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Supplementary Methods and Figures

Methods

Sampling:

The coral core was sectioned longitudinally into 7 mm thick slabs. The coral slabs were x-rayed in order to expose annual density band couplets. Powdered samples for stable isotope analysis were collected using a low-speed micro drill. The slabs were sampled continuously along the corallite walls (theca), in order to avoid mixing of sample powder from different skeletal elements. Samples for oxygen isotope analysis were retrieved at approximately 1 mm increments, yielding a mean resolution of 12 samples per year.

Oxygen isotope analysis and chronology:

Coral $\delta^{18}O$ was analyzed using a Thermo Finnigan Gasbench II Deltaplus at IFM-GEOMAR. The isotopic ratios are reported in ‰ VPDB relative to NBS 19 (analytical error is less than 0.06‰ (1σ)). The chronology was developed on the basis of the seasonal cycle in coral $\delta^{18}O$, and by counting the well-developed annual density bands. The coral $\delta^{18}O$-record extends from 1918 to 2004. The measured skeletal d18O minimum (maximum) was assigned to the month September (February) which represents the average seasonal SST maximum (minimum) at the study site. Linear interpolation was used in order to obtain monthly resolution for statistical analysis. The uncertainty of the age model is approximately 1-2 months in any given year. The overlapping parts of sampling transects along different thecal walls were used to assess the reproducibility of the oxygen isotopic signal. Reproducibility is excellent (RSD: 1.45%, n = 39).

Calculation of $\delta^{18}O_{residual}$:

The $\delta^{18}O_{residual}$ is calculated by subtracting the temperature component from measured coral $\delta^{18}O$ using instrumental SST (HadISST 1.1). The resulting signal is an estimate of seawater $\delta^{18}O$ ($\delta^{18}O_{seawater}$) (Iijima et al., 2005; Linsley et al., 2006). We calculated relative changes of $\delta^{18}O_{seawater}$ following the methods described in Linsley et al. (2006) and Ren et al. (2002), assuming a $\delta^{18}O_{coral}$-SST relationship of -0.2 per mil/1°C, which corresponds to the average coral $\delta^{18}O$-SST slope obtained by SST-calibrations of *Porites* corals from the Indo-Pacific (range: -0.18 and -0.22 per mil per 1°C (Gagan et al., 1994; Juillet-Leclerc and Schmidt, 2001; Weber and Woodhead, 1972; Wellington et al., 1996)), and a *Diploria strigosa* coral from the Atlantic (range: -0.18 and -0.20 per mil per 1°C (Hetzinger et al., 2006)). We centered the $\delta^{18}O_{residual}$ and smoothed the time series with an 11 point running mean.

Significance of correlations:

All shown correlations were computed using ordinary least squares regression with zero-lag. The significance levels reported were determined using a very conservative estimate of the degrees of freedom (n-2) after taking into account the autocorrelation of the time series. The significance levels were estimated at: http://www.met.rdg.ac.uk/cag/stats/corr.html.

Calculation of mean errors:

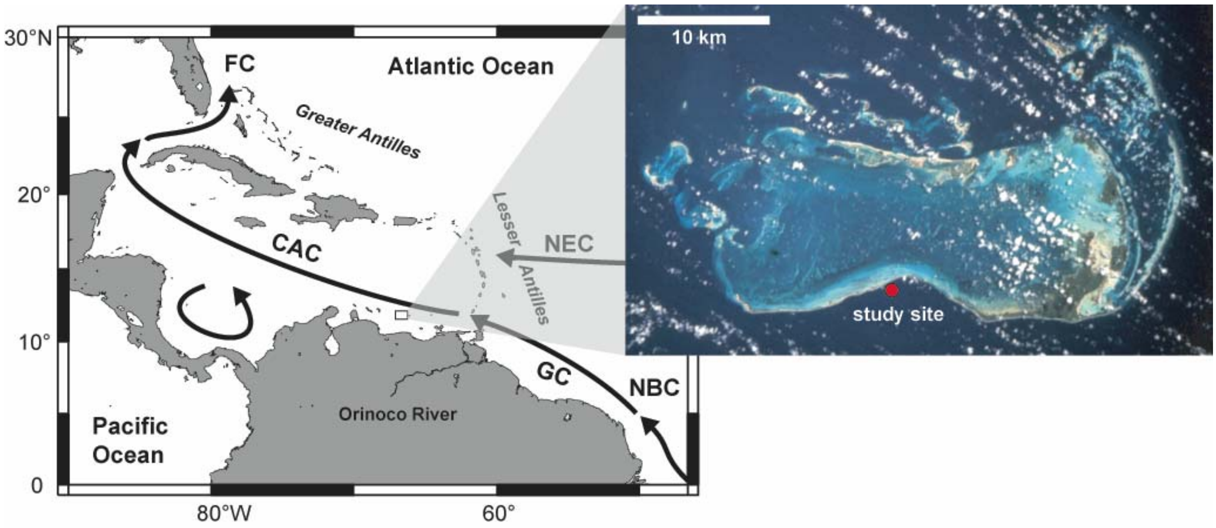
The measurement errors of any two isotopic determinations are independent, and the mean error reduces according to the formula: $\sigma_{Total} = (\sigma^2/N)^{1/2}$; where N is the number of independent measurements and σ the analytical error. For annual mean $\delta^{18}O$ values calculated from twelve monthly values, the total analytical uncertainty reduces to ±0.017‰. For 11-year averages the uncertainty reduces to ±0.005‰, respectively.

Legends for supplementary figures DR1 and DR2:

Figure DR1. Oceanographic setting of the western tropical Atlantic and Caribbean region showing major surface currents. The small box indicates the location of the study site. The inlet shows the location map of the Los Roques Archipelago. The sampling locality „Cayo Sal“ is marked by a red circle. Major surface currents are indicated based on data from Gordon (1967): CAC: Caribbean Current; FC: Florida Current; NBC: North Brazil Current; GC: Guyana Current; NEC: North Equatorial Current. The inlet-image was obtained at http://eol.jsc.nasa.gov and is courtesy of the Earth Sciences and Image Analysis Laboratory, NASA Johnson Space Center.

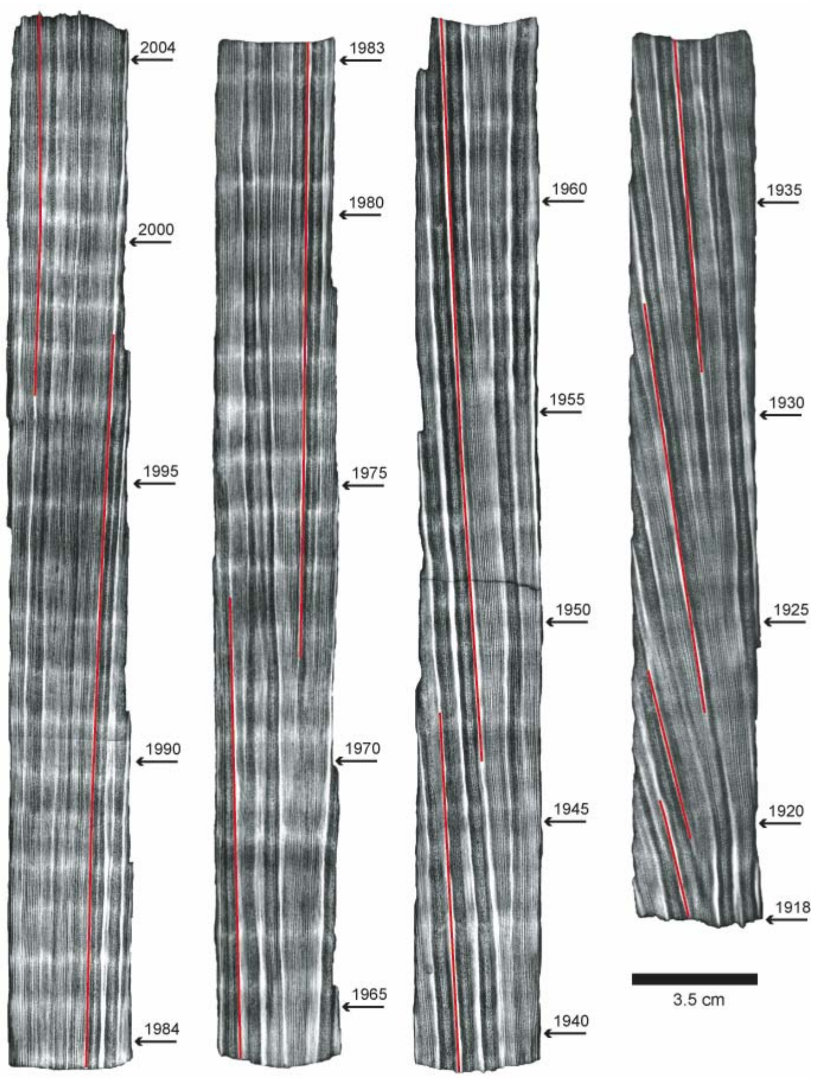
Figure DR2. X-radiograph prints of slabs from coral core Roq6 (*Diploria strigosa*). Alternating high (light) and low density (dark) bands can be observed clearly and banding is in a near perpendicular orientation with respect to the axis of the coral core. In the skeletal density banding pattern, one year of coral growth is representated by one high- and low-density band couplet. Years indicate coral chronology. Sampling transects are indicated by red solid vertical lines on each slab. Note the goodness of fit between individual slabs.

Figure DR1



30°N
20°
10°
0
80°W
60°
FC
Atlantic Ocean
Greater Antilles
Lesser Antilles
NEC
CAC
GC
NBC
Pacific Ocean
Orinoco River
10 km
study site

Figure DR2



Supplementary references

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