Temporal evolution of mineralogical Associations of Atmospheric Dust

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Mineral dust produced from windblown soils and deserts is one of the largest contributors to the global aerosol loading and has strong impacts on regional and global climates, long-term climate trends as well as marine and terrestrial ecosystems. Cape Verde is located in an area of massive dust transport from land to ocean, and is thus ideal to set up sampling devices that will able the characterization and the quantification of the dust transported from Africa.

Aerosol sampling is being performed at Praia airport during one year and mineralogical composition is being studied by X-ray diffraction, TEM and scanning electron microscopy.

On a first stage, 16 samples corresponding to the first month of sampling were analyzed with greater detail, in order to assess the main and accessory minerals, their relative proportions, check the eventual heterogeneities, and establish the mineralogical markers. Mineralogical phases identified include various silicates and aluminosilicates, carbonates, sulphates, phosphates, oxides and hydroxides. Iron hydroxides, such as lepidocrocite and goethite, and carbonates, such as calcite and siderite, are the most discriminating phases, allowing to differentiate 3 subsets: A) Iron hydroxides rich; B) Calcite rich; C) Siderite rich (7, 8, 15). Samples showing higher HiVol conc. belong to first group, whereas those with lower HiVol conc. belong to second one. On the contrary, silicates, such as quartz, feldspars and phyllosilicates (mainly micas), did not show any particular tendency, being ubiquitous and generally on small amounts.

On a second stage, 103 samples corresponding to 12 months of sampling, were analyzed with the same methodology, the semiquantification being computed on the XRD mineralogical data. The results of the semiquantification of the identified mineral phases were submitted to Principal Component Analysis, as well as to Cluster Analysis, in order to clarify the identification of the main sources and origins of the particles sampled. Cluster analyses show the same associations established at our first stage: A – iron oxides (with quartz and feldspars); B – calcite (with sulphates); C – siderite (with halite, phyllosilicates and phosphates). Factor analyses enhanced the dichotomic behaviour of iron oxides and siderite (factor 1), as well as between quartz and phyllosilicates plus halite (factor 2), calcite being discriminated by factor 3. The evolution of factor scores along the samples sequence (factor 1 in blue, 2 in red, 3 in gray) enhances the previous considerations. Factor 3 (calcite) shows important scores only at the beginning of the sequence; factor 2 (quartz vs phyllosilicates) mainly at the final part; factor 1 (iron oxides vs siderite) is the main player showing higher scores either positive (iron oxides) or negatives (siderite).