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Chemical composition of PM2.5 and PM10 at urban and biomass burning sites in São Paulo State, Brazil

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Particulate matter samples (PM2.5 and PM10) were collected at urban and biomass burning sites in São Paulo State, Brazil. In order to characterize the chemical composition, several chemical components were analyzed: inorganic ions (Choride, nitrate, sulfate, phosphate, sodium, potassium, ammonium, calcium, magnesium), organic acid anions (acetate, formate, oxalate, glyoxylate, malonate, maleate, succinate, malate, adipate, pinonate, pinate and azelate), monosaccharide anhydrides as levoglucosan, galactosan and mannosan, organic carbon and elemental carbon. The measurements were made in two cities. The urban and industrial site (SPA) is located at the western region of the São Paulo city, which is potentially impacted by different type emission sources. This city is the largest industrialized region in Latin America (petrochemical, pharmaceutical). São Paulo Metropolitan Area has over 19 million inhabitants and a fleet of over 7 million vehicles. The second measurement site is located in Piracicaba city (PRB). It is an urban area 200 km far from SPA. The city has over 360,000 inhabitants and a vehicle fleet of over 185,000. The principal activities are agriculture (sugarcane, coffee, orange) and industries. Biomass burning has been the largest factor affecting the local air quality. The dry and cold season and the long-range transport of the particulate matter during sugar cane burning period contributed to the increase of PM2.5 and PM10 concentrations samples analyzed. Sulphate, nitrate, ammonium, elemental carbon and particulate organic material were major components of the total PM2.5 and PM2.5-10. In the dry periods and low temperatures, the sulfate/ nitrate ratio and its high correlation found in some SPA and PRB samples indicating strong influence of vehicle emissions for PM2.5 and PM2.5-10 and the stability of nitrate. Conversely, at SPA, some samples collected in the summer, the high nitrate volatility is observed in this ratio. The high correlation between sulfate, nitrate, and ammonium in PM2.5 and PM2.5-10 confirms the in situ secondary formation of these species. chloride/sodium ratio at some SPA samples site (PM2.5) was 1.8, differently from the other sites where chloride depletion can indicate several sources beyond sea salt. The presence of levoglucosan and the correlations with potassium confirm the contribution of local biomass burning (PRB) and long-range transported particles at the other sites investigated. OC/EC ratios and the correlation coefficients indicated secondary formation of OC at both sites. The present study demonstrated that several emission sources contributed to the formation of particulate matter PM2.5 and PM2.5-10 at the different characteristic sites. Further studies are necessary for better understanding of atmospheric chemistry of species emitted by different emissions sources including the combustion of alternative fuel.