Radiocarbon measurement of carbonaceous aerosols in the Outflow from Northeast China

YAN-LIN ZHANG[1,2,*], KIMITAKA KAWAMURA[2], KONSTANTINOS AGRIOS[3,4], MEEHYE LEE[5], SÖNKE SZIDAT[3]

[1] Yale-NUIST Center on Atmospheric Environment, Nanjing University of Information Science and Technology, Nanjing10044, China
[2]Institute of Low Temperature Science, Hokkaido University, N19 W08, Kita-ku, Sapporo 060-0819, Japan
[3] Department of Chemistry and Biochemistry & Oeschger Centre for Climate Change Research, University of Bern, Bern 3012, Switzerland
[4]Paul Scherrer Institute (PSI), Villigen-PSI 5232, Switzerland
[5]Department of Earth and Environmental Sciences, Korea University, Seoul 136-701, South Korea

Carbonaceous aerosols, which comprise the large fractions of elemental carbon (EC) and organic carbon (OC), badly affect climate and human health. However, there is a large uncertainty about detailed apportionment and quantification of its sources due to the large number of origins and chemical compounds associated with the aerosols. Radiocarbon (^{14}C) measurements provide a powerful tool for unambiguously determining fossil and non-fossil sources of carbonaceous particles, since ^{14}C is completely depleted in fossil-fuel emissions due to its age, whereas non-fossil carbon sources (e.g. biomass burning, cooking or biogenic emissions) show a contemporary ^{14}C content. Moreover, a better ^{14}C-based source apportionment can be obtained, when ^{14}C determinations are performed on EC and OC separately, since EC originates exclusively from combustion of biomass and fossil fuels. In this study, ^{14}C measurement combined with the Latin-Hypercube Sampling (LHS) model was applied to aerosol samples from an East Asian receptor site (Gosan supersite at Jeju Island, Korea) in order to obtain fruitful information on regionally integrated sources and formation processes of carbonaceous aerosols from China. To the best of our knowledge, this is the first time that ^{14}C-based source apportionment was carried out on both EC and OC aerosols in East Asian continental outflow regions, covering a full seasonal cycle. We quantified source contributions including EC from combustion of biomass and fossil fuel, OC from fossil emissions including primary and secondary sources (as well as OC from non-fossil sources including primary biomass burning and all the other non-fossil OC.