Optical properties, size distribution and composition of aerosol particles in the urban area of Sao Paulo

PAULO ARTAXO[1], JOHN BACKMAN[2], LUCIANA RIZZO[3], FABIO JORGE[1] AND MARKKU KULMALA[2]

[1]Institute of Physics, University of São Paulo, Brazil (artaxo@if.usp.br)
[2] Division of Atmospheric Sciences, Department of Physics, University of Helsinki, Finland.
[3] Department of Exact and Earth Sciences, Federal University of Sao Paulo, Diadema, Brazil.

The megacity of São Paulo with its 19 million people and 7 millions cars is a challenge from the point of view of air pollution. High levels of PM10, black carbon and ozone and the peculiar situation of the large scale use of ethanol fuel makes it a special case. Little is known about the impact of ethanol on air quality and human health and the increase of ethanol as vehicle fuel is rising worldwide An experiment was designed to physico-chemical properties of aerosols in São Paulo, as well as their optical properties. Aerosol size distribution is being measured with a Helsinki University SMPS and a GRIMM OPC. Optical properties are being meeasured with a TSI Nephelometer and a MAPPF absorption photometer. An CIMEL sunphotometer from the AERONET network measure the aerosol optical depth.

The measured total particle concentration typically varies between 10,000 and 30,000 cm-3 being the lowest late in the night and highest around noon and frequently exceeding 50,000 cm-3. Clear diurnal patterns in aerosol optical properties were observed ranging between 21 and 64 Mm-1 for light scattering coefficients (σSP) and between 12 and 33 Mm-1 for light absorption coefficients (σAP). The diurnal patterns measured at the site show peaks in light absorption and scattering coefficients during morning rush hours where the single-scattering albedo (ω0) is at its lowest. Surface mean diameters can be seen growing from the minimum at noon to late into the night which can also be seen from the size dependent Angstrom exponents calculated from the light scattering coefficients. During the first month a total of seven new particle formation events were observed with growth rates ranging from 9 to 25 nm h-1. During these events the condensation sink, vapour abundance explaining the growth, and vapour production rates were calculated. Interestingly enough there were also events were condensed vapours were evaporating from the condensed phase thus shrinking the size of the particles in all sizes. Aerosol optical thickness were relativelly small at 0.1-0.3 at 500 nm, indicating low boundary layer height.

Evolution of the cratonic lithosphere inferred from lithospheric mantle heterogeneity: A geophysical perspective

IRINA M. ARTEMIEVA

IGG, University of Copenhagen, Denamrk, (irina@geo.ku.dk)

Large-scale geohysical models indicate a significant lateral heterogeneity of the cratonic lithosphere. In contrast to xenolith data, which suggest little variation in lithospheric thickness in the cratons, significant lateral variations in lithospheric thickness are seen in global thermal [1] and seismic tomography models [e.g. 2, 3]. These variations reflect the cumulative effect of the processes of lithosphere formation and its later reworking by tectonic and mantle processes, and thus provide information on the preservation style of the lithospheric mantle. Thermal [1] and seismic tomography models [2, 3] of lithospheric thickness, complemented by a global 1 deg x 1 deg database for tectono-thermal ages for the continental crust [4], are used to calculate (i) the volume of the preserved continental lithosphere of different ages within the individual cratons, (ii) a global model of lithosphere preservation since the Archean. In accord with independent estimates of the growth rate of juvenile crust [5], three major peaks in lithosphere preservation rate can be recognized globally. However, the amplitude at 2.1-1.7 Ga is at least double of that at the peaks at ca. 2.7-2.6 Ga and 1.3-1.1 Ga, and significant differences both in the time and in the amplitude of the peaks exist between different cratons [6].

Extracting non-thermal signal from seismic tomography models allows for distinguishing compositional variations in the cratonic lithosphere, which also reflect the cumulative effect of varios processes related to lithosphere formation and its later reworking [7]. Compositional seismic velocity variations in the lithospheric mantle show strong qualitative correlation with its tectono-thermal ages and with regional variations in the lithospheric thickness. Their amplitude, however, varies both laterally and vertically, reflecting either a peripheral growth of the cratons in Proterozoic or their peripheral metasomatic reworking in the post-Archean time.

[1] Artemieva & Mooney (2001), *JGR 106*, **16387-16414.**
[2] Grand (2002), *Phil. Trans. R. Soc. London 360,* 2475-91.
[3] Shapiro & Ritzwoller (2002), *Geophys. J. Int. 151*, 1–18.
[4] Artemieva (2006), *Tectonophysics 416*, 245-277.
[5] Condie & Aster (2010), *Precambr. Res. 180,* 227-236.
[6]Artemieva (2011), *Cambridge University Press*, 824 pp.
[7] Artemieva (2009), *Lithos 109*, 23-46.