



Strong meridional overturning circulation during the Late Miocene

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The Cenozoic climate evolution includes significant changes in oceanic transports which are ultimately linked to the paleotopography and opening/closing of seaways. We estimate the effect of vegetation on the ocean general circulation using atmospheric circulation model simulations for the late Miocene climate. The open Central American Seaway leads to import of upper-level, comparatively fresh Pacific water into the Atlantic, thereby reducing the density in the North Atlantic Ocean and weakening of the large-scale ocean circulation. For the late Miocene, we find that a modified land surface cover can compensate this gateway effect showing an almost present oceanic northward heat transport. Interestingly, the benthic record in the North Atlantic Ocean indicates a relatively warm deep water signature for the late Miocene (Lear et al., 2003) which can be interpreted as an already established meridional overturning circulation at this time. We conclude that reorganizations of vegetation zones, topographical changes and changes in the global ocean circulation play a dominant role for the major Cenozoic climate transitions.