Chemical and mineralogical composition of aerosol particles at Cape Verde

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The Saharan Mineral Dust Experiment II (SAMUM II) is dedicated to the understanding of the radiative effects of mineral dust. In January and February of 2008 a field campaign, focussed on investigation of aged Saharan dust and admixtures of biomass burning and marine aerosols, was conducted at the Island of Santiago, Cape Verde. Ground-based and airborne particle measurements and sampling were performed in the winter season, where mineral dust from the Western Sahara and biomass burning aerosol from the Sahel region are observed to occur.

The size-resolved particle aspect ratio and chemical composition is determined by individual particle analysis, performed by semi-automated energy dispersive X-ray microanalysis in a scanning electron microscope. Mineralogical bulk composition is analyzed by X-ray diffractometry.

First investigations of the collected samples confirm the presence of a mixture of sea salt, mineral dust, and anthropogenic material. A complex aerosol consisting of externally mixed particle types as well as internally mixed species – e. g., sea salt/mineral dust mixtures – is encountered in the marine boundary layer at the Island of Santiago.

By comparison with earlier measurements in Morocco, further analyses of the samples will yield information on the change in chemical composition, particle morphology, and mixing state of the aerosol during transport from the African continent to Cape Verde.

New ^{230}Th dating methods applied to Chinese caves: Climate change on glacial to cultural timescales

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We present a 350,000-year record of the oxygen isotopic composition of cave calcite from Hulu, Dongge, Sanbao, and Wanxiang Caves. The record is improved in oxygen isotope resolution (3 y to several decades), range, and dating precision over published results. It is, in essence, a history of the oxygen isotopic composition of meteoric precipitation, which is related to and integrates monsoonal precipitation.

Portions of the chronology were established with new generation ^{230}Th dating methods using multi-collector, inductively-coupled plasma mass spectrometry, yielding precisions (for cave calcite) of ±1 y at 1000 y, ±10 y at 10 ky, ±100 y at 100 ky, ±10 ky at 600 ky, and a range of >700 ky. Key points include high ionization/transmission efficiency for U and Th (1 - 2%), yielding high precision on calcite with low U abundances and new half-life values for ^{234}U and ^{230}Th.

The monsoon is dominated by orbital-scale variability throughout and millennial-scale variability during glacial periods. The monsoon follows boreal summer insolation with no discernable phase shift, supporting a direct link between seasonal heating and the monsoon. At millennial scales, the last glacial record correlates strikingly with the Greenland record, with Chinese correlatives to all 25 Greenland interstadial events, and similar sequences for penultimate and antepenultimate glacial periods. The Holocene monsoon correlates significantly with proxies for solar irradiance, linking some monsoon variability to solar changes. The highest resolution portion of the record (<1800 y) establishes links between the cultural history of China and climate.

The monsoon exhibits remarkable relationships with atmospheric methane, the isotopic composition of atmospheric O_2, and Heinrich Events. These links allow correlations among ice core, marine, and monsoon records, thereby establishing, for key periods, the timing and sequence of events recorded around the globe in different environments. Using this strategy, we have characterized events during the last 4 glacial terminations, placing strong constraints on the causes the rapid endings of ice age cycles.