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Quantifying post Little-Ice-Age freshwater influences and ocean dynamics in the Caribbean Sea using a novel tracer combination: $^{234}U/^{238}U$-(P)SST

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The Caribbean Sea is predicted to experience even further warming in the near future with large implications for regional sea surface temperature, precipitation patterns, and formation of tropical cyclones. The regional forcing mechanisms of seasonal to multidecadal variability include variations in strength of ocean circulation, ocean-atmospheric interaction, solar irradiance, freshwater discharge, and volcanic aerosols. In particular the impact of small-scale variations of surface ocean motion and SST variability is difficult to assess and therefore largely unknown. This includes for example regional freshwater discharge, or the influence of vertical mixing and sub-mesoscale eddies.

In this project we explore a novel tracer combination in tropical biomineralized carbonates consisting of U-isotopes ($\delta^{234}U$), proxy-derived SST, and radiocarbon to reveal freshwater discharge changes, ocean advection and mixing as well as surface heat exchange. In a first step we present a 250 year near annually resolved record of high-precision $\delta^{234}U$ values together with SST reconstructions obtained from the skeleton of the modern tropical coral *Orbicella faveolata* collected in the northern part of Cuba, Gulf of Mexico. This record is complemented by $\delta^{234}U$ values deduced from $^{230}Th/U$-dated sclerosponges off the coast of Puerto Rico.

The measured $\delta^{234}U$ values show a significant variability on (multi-) decadal timescales ranging from 144 to 149‰. A comparison with coral growth band density and extension rate suggests negligible impacts, supporting that the investigated archives reflect the U-isotopic composition of the seawater. Thus, precipitation, riverine input and possibly submerged groundwaters are investigated as potential drivers of coralline $\delta^{234}U$ variability. For example, elevated $\delta^{234}U$ values occurred within the period of less fluvial input from 1952 to 1970.

The combination of SST proxies, $\delta^{234}U$ values, and radiocarbon compared to regional precipitation estimates and tropical cyclone reconstructions will elucidate the sensitivity of excess ^{234}U to continental freshwater discharge. In addition, the observed excess ^{234}U variability narrows the range of permissible initial $^{234}U/^{238}U$ ratios of corals with respect to high precision $^{230}Th/U$ dating.