Subject offered for a contract starting october 2016

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Financing: Doctoral contract with or without teaching assignment

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Saharan dust input to North Tropical Atlantic Islands

The Sahara desert is the strongest source of atmospheric dust from continental origin, with an average of about 1 km^3 of yearly emissions. Large masses of dust are emitted from different parts of the Sahara and transported over the Atlantic Ocean up to Equatorial South America. Tropical forests and soils are supplied by Saharan dust with essential nutrients, as phosphorus[1]. La Guadeloupe island is subjected to frequent Saharan dust inputs which are captured by soils and plants, are of major importance for plant growing, and finally become a component of its soil.

Photo of the Saharan Air Layer during a Saharan Air Layer Experiment mission on 18 September 2006. Saharan dust gives the sky an orange glow during this late afternoon sunset in the eastern Caribbean. Small cumulus clouds poke through the tops of the dust layer. Photo credit: Jason Dunion NOAA/HRD - See more at: http://www.ssec.wisc.edu/news/articles/5291#sthash.UDCmBJWK.dpuf

Fore coming climate change will certainly disturb the intensity and transportation patterns of Saharan dust revealing a strong necessity of a better knowledge of the dynamic of Saharan dust incorporation in tropical soils. We propose here to study the variability of the Saharan nutrients inputs at different time scale levels from source to deposition and its footprint in the

1 Yu, H., M. Chin, T. L. Yuan, H. Bian, J. M. Prospero, A. H. Omar, L. A. Remer, D. M. Winker, Y. Yang, Y. Zhang, Z. Zhang, and C. Zhao, The fertilizing role of African dust in the Amazon rainforest: A first multiyear assessment based on CALIPSO lidar observations, Geophysical Research Letters, 42, doi:10.1002/2015GL063040, 2015

environment. This will be done on the basis of field experiments using elemental and isotopic measurements in past and present samples.
A continuous atmospheric deposition sampling is already operated from one year at La Guadeloupe (15°58'50" N, 61°42'13" W) and is intended to be continued for two extra years. Simultaneously, emitted dust will be sampled at three points in the Sahel source zone from Niger to Senegal. Chemical and isotopic analyses of these samples will bring required information on the short term present day chemical dynamic of the Saharan dust emission and deposition and bring necessary tools to discriminate Saharan atmospheric deposition from other inputs. Soil cores will be used to investigate the incorporation behaviour and fate of Saharan dust in the Caribbean soils at La Guadeloupe and at other neighbourhood islands. Coupled with surface sediment core collected in the North tropical Atlantic, these measurements will give long term dynamic of past Saharan dust deposition history. A scientific background already exists for measurements in soils[2][3] or in the suspended atmospheric aerosol[4] but this work will bring the first time series for isotopic determination in the total atmospheric deposition over North Tropical Atlantic regions.

For this thesis, field and laboratory work will be done and also investigations using chemical, environmental, geochemical or atmospheric models will be developed, depending on the capabilities and the feelings of the student. The applicant must love analytical chemistry, carefully done experiments and also the environmental and geo- sciences. He/She will gain a consequent upgrade on her/his analytical and laboratory expertise and geochemical exploitation of environmental data.

2 Clergue et al., Influence of atmospheric deposits and secondary minerals on Li isotopes budget in a highly weathered catchment, Guadeloupe (Lesser Antilles), Chemical Geology 414 (2015) 28–41.
3 Mc Clintock et al., Spatial variability of African dust in soils in a montane tropical landscape in Puerto Rico, Chemical Geology 412 (2015) 69–81.
4 Kumar et al., A radiogenic isotope tracer study of transatlantic dust transport from Africa to the Caribbean, Atmospheric Environment 82 (2014) 130e143.