

# Lu Shen

Atmospheric Chemistry Modeling Group

School of Engineering and Applied Sciences, Harvard University, USA, MA 02138

Email Address: [lshen@fas.harvard.edu](mailto:lshen@fas.harvard.edu)

Google Scholar: <https://scholar.google.com/citations?hl=en&user=SXSO620AAAAJ>

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## EDUCATION

- **Ph.D., Harvard University**, Atmospheric Chemistry, Advisor: Loretta Mickley, Sep 2012 – Mar 2017
- **M.S., Tsinghua University**, Atmospheric Science, Advisor: Yuxuan Wang, Sep 2010 – Jun 2012
- **B.S., Peking University**, Statistics (minor), Sep 2006 – Jun 2010
- **B.S., Peking University**, Environmental Science, Sep 2006 – Jun 2010

## RESEARCH EXPERIENCE

- **Postdoctoral research fellow, Harvard University**, Advisor: Daniel Jacob, April 2017-present.
- **Research Assistant, Harvard University**, Advisor: Loretta Mickley, Sep 2012-Mar 2017.
- **Research Assistant, Tsinghua University**, Advisor: Yuxuan Wang, Oct 2009- Jul 2012.

## PUBLICATIONS

### Under Review (*N*=1)

2019 **Shen, L.**, D.J. Jacob, M. Santillana, X. Wang, and W. Chen: An adaptive method for speeding up the numerical integration of chemical mechanisms in atmospheric chemistry models, under review in *Geosci. Model Dev.* (IF=5.15)

### Published papers as the first/corresponding authors (*N*=11)

2017 **Shen, L.**, and Mickley, L.J.: Seasonal prediction of US summertime ozone using statistical analysis of large-scale climate patterns. *Proc. Natl. Acad. Sci. U.S.A.*, 114(10), 2491-2496, 2017. (IF=9.58)

2019 **Shen, L.**, Jacob, D. J., Liu, X., Huang, G., Li, K., Liao, H., and Wang, T.: An evaluation of the ability of the Ozone Monitoring Instrument (OMI) to observe boundary layer ozone pollution across China: application to 2005–2017 ozone trends, *Atmos. Chem. Phys.*, 19, 6551-6560, <https://doi.org/10.5194/acp-19-6551-2019>, 2019. (IF=5.67)

2019 **Shen, L.**, D.J. Jacob, L. Zhu, Q. Zhang, B. Zheng, M.P. Sulprizio, K. Li, I. De Smedt, G. Gonzalo Abad, H. Cao, T.-M. Fu, and H. Liao: The 2005-2016 trends of formaldehyde columns over China observed by satellites: increasing anthropogenic emissions of volatile organic compounds and decreasing agricultural fire emissions, 46, *Geophys. Res. Lett.*, <https://doi.org/10.1029/2019GL082172>, 2019. (IF=4.58)

2019 Pendergrass D.C., **Shen L.**, Jacob D. J.: Mickley L. J., Predicting the impact of climate change on severe wintertime particulate pollution events in Beijing using extreme value theory, *Geophys. Res. Lett.*, 46(3), <https://doi.org/10.1029/2018GL080102>, 2019. (IF=4.58)

2018 **Shen, L.**, Jacob, D. J., Mickley, L. J., Wang, Y., and Zhang, Q.: Insignificant effect of climate change on winter haze pollution in Beijing, *Atmos. Chem. Phys.*, 18, 17489-17496, <http://sci-hub.tw/10.5194/acp-18-17489-2018>, 2018. (IF=5.67)

- 2017 **Shen L.**, Mickley L.J., Leibensperger E., and Li M. Strong dependence of U.S. summertime air quality on the decadal variability of Atlantic sea surface temperatures. *Geophys. Res. Lett.*, 44, <https://doi.org/10.1002/2017GL075905>, 2017. (IF=4.58)
- 2017 **Shen L.** and Mickley L.J. Effects of El Niño on summertime ozone air quality in the eastern United States. *Geophys. Res. Lett.*, 44. <https://doi.org/10.1002/2017GL076150>, 2017. (IF=4.58, GRL highlight)
- 2017 **Shen L.**, Mickley L.J., and Murray L. Influence of 2000-2050 climate change on PM<sub>2.5</sub> concentrations in the United States: statistical inference vs. chemistry models. *Atmos. Chem. Phys.*, 17, 4355-4367, doi:10.5194/acp-17-4355-2017, 2017. (IF=5.67)
- 2016 **Shen L.**, Mickley L.J., and Gilleland E. Impact of increasing heatwaves on US ozone episodes in the 2050s: Results from a multi-model analysis using extreme value theory. *Geophys. Res. Lett.*, 43 (8), 4017-4025, 2016. (IF=4.58, GRL highlight)
- 2015 **Shen L.**, Mickley L.J., and Tai A.P.K. Influence of synoptic patterns on surface ozone variability over the eastern United States from 1980 to 2012. *Atmos. Chem. Phys.*, 15(19), 10925-10938, 2015. (IF=5.67)
- 2012 **Shen, L.** and Wang, Y., 2012. Changes in tropospheric ozone levels over the Three Representative Regions of China observed from space by the Tropospheric Emission Spectrometer (TES), 2005–2010. *Science Bulletin*, 57(22), 2865-2871, 2012. (IF=6.28)

#### Published papers as a co-author (N=15)

- 2019 Li, K., D.J. Jacob, H. Liao, J. Zhu, V. Shah, **L. Shen**, K.H. Bates, Q. Zhang, and S. Zhai: A two-pollutant strategy for improving ozone and particulate air quality in China, *Nature Geosci.*, 12, 906-910, 2019.
- 2019 Xie Y., Wang Y., Dong W., Wright J.S., **Shen L.**, and Zhao Z., Evaluating the response of summertime surface sulfate to hydroclimate variations in the continental US: role of meteorological inputs in the GEOS-Chem model. *J. Geophys. Res.*, <https://doi.org/10.1029/2018JD029693>, 2019.
- 2019 Zhai S., Jacob D.J., Wang X., **Shen L.**, Li K., Zhang Y., Gui K., Zhao T., and Liao H., Fine particulate matter (PM<sub>2.5</sub>) trends in China, 2013-2018: separating contributions from anthropogenic emissions and meteorology, *Atmos. Chem. Phys.*, 19, 11031-11041, 2019.
- 2019 Lu X., Zhang L., and **Shen L.**, Meteorology and Climate Influences on Tropospheric Ozone: a Review of Natural Sources, Chemistry, and Transport Patterns. *Curr. Pollut. Rep.*, 2019, 10.1007/s40726-019-00118-3.
- 2019 Li, K., Jacob D.J., Liao H., **Shen L.**, Zhang Q., and Bates K.H., Anthropogenic drivers of 2013-2017 trends in summer surface ozone in China, *PNAS*, 116, 422-427, 2019.
- 2018 Leung D.M., Tai A.P.K., Mickley L.J., Moch J.M., van Donkelaar A., **Shen L.**, and Martin R.V. Synoptic meteorological modes of variability for fine particulate matter (PM<sub>2.5</sub>) air quality in major metropolitan regions of China, *Atmos. Chem. Phys.*, 18, 6733-6748, 2018.
- 2018 Lu, X., Wang Y., Li J., **Shen L.**, and Fung J., Evidence of Heterogeneous HONO Formation from Aerosols and the regional photochemical impact of this HONO source, *Environ. Res. Lett.*, 13, <http://sci-hub.tw/10.1088/1748-9326/aae492>, 2018.
- 2017 Achakulwisut P., **Shen L.**, and Mickley L.J. What controls springtime fine dust variability in the western United States? Implications for the recent dust increase in the Southwest. *J. Geophys. Res.*, 122, <https://doi.org/10.1002/2017JD027208>, 2017.

- 2017 Wang Y., Xie Y., Dong W., Ming Y., Wang J., and **Shen L.** Adverse effects of increasing drought on air quality via natural processes. *Atmos. Chem. Phys.*, 17, 12827-12843, <https://doi.org/10.5194/acp-17-12827-2017>, 2017.
- 2017 Lee W.C., **Shen L.**, Catalano P.J., Mickley L.J., and Koutrakis P. Effects of future temperature change on PM<sub>2.5</sub> infiltration in the Greater Boston area. *Atmos. Environ.*, 150, 98-105, 2017.
- 2016 Ding J., Xiang Y., **Shen L.**, and Tarokh V. Multiple Change Point Analysis: Fast Implementation and Strong Consistency. *IEEE Trans. Signal Process.*, 65(17),4495-4510, 2016.
- 2016 Wang Y., Jia B., Wang S.C., Estes M., **Shen L.**, and Xie Y. Influence of the Bermuda High on interannual variability of summertime ozone in the Houston–Galveston–Brazoria region. *Atmos. Chem. Phys.*, 16(23), 15265-15276, 2016.
- 2013 Wang Y., **Shen L.**, Wu S., Mickley L., He J., and Hao J. Sensitivity of surface ozone over China to 2000–2050 global changes of climate and emissions. *Atmos. Environ.*, 75, 374-382, 2013.
- 2013 Wang Y., Li M., and **Shen L.** Accelerating carbon uptake in the Northern Hemisphere: evidence from the interhemispheric difference of atmospheric CO<sub>2</sub> concentrations. *Tellus B*, 65, 20334, 2013.
- 2011 He J., Wang Y., Hao J., **Shen L.**, and Wang, L., 2012. Variations of surface O<sub>3</sub> in August at a rural site near Shanghai: influences from the West Pacific subtropical high and anthropogenic emissions. *Environmental Science and Pollution Research*, 19(9), 4016-4029, 2011.

## **Selected Oral Conference Presentation (\* invited talk)**

- 2018 Insignificant effect of climate change on winter haze pollution in Beijing, AGU 2018
- 2017 Effects of El Niño on summertime ozone air quality in the eastern United States, AGU 2017.
- 2016\* Evidence of the Atlantic Multidecadal Oscillation driving multi-decadal variability of summertime surface air quality in the eastern United States: Implications for air quality management in the coming decades (AGU invited talk), AGU 2018.
- 2015 Drivers of multidecadal variability in JJA ozone concentration in the eastern United States, at Saint Louis, 9th ACAST meeting, Wednesday, June 3, 2015
- 2014 The influence of the polar jet and Bermuda High on the variability of surface ozone over the eastern United States, at San Francisco, AGU, Friday, December 19, 2014
- 2014 Using extreme value theory to predict ozone episodes in the future, at Atlanta, 8th ACAST meeting, Wednesday, December 3, 2014

## **SKILLS**

- Programming language: Python, R, Matlab, Fortran, IDL, and Javascript
- Chemistry and climate models: GEOS-Chem, and GISS
- Journal reviewers: *Atmos. Chem. and Phys.*, *J. Climate*, *Geophys. Res. Lett.*, and *Environ Sci Technol.*

## **Press**

Apr 20-27, 2016: My research on future ozone episodes (Shen et al., 2016, *GRL*) receives media attention. ([NBC News](#), [AGU news](#), [Harvard news](#), etc.)

Feb 2017: My research (Shen et al., 2017, *PNAS*) on seasonal prediction of ozone pollution in China Science and Technology Daily.