Monitoring of transatlantic particles over São Paulo (Brazil) by sun-photometry, ground-based lidar and CALIOP

J.L. Guerrero-Rascado[1,2], F. J. S. Lopes[3,4], E. Landulfo[4] and L. Alados-Arboledas[1,2]

[1]Andalusian Center for Environmental Research (CEAMA), University of Granada, Autonomous Government of Andalusia, Av. del Mediterráneo, s/n, 18006, Granada, Spain
[2]Dpt. of Applied Physics, University of Granada, Fuentenueva s/n, 18071, Granada, Spain
[3]Universidade de São Paulo, Instituto de Astronomia, Geofísica e Ciências Atmosféricas, Rua do Matão, 1226, Cidade Universitária, CEP 05508-090, São Paulo, SP, Brazil
[4]Instituto de Pesquisas Energéticas e Nucleares, Centro de Lasers e Aplicaçoes Avenida Lineu Prestes, 2242 Cidade Universitária, CEP 05508-000, São Paulo, SP, Brazil
Keywords: aerosol particles, Brazil, CALIPSO, lidar, sun-photometry, transatlantic transport
Presenting author email: alados@ugr.es

Two aerosol types have been traditionally reported over the Brazilian area. On the one hand, it is well recognized that the biomass burning activity has an important impact on the air quality in Brazil. According to CPTEC/INPE (www.cptec.inpe.br/queimadas), between $11.5 \cdot 10^4$ and $20.5 \cdot 10^4$ actives fires per year were detected in 2006-2012 period. In particular, biomass burning activities related to sugarcane crops is especially relevant in the Northeastern and Southeastern areas. Several works reported studies related to biomass burning covering different aspects such as gases, particulate matter and their transport. On the other hand, the largely local emission sources determine the chemical composition of the atmospheric aerosol in all metropolitan regions, with the most populated and industrialized areas in the Southeastern Brazil. This results in a small influence of long-range transported particles from elsewhere in term of aerosol load in Brazil and traditionally other different long-range transported aerosol types have been ignored over the Southeastern metropolitan areas as the State of São Paulo. However, it is possible to detect their presence on intensive optical properties such as the lidar ratio.

In order to achieve a better understanding of the spatial and temporal variability of the complex aerosol distributions on both regional and global scales, the transcontinental transport of different aerosol types is of the special importance and must be understood. Regarding Saharan dust, many field campaigns and studies have been conducted during the last years. However, most of them were performed close to source regions or considering short-range transport, and therefore the evolution of dust properties during transport is still misunderstood. The Atlantic Ocean is the major pathway of dust transport from North Africa, the latter being the Earth's largest source of mineral dust. Several studies have already been conducted to understand the physic-chemical properties of Saharan mineral dust. However, most of them were performed close to source regions or considering short-range transport, therefore the evolution of dust properties during transport is still misunderstood and many examples illustrate the need of a thoroughly understanding on the transcontinental transport of aerosols. Although the location of the Inter Tropical Convergence Zone (ITCZ) can be an indicator of the dust meteorology as a rough approximation, both meteorology and source features are the overriding factors determining the transport of dust in the atmosphere. Synoptic scale system provides a mechanism in the western Atlantic to inject dust across an active ITCZ. Up to now, the vertical distribution of Saharan mineral dust over South America is almost limited to a case study and a medium-term analysis of systematic (1 year) multiwavelength polarization Raman lidar observations of optical and microphysical particle properties, both over the Amazon Basin.

The analyses presented in this study are an evidence of the arrival of the transcontinental advection of Saharan dust and its subsequent detection in São Paulo, at latitudes very far from the Equator. For that goal, the synergetic combination of several approaches, including active (lidar) and passive (sun-photometer) remote sensing from ground and satellite platform (CALIPSO), were used.

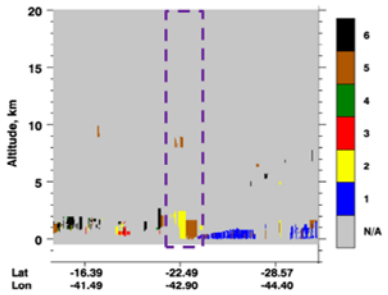

Figure 1. Aerosol subtype from CALIPSO on 26/12/2007 (night) around São Paulo (shaded box) detecting dust (yellow) and polluted dust (brown).

This work was supported by the Santander Bank through the fellowship program "Becas Iberoamérica. Jóvenes Profesores e Investigadores. Santander Universidades. Convocatoria España, 2012", the Andalusia Regional Government through projects P08- RNM-3568 and P10-RNM-6299, by the Spanish Ministry of Science and Technology through projects CGL2011-16124-E, CGL2010-18782, CSD2007-00067 and CGL2011-13580-E/CLI, and by the EU through the ACTRIS project (EU INFRA-2010-1.1.16-262254).