Dust aerosol impact on monsoon dynamics and regional precipitation over western Africa, sensitivity to absorption properties

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We investigate the climatic impact of shortwave and longwave radiative forcing of Saharan dust on the West African monsoon and Sahel precipitation using a regional climate model coupled to a dust model and running for the period 1996-2006. Two competing effects are found. First a reduction of monsoon intensity in the lower troposphere induced by the dust surface cooling causes a reduction of precipitation, and second an 'elevated heat pump effect' in the higher troposphere induced by the dust diabatic warming causes an increase of precipitation. The net impact of these simulated effects is a reduction of precipitation over most of the Sahelian region (by about 8 % on average) except over a Northern Sahel - Southern Sahara band, where precipitation increases. These patterns are very sensitive to the dust absorbing properties, which modulate the intensity of the patterns and the boundary between enhanced and decreased precipitation areas. Finally we show that taking into account dust could be factor reducing the model precipitation bias compared to available observations.

Interactions between two types of nanoparticles (nC_{60} and TiO_2) and porous media

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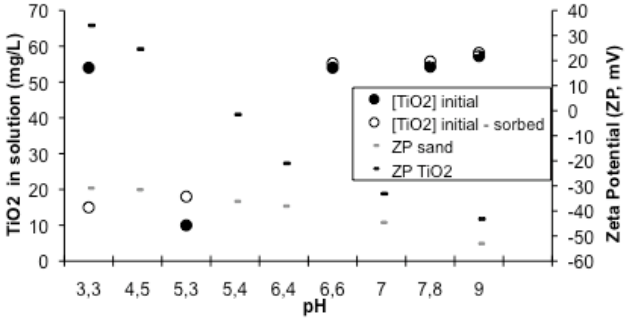
Introduction

The mobility vs. attachment of manufactured nanoparticles (nC_{60} and TiO_2) in a sandy porous media saturated with water has been studied. In this aim, the nanoparticle (NP) aqueous suspensions and the porous media were priory characterised in terms of size, mineralogy and surface charge. The interactions between the NPs and sand vs. pH and ionic strength were also studied by batch experiments.

Results and Discussion

TiO_2/sand interactions : Role of the pH

TiO_2 suspension displays a zeta potential ranging from +40 to -40 mV with pH from 3 to 10, and an isoelectric point at pH = 5.5, whereas the sand surface charge remains negative (-10 to -50 mV) in the whole range of pH. These respective surface charges, and their electrostatic interactions implied, enable to explain sand / NPs interactions observed experimentally (Figure).



A significant adsorption of nanoparticles onto the sand was observed at pH < 4 due to opposite charges. At pH > 6, repulsive interactions prevents any adsorption. At pH close to the isoeletric point, the aggregation of the NPs removes them from the suspension so that they are not available for adsorption.