Regional and seasonal variations in the elemental compositions of solid particles in rainwater in the Kyoto-Osaka-Kobe area, Japan

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We determined the elemental compositions of monthly solid particles (air dust; > 0.2 μm) in rainwater samples in order to elucidate the regional and seasonal variations in their provenance. We collected rainwater samples at Kyoto city and Kyotanabe city in Kyoto prefecture, at Neyagawa city in Osaka prefecture and at Nishinomiya city in Hyogo prefecture from January 2010 to December 2011, and analyze the elemental concentrations using ICP-MS, of dust after filtering rainwater samples.

At the four sites, concentrations of Na, Mg, K, Ca, Al, Ti and Fe in the dust were less than those in the mean upper crust. The heavy metals, especially Pb, Zn and Cu, had the enrichment factor (EF): $(X/Al)_{sample}/(X/Al)_{crust}$ over one. Their EF values tend to be high in May or June. These results suggest a part of the dust were originated from anthropogenic substances such as road dust, generally high in Pb, Zn and Cu, and their influences have fluctuation.

The dust in June contained less particles of soil origin than other months, suggesting that this seasonal variation could be attributed to the Monsoon rain and high humidity. The dust in spring and autunm contained more elements originated from soil than other seasons, indicating aeolian dust from Asian continent affected precipitation chemistry. In spring and autunm, the pH values of rainwater are slightly higher and Rb contents in dust had higher values than those in the mean upper crust, supporting the input of aeolian dust.

The concentrations of Pb, Zn and Cu in the dust were high at Neyagawa and Nishinomiya during the construction period of builidings near the sampling sites. These results suggest that the construction works have influence on these elemental concentrations. At Nishinomiya, Pb, Zn and Cu in the dust showed low concentrations in winter. It is ascribed to the contribution of soil substance transported by the northwest wind from the northern mountain area consists of granites, that dilute these element concentrations.