Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

AAS21-04 Room:201B Time:May 22 09:15-09:30

Perspective on atmospheric chemistry and climate change from aerosols

TAKEMURA, Toshihiko[1*]

[1]RIAM, Kyushu University

Atmospheric aerosols, as well as causing respiratory and allergic diseases, submicron-sized material in order to circulate throughout the body are incorporated into the blood from the lungs, which is known to potentially cause any diseases. Japan had a problem of air pollution by aerosols throughout a period of high economic growth after World War II, and in recent years it has been frequent around the western region that air pollution caused by rapid economic growth in China (Yamaguchi and Takemura, 2011). As China has suffered severe air pollution remains (Washington Post, 2012), it is necessary to clarify the physical and chemical properties, behavior in the atmosphere, and health effects of aerosols. In particular, considering that the desulfurization equipment is gaining popularity even in developing countries, quantitative assessment and prediction of properties of nitrate particles, with complex chemical reaction than sulfate, and organic particles will become more important. As for the increased levels of photochemical oxidant which is one of the air pollution, in Japan, the advisory and warning are made known to the public when the level is high because the criteria of them is clear. On the other hand, the communication system to the public has not been established when the aerosol concentration is high with low concentrations of photochemical oxidant and Asian dust. With the Japan's environmental standard of PM2.5 set in 2009, it is important to quickly develop a system to disseminate information on observation and forecasting of air pollutants.

Aerosols, in addition to air pollution, absorb or scatter solar and infrared radiation (direct effect), and act as nuclei of clouds (indirect effect), so that the change in their concentration causes climate change by changing the energy balance in the atmosphere. In addition, the aerosol contribution to the marine ecosystem as a nutrient, changes in snow surface albedo due to deposition of the aerosols that absorb radiation, providing opportunities for chemical reactions (heterogeneous reactions), and etc., have been pointed out to impact on climate. However, the evaluation of the radiative forcing relative to the preindustrial era in the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) still has a large uncertainty; -0.1 to -0.9 W m^{-2} for the direct effect, -0.3 to -1.8 W m^{-2} for the first indirect effect, and 0.0 to +0.2 W m^{-2} for the change in snow surface albedo due to deposition of black carbon. There are various factors to produce these uncertainties both in observation and numerical modeling studies. As the aerosol radiative forcing, even though they are quantitatively similar to that of greenhouse gases, has large uncertainties, reduction of the uncertainties is a major key in terms of predicting future climate change.

In this lecture, the global aerosol climate model SPRINTARS (Takemura et al., 2005, 2009) provides central topics for researches in order to think about the direction in addressing the above issues.

References

Takemura, T., et al. (2005), J. Geophys. Res., 110, doi:10.1029/2004JD005029.
Takemura, T., et al. (2009), Atmos. Chem. Phys., 9, 3061-3073.
Washington Post (2012), http://www.washingtonpost.com/world/asia-pacific/beijing-makes-rare-concession-on-pollution-measure/2012/01/19/gIQApsI6BQ_story.html.
Yamaguchi, Y., and T. Takemura (2011), Tenki, 58, 965-968 (in Japanese).

Keywords: aerosol, climate change, atmospheric chemistry, atmospheric pollution