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Validation of the Large Power Plants Emissions over South Korea Using NASA KORUS-AQ Aircraft Field Campaign

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The air quality over Northeast Asia have been deteriorated for decades due to high population and energy use in the region. The needs of more scientific understanding of inter-relationship among emissions, transport, chemistry over the region are much higher to effectively protect public health and ecosystems. The KORUS-AQ aircraft field campaign have been conducted to study the air quality of over Korea and East Asia relating to chemical evolution, emission inventories, trans-boundary contribution, and satellite application. We developed a new East-Asia emissions inventory, named KORUS 2015, based on NIER/KU-CREATE (Comprehensive Regional Emissions inventory for Atmospheric Transport Experiment), in support of the filed campaign. One of the major issues has been raised for long time is the uncertainty of the Large Point Sources(LPSs) emissions which affect much on the local-regional air quality.
In this study, we have evaluated emissions of six major power plants by inter-comparing the stack emissions-based concentrations from the Gaussian dispersion model and aircraft-based concentration measurements from NASA DC-8 “around-the-stack” flights. The stack-based bottom-up emission estimates, aircraft measured wind, and dispersion parameters were used for the Gaussian modeling. When we compare the initial modeled concentration to the aircraft measurements near the Danjin power plant stacks, about 63% (SO_2) and 4% (NO_x) underestimation were found. Addition of the new power generation facilities, constructed after the emission inventory baseyear, improved the underestimation ratio for SO_2 to 30%, whereas ratio for NO_x was overestimated to 52%. We found these analyses are useful to correctly evaluate high-and-large emitters, such as large power and industrial plants. More analysis results on the large power and industrial plants will be presented at the conference.

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