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Bispectra of climate cycles show how ice ages are fuelled

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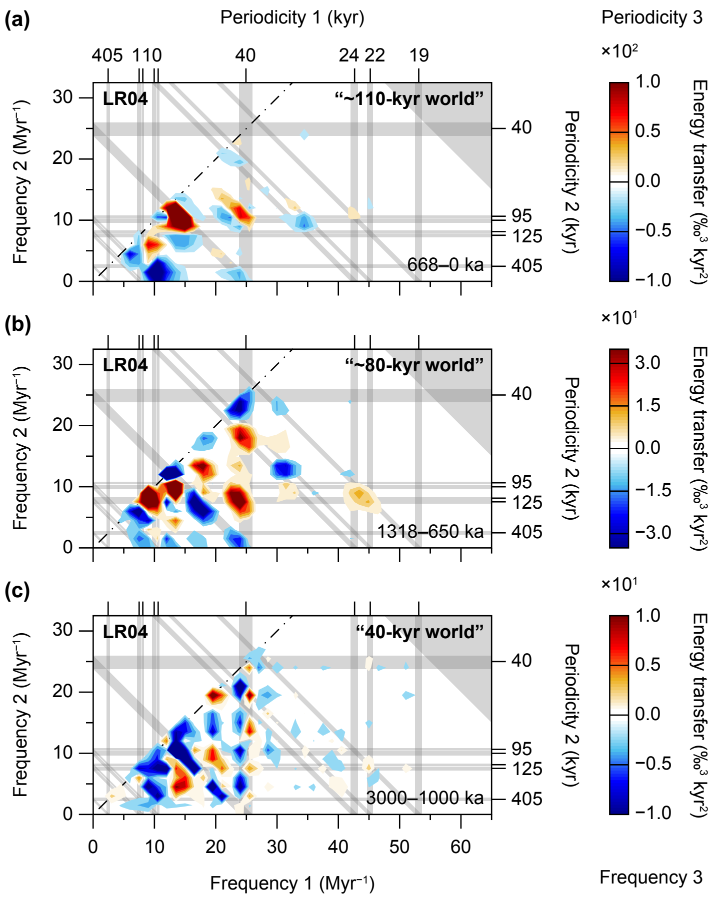
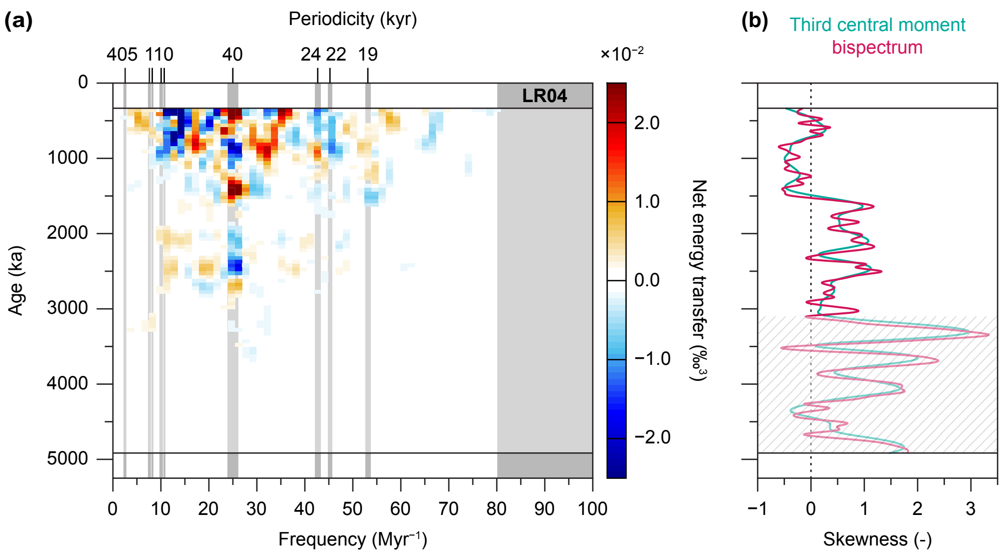
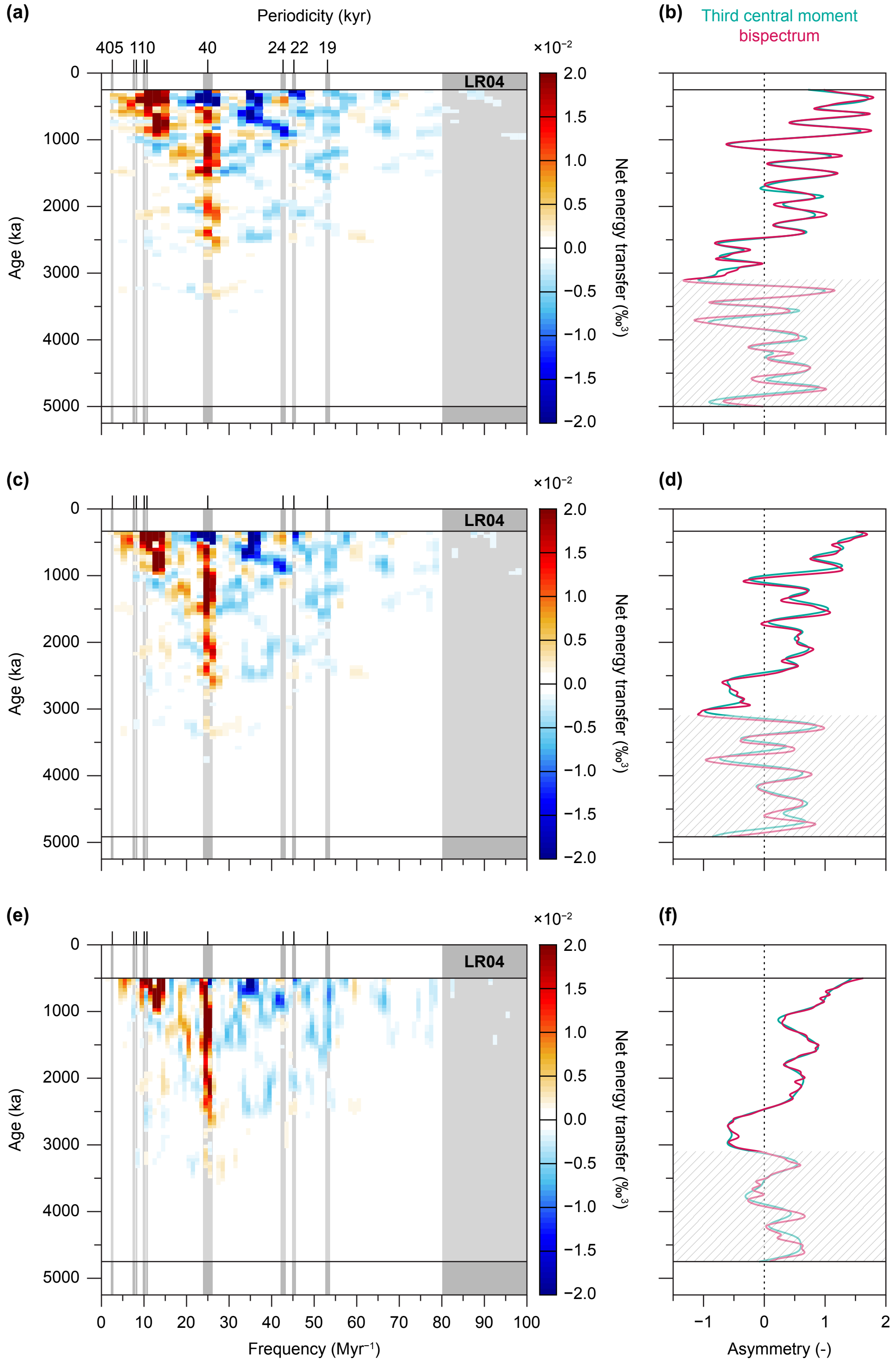


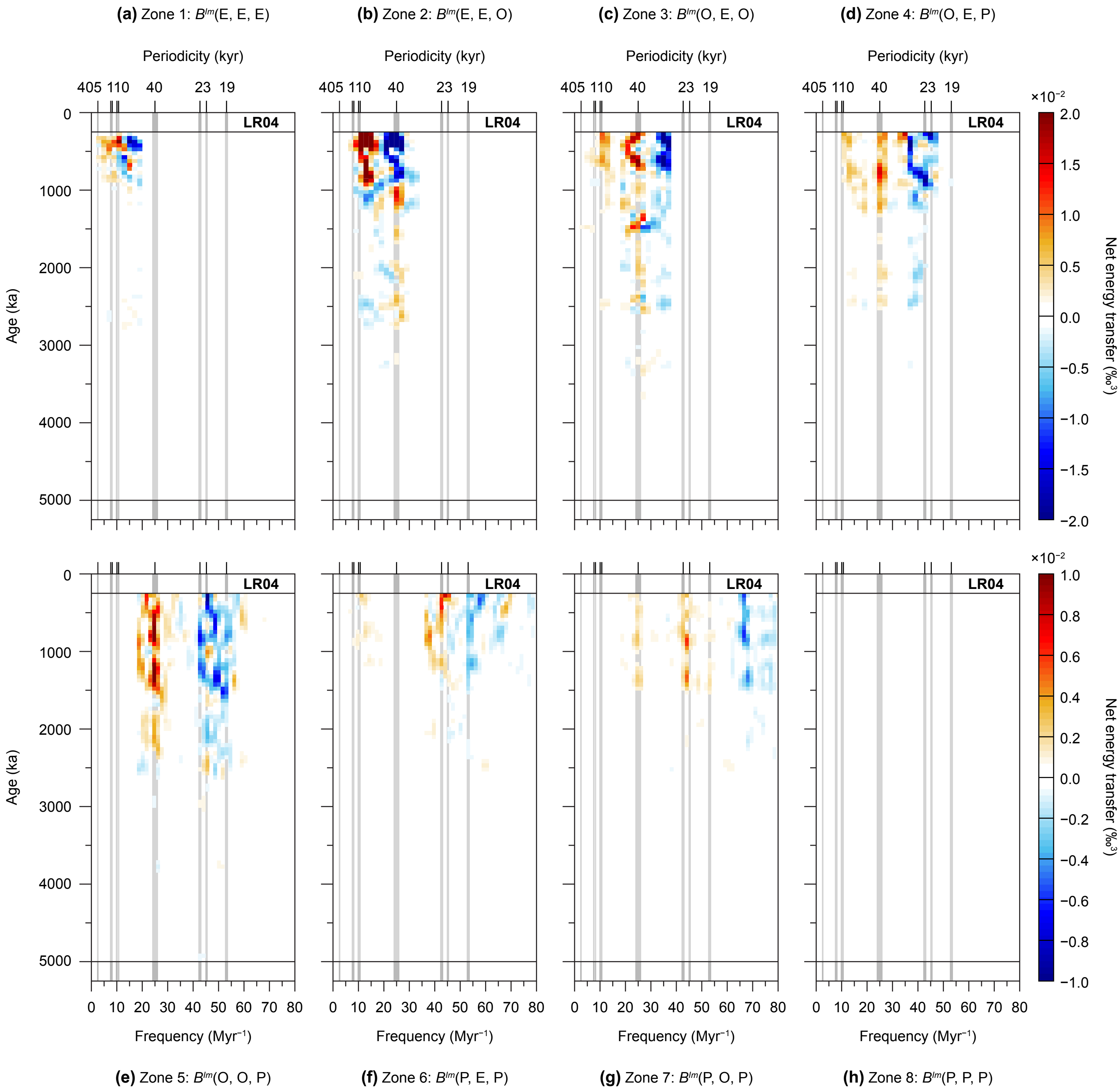
Supplementary Figure S1. Examples of the real part of the bispectrum. **(a)** Real part of a bispectrum of the Middle and Late Pleistocene "~110-kyr world". Min value = −146 ‰³ kyr². Max value = 397 ‰³ kyr². **(b)** Real part of a bispectrum of the mid-Pleistocene transition "~80-kyr world". Degrees of freedom = 2. Min value = −108 ‰³ kyr². Max value = 112 ‰³ kyr². **(c)** Real part of a bispectrum of the Pliocene and Early Pleistocene "40-kyr world". Min value = −63 ‰³ kyr². Max value = 14 ‰³ kyr². Note the different scaling of the *z* axes between panel **(a)**, **(b)**, and **(c)**. Computational settings as in Fig. 4 (see main document). These bispectra are computed on the LR04 stack (see methods section) (Lisiecki and Raymo, 2005).



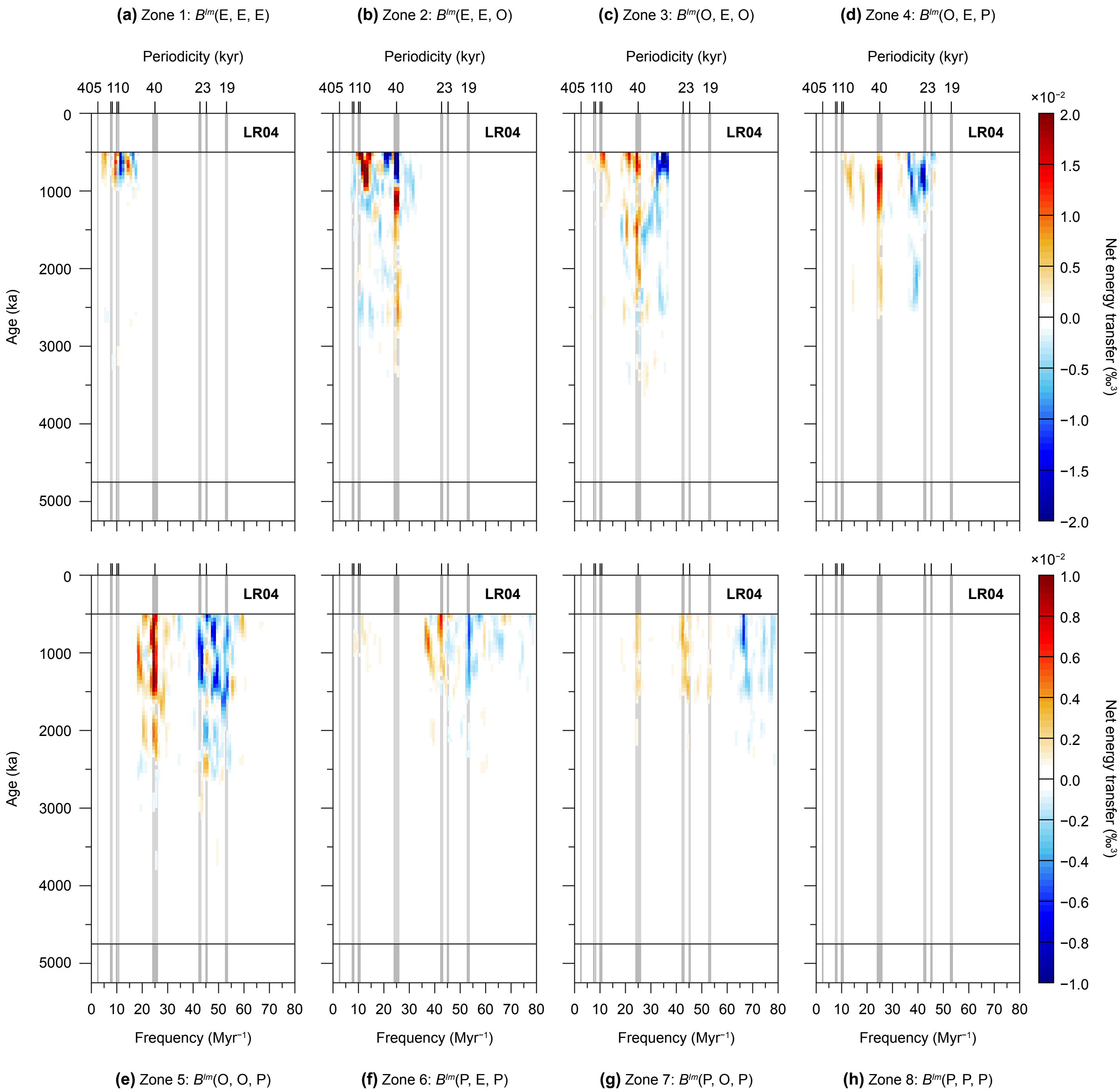
Supplementary Figure S2. Integration over the real part of the bispectrum. **(a)** Total integration over the real part of the bispectrum. **(b)** Skewness corresponding to panel **(a)**. Computational settings as in Fig. 5b (see main document).



Supplementary Figure S3. Conservative net energy transfers during the Pliocene and Pleistocene, computed by integrating over the entire imaginary part of the bispectrum (see methods section). Input data is the resampled LR04 stack (Lisiecki and Raymo, 2005). **(a)** Window length = 500 data points (500 kyr), step-size = 50 data points (50 kyr). No blocks. No frequency merging. Frequency resolution = 2.00 Myr^{-1}. Degrees of freedom = 2. **(b)** Asymmetry corresponding to panel **(a)**. **(c)** As in Fig. 5b (see main document). Window length = 668 data points (668 kyr), step-size = 50 data points (50 kyr). No blocks. No frequency merging. Frequency resolution = 1.50 Myr^{-1}. Degrees of freedom = 2. **(d)** Asymmetry corresponding to panel **(c)**. **(e)** Window length = 1,000 data points (1,000 kyr), step-size = 50 data points (50 kyr). No blocks. No frequency merging. Frequency resolution = 1.00 Myr^{-1}. Degrees of freedom = 2. **(f)** Asymmetry corresponding to panel **(e)**.



Supplementary Figure S4. Conservative net energy transfers during the Pliocene and Pleistocene over specific zones in the imaginary part of the bispectrum (see methods section). Computational settings as in Fig. S3a (i.e., window length = 500 data points). **(a)** Zone 1. **(b)** Zone 2. **(c)** Zone 3. **(d)** Zone 4. **(e)** Zone 5. **(f)** Zone 6. **(g)** Zone 7. **(h)** Zone 8. See also Fig. 3 and Table A1 (main document).



Supplementary Figure S5. Conservative net energy transfers during the Pliocene and Pleistocene over specific zones in the imaginary part of the bispectrum (see methods section). Computational settings as in Fig. S3c (i.e., window length = 1000 data points). **(a)** Zone 1. **(b)** Zone 2. **(c)** Zone 3. **(d)** Zone 4. **(e)** Zone 5. **(f)** Zone 6. **(g)** Zone 7. **(h)** Zone 8. See also Fig. 3 and Table A1 (main document).

Supplementary References

Lisiecki, L. E., and Raymo, M. E.: A Pliocene-Pleistocene stack of 57 globally distributed benthic $\delta^{18}O$ records, Paleoceanography, 20, PA1003, https://doi.org/10.1029/2004PA001071, 2005.