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Mineral dust under different climate conditions with a particular focus on the Antarctic region

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Mineral dust plays an important role in the climate system. It is one of the main contributors to the global aerosol burden and has a large impact on Earth's radiative budget due to the absorption and scattering of solar and infrared radiation.
Ice cores in Antarctica represent a unique archive for the deposition of aeolian dust particles in the past. Dust deposition reflects both variations in source distribution/strength and atmospheric transport/deposition. The interpretation of the ice core records is thus nontrivial. The global aerosol-climate model ECHAM/HAM was used to simulate the aerosol cycle for several past time slices. Dynamic vegetation models were used to obtain appropriate vegetation cover maps for each time slice, and these were used as input to the aerosol-climate model.
Simulations calculate a two- to three-fold increase of the global dust emissions in LGM (compared to present-day conditions), caused by drier climate, decrease in vegetation cover, lower sea level, and changes in wind speed. The model indicates an increase in the strength of the dust sources in Asia, Northern Siberia, the Sahara and Patagonia. The resulting increase in deposition over Antarctica, together with reduced precipitation rate in this region, leads to an increase by factor of 10 in the dust concentration in the simulated South Polar ice.
In the Eemian (126,000 before present) we see an extension of some Southern Hemisphere sources as a result of drier conditions on the southern hemisphere due to reduced monsoonal activity, which is a direct consequence of the changes in insolation. Simulations for other time slices are ongoing.