Changes in the near future surface air quality in Asia under different future emission scenarios

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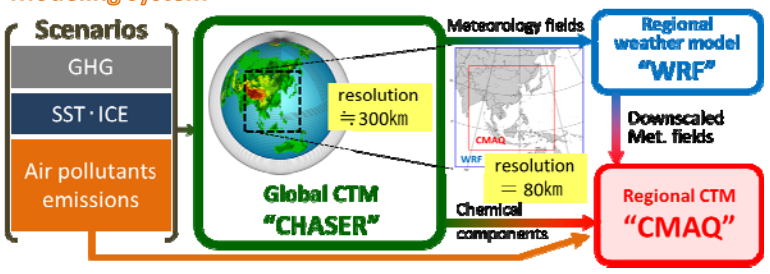
Motivation

- Recently, Ozone(O_3) and aerosols (SO_4, NO_3, OC or BC) have been called SLCPs (Short-Lived Climate Pollutants), because they are well-known air polllutants as well as have large radiative impacts in the atmosphere.
- Therefore, adeqate control on the emissions of SLCPs (or their precursors) would bring both an improvement of air quality and a mitigation of rapid climate change; "SLCPs co-benefit".
- In order to estimate possibility of SLCPs co-benefit approach in East Asia, we examined several near future (2030) emission scenarios of SLCPs by using global and regional chemistry transport models.
- Here, we show the impacts of near future emission scenarios of SLCPs provided from IIASA (International Institute for Applied Systems Analysis) on the air quality in East Asia.

Modeling system

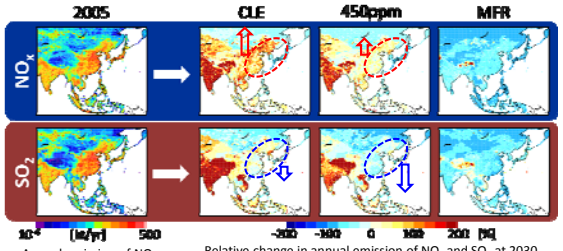


Input scenarios into global CTM to get global meteorology and chemical component fields, which are then downscaled with WRF/CAMQ system.

Results

Three near future (2030) "reference" emission scenarios provided by IIASA

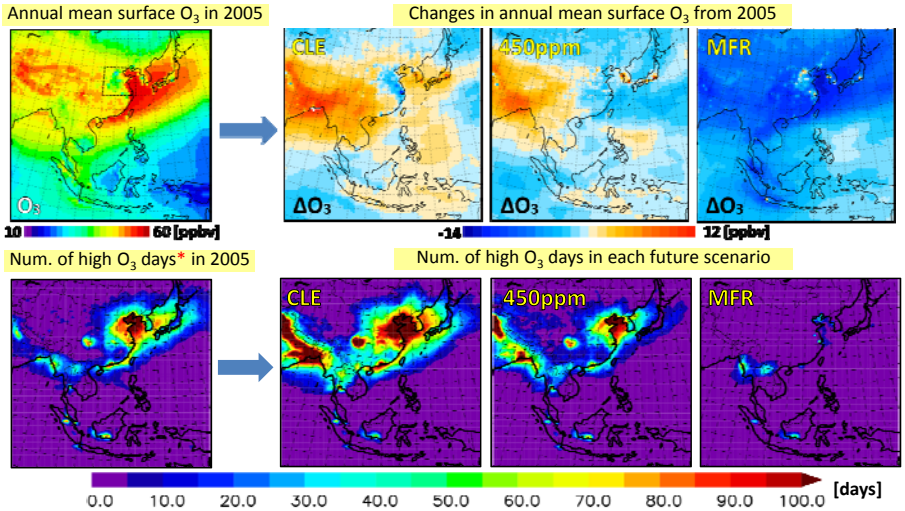
Scenario name	content/remarks
CLE Current Legislation (Cofala et al., 2006)	Only consider the current (as of 2002) policy to reduce emissions of air pollutants
	• practical and needs minimum efforts to attain
450ppm CO_2-eq 450ppm stabilization (IEA, 2009)	Stabilize CO_2-equivalent GHG mixing ratio at 450 ppm for global mean temperature not to exceed 2°C by peaking out GHG emissions until 2020.
	• developed by IEA(Intl. Energy Agency) • considered as the standard scenario to elude fatal climate change
MFR Maximum technically Feasible Reduction	Adopt all technically feasible measures to reduce emissions of air pollutants regardless of their cost.
	• hard to attain



Annual emission of NO_x and SO_2 in 2005

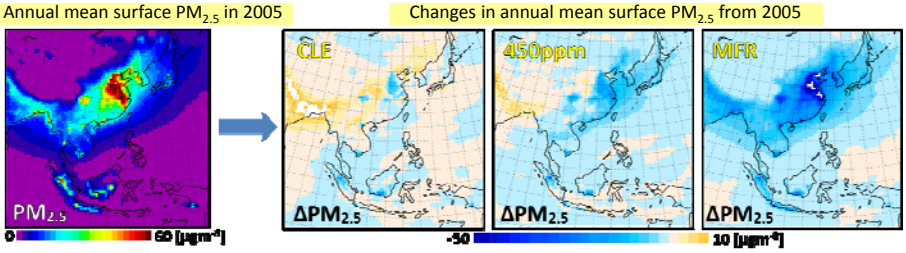
Relative change in annual emission of NO_x and SO_2 at 2030 from 2005 for each scenario

- 450 ppm scenario has been widely used in many researches to examine future GHG reduction .
- But its ability to improve air quality has not been examined well so far.
- Therefore, we tested the ability by comparing it with those of CLE and MFR scenarios which have been used in estimating the future air quality.



* High O_3 day = The day with daily maximum 8hr-mean O_3 exceeds 75 ppbv

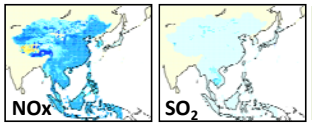
- 450ppm scenario doesn't entirely improve O_3 pollution in E Asia and worsen those in S and SE Asia.
- The impact of future scenarios can appear in different way for different index (annual mean vs high O_3 days)



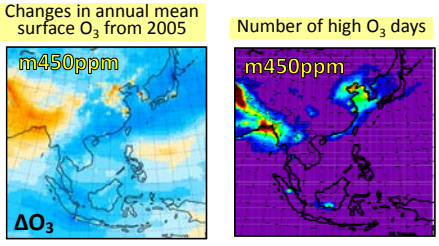
- 450ppm scenario can bring some improvement in $PM_{2.5}$ pollution in E Asia, but the $PM_{2.5}$ in China or Korea is still above the AAQS of Japan (annual mean $PM_{2.5}$ < 15μg/m^3)

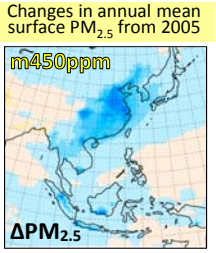
m-450ppm : Modified 450ppm scenario (IIASA)

Based on 450ppm scenario with reinforced air quality control in East Asia (and SE Asia)



Annual emission change from 450ppm to m-450ppm scenario





- m-450ppm scenario doesn't have much impact on annual mean O_3 in E Asia but largely improves summer time O_3 and reduces high O_3 days in highly polluted areas
- m-450ppm scenario significantly reduces $PM_{2.5}$ in E Asia particularly in fall and winter.

Cofala, J., Amann, M., and Mechler, R. (2006): Scenarios of world anthropogenic emissions of air pollutants and methane up to 2030, IR-06-023, International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria.

IEA (2009). World Energy Outlook 2009, OECD/International Energy Agency, Paris, France.