An impact of tropospheric air pollution changes over Japan due to future climate and emission change

*Natsumi Kawano[1], Tatsuya Nagashima[1], Masayuki Hara[2], Satoru Chatani[1], Syuichi Itahashi[3]

1. National Institute for Environmental Studies, 2. Center for Environmental Science in Saitama, 3. Central Research Institute of Electric Power Industry

Air pollutants and climate change, which are known as critical environmental issues, have inter-related closely (Jacob and Winner (2008)). Besides, an increase of anthropogenic emissions arising from future urban expansion, which are responsible for the emission of gaseous and particulate pollutants, is also concerned to have adverse influences on their surrounding environments (Fenger (1999); Martins (2012); Monks *et al.*, 2015). In order to address these issues, it is necessary for evaluating the impacts of change in climate and air pollutant emission in the future on regional air quality.
In this study, we investigated the projected changes in tropospheric ozone (O_3) and fine particulate matter ($PM_{2.5}$) concentrations over Japan by examining regional-scale chemical transport model with considering future climate and air pollutant emissions under future climate change scenarios. To predict the future climate in a specific region, the Pseudo global warming (PGW) method (Sato *et al.*, 2007), which is a tool to downscale future climate simulated by global circulation models (GCM), are widely used in regional to urban scale climate studies (Hara *et al.*, 2010; Kusaka *et al.*, 2014; Adachi *et al.*, 2018; Darmanto *et al.*, 2019). Here, we applied the PGW method to the regional-scale chemical transport modelling study as following steps. First, a PGW dataset is required which is calculated from the difference of decadal average monthly climatologies in the future climate (2030s, 2050s, 2090s) and present climate (2010s). The output of MIROC5 model in the 5th Coupled Model Intercomparison Project (CMIP5) datasets under the RCP 2.6 and RCP 8.5 climate scenarios was used to calculate climatologies in future. Second, the PGW dataset is added to the present initial and lateral boundary datasets (i.e. JRA-55, NCEP1, and RTGSST data). Moreover, the future change in air pollutant emission, which consist of emissions from vegetation sources (VG) and from anthropogenic sources (ANTH) were estimated from MIROC_CHEM as well as climatologies estimated from MIROC5.
To discuss the impact of future changes in climate and emission, we performed three different setups of experiments; one for the present climate with present VG and ANTH emission, second for the future climate with future VG and present ANTH emissions (for climate impact only), and the other for the future climate with future VG and ANTH emission (for both climate and emission impact). In the presentation, we plan to quantify the impacts on changes in tropospheric O_3 and $PM_{2.5}$ by dividing into seasons and day/night.

Keywords: ozone, fine particulate matter, regional air quality prediction, dynamical downscaling

