Suggestions from a global cloud system resolving simulation to global climate model -Transportation of black carbon aerosol to the Arctic-

*Yousuke Sato[1], Hiroaki Miura[2], Hisashi Yashiro[1], Daisuke Goto[3], Toshihiko Takemura[4], Takuro Michibata[4], Kentaroh Suzuki[5], Teruyuki Nakajima[6]

1. RIKEN Advanced Institute for Computational Science, 2. Department of Earth and Planetary Science, The University of Tokyo, 3. National Institute for Environmental Studies, 4. Research Institute for Applied Mechanics, Kyushu University, 5. Atmosphere Ocean Research Institute, The University of Tokyo, 6. Earth Observation Research Center, Japan Aerospace Exploration Agency

In this study, we investigated effects of horizontal grid resolution on the transportation of black carbon aerosol (BCA) to the Arctic region. BCA in the Arctic has unique and large impact on the climate system through changing the albedo of snow-covered surface as well as absorbing and scattering sunlight. Despite its profound impact, most of the current generation general circulation models (GCM) underestimate BCA in the Arctic. To clarify the reason of the underestimation, the global aerosol transport simulation with kilometer order resolution (3.5km) was conducted. We also conducted sensitivity experiments with coarsening horizontal grid resolution from 3.5 km to 56 km to investigate the impacts of horizontal grid resolution. Our results indicated that BCA mass concentration in the Arctic increased with fining grid resolution, and the BCA mass concentration in the Arctic simulated with the 3.5-km grid resolution was 4.2 times larger than that simulated with a coarse (56-km) grid resolution. The underestimation of BCA was reduced by fining the grid resolution. Results of this study propose that global simulations using kilometre-order or finer horizontal resolution can lead to more accurate estimations of the distribution of BCA in the Arctic and reduce uncertainties regarding the effects of aerosols on global climate. As well as the BCA, we will introduce the several results of global cloud system resolving simulation coupled with aerosol transport model.

Keywords: Black carbon aerosol, Cloud system resolving model, Aerosol transpot model

