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Linking tropical vegetation development and variations in sea water temperatures off Angola during Heinrich events

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During periods associated with North Atlantic Heinrich events (HE) North Atlantic Deep Water formation is weakened and hence Atlantic Meridional Overturning Circulation (AMOC) is strongly reduced. According to the hypothesis of inter-hemispheric climate coupling via bipolar seesaw a weaker AMOC would lead to an accumulation of heat in the South Atlantic. Abrupt climatic perturbations as HE are furthermore thought to influence the vegetation development on land due to the ocean-atmosphere linkage.

To address the issue of the connection between tropical African vegetation development and possibly changing marine surface conditions during the last glacial, high-resolution palynological and geochemical investigations were performed on marine sediments from ODP Site 1078 (11°55'S, 13°24'E) off Angola. The distribution of pollen provides information about the dominant vegetation and corresponding climate on the continent during the last glacial. Analysing the Mg/Ca ratios of G. ruber (pink) and G. bulloides gives the opportunity to determine the glacial temperatures of the ocean surface and mixed layer. Combining the vegetation record with the reconstructed sea water temperatures from the same site enables us to directly link variations in the marine and terrestrial realms and get insights in their interaction.

Surprisingly, it appears that none of the prevalent southwest African vegetation types shows a distinct response to HE. Indeed, it seems that the vegetation development follows atmospheric carbon dioxide concentration and Southern Hemisphere temperature. In contrast, an increase in sea surface temperatures does indicate an impact of HE off Angola. Modeling experiments performed with an Earth System Climate Model that includes a dynamical vegetation and land surface component provide a possible explanation for the difference in the response of both records.