# Changes in atmospheric loading, composition and $^{13}C$ isotope ratios of organic aerosols with biological activity in northeast Asia

CHANDRA MOULI PAVULURI[1,2], KIMITAKA KAWAMURA[2,3], PINGQING FU[2,4], ERI TACHIBANA[2]

[1]Institute of Surface-Earth System Science, Tianjin University, Tianjin, China (cmpavuluri@tju.edu.cn)
[2]Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan
[3]Now at Chubu Institute for Advanced Studies, Chubu University, Kasugai, Japan
[4]LAPC, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China

High aerosol loadings are commonly observed in the east Asian atmosphere. Organic aerosols (OA) account for a large (20-90%) fraction of the fine aerosol mass. They impact the Earth's climate system directly by scattering and absorbing solar radiation and indirectly by acting as cloud condensation nuclei, and cause adverse effects on human health. However, their seasonality and origins in northeast Asia are not fully understood. We analyzed the aerosol samples collected from Sapporo, northern Japan (43.07°N, 141.36°E) over a one-year period (2 September 2009 to 5 October 2010) for total carbon (TC) and water-soluble organic carbon (WSOC) and their stable carbon ($^{13}C$) isotope ratios ($\delta^{13}C$). Diacids, ketoacids, α-dicarbonyls and fatty acids and their $\delta^{13}C$ as well as molecular marker species were also measured.

$\delta^{13}C$ of TC and WSOC showed very similar temporal trends with a gradual enrichment of $^{13}C$ from mid-autumn to winter followed by a depletion in the $^{13}C$ to early summer. Saturated *n*-diacids ($C_2$-$C_{11}$, except for $C_5$ and $C_6$), long-chain ketoacids ($C_7$-$C_9$) and even-carbon numbered fatty acids ($C_{14}$-$C_{24}$) as well as biomarkers (plant wax *n*-alkanes and fatty alcohols) and biogenic secondary OA tracers (isoprene-, α-pinene-derived compounds and β-caryophyllinic acid) showed a clear seasonal pattern with a gradual decrease from autumn to winter and then a gradual increase from spring to summer, whereas hopanes and 2,3-dihydroxy-4-oxopentanoic acid (fossil fuel combustion-derived OA and SOA tracers, respectively) did not show any clear trend. $\delta^{13}C$ of diacids showed an enrichment of $^{13}C$ in $C_2$ than in $C_3$ and $C_4$. Based on the results obtained from this study, together with the air mass trajectories, we found that the OA in northeast Asia are mainly originated from biogenic sources and their seasonal variations are associated with the biological activity, while fossil fuel combustion emissions are peaked in winter.