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Fire activity over the last Glacial Cycle in West Africa

T. Brücher (1), A.-L. Daniau (2), G. Lasslop (3), P. Köhler (4), and P.J. Valdes (5)

(1) GEOMAR - Helmholtz Centre for Ocean Research, Kiel; Germany (tbruecher@geomar.de), (2) CNRS, EPOC, Bordeaux; France, (3) Max Planck Institute for Meteorology, Hamburg; Germany, (4) Alfred Wegener Institut, Bremen; Germany, (5) Cabot Institute and School of Geographical Sciences, University of Bristol, Bristol; UK

Responses of fire activity to changes in climate are still uncertain and biases exist by integrating this non-linear process into global modelling of the Earth system. Warming and regional drying can force fire activity in two opposite directions: an increase in fire in fuel supported ecosystems or a fire reduction in fuel-limited ecosystems. Therefore, climate variables alone cannot be used to estimate the fire risk because vegetation variability is an important determinant of fire dynamics and responds itself to change in climate.

Southern Africa (south of 20°S) paleofire history reconstruction obtained from the analysis of microcharcoal preserved in a deep-sea core located off Namibia reveals changes of fire activity on orbital timescales in the precession band. In particular, increase in fire is observed during glacial periods, and reduction of fire during interglacials such as the Eemian and the Holocene. The Holocene was characterized by even lower level of fire activity than Eemian. Those results suggest the alternance of grass-fuelled fires during glacials driven by increase in moisture and the development of limited fuelled ecosystems during interglacial characterized by dryness. Those results question the simulated increase in the fire risk probability projected for this region under a warming and drying climate obtained by Pechony and Schindell (2010).

To get better understanding of fire variability in South Africa we compare data of a deep sea record to model results obtained by JSBACH - the land component of the Max Planck Institute Earth System Model. Fire dynamics over the last 130.000 years is simulated in an offline mode. Climate data like precipitation and temperature as well as vegetation data like soil moisture, productivity (NPP) on plant functional type level are used to explain the trends and variability of fire activity over the last glacial cycle - trends which are driven by vegetation and climate, while vegetation itself is coupled to fire.