete records spanning the same time period at different locations.

Application of method

DTW was applied to bulk sediment carbon isotope ($\delta^{13}\text{C}$) records from ODP Sites 1262, 1263, 1265 and 690 records spanning the Paleocene-Eocene Thermal Maximum (PETM).



First, $\delta^{13}\text{C}$ records for Walvis Ridge sites 1262 and 1265 were aligned to the more complete site 1263 record. These alignments were found to be similar to existing published alignments based on correlating breaks and inflections in the isotope record by hand. The $\delta^{13}\text{C}$ record from Maud Ridge site 690 was then aligned to Site 1263. This alignment shows a previously

unidentified gap in Site 690, indicating that the CIE did not reach its minimum value.

These preliminary results indicate that DTW may provide an objective way to align isotope records, identify gaps and distortions, and together with astrochronology and geochronology, lead to a more complete understanding of the geologic record of biospheric events in deep time.