A33I-3060

Development of a Comprehensive Regional Emissions Inventory in Support of Air Quality Modeling and Aircraft Field Campaign over East Asia

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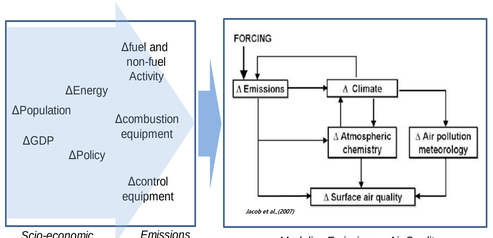
Ⅰ. Introduction & Objectives

- Air pollution in East Asia is one of the very severe issues for many years. Governments in this region have been putting more stringent air pollution control policies for years. In order to seek effective ways to mitigate air pollution, it is essential to understand the current status of pollutant emissions, which are the basis of air pollution.
- More up-to-date Emissions Inventory(EI) and Chemical Transport Models (CTMs), along with comprehensive monitoring data, are the important components to understand air quality of the region. Two aircraft field campaigns, MAPS-Seoul and KORUS-AQ, had been conducted to understand the processes related to air quality and the effectiveness of air pollution controls over Korea and East Asia.
- We had developed an updated version of our Asian emissions inventory, NIER/KU-CREATE (Comprehensive Regional Emissions inventory for Atmospheric Transport Experiment), which is the main source of KORUS EI, in support of the field campaigns.

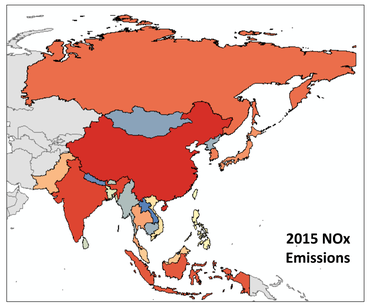
Ⅱ. Data and Methodology

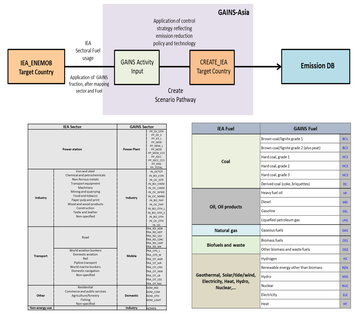
- Emissions could be the beginning of air pollution processes. The energy use and mitigation policy, however, are the beginning of emissions, which are represented by the fuel and non-fuel activities, emission factors, and control technologies.
- The emission scenarios using the IIASA-GAINS model were created by reflecting the IEA and national energy consumption statistics, international and national emission factors, and recent control policies by country.



$Em_A = (EF_A)(Act)\ [(1- (CE)(RP)(RE)]$

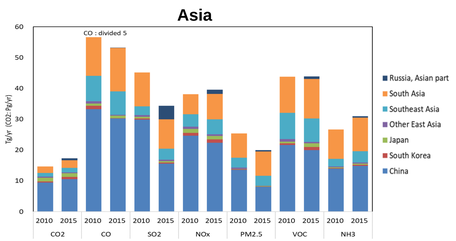
Em_A = Controlled point/area source emissions of pollutant A
EF_A = Uncontrolled emission factor for pollutant A
Act = Category activity CE = % Control efficiency/100
RE = % Rule effectiveness RP = % Rule penetration/100

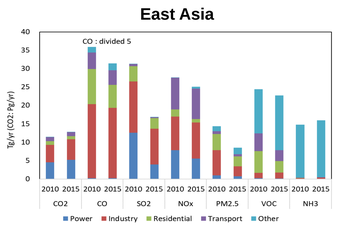


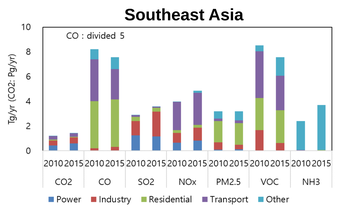


Ⅲ. Bottom-up Emissions Inter-comparison

III-1. Year 2010 vs. Year 2015 emissions

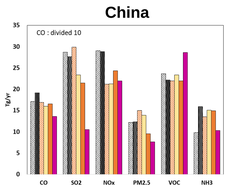


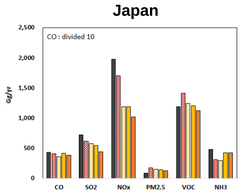


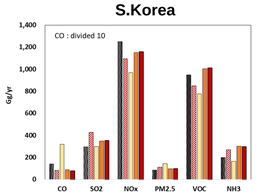


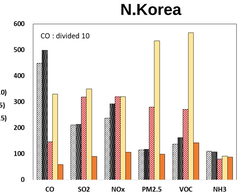
- Russia(Asia region) emissions are added in the new version (year 2015) in support of the North-East Asia Clean Air Partnership(NEACAP) of United Nations.
- Year 2015 emissions of combustion-related pollutants, such as CO, SO_2, NO_x, are decreased much from year 2010 level, however, fugitive pollutants emissions are not decrease, or even increased.

III-2. Inter-comparison with other inventory in East Asia



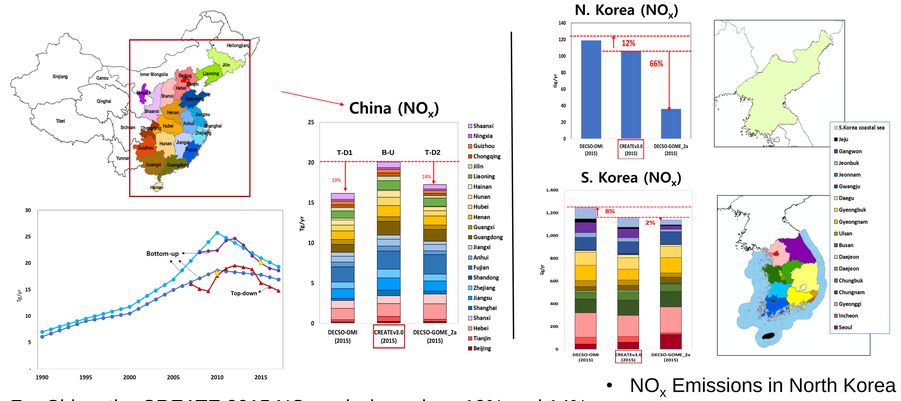


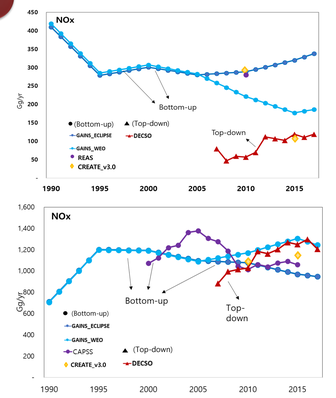




- For China, emission differences from the multiple bottom-up inventories are as small as 20% for NO_x but more than 30% for NH_3.
- Emissions for North Korea show big differences among bottom-up inventories which needs more independent evaluation, such as satellite-based top-down estimates.

Ⅳ. Bottom-up to Top-down Emissions Inter-comparison



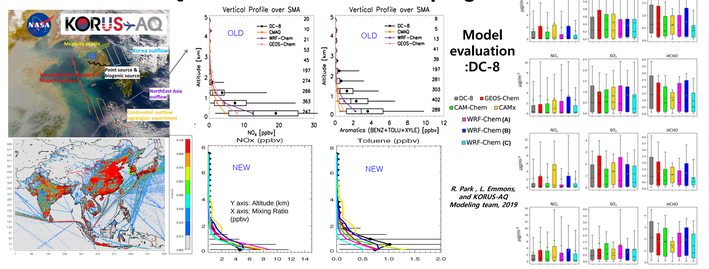


For China, the CREATE 2015 NO_x emissions show 19% and 14% higher estimates than OMI-based and GOME-based top-down emissions, respectively, from GlobeEmissions-DECSO.

- NO_x Emissions in North Korea show only 12% difference compare to OMI-based top-down emissions in year 2015, which is much better agreement than year 2010 estimates.
- For South Korea, NO_x emission from the bottom-up and top-down emissions show good agreement over the country. peninsular

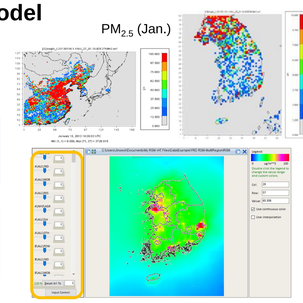
Ⅴ. Support of Air Quality Modeling and Aircraft Field Campaign

V-1. KORUS-AQ/MAPS-Seoul field campaign



- The KORUS-AQ field Campaign had been conducted in South Korea during May-June, 2016. The overarching goal of this study was to improve our understanding of the factors contributing to air quality in Korea.
- The KORUS EI, which mainly based on the CREATE EI, has been developed in support of the campaign. It has been updated and upgraded (version 5.0, as latest) by feedback from the participating modeling and monitoring experts.

V-2. GUIDE+ IAM model



- The GUIDE is the new Integrate Assessment Model(IAM) to estimate effectiveness of climate and air quality policies in Korea
- The CREATE EI, backed by KORUS experience, has been used in support of the integrated evaluation of recent mitigation policies in Korea and China.

Ⅵ. Summary & Future Works

- In order to establish an emission inventory that reflects fast-changing regional emission conditions in East Asia, NIER/KU-CREATE inventory had updated with the latest energy and policy data.
- Differences in the bottom-up inventories are less than 5 % for NOx as smallest but more than 30% for NH_3 for China. The discrepancies of emission amounts, however, are very high in North Korea. South Korea emissions remains stable and relatively good agreements
- The satellite-driven top-down estimates show relatively good agreement in total emissions amounts in China, but show some possibility of under/over-estimation of control policy penetration
- We are evaluating baseline emissions with KORUS-AQ participants and assessing effectiveness of emissions reduction using the new GUIDE IAM to correctly understand current pollution situation and to setup more reasonable solutions.

Ⅶ. Reference

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