Siyuan Shen

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EDUCATION

Washington University in St. Louis   2020 - Present
  Ph.D., Energy, Environmental & Chemical Engineering

Peking University   2016 – 2020
  B.S., Physics
  B.S., Economics

RESEARCH INTERESTS

My current research focuses on applying deep learning methods to advance understanding of air quality by utilizing satellite-based retrievals, chemical transport models' outputs, and ground measurements. I am also interested in exploring the connections among air quality, anthropogenic activities, climate change, and public health.

PROFESSIONAL EXPERIENCE

Graduate Research Assistant, Washington University in St. Louis   2020 – Present
  Advisor: Randall V. Martin
  - Developing deep learning methods to estimate surface air pollution by integrating satellite retrievals, chemical transport model outputs, and ground observations at different spatial and temporal scales.

Visiting Undergraduate Student, University of Colorado, Boulder   2019
  Advisor: Daven K. Henze
  - Studied the adjoint model of the GEOS-Chem Model.

Undergraduate Research Assistant, Peking University   2018 – 2020
  Advisor: Lin Zhang
  - Using the adjoint model to analyze the sources and sectors of $PM_{2.5}$ in major regions of China.
  - Analyze the diurnal variation of ammonia and apply a diurnal emission scale factor in GEOS-Chem to correct the model performance.

SELECTED HONORS

Lead developer of a dataset (SatPM2.5) selected by AGU Impactful Dataset Project   2026
Award for Academic Excellence, Peking University.   2018 – 2019

PUBLICATIONS (*SUBMITTED or IN PREPARATION)

Shen, S., van Donkelaar, A., Jacobs, N., Li, C., Zhang, Y., and Martin, R. V.: *Enhancing Estimation of Daily 1-km Resolution Fine Particulate Matter Concentrations for North America with Deep Learning from Geophysical A Priori Information.*[*] (In preparation)

Shen, S., van Donkelaar, A., Jacobs, N., Li, C., and Martin, R. V.: *Enhancing Estimation of Fine Particulate Matter Chemical Composition Across North America by Including Geophysical A*

Priori Information in Deep Learning with Uncertainty Quantification. ES&T Air. DOI: 10.1021/acsestair.5c00251

Aaron van Donkelaar, Bonnie Ford, Chi Li, Amanda J. Pappin, **Siyuan Shen**, Dandan Zhang, and Randall V. Martin: *North American Fine Particulate Matter Chemical Composition for 2000–2022 from Satellites, Models, and Monitors: The Changing Contribution of Wildfires.* ACS ES&T Air. DOI: 10.1021/acsestair.4c00151

Shen, S., Li, C., van Donkelaar, A., Jacobs, N., Wang, C., and Martin, R. V.: *Enhancing Global Estimation of Fine Particulate Matter Concentrations by Including Geophysical a Priori Information in Deep Learning.* ACS ES&T Air. DOI: 10.1021/acsestair.3c00054

SELECTED CONFERENCE PRESENTATIONS

2025 AGU Fall Meeting, New Orleans, LA, U.S.A. (Poster)
2024 AGU Fall Meeting, Washington D.C., U.S.A. (Poster)
2024 11th International GEOS-Chem Meeting, St. Louis, MO, U.S.A. (Poster)
2023 AGU Fall Meeting, San Francisco, CA, U.S.A. (Talk)
2023 AERSS Annual Meeting, Wuhan, Hubei, P.R.C. (PICO)
2023 NASA HAQAST Missouri Meeting, St. Louis, MO, U.S.A. (Poster)
2022 AGU Fall Meeting, Chicago, IL, U.S.A. (Poster)
2022 10th International GEOS-Chem Meeting, St. Louis, MO, U.S.A. (Poster)

TEACHING EXPERIENCE

Washington University in St. Louis Department of Energy, Environmental, and Chemical Engineering
EECE 301: Transport Phenomena I: Basics and Fluid Mechanics   **Spring 2023**
EECE 314 Air Quality Engineering with Lab   **Fall 2022**

RESEARCH ADVISING

Undergraduate Students:
- Evan Sharafuddin, (Spring 2023 – Summer 2023, Washington University in St. Louis): *"Replicate the chemical solver of the GEOS-Chem High Performance (GCHP) with Deep Learning Methods"*

Graduate Students:
- Xiaoyi (Jason) Liu, (Autumn 2024 – Spring 2025, Washington University in St. Louis): "*Chemical and Transport Solver of the GEOS-Chem High Performance (GCHP) based on neural operators*"
- Yu Yan, (Autumn 2024 – Present, Washington University in St. Louis): *"Developing Global NO2 by combining satellite retrievals and chemical transport modeling with deep learning methods."*

SYNERGISTIC ACTIVITIES

Co-leader of Statistical Learning in Atmospheric Chemistry (SLAC) group, seminar series (2023–Present)
OSPA Judge at AGU Fall Meeting (2023, 2024)
Peer reviewer for *The Lancet Planetary Health, Artificial Intelligence for the Earth Systems, Atmospheric Environment, Environmental Research Letters, ACS ES&T Letter, and ACS ES&T Air.*

SKILLS

- Familiar with machine learning and deep learning structures.
- Experiences in modeling global air quality with a chemical transport model, GEOS-Chem
- Familiar with the AWS platform.
- Programming: Python, C++, and IDL
- Software: Matlab, Stata
- Language: Chinese (native); English (professional)