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Tracking tropical Atlantic climate variability of the last century using a 93-year monthly resolved δ^{18}O and Sr/Ca record from a Caribbean coral

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A 93-year high resolution record of coral aragonite Sr/Ca and δ^{18}O variations is presented from a colony of the massive reef-building coral *Diploria strigosa* from Guadeloupe, Caribbean Sea. During seasonal flood-events, the Lesser Antilles are regularly affected by low-salinity plumes which are generated by the maximum seasonal discharge of the Orinoco river. The seasonal flood plume, and the corresponding sea-surface salinity (SSS) anomaly, generally propagate northwards along the coastline towards the Caribbean Sea due to advection by mean ocean currents and extend from the Venezuelan coast to Puerto Rico shortly after maximum discharge. Highest seasonal discharge during late boreal fall is expected to correlate with the precipitation maximum associated with the Intertropical Convergence Zone (ITCZ).

Using a paired analysis of two geochemical proxies (oxygen isotopes and Sr/Ca elemental ratios) it is possible to unlink the effects of SST and seawater δ^{18}O composition ($\delta^{18}O_{SW}$), which in turn is related to salinity, in the coral δ^{18}O time series. Coral skeletal δ^{18}O was measured in monthly resolution for the growth period between 1907 and 2000. High precision Sr/Ca-ratios were measured using inductively coupled plasma optical emission spectroscopy (ICP-OES). Both proxy time series deduced from the same subsamples of coral aragonite were combined with monthly averaged instrumental SSTs of a 1° by 1° gridded data set (NOAA NCEP, Reynolds et al. 2002) for a corresponding time period (1982-2000) to derive a Sr/Ca-SST calibration. Our results indicate that monthly resolved Sr/Ca-ratios of *Diploria strigosa*, in contrast to other massive growing coral species sampled in the tropical Atlantic, capture the full amplitude of the seasonal SST cycle. The coral δ^{18}O, in contrast, shows

a larger seasonal amplitude (approx. 0,2 per mil) than expected from SST alone, owing to the large seasonal salinity change. Therefore, $\delta^{18}O_{SW}$ reconstructed from the coral should provide evidence of past hydrologic balance, including information about precipitation-evaporation cycles and riverine freshwater input. A multi-taper spectral analysis indicates that significant interannual coral $\delta^{18}O$ oscillations occur at average periods near 4 – 5.5 years. Further, a shift towards lower $\delta^{18}O$ values from the mid-80‘s is observable. On interannual to centennial time scales, our reconstructions will help to provide information on variability of past sea surface conditions in the tropical Atlantic and to establish an apparent link between Caribbean SSS extremes recorded in the aragonitic skeletons of *Diploria strigosa* corals and the entrainment of low-salinity plumes induced by seasonal Orinoco river discharge events.