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The role of tropical vegetation dynamics during Heinrich event 1

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Heinrich events are thought to be associated with a slowdown of the Atlantic Meridional Overturning Circulation (AMOC), which in turn would lead to a cooling of the North Atlantic Ocean and a warming of the South Atlantic Ocean (the “bipolar seesaw” hypothesis). On land, the spatial pattern turns out to be more complex and some additional processes are possibly involved.

We present new pollen data from ODP Site 1078 (12°C) off Angola and from core GeoB3910 off the Brazilian coast in the tropical west Atlantic Ocean. The data from West Africa indicates a retreat of the evergreen forest and an expansion of the coastal desert apparently synchronous with Heinrich event 1 in the North Atlantic Ocean. However, during the same time period, the vegetation in north-east Brazil got more varied. First shrubs appeared and eventually, a lush vegetation of dry forest, Atlantic rain forest and gallery forest developed.

For the interpretation of our data, we used the University of Victoria Earth System-Climate Model, which includes a comprehensive dynamic global vegetation component (“TRIFFID”). In response to a near-collapse of the AMOC, the model showed a bipolar seesaw in temperature and precipitation over the Atlantic Ocean. However, a strong decrease in precipitation affected not only Northwest Africa, but West Africa as a whole and a large part of northern South America. Precipitation indeed decreased in south-eastern South America (north-east Brazil). We discuss the associated succession in plant-functional types as well as the possible feedback of this tropical vegetation

dynamics to the global climate system.