

## Supplements

**Supplementary Table S1:** Rate of coral  $\Delta\delta^{18}\text{O}$  change ( $\text{‰/ky}$ ) derived from Bonaire corals given by a range of Sr/Ca-SST and  $\delta^{18}\text{O}$ -SST calibrations. Note that all calculations reveal negative slopes indicating trend towards more positive values throughout the mid to Late Holocene.

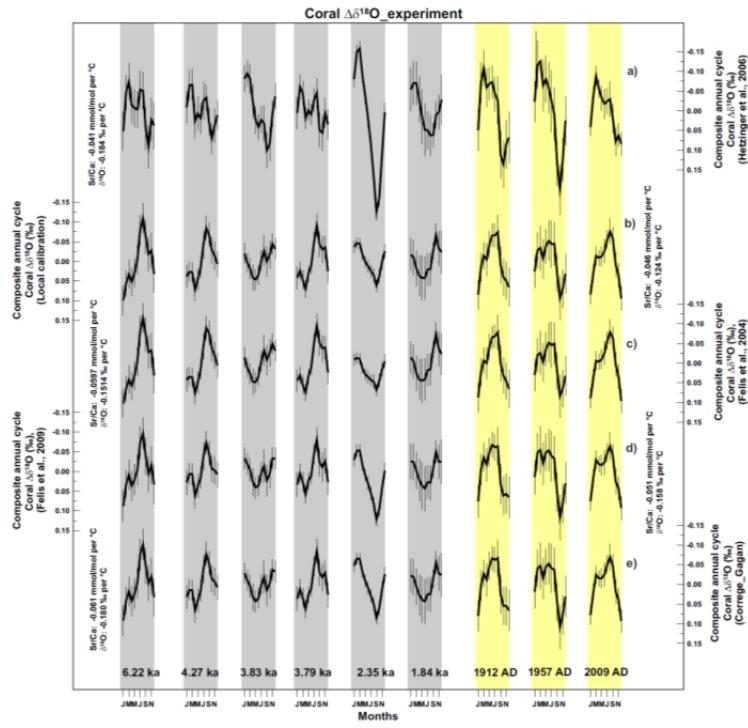
Sr/Ca-SST = -0.04 mmol/mol/°C		
$\delta^{18}\text{O}$ -SST	Slope ( $\text{‰/ky}$ )	SE slope
-0.14‰/°C	-0.0608	0.0278
-0.18‰/°C	-0.0911	0.0334
-0.22‰/°C	-0.1214	0.0392

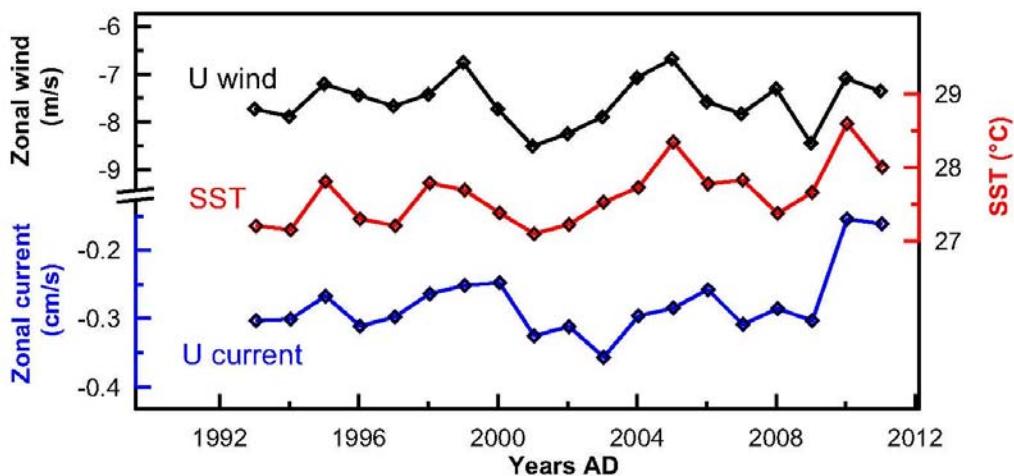
Sr/Ca-SST= -0.06 mmol/mol/°C		
$\delta^{18}\text{O}$ -SST	Slope ( $\text{‰/ky}$ )	SE slope
-0.14‰/°C	-0.0254	0.0217
-0.18‰/°C	-0.0456	0.0251
-0.22‰/°C	-0.0658	0.0287

Sr/Ca-SST= -0.08 mmol/mol/°C		
$\delta^{18}\text{O}$ -SST	Slope ( $\text{‰/ky}$ )	SE slope
-0.14‰/°C	-0.0077	0.0190
-0.18‰/°C	-0.0229	0.0213
-0.22‰/°C	-0.0381	0.0238



**Supplementary Figure S1:** Response of reconstructed composite coral  $\Delta\delta^{18}\text{O}$  annual cycle to different proxy-SST regression slopes. Composite annual cycles are calculated with the centering method (Cahyarini et al., 2008). Proxy-SST regression slopes used in this experiment are from a) Hetzinger et al., (2006), b) coral Sr/Ca and  $\delta^{18}\text{O}$  in reference to local SST data (this study), c) Felis et al., (2004), d) Felis et al., (2009) e) and well-accepted calibrations for coral  $\delta^{18}\text{O}$  (Gagan et al., 1998) and coral Sr/Ca (Corrège, 2006). Note that the experiment using the calibration of Hetzinger et al., (2006) gives very different composite annual  $\Delta\delta^{18}\text{O}$  cycles than all four other experiments which reveal very similar pattern for individual coral time windows. Error bars represent the standard error of the mean of monthly values.



**Supplementary Figure S2:** Annual conditions at Bonaire for the period 1993-2011. The zonal component of the wind is displayed in black (Kalnay et al., 1996), the sea surface temperature (SST) in red (Smith et al., 2008) and the zonal component of the current at the sea surface in blue (Bonjean and Lagerloef, 2002). For this time interval, the correlation coefficient between U-wind and SST is  $r=0.61$ ; between U-wind and U-current is  $r=0.48$ ; and between U-current and SST is  $r=0.65$ .