

Report of

Consultation Workshop on Modeling of Source-Receptor Relationship of Transboundary Air Pollution

18-21 March 2015

Pusan National University and National Institute of Environmental Research, Republic of Korea, and
Chinese Research Academy of Environmental Sciences, China

Background

Further to the decision of the 18th Senior Officials Meeting (SOM) of North-East Asian Subregional Programme for Environmental Cooperation (NEASPEC) in November 2013 to implement the project “the Development of Technical and Policy Framework for Transboundary Air Pollution Assessment and Abatement” proposed by the Russian Government, an Expert Group Meeting (EGM) in May 2014 discussed technical approaches and activities of the project as well as the proposed subregional framework, and came to the following recommendations:

- **Target pollutants of the subregional framework:** Particulate Matter (PM_{2.5} and PM₁₀) and Ozone and their linkages with other pollutants including Sulfur Oxide (SO_x), Nitrogen Oxide (NO_x), Black Carbon, Ammonia (NH₃) and Volatile Organic Compounds (VOCs).
- **Priorities of the framework:** (a) health impact of air pollution, (b) policy scenarios, (c) emission inventory, (d) abatement technology assessment, (e) modeling of source-receptor relationship of transboundary air pollution, policy scenarios, impact assessment, etc.
- **Focuses of the activities under the current project:** modeling of source-receptor relationship of transboundary air pollution in collaboration with the planned modeling work of the Joint Research Project on Long-range Transboundary Air Pollutants in North-East Asia (LTP) and relevant research, and by utilizing national emission inventories and monitoring data of the Acid Deposition Monitoring Network in East Asia (EANET).
- **Implementing body of the modeling:** the Scientific Research Institute for Atmospheric Air Protection (SRI), the Russian Federation, other national institutions including the Chinese Research Academy of Environmental Sciences (CRAES) and Pusan National University (PNU), Republic of Korea, and national experts involved LTP.

The recommendations of the EGM were generally supported by the SOM-19 held in September 2014 while the SOM highlighted the need to seek synergies and avoid duplication with existing mechanisms and to focus on modelling research cooperation. The SOM also confirmed that the modeling work will

be conducted by the SRI in collaboration with the Chinese Academy of Environmental Sciences and Pusan National University (PNU) of the ROK.

Consultation workshop

In this connection, this consultation was held to (a) connect the on-going work in North-East Asia, in particular, the Joint Research Project on Long-range Transboundary Air Pollutants in North-East Asia (LTP Project), with the planned work of SRI on modeling of source-receptor relationship of transboundary air pollution, (b) share the information of modeling methodologies and emission inventories in North-East Asia with experts at SRI, (c) develop a detailed plan of SRI's modeling including required technical support from other institutions.

The workshop at the Pusan National University during 18-19 March covered the following topics, which was followed by a visit to the National Institute of Environmental Research of the ROK on 20 March to observe the nation-wide monitoring and forecast system of air pollution, in particular, PM.

1. Overview of Modelling under LTP
2. Progress of model comparison studies during LTP Expert Meeting among China, Japan, and the Republic of Korea
3. Overview of national, regional and global emission inventories pertaining to the planned modelling
4. Major programmes and operation of the Community Multiscale Air Quality Model (CMAQ)
5. Air quality Modelling in Russia
6. LTP's configurations of meteorological and air quality model
7. Model performance evaluation and verification
8. Source and arrangement of input data
9. Technical support from LTP institution and experts
10. Plan of SRI's modelling

After the workshop and visit in the ROK, the team of Russian experts visited the Chinese Research Academy of Environmental Sciences on 21 March to review the modeling work of Chinese scientists and discuss potential technical collaboration. Chinese experts presented on their work under the framework of the LTP Project, explained issues related to input data collection and processing, particular WRF-CMAQ modeling issues, provided information on hardware and software applied for the modeling work. The Russian team was invited to join the regional research work on transboundary air pollution through participation in expert meetings, expert exchange programmes, and information and data sharing.

Key conclusions of the consultation workshop

- **CMAQ and Weather Research Forecast Model (WRF):** While the SRI Atmosphere has already installed CMAQ and used Fifth-Generation Penn State/NCAR Mesoscale Model (MM5),

there was a shared view on the value of WRF for this modeling work as designed as the successor to MM5. The team of Pusan National University will provide further assistance in the configuration of CMAQ and WRF.

- **Input data:** Reviewed all major inventories and discrepancies between them, and decided to use EDGAR as the primary source of input data. However, the current EDGAR version (4.2) would not have sufficient data for the proposed domain (Asian part of Russia - Siberia and Russian Far East) as EDGAR's two major data sources (EMEP and REAS) do not cover the domain or data from the Russian national inventory. Thus, SRI will look at the opportunity of using the data from a new version to be released as it would also have input from MIX inventory.
- **CMAQ ready file:** The Secretariat and SRI will seek the support of Konkuk University, Republic of Korea, for converting EDGAR data into CMAQ ready file.
- **Technical support:** The team of Pusan National University will provide technical support required for the configuration and running of CMAQ -WRF and input data.
- **Evaluation and verification:** Seek the participation of LTP members of China, Japan and the Republic of Korea for evaluation and verification, and the need for a meeting on the topics.

Plan of project implementation

Further to the consultation, SRI and the Secretariat have developed the following detailed implementation plan of the project to be carried out under a Letter of Agreement between ESCAP and SRI during July 2015- July 2016.

Result 1: Assess data and technical approaches; prepare a modelling methodology of TAP

Activities		Responsible Entity	Time Frame
1.1	Upgrade computation capacity: specification development, purchasing of the hardware	SRI	July -August 2015
1.2	Download the EDGAR emission database for 2005 and interpolate acquired data for the developed modeling grid	SRI in consultation with ESCAP and PNU	July - August 2015
1.3	Install necessary software (operating system Linux, compilers, packages and libraries)	SRI	July-August 2015
1.4	Develop modeling domain and grid (tentative resolution 240*170), including existing modeling grid and surrounding regions (oblasts) of the Russian Federation (Far East, Eastern Siberia) with horizontal grid cell resolution of 36 km	SRI in consultation with ESCAP and PNU	July-September 2015

1.5	Collect, process and format data on emission of pollutants (including NO _x , Sox, PM ₁₀ /PM _{2.5} , etc) from identified sectors (economic activities) for 2010 over Russian regions, included into the modeling domain; prepare input emission files for modeling based on Russian emission data for 2010 and EDGAR emissions data for 2005	SRI (in consultation with ESCAP and PNU)	July- September 2015
1.6	Prepare and launch MM5 model (compilation) for the developed grid for the year 2010 (the year with known boundary conditions)	SRI (in consultation with ESCAP and PNU)	July - September 2015
1.7	Conduct MM5 calculation of meteorological fields for 2010 for the modeling grid	SRI (in consultation with ESCAP and PNU)	August- September 2015
1.8	Install and launch WRF model (basic and multiprocessor modes)	SRI (in consultation with ESCAP and PNU)	August - October 2015
1.9	Conduct WRF calculation of meteorological fields for 2010 for the modeling grid	PNU (primary) in consultation with SRI	September - October 2015
1.10	Compare selected parameters of main meteorological fields (T _{2M} , Ps and deposition quantities), calculated with MM5 with similar fields calculated with WRF by PNU team	SRI in cooperation with PNU (and other potential partners LTP project)	September - October 2015
1.11	Prepare emission data/files for developed modeling grid in the CMAQ model format with applications of I/O API	SRI in consultations with ESCAP and PNU	September- October 2015
1.12	Prepare for launching the CMAQ (version 4.6) model based on meteorological data (MM5 output) and data on emissions of selected pollutants prepared during steps 1.5, and 1.7)	SRI in consultations with ESCAP and PNU	October- November 2015
1.13	Prepare for launching the CMAQ (version 4.7) model based on meteorological data (WRF output) and data on emissions of selected pollutants prepared during steps 1.5, and 1.9)	SRI in consultations with ESCAP and PNU	October- November 2015
1.14	Prepare emission data with SMOKE model application for the developed CMAQ grid ¹	PNU/Konkuk Univ.	October- December 2015

¹ PNU and Konkuk University's direct involvement is required since SRI does not have sufficient experiences.

		(primary) in consultations with SRI	
1.15	Calculate concentrations and depositions of selected pollutants for 2010 with CMAQ (v.4.6) on the developed model grid with MM5-modeled meteorological fields	SRI in consultations with ESCAP and PNU	October-December 2015
1.16	Calculate concentrations and depositions of selected pollutants for 2010 with CMAQ (v.4.7) on the developed model grid with WRF-modeled meteorological fields	PNU/Konkuk Univ. (primary) in consultations with SRI	October-December 2015
1.17	Inter-comparison of modeling results	SRI in cooperation with PNU (and other potential partners/LTP Project)	November 2015-January 2016

Result 2: Carry out modeling of TAP in the subregion

Activities		Responsible Entity	Time Frame
2.1	Install and launch CMAQ model (version 5.0), do test runs with WRF-developed meteorological fields (basic and multiprocessor modes)	SRI in consultations with ESCAP and PNU	January-February 2016
2.2	Carry out CMAQ-WRF joint modeling runs	SRI in consultations with ESCAP and PNU	January-February 2016
2.3	Prepare the final report	SRI in consultations with ESCAP and PNU	January-March 2016

Result 3: Formulate the concept of a subregional framework on assessment and mitigation of TAP

Activities		Responsible Entity	Time Frame
3.1	Review existing impact assessments (especially health impact) of air pollution for formulating the concept ²	ESCAP	1 July - 31 Aug 2015 (per graphic

² The work involves the review of existing studies on correlation between a degree/kinds/mixture of air pollutants and adverse health impact, including the effects of particular matters (PM2.5) on cardiovascular and respiratory mortalities. The

			schedule this work goes till Aug 2016?)
3.2	Elaborate and review the concept of a subregional framework in consultation with national partners, NEASPEC secretariat and other relevant stakeholders.	SRI/ ESCAP	1 March - 31 May 2016
3.3	Prepare the paper on a subregional framework on assessment and mitigation of TAP for submission to the NEASPEC SOM. The paper should contain (i) mandate, (ii) aims and objectives/tasks, (iii) short and long-term work plans, (iv) science-policy links and (iv) institutional structure	SRI/ ESCAP	1 March - 31 July 2016

work is also expected to draw recommendations on sharing relevant data and methodologies, and developing a holistic and unified methodology.