Jinhyeok Yu

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EDUCATION

Ph.D. in Earth Sciences and Environmental Engineering August, 2023
Gwangju Institute of Science and Technology (GIST) Gwangju, Republic of Korea

Advisor: Prof. Chul. H. Song
Dissertation: Development of Korean Air Chemistry Modeling System version 2.0 (K_ACheMS v2.0) and its applications to operational forecasts and reanalysis products

M.S. in Earth Sciences and Environmental Engineering August, 2017
Gwangju Institute of Science and Technology (GIST) Gwangju, Republic of Korea

Advisor: Prof. Chul. H. Song
Dissertation: Improvement and Evaluation of Biogenic Emission Inventories in South Korea Using KORUS-AQ Campaign Observations

B.S. in Chemical Engineering February, 2015
Jeju National University Jeju, Republic of Korea

PROFESSIONAL EXPERIENCE

Postdoctoral Fellow Mar., 2025–Present
Jet Propulsion Laboratory (JPL) Pasadena, CA, USA

Advisor: Dr. Kazuyuki Miyazaki

- Analyzing, validating, and improving of JPL's multi-component, multi-model chemistry (MOMO-Chem) data assimilation system
- Investigating the complex interactions among natural and anthropogenic emissions, atmospheric chemistry, and pollutant concentrations in a perturbed Earth system using MOMO-Chem

Postdoctoral Fellow Sep., 2023–Jan., 2025
Gwangju Institute of Science and Technology (GIST) Gwangju, Republic of Korea

Advisor: Prof. Chul H. Song

- Advanced three-dimensional variational (3D-Var) and Ensemble Kalman Filter (EnKF) data assimilation systems for the Community Multiscale Air Quality (CMAQ) model
- Produced regional-scale chemical reanalysis products and top-down emissions through data assimilation
- Investigated the long-range transport of air pollutants over northeast Asia during the ASIA-AQ campaign
- Assessed the international and national emission contributions to air pollutants in South

Korea during the ASIA-AQ campaign using the Brute Force Method (BFM)

Graduate Research Assistant Sep., 2015–Oct., 2023
Gwangju Institute of Science and Technology (GIST) Gwangju, Republic of Korea

Advisor: Prof. Chul H. Song

- Developed the 3D-Var data assimilation system for the CMAQ model
- Developed the operational air quality prediction system based on the K_ACheMS v2.0
- Involved in the development of EnKF data assimilation system for the CMAQ model

AWARDS, HONORS, AND SCHOLARSHIPS

Nov. 13, 2020	**Prof. Kyoo Won Lee's Scholarship for Atmospheric Aerosol Research** School of Earth Sciences and Environmental Engineering, Gwangju Institute of Science and Technology (GIST), Gwangju, Republic of Korea
Dec. 6, 2017	**Research Assistant (RA) Scholarship** School of Earth Sciences and Environmental Engineering, Gwangju Institute of Science and Technology (GIST), Gwangju, Republic of Korea
2017–2020	**Brain Korea 21 Program for Leading Universities & Students (BK21 PLUS)** National Research Foundation of Korea (NRF), Seoul, Republic of Korea
2015–2021	**Government Graduate Scholarship** Gwangju Institute of Science and Technology (GIST), Gwangju, Republic of Korea
2009–2015	**Undergraduate Scholarship** Jeju National University, Jeju, Republic of Korea

PUBLICATIONS

[+]Contributed equally

[1] **Yu, J[+].**, Kim, J[+]., Kim, H. S., Park, S.-Y., Choi, Y., Woo, J.-H., and Song, C. H.: Implementation of a machine learning-based bias-correction for wind speed to improve $PM_{2.5}$ predictability in a chemistry transport model, *In Preparation*.

[2] Choi, T., **Yu J.**, Park, S.-Y., Lee, D., and Song, C. H.: Implementing an update of aerosol initial states for Community Multiscale Air Quality (CMAQ) model simulation through kriging method, *In Preparation*.

[3] Han, K. M., Jung, C. H., Song, C. H., **Yu, J**., Pan, Y., Cho, S. J., Shin, S. D., Koo, J. H., Woo, J. H., Madalipay, J., Kim, K., and Kim., H. S.: Evaluation of accuracy on bottom-up NH_3 emissions and sensitivity of $PM_{2.5}$ to emission control in South Korea, *Atmos. Environ.*, *Under Review*.

[4] Cha, Y. Lee, J.-J., Song, C. H., Kim, S., Park, R. J., Lee, M.-I., Woo, J.-H., Bae, K., Choi, J.-H., **Yu, J.**, Kim, E., Kim, H., Lee, S.-H., Kim, J., and Chang, L.-S.: Investigating uncertainties in air quality models used in GMAP/SIJAQ 2021 field campaign: General performance of different models and ensemble results, *Atmos. Environ.*, 340, 120896, https://doi.org/10.1016/j.atmosenv.2024.120896, 2025.

[5] Kim, K., Han, K. M., Song, C. H., Lee, H., Beardsley, R., **Yu, J.**, Yarwood, G., Koo, B., Madalipay,

J., Woo, J.-H., and Cho, S.: An investigation into atmospheric nitrous acid (HONO) processes in South Korea, *Atmos. Chem. Phys.,* https://doi.org/10.5194/acp-24-12575-2024, 24(22), 12575–12593, 2024.

[6] **Yu, J.**, Song, C. H., Lee, D., Lee, S., Kim, H. S., Han, K. M., Jeon, M., Park, S., Im, J., Park, S.-Y., Peuch, V.-H., Saide, P. E., Carmichael, G. R., Kim, J., Kim, J., Song, C.-K., Woo, J.-H., and Ryu, S.-H.: Synergistic combination of information from ground observations, geostationary satellite, and air quality modeling towards improved $PM_{2.5}$ predictability, *npj Clim. Atmos. Sci.*, 6, 41, https://doi.org/10.1038/s41612-023-00363-w, 2023.

[7] Dash, U. K., Park, S.-Y., Song, C. H., **Yu, J.**, Yumimoto, K., and Uno, I.: Performance Comparisons of the Three Data Assimilation Methods for Improved Predictability of $PM_{2.5}$: Ensemble Kalman Filter, Ensemble Square Root Filter, and Three-Dimensional Variational Methods, *Environ. Pollut.*, 322, 121099, https://doi.org/10.1016/j.envpol.2023.121099, 2023.

[8] **Yu, J.**, Han, K. M., Song, C. H., Lee, K., Lee, S., Kim, Y., Woo, J.-H., Kim, S., and Wisthaler, A.: Evaluation of biogenic emissions from three different vegetation distributions in South Korea, *Atmos. Environ.*, 296, 119588, https://doi.org/10.1016/j.atmosenv.2023.119588, 2023.

[9] Park, S.-Y., Dash, U. K., **Yu, J.**, Yumimoto, K., Uno, I., and Song, C. H.: Implementation of an ensemble Kalman filter in the Community Multiscale Air Quality model (CMAQ model v5.1) for data assimilation of ground-level $PM_{2.5}$, *Geosci. Model Dev.*, 15(7), 2773–2790, https://doi.org/10.5194/gmd-15-2773-2022, 2022.

[10] Lee, S., Song, C. H., Han, K. M., Henze, D. K., Lee, K., **Yu, J.**, Woo, J.-H., Jung, J., Choi, Y., Saide, P. E., and Carmichael, G. R.: Impacts of uncertainties in emissions on aerosol data assimilation and short-term $PM_{2.5}$ predictions over Northeast Asia, *Atmos. Environ.*, 271, 118921, https://doi.org/10.1016/j.atmosenv.2021.118921, 2022.

[11] Kenagy, H. S., Romer Present, P. S., Wooldridge, P. J., Nault, B. A., Campuzano-Jost, P., Day, D. A., Jimenez, J. L., Zare, A., Pye, H. O. T., **Yu, J.**, Song, C. H., Blake, D. R., Woo, J.-H., Kim, Y., and Cohen, R. C.: Contribution of Organic Nitrates to Organic Aerosol over South Korea during KORUS-AQ, *Environ. Sci. Technol.*, 55(24), 16326–16338, https://doi.org/10.1021/acs.est.1c05521, 2021.

[12] Lee, K., **Yu, J.**, Lee, S., Park, M., Hong, H., Park, S. Y., Choi, M., Kim, J., Kim, Y., Woo, J.-H., Kim, S.-W., and Song, C. H.: Development of Korean Air Quality Prediction System version 1 (KAQPS v1) with focuses on practical issues, *Geosci. Model Dev.*, 13(3), 1055–1073, https://doi.org/10.5194/gmd-13-1055-2020, 2020.

CONFERENCE AND WORKSHOP PRESENTATIONS

International Conferences

[1] **Yu, J.**, Song, C. H., and Kim, M. C.: Development of the Korean Air Chemistry Modeling System version 2.0 (K_ACheMS v2.0) and its performance of operational mode, EGU General Assembly 2023, Vienna, Austria, April 27, 2023 (oral presentation).

[2] **Yu, J.**, Lee, S., Lee, K., Park, S.-Y., Hong, H., Dash, U. K., Kim, J., Woo, J.-H., Song, C. H.: Improvement of the performances of $PM_{2.5}$ predictions using data assimilation techniques

over northeast Asia during the KORUS-AQ campaign, AGU Fall Meeting 2019, San Francisco, United States, December 9, 2019 (poster presentation).

[3] **Yu, J.**, Lee, K., Lee, S., Song, C. H.: Update and Evaluation of Biogenic Emission Modeling in South Korea Using KORUS-AQ Campaign Observations, AOGS 14th Annual Meeting, Singapore, August 9, 2017 (poster presentation).

International Workshops

[1] **Yu, J.**, Song, C. H., and K_ACheMS science team: Implementing an operational $PM_{2.5}$ prediction using Korean Air Chemistry Modeling System version 2.0 (K_ACheMS v2.0), The 2nd International workshop for the Fine Particle Research Initiative in East Asia Considering National Differences (FRIEND) Project, Busan, South Korea, October 23, 2023.

[2] **Yu, J.**, Lee, K., Kim, J., and Song, C. H.: Air quality forecasts via data assimilation technique over Northeast Asia during KORUS-AQ, The 9th GEMS Science Team Meeting, Seoul, South Korea, October 10, 2018.

SPECIAL ACTIVITIES

[1] The 2nd International Workshop for the Fine Particle Research Initiative in East Asia Considering National Differences (FRIEND) Project, Busan, South Korea, Oct. 23–25, 2023.

[2] Ewha International School on Data Assimilation (EISDA) 2023, Seoul, South Korea, Aug. 7–11, 2023.

[3] The 2nd SIJAQ 2022 Science Team Meeting, Seoul, South Korea, Jun. 2, 2022.

[4] The 9th GEMS Science Team Meeting, Seoul, South Korea, Oct. 1–3, 2018.

[5] The 1st Workshop for the Development of Korean Air Quality Forecasting System, Busan, South Korea, Nov. 8–10, 2018.

[6] The 2nd KORUS-AQ Science Team Meeting, Irvine, CA, United States, Aug. 28–30, 2018.

[7] The 1st KORUS-AQ Science Team Meeting, Jeju, South Korea, Feb. 27–Mar. 3, 2017.

[8] The 10th Regional Environmental and Sustainable Development (RESD) Program: "Topic: Air Pollution", South Korea, China, and Japan, Jul., 2017.

TEACHING AND MENTORING EXPERIENCE

Jul., 2018 — **Earth and Environmental Science Olympiad Assistant**
School of Earth Sciences and Environmental Engineering
Gwangju Institute of Science and Technology (GIST), Republic of Korea

Sep.–Dec., 2017 — **Teaching Assistant, [EN4214] Atmospheric Chemistry & Climate Change**
School of Earth Sciences and Environmental Engineering
Gwangju Institute of Science and Technology (GIST), Republic of Korea

Aug., 2017 — **Multi-Company Experience in Environmental Technology for Undergraduate Students (MEET US) Program Assistant**
School of Earth Sciences and Environmental Engineering
Gwangju Institute of Science and Technology (GIST), Republic of Korea

SCIENTIFIC AND TECHNICAL SKILLS

- **Modeling:** Weather Research and Forecasting (WRF), Community Multiscale Air Quality (CMAQ), and Model of Emissions of Gases and Aerosols from Nature (MEGAN)
- **Programing languages:** Advanced in shell script and NCAR Command Language (NCL); Intermediate in Python; and Basic in Fortran and Geographic Information System (GIS) program
- **Data Analyses:**
  - **Chemical reanalysis data:** Copernicus Atmosphere Monitoring Service Reanalysis (CAMSRA), Tropospheric Chemistry Reanalysis (TCR), Modern Era Retrospective analysis for Research and Applications Aerosol reanalysis (MERRAero)
  - **Remote sensing retrievals:** Moderate Resolution Imaging Spectroradiometer (MODIS), Advanced Himawari Imager (AHI), Advanced Meteorological Imager (AMI), Geostationary Ocean Color Imager I & II (GOCI-I & -II), Geostationary Environment Monitoring Spectrometer (GEMS) sensors and Aerosol Robotic Network (AERONET) sun-photometer
  - **Ground-based measurements:** Ground-based observations from South Korea, Japan, and China, and the Acid Deposition Monitoring Network in East Asia (EANET) instrument