P. Obin Sturm

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EDUCATION

Ph.D. student, Department of Earth Sciences 2022-present
University of Southern California
Atmospheric Composition & Earth Data Science group advised by Sam J. Silva

M.Sc. Applied Mathematics 2020 - 2021
Delft University of Technology

- Graduation *cum laude* in TU Delft Mathematical Physics Group
- Thesis *Advecting Superspecies: Reduced order modeling of organic aerosols in LOTOS-EUROS using machine learning*
  advised by Astrid Manders (TNO) and Hai Xiang Lin (TU Delft)

M.Sc. Scientific Computing 2019 - 2021
Technical University of Berlin
TU Delft and TU Berlin: Computer Simulations for Science and Engineering (COSSE)

B.S. Chemical Engineering 2013 - 2017
University of California, Davis

- Graduation with honors
- Capstone Project: *Glycerol to Acrylic Acid*
  Rich Anderson Award for Best Design Project, 2017
  advised by Ahmet Palazoglu

RESEARCH INTERESTS

atmospheric chemistry, earth system modeling, air quality, operational forecasting, secondary organic aerosol, climate change and variability, graph theory analysis of chemical systems, dimensionality reduction, physics-guided machine learning

PUBLICATIONS

Peer-Reviewed

Sturm, P. O. and Wexler, A. S. (2022). Conservation laws in a neural network architecture: Enforcing the atom balance of a Julia-based photochemical model (v0.2.0), *Geosci. Model Dev.*, 15, 3417–3431, https://doi.org/10.5194/gmd-15-3417-2022

Sturm, P. O. and Wexler, A. S. (2020) A mass- and energy-conserving framework for using machine learning to speed computations: a photochemistry example, *Geosci. Model Dev.*, 13, 4435–4442, https://doi.org/10.5194/gmd-13-4435-2020

Under Review

Sturm, P. O., Manders, A.M., Janssen, R.H.H., Segers, A.J., Wexler, A.S., and Lin, H.X. (under review for AGU JAMES). Advecting Superspecies: Efficiently Modeling Transport of Organic Aerosol with a Mass-Conserving Dimensionality Reduction Method, https://doi.org/10.31223/X58W64

RESEARCH EXPERIENCE

Senior Scientific Programmer March 2022 - present
NASA Global Modeling and Assimilation Office (GMAO)
Science Systems and Applications Inc. (SSAI)

- Development work on the earth system model GEOS-CF. Advised by Christoph A. Keller.

Research Programmer June 2020 - March 2022
Air Quality Research Center, UC Davis

- Developing methods for incorporating conservation laws into machine learning surrogate models of atmospheric chemistry and aerosol microphysics. Advised by Anthony S. Wexler.

Intern May 2021 - September 2021
TNO Department of Climate, Air, and Sustainability

- Reduced order modeling of organic aerosols in the chemical transport model LOTOS-EUROS using machine learning. Advised by Astrid Manders.

TALKS AND PRESENTATIONS

Conference Presentations

3 **Sturm, P.O.**, Manders-Groot, A.M.M., Janssen, R.H.H., Segers, A.J., Lin, H.X. Reduced order modeling of organic aerosol tracers in LOTOS-EUROS using machine learning. *Meteorology and Climate – Modeling for Air Quality*, UC Davis AQRC. Virtual, September 15, 2021, Principal presentation

2 **Sturm, P.O.** and Wexler, A.S. Operator Replacement Using Machine Learning with Conservation Laws. *AMS Annual Meeting*, January 14, 2021, Poster

1 **Sturm, P.O.** and Wexler, A.S. Operator Replacement Using Machine Learning with Conservation Laws. *AGU Virtual Fall Meeting*, December 9, 2020, Poster

Workshops and Seminars

4 **Sturm, P.O.** and Wexler, A.S. Conservation laws in a neural network architecture: Balancing atoms in a photochemical model *UCD Center for Data Science and Artificial Intelligence Research Annual Symposium*, Virtual, March 14, 2022, Talk

3 **Sturm, P.O.**, Manders-Groot, A.M.M., Janssen, R.H.H., Segers, A.J., Lin, H.X. Advecting superspecies: Reduced-order transport using physically interpretable machine learning, *LOTOS-EUROS 2022 Workshop*, Virtual, January 19, 2022, Talk

2 **Sturm, P.O.** and Wexler, A.S. Development of a mass-conserving machine learning algorithm for atmospheric chemistry surrogate models. *UCD Center for Data Science and Artificial Intelligence Research Annual Symposium*, Virtual, May 10, 2021, Talk

1 **Sturm, P.O.** and Wexler, A.S. Incorporating Mass Conservation in Machine Learning Emulators for CTMs. *LOTOS-EUROS 2021 Workshop*, Virtual, January 14, 2021, Talk

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TEACHING EXPERIENCE

Teaching Assistant
University of Southern California
Climate Change — Fall 2022

Graduate Teaching Assistant
TU Delft Department of Electrical Engineering
Machine Learning for Electrical Engineers — Spring 2021
Instruction by Bahareh Abdi, Alle-Jan van der Veen

- Provided online support with Jupyter Notebooks/Colaboratory, question sessions, and weekly grading of labs.

Departmental Tutor
UC Davis Department of Chemical Engineering
Fluid Mechanics — Winter 2017
Instruction by Ronald Phillips
Mass Transfer — Spring 2017
Instruction by Nael El-Farra

- Organized 3 discussion sessions a week with attendance from 10 to 40 students

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WORK EXPERIENCE

Project Coordinator — March 2018 – July 2019
UC Davis Department of Environmental Toxicology

- Project coordinator for ICARUS (Integrated Chamber Atmospheric data Repository for Unified Science), https://icarus.ucdavis.edu/, a database project for the atmospheric chamber community. Creation of a database architecture and a set of metadata through multiple releases of the ICARUS File Generator leading to the the current online tool. Supervised by lead P.I. Tran B. Nguyen.

Praktikant/Intern — July 2017 - February 2018
Process Simulation and Digitalization Group, Fresenius Kabi, Oberursel, Germany

- Optimization and Simulation: Creation of the Strategic Planning Tool for the Supply Chain department, formulation of supply and demand as a linear programming optimization problem to minimize shipping distances and costs. Supervised by Dr. Georg Hartung.

Laboratory Assistant — September 2015 - February 2016
Air Quality Research Center, Crocker Nuclear Laboratory, UC Davis

- Worked at the IMPROVE Sample Handling Lab processing and shipping filter samples for the IMPROVE EPA/National Parks Service program.

AWARDS

Wrigley Institute Graduate Fellow — January 2023
Travel Award – Atmospheric Chemical Mechanisms Conference — December 2022
Rich Anderson Award for Best Design Project — June 2017
BeerBev Young Talents Award, drinktec conference — May 2017
Chevron Scholarship — May 2016

HONORS

TU Delft *cum laude* predicate — October 2021
Erdős number of 3 — September 2020
Certificate of Outstanding Achievement, College of Engineering — May 2017
Dean's Honors List, College of Engineering — June 2014, March 2015 - June 2017

OTHER INTERESTS

Outdoor Activities: Trail running, mountain biking, bicycle tours
Other Languages: German and Dutch (conversational)
Music: Fiddle, banjo, guitar, and pedal steel guitar
Contra for a Cause Fundraiser 2016-2019 for Opening Doors Sacramento

PROFESSIONAL ACTIVITIES

Peer Reviewer for *npj Climate and Atmospheric Science*, *Geoscientific Model Development*
Member of American Meteorological Society, American Geophysical Union

COMPUTING EXPERIENCE

Model development:

- GEOS-CF
- LOTOS-EUROS
- Julia Photochemical Model: https://doi.org/10.5281/zenodo.3733502

Other model experience: GEOS-Chem, Kinetic PreProcessor, MOSAIC/CBM-Z
Languages: Fortran 90, Python, Julia, C, MATLAB
Libraries: Tensorflow, Keras, scikit-learn, MPI, netCDF4