Development of the CREATE inventory in support of integrated modeling of climate and air quality for East Asia

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Highlights

- A new regional emissions inventory, named NIER/KU-CREATE, is developed using an international assessment modeling framework (i.e. GAINS) in support of various research/regulatory needs of Korea and East Asia.

- It is designed as a comprehensive, model-friendly emissions framework which covers science-related as well as policy-related and processing/modeling-related parameters for anthropogenic, biogenic, and biomass burning.

- It will serve as the emissions inventory for upcoming Air Quality Forecasting System (AQFS), integrate assessment/management modeling (GAINS-Korea), future CC-AQ impact modeling study (ICAMS-scenario), aircraft field campaign (MAPS/GAMBAI), GEO satellite validation (GEMS), and etc.
Development of a New Asia Inventory: CREATE* - Framework Design

* Comprehensive Regional Emissions inventory for Atmospheric Transport Experiments

1. Emission Inventory: Improve GAINS-Asia emissions using updated national data, MEGAN/BlueSky emissions model
2. Year 2009/2010, Asia regions, ~10000 source categories
3. Pollutants: CO₂, CH₄, NOₓ, N₂O, PM₁₀, PM₂.₅, SO₂, VOC, NH₃, CO, BC, OC, Mercury
4. Anthropogenic, Biogenic, Biomass burning
5. SMOKE, KU-EPS (Windows based) Emissions processing
Development of a New Asia Inventory: CREATE - Emissions Estimation Result

NIER_KU vs. CAPSS/MICS-Asia

Korea

China

Japan

SO2
Development of a New Asia Inventory: CREATE
- Control Tech (China) and Emissions (North Korea)

S. Wang, 2012
Development of a New Asia Inventory: CREATE - Emission Pathways (China and South Korea)

This study - BAU[0]
This study - BAU[1]
This study - BAU[2]
This study - PC[0]
This study - PC[1]
This study - PC[2]
Amann et al. (2008) - current legislation
Amann et al. (2008) - advanced control technology
Amann et al. (2008) - optimized
Ohara et al. (2007) - policy failure
Ohara et al. (2007) - best guess
Ohara et al. (2007) - optimistic
Xing et al. (2011) - current legislation and implementation
Xing et al. (2011) - improved energy efficiency and current environmental legislation
Xing et al. (2011) - improved energy efficiency and better implementation of environmental policy
Xing et al. (2011) - improved energy efficiency and strict environmental legislation
Cofala et al. (2007) - current legislation
Cofala et al. (2007) - maximum feasible reduction
Cofala et al. (2012) - current policy
Cofala et al. (2012) - new policy
Cofala et al. (2012) - high energy efficiency
Cofala et al. (2012) - 450 ppm
Wang et al, ACP, 2014

No Further Control (NFC)
Current Legislation (CLE)
Maximum Feasible Reduction (MFR)

South Korea

China

Emissions vs. Year Graph

SO₂ Emissions (Mt)


0 10 20 30 40
Development of a New Asia Inventory: CREATE - Challenges and Opportunities

Emissions Estimation

\[ \text{CAE}_A = (\text{EF}_A)(Q)[(1-(\text{CE})(\text{RP})(\text{RE})] \]

Emissions Inventory

Emissions Model

Biogenic, Biomass Burning, Dust, Sea salt, NH3, and etc.

Emission Processor Spatial, Temporal, Chemical

Modeling Emissions Inventory

AQ & CC Modeling

SMOKE-Asia/KU-EPS (Woo et al., AE, 2009)

ICAMS, PM Forecasting NIER, 2008~2017


AQ & CC Management (Bottom-up)

Admin, Annual, by sector/fuel

Bottom-up

GAINS-Korea (2013~2015)

Special Measure SMA (2005~2024)

Regulatory

Science