Evidence for decoupling of climate and carbonaceous aerosol over the past 160 kyrs

HARUKI HONDA[1], OSAMU SEKI[2], KAORI ONO[2], YOSHINORI IIZUKA[2]

[1]Graduate School of Envonmental Earth Science, Hokkaido University
[2]Institute of Low Tempearture Science, Hokkaido University (seki@lowtem.hokudai.ac.jp)

Carbonaceous aerosols influence climate via direct and indirect effects on radiative balance and are thought to have a potential to substantially affect global climate. Although numerous studies have been conducted to better understand chemical and physical properties, source, transport and fate of carbonaceous aerosols in the atmosphere, significance of carbonaceous aerosol for global scale climate still remains uncertain. This is mainly due to difficulty to evaluate net radiative effects of carbonaceous aerosol. In this study, we reconstructed changes in terrestrial and marine derived biogenic carbonaceous aerosols during the glacial-interglacial cycle (over the past 160 kyrs) based on analysis of organic molecular tracers in Antarctic ice core, Dome Fuji, in order to evaluate substantial role and impact of biogenic carbonaceous aerosol on glacial-interglacial scale climate. The fluxes of both terrestrial and marine derived organic molecular tracers show large variations over the past 160 kyrs with low and high during the glacial and deglacial to interglacial periods, respectively. Their variation patterns are consistent with biomass changes in the aerosol source regions; high latitude regions of the South America and South Atlantic Ocean. This correspondence suggests emissions of the biogenic carbonaceous aerosols are primary controlled by biomass of aerosol sources. Comparison of the organic molecular tracers and surface air temperature records in the Dome Fuji ice core and sea surface temperature in the water vapor source revealed that the emission of biogenic carbonaceous aerosol does not correlate with Antarctic and Southern Ocean temperatures. The observed decoupling of high latitude temperature in the southern hemisphere and biogenic carbonaceous aerosol indicates that carbonaceous aerosol does not play an important role in affecting large scale climate change and thus, that net radiative effect of carbonaceous aerosols is almost negligible.