Stable carbon and nitrogen isotopic compositions of atmospheric aerosols from Chichijima Island in the western North Pacific

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Stable isotopic composition analysis of total carbon (TC) and total nitrogen (TN) is a powerful tool for investigating sources and atmospheric processing of carbonaceous and nitrogenous aerosols. We measured $\delta^{13}C$ of TC and $\delta^{15}N$ of TN using an elemental analyzer coupled with an isotopic ratio mass spectrometer (EA-IRMS) in total suspended particle (TSP) aerosol samples collected over the remote Chichijima Island in the western North Pacific from 2001 to 2012.

The concentration of TC ranged from 0.21 to 6.29 μg m^{-3} (ave. 0.83 μg m^{-3}), whereas that of TN ranged from 0.01 to 1.72 μg m^{-3} (ave. 0.22 μg m^{-3}). TC and TN showed a clear seasonal trend with spring and winter maxima and autumn and summer minima. The analyses of backward air mass trajectories demonstrated that the long-range transport significantly affects the season variations of TC and TN in Chichijima aerosols. The higher concentrations of TC and TN in spring and winter are due to atmospheric transport of polluted aerosols from the Asian continent to the western North Pacific whereas clean oceanic air masses causes lower values in autumn and summer. The $\delta^{13}C$ ratios ranged from -27.4 to -15.1‰ (ave. -23.7‰) during the campaign. The $\delta^{13}C$ ratios in spring (ave. -23.6‰) and winter (ave. -23.6‰) are similar and ca. 1‰ higher than that of summer (ave. -24.5‰). The similar $\delta^{13}C$ values in spring and winter suggest similar sources or source regions of carbonaceous aerosols in the western North Pacific. The $\delta^{15}N$ ratios ranged from -5.33 to 26.1‰ with an average of 9.84‰. The $\delta^{15}N$ values are lower in winter (ave. 8.04‰) and higher in spring season (ave. 11.4‰). High concentrations of nitrate and ammonium in winter and spring imply that vehicular emission and biomass burning in the Asian continent may control the atmospheric processing of nitrogenous aerosols in the western North Pacific.