ITCZ variability in the tropical Atlantic during the last deglaciation

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Abrupt climate shifts during the last deglaciation, similar to the Glacial-Bolling/Allerod-Younger Dryas-Preboreal sequence of the high-latitude North Atlantic region, have been identified in tropical South America, primarily through changes in precipitation and trade wind intensity. Records of vegetation, dustiness, wind strength and river runoff from northern tropical South America (10°N-10°S) reveal dry and windy conditions during the Glacial and Younger Dryas, and non-windy, wet climates during the Bolling/Allerod and Preboreal. Sites located further south (15°-20°S) show the opposite trend, with wet conditions during the Glacial and Younger Dryas, and dry Bolling/Allerod and Preboreal. This pattern of changes is consistent with a southward shift of the ITCZ during times of cold high-latitude northern climate, with northward ITCZ shifts during northern warming.

Such ITCZ variability could be forced by mechanisms originating at high northern latitudes (e.g., cooling following shutdown of North Atlantic Deep Water formation) or possibly in the tropics (e.g., an ENSO-like mechanism operating at longer time scales). These different forcing scenarios might be identifiable through leads and lags between tropical and high-latitude sites. The Cariaco Basin, off Venezuela, is an ideal location for recovering high-resolution records of both ITCZ and North Atlantic variability. Cariaco records of the last deglaciation show decade-scale shifts in NADW formation at the same time as changes in local trade winds and precipitation. In addition, lower resolution pollen data from Cariaco and elsewhere in northern South America record dramatic changes in local vegetation, shifting between humid rainforest during the Bolling/Allerod and Preboreal periods, and dry grasslands during the Glacial and Younger Dryas. To investigate the relative timing of these rapid changes, we have constructed high-resolution records of tropical vegetation change from vascular plant biomarkers in Cariaco Basin sediments. Molecular composition and stable isotopic analyses of plant leaf waxes were used to distinguish grasslands from rainforest vegetation, and show distinct evidence of drier/cooler and wetter/warmer conditions during the Glacial-Younger Dryas and Bolling/Allerod-Preboreal climatic periods, respectively. At the current sampling resolution of 50 years, shifts in ITCZ location over tropical South America appear synchronous with climate changes in the high latitude North Atlantic region, consistent with either high- or low-latitude forcing.