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Experimental determination of the refractive index and single scattering albedo of African mineral dust as a function of source region

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By scattering and absorbing both the solar and terrestrial radiations, gaseous compounds and airborne particles, have an impact on climate. If the radiative impact of some of these compounds are now relatively well known, many uncertainties remain about mineral dust emitted from aeolian erosion in arid and semi-arid regions (IPCC 2007). These uncertainties are linked to our capacity in representing the spatial and temporal variability of their atmospheric concentration and their optical and radiative properties. Those latter depend on the physico-chemical properties of dust (chemical and mineralogical composition, shape and size) which, to date, are also poorly known. In this work we present measurements of the elemental and mineralogical composition, size distribution and shape of mineral dust observed during the African Monsoon Multidisciplinary Analyses (AMMA) field campaigns, conducted in western Africa during both the dry and wet seasons of 2006. As a matter of fact, in terms of emitted mass, the arid and semi-arid regions of western Africa are the most important dust sources at a global scale. Measurements have been carried out at the ground supersite of Banizoumbou in Niger, which is both a transport region for Saharan dust and a source region for Sahelian dust. We will focus our attention on the differences of the mineralogical composition of dust emitted from these two major source areas, in particular regarding minerals ruling its radiative effect (calcite, clay, iron oxides…), and on the variability of the size distribution and shape factor.
All these results are used to estimate the dust complex refractive index and single scattering albedo in the visible and infrared spectra as a function of source region. These are key input parameters in order to evaluate the direct radiative impact of African mineral dust at the regional scale.