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Elemental and isotopic (Sr and Nd) characterization of deposited dust on the Senegalese margin and implications for Saharan dust source geochemical fingerprinting

Meryll Le Quilleuc (1), Aloys Bory (1), Yevgeny Derimian (2), Sylvie Philippe (1), Viviane Bout-Roumazeilles (1), Charlotte Skonieczny (3), Déborah Ponleve (1), Aboubacry Diallo (4), Thierno Ndiaye (4), Wendy Debouge (5), Aubry Vanderstraeten (5), Nadine Mattielli (5), Veronique Alaimo (6), Gabriel Billon (6), Michel Legrand (2), and Philippe François (2)

(1) Laboratoire d'Océanologie et Géosciences, Université de Lille, CNRS, Université du Littoral Côte d'Opale, UMR 8187 LOG, Lille, France, (2) Laboratoire d'Optique Atmosphérique, Université de Lille, CNRS, UMR 8518 LOA, Lille, France, (3) Laboratoire Géosciences Paris Sud, Université Paris Sud, Orsay, CNRS, UMR 8148 GEOPS, Orsay, France, (4) IRD, US191 IMAGO, Dakar, Senegal, (5) Laboratoire G-Time, Université Libre de Bruxelles, DGES, ULB, Bruxelles, Belgium, (6) Laboratoire de Spectrochimie Infrarouge et Raman, Université de Lille, CNRS, UMR 8516 LASIR, Lille, France

Considering the vastness of Sahara-Sahel region and the numerous dust emission areas within contrasting geological contexts, Saharan dust composition is expected to be mineralogically and geochemically diverse. The large number of sources, whose contributions are both quantitatively and temporally variable, and are often mixed during dust outbreaks at changing spatial scales, makes it particularly challenging to satisfactorily appreciate the compositional variability of Saharan dust though. In order to improve our understanding of Saharan dust composition diversity, we launched a continuous sampling of dust deposition at Mbour (∼80 km south of Dakar) on the Senegalese margin in 2006, as part of the African Multidisciplinary Monsoon Analysis (AMMA) framework. The sampling site, located under the major corridor for Saharan dust transport, is ideally situated for monitoring mineral dust as they reach the North-eastern Tropical Atlantic. Dust deposits have been collected for more than a decade at a weekly (or better) resolution using a PVC Capyr-type reversed pyramid-shaped passive collector installed at about 12 m above the ground on a sampling tower facing the Atlantic Ocean. The building of this long time series has two main objectives: first, to document the temporal change in mineralogical and geochemical composition of Saharan dust transported towards the Tropical Atlantic, and second, to typify the mineralogical and geochemical signature of the major dust sources "feeding" the tropical Atlantic and identified with the help of back-trajectories, dust transport models and satellite data (the Infrared Difference Dust Index (IDDI) satellite product in particular; Legrand et al., 2001). Here we will present major and trace elements data covering several seasonal cycles of dust deposition at Mbour, as well as elemental and Sr and Nd isotope ratios measured during most major outbreaks recorded across the 12-year long time series. Elemental time series show significant variability in the dust chemical composition on the Senegalese margin. Major changes are associated with seasonal shift in transport patterns but some also occur on much shorter time scales across Saharan dust outbreaks. The observed compositional range at Mbour often matches and sometimes even exceeds the entire span reported in the literature for West African source regions [Scheuvens et al., 2013], underlining the interest of long-time series for dust characterization. Remarkably, the elemental composition of mineral dust collected during large Saharan outbreaks, however, is much less varied, suggesting a more modest compositional diversity between the sources involved during major outbreaks. Sr and Nd measured during these main outbreaks originating from various sectors of West Africa also display limited variability compared to data reported in the literature for potential source areas. Yet, the three main sources regions of provenance (as identified by back trajectories and IDDI images), show somewhat distinct Sr and Nd isotopic composition, emphasizing the potential of Sr and Nd isotopic ratios for dust provenance discrimination. These results will be discussed in the light of Tropical Atlantic aerosol, sediment trap and bottom sediment data available in the literature.

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