

# JIAN HE

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## Education

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Ph.D. in Atmospheric Science, North Carolina State University, 2015

M.S. in Marine Geology, Nanjing University, 2011

B.S., in Geographical Science, Nanjing University, 2008

## Research Specialties and Skills

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My research specialties include methane trends and variability, atmospheric chemistry-climate interactions, air quality health and socioeconomic impacts, gas-phase chemistry and interaction with aerosols, aerosol microphysics and thermodynamics, aerosol-cloud-precipitation-climate interactions, air-sea interactions, and data assimilation.

I have strong coding skills in both global and regional Earth system models, atmospheric models, and ocean models, including GFDL-ESM4 (AM4), CESM (CAM-Chem), WRF (including WRF-Chem, WRF-CAM5, WRF-CMAQ), and COAWST (ROMS), and program languages such as FORTRAN, NCL, C, Matlab, and Python. I also have extensive model evaluation experience using surface observations, aircraft measurements, and satellite retrievals.

## Professional Experience

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**Postdoctoral Research Associate**, Program in Atmospheric and Oceanic Sciences (AOS), Princeton University/Geophysical Fluid Dynamics Laboratory, Princeton, NJ, November 2017-present

- Quantify the contribution of individual methane sources and sinks to atmospheric methane trend and variability using NOAA GFDL's Earth System Model version 4.1 (ESM4.1).

**Postdoctoral Fellow**, ORISE Research Participation Program and NRC Research Associateship Program at U.S. Environmental Protection Agency, Durham, NC, November 2015-2017

- Surface data assimilation in the Weather Research and Forecasting (WRF) model;
- Impacts of convective adjustment time scale on deep convection and precipitation using WRF model;
- Quantify aerosol direct/indirect effects on large scale and subgrid-scale clouds in the two-way coupled WRF and the Community Multiscale Air Quality (CMAQ).

**Visiting Graduate Student**, Advanced Study Program at the National Center for Atmospheric Research, Boulder, CO, April-June, 2014

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- Incorporate NCSU's version of the Community Atmosphere Model (CAM) to the latest CAM (version 5.3) within the Community Earth System Model (CESM, version 1.2.2) for potential community use;
- Implement extended Model for Ozone And Related chemical Tracers (MOZART) mechanism into CESM1.2.2/CAM5 and coupled with NCSU's version of aerosol module;
- Evaluating model performance and comparing extended MOZART with the 2005 Carbon Bond mechanism with Global Extension (CB05\_GE) to investigate the impacts of different mechanisms on secondary gas and aerosol predictions (e.g., O<sub>3</sub>, CO, NO<sub>x</sub>, SOA, PM, etc).

**Graduate Research Assistant**, North Carolina State University, Raleigh, NC, August 2011-2015

- CESM/CAM5 development/improvement of chemistry and aerosol microphysics (e.g., gas-phase chemistry, heterogeneous chemistry, particle formation, and aerosol thermodynamics) to reduce the model uncertainties associated with these processes;
- Retrospective decadal applications of CESM/CAM5 and comprehensive model evaluation to investigate the model's capability to represent present atmosphere and uncertainties for future climate projection;
- Develop regional earth system model by coupling the Regional Ocean Modeling System (ROMS) with the Weather Research and Forecasting model with Chemistry (WRF/Chem) within the frame work of the Coupled-Ocean-Atmosphere-Wave-Sediment Transport Modeling System (COAWST) to study the impacts of air-sea interactions on regional air quality and climate;
- Comprehensive evaluation of WRF-CAM5 over East Asia to examine the model's capability in reproducing current regional air quality, climate, and their interactions.

**Graduate Research Assistant**, Nanjing University, Nanjing, China, September 2008-July 2011

- Investigate sediment dynamics in coastal systems through measuring radioisotopes from field samples.

## Professional Activities

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**Contributor**, Methane Assessment for the Climate and Clean Air Coalition, 2019.

**Contributing Author**, Intergovernmental Panel on Climate Change Assessment Report 6 Working Group I, Chapter 5 (Global Carbon and other Biogeochemical Cycles and Feedbacks), 2018-2021.

**Contributing Author**, Intergovernmental Panel on Climate Change Assessment Report 6 Working Group I, Chapter 6 (Short-lived Climate Forcers), 2018-2021.

**Reviewer**, *Atmospheric Chemistry and Physics (Copernicus Publications for the European Geosciences Union)*, *Atmospheric Environment (Elsevier Publications)*, *Environmental Research (Elsevier Publications)*, *Atmospheric Pollution Research (Elsevier Publications)*, *Journal of Environmental Management (Elsevier Publications)*, *Atmosphere (Multidisciplinary Digital Publishing Institute Publications)*, *Remote Sensing (Multidisciplinary Digital Publishing Institute Publications)*.

**Member**, Air & Waste Management Association (2015-2016), American Geophysical Union (since 2012), American Meteorological Society (since 2012), Earth Science Women's Network (since 2019).

## Publications

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### *To-be-submitted*

1. Seltzer, K. M., Shindell, D. T., Faluvegi, G., **He, J.**, Horowitz, L., Lamarque, J.-F., Naik, V., and Sudo, K.: Methane as an Ozone Driver: A Multi-Model Assessment, to be submitted to GRL.

### *In-review*

1. Dunne, J. P., Horowitz, L. W., Adcroft, A. J., Ginoux, P., Held, I. M., John, J. G., Krasting, J. P., Malyshev, S., Naik, V., Paulot, F., Shevliakova, E., Stock, C. A., Zadeh, N., Blanton, C., Balaji, V., Durachta, J., Dunne, K. A., Dupuis, C., Gauthier, P. P. G., Griffies, S. M., Guo, H., Hallberg, R. W., Harrison, M., **He, J.**, Hurlin, W., Menzel, R., Milly, P. C. D., McHugh, C., Nikonov, S., Paynter, D. J., Ploshay, J., Radhakrishnan, A., Rand, K., Robinson, T., Schwarzkopf, D. M., Seman, C. J., Underwood, S., Vahlenkamp, H., Winton, M., Wittenberg, A. T., Wyman, B., Zeng, Y., and Zhao, M.: The GFDL Earth System Model version 4.1 (GFDL-ESM4.1): Model description and simulation characteristics, submitted to JAMES, 2019.
2. Horowitz, L. W., Naik, V., Paulot, F., Ginoux, P. A., Dunne, J. P., Mao, J., Jordan Schnell, J., Chen, X., **He, J.**, Lin, M., Lin, P., Malyshev, S., Paynter, D., Shevliakova, E., Zhao, M.: The GFDL Global Atmospheric Chemistry-Climate Model AM4.1: Model Description and Simulation Characteristics, submitted to JAMES, 2019.
3. Glotfelty, T., Alapaty, K., **He, J.**, Hawbecker, P., Song, X. L., and Zhang, G.: Studying scale dependency of aerosol cloud interactions using scale-aware cloud formulation, *Journal of the Atmospheric Sciences*, in review, 2019.

### *Peer-reviewed*

4. **He, J.**, Naik, V., Horowitz, L. W., Dlugokencky, E., and Thoning, K.: Investigation of the global methane budget over 1980-2017 using GFDL-AM4.1, *Atmos. Chem. Phys.*, <https://doi.org/10.5194/acp-2019-529>, in press, 2019.
5. Glotfelty, T., Alapaty, K., **He, J.**, Hawbecker, P., Song, X. L., and Zhang, G.: The Weather Research and Forecasting Model with aerosol cloud interactions (WRF-ACI): Development, evaluation, and initial application, *Monthly Weather Review*, 1491-1511, <https://doi.org/10.1175/MWR-D-18-0267.1>, 2019.
6. **He, J.**, and Alapaty, K.: Precipitation partitioning in multiscale atmospheric simulations: Impacts of stability restoration methods, *Journal of Geophysical Research: Atmospheres*, 123, <https://doi.org/10.1029/2018JD028710>, 2018.
7. **He, J.**, He, R., and Zhang, Y.: Impacts of air-sea interactions on regional air quality predictions using a coupled atmosphere-ocean model in southeastern U.S., *Aerosol and Air Quality Research*, 18, 1044-1067, doi: 10.4209/aaqr.2016.12.0570, 2018.

8. Glotfelty, T., **He, J.**, and Zhang, Y.: Improving organic aerosol treatments in CESM/CAM5: Development, application, and evaluation, *J. Adv. Model. Earth Sy.*, 9, doi:10.1002/2016MS000874, 2017.
9. Zhang, Y., Wang, K., and **He, J.**: Multi-year application of WRF-CAM5 over East Asia-Part II: Interannual variability, trend analysis, and aerosol indirect effects, *Atmospheric Environment*, 165, 222-239, <https://doi.org/10.1016/j.atmosenv.2017.06.029>, 2017.
10. **He, J.**, Zhang, Y., Wang, K., Chen, Y., Leung, L. R., Fan, J.-W., Li, M., Zheng, B., Zhang, Q., Duan, F.-K., and He, K.-B.: Multi-year application of WRF-CAM5 over East Asia-Part I: Comprehensive evaluation and formation regimes of O<sub>3</sub> and PM<sub>2.5</sub>, *Atmospheric Environment*, 165, 122-142, <https://doi.org/10.1016/j.atmosenv.2017.06.015>, 2017.
11. **He, J.**, Glotfelty, T., Yahya, K., Yu, S., and Alapaty, K.: Does temperature nudging overwhelm aerosol radiative effects in regional integrated climate models?, *Atmospheric Environment*, 154, 42-52, <https://doi.org/10.1016/j.atmosenv.2017.01.040>, 2017.
12. Yahya, K., Wang, K., Campbell, P., Chen, Y., Glotfelty, T., **He, J.**, Pirhalla, M., and Zhang, Y.: Decadal application of WRF/Chem for regional air quality and climate modeling over the U.S. under the representative concentration pathways scenarios: Part I. Model evaluation and impact of downscaling, *Atmospheric Environment*, 152, 562-583, <https://doi.org/10.1016/j.atmosenv.2016.12.029>, 2017.
13. Glotfelty, T., **He, J.**, and Zhang, Y.: Impact of future climate policy scenarios on air quality and aerosol-cloud interactions using an advanced version of CESM/CAM5: Part I. Model evaluation for the current decadal simulations, *Atmospheric Environment*, 152, 222-239, <http://dx.doi.org/10.1016/j.atmosenv.2016.12.035>, 2017.
14. Zhang, Y., **He, J.**, Zhu, S., and Gantt, B.: Sensitivity of simulated chemical concentrations and aerosol-meteorology interactions to aerosol treatments and biogenic organic emissions in WRF/Chem, *J. Geophys. Res. Atmos.*, 121, 6014-6048, doi:10.1002/2016JD024882, 2016.
15. Yahya, K., Wang, K., Campbell, P., Glotfelty, T., **He, J.**, and Zhang, Y.: Decadal evaluation of regional climate, air quality, and their interactions over the continental US and their interactions using WRF/Chem version 3.6.1, *Geosci. Model Dev.*, 9, 671-695, doi:10.5194/gmd-9-671-2016, 2016.
16. Yahya, K., **He, J.**, and Zhang, Y.: Multi-year applications of WRF/Chem over continental U.S.: Model evaluation, variation trend, and impacts of boundary conditions, *J. Geophys. Res. Atmos.*, 120, 12,748-12,777, doi:10.1002/2015JD023819, 2015.
17. **He, J.**, Zhang, Y., Tilmes, S., Emmons, L., Lamarque, J.-F., Glotfelty, T., Hodzic, A., and Vitt, F.: CESM/CAM5 improvement and application: comparison and evaluation of updated CB05\_GE and MOZART-4 gas-phase mechanisms and associated impacts on global air quality and climate, *Geosci. Model Dev.*, 8, 3999-4025, doi:10.5194/gmd-8-3999-2015, 2015.
18. Zhang, Y., Zhang, X., Wang, K., **He, J.**, Leung, L. R., Fan, J.-W., and Nenes, A.: Incorporating an advanced aerosol activation parameterization into WRF-CAM5: Model

evaluation and parameterization intercomparison, *J. Geophys. Res. Atmos.*, 120, 6952-6979, doi:10.1002/2014JD023051, 2015.

19. **He, J.**, Zhang, Y., Glotfelty, T., He, R., Bennartz, R., Rausch, J., and Sartelet, K.: Decadal simulation and comprehensive evaluation of CESM/CAM5.1 with advanced chemistry, aerosol microphysics, and aerosol-cloud interactions, *J. Adv. Model. Earth Sy.*, 7, 110-141, doi:10.1002/2014MS000360, 2015.
20. **He, J.** and Zhang, Y.: Improvement and further development in CESM/CAM5: gas-phase chemistry and inorganic aerosol treatments, *Atmos. Chem. Phys.*, 14, 9171-9200, doi:10.5194/acp-14-9171-2014, 2014.
21. Gantt, B., **He, J.**, Zhang, X., Zhang, Y., and Nenes, A.: Incorporation of advanced aerosol activation treatments into CESM/CAM5: model evaluation and impacts on aerosol indirect effects, *Atmos. Chem. Phys.*, 14, 7485-7497, doi:10.5194/acp-14-7485-2014, 2014.
22. Cao, L.-G., Pan, S.-M., **He, J.**, Zhang, K.-X., Xu, Y.-H., Zhao, Y.-F., Chen, Y.-Y., Xu, W., and Wu, M.-M., <sup>137</sup>Cs atmospheric deposition in the Liaodong Bay, *Acta Scientiae Circumstantiae*, 35(1), 80-86, 2015. (in Chinese)
23. **He, J.** and Pan, S.-M.: <sup>137</sup>Cs Reference inventory and its distribution in soils along the Liaodong Bay, *Journal of Soil and Water Conservation*, 25(3), 169-173, 2011. (in Chinese)
24. **He, J.**, Pan, S.-M., Sha, H.-L., and Chen, W.-Q.: The analysis on the grain size variation of bed materials at Datong hydrological station and its response to the project constructions along the Yangtze River, *Journal of Nanjing University (Natural Sciences)*, 46(3), 344-357, 2010. (in Chinese)

### Invited Talks

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- **He, J.**, *Investigation of the global methane budget over 1980-2017 using GFDL-AM4.1*, Ocean and Climate Physics Seminar, Lamont-Doherty Earth Observatory, Palisades, NY, October 25, 2019.
- **He, J.**, *The role of atmospheric chemistry and aerosol microphysics in earth system models*, Group on Atmospheric Science and Pollution Seminar, University of North Carolina at Chapel Hill, Chapel Hill, NC, August 17, 2017.
- **He, J.**, *CESM/CAM5 development and evaluation: Aerosol chemistry and dynamics, and retrospective decadal applications*, National Center for Atmospheric Research, Boulder, CO, April 4, 2014.

### Conference and Workshop Presentations (first-authored only)

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- **He, J.**, V. Naik, L. Horowitz, E. Dlugokencky, and K. Thoning, 2019: Evolution of the Global Methane Budget Over the 1980-2017 period Using GFDL-AM4 Model, poster presentation at 2019 Atmospheric Chemistry Gordon Research Conference, July 28-August 02, 2019, Newry, ME.
- **He, J.**, V. Naik, L. Horowitz, E. Dlugokencky, and K. Thoning, 2018: Simulating Methane Trends and Variability Over the 1980-2014 period Using GFDL-AM4 Model,

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poster presentation at American Geophysical Union Annual Fall Meeting, December 10-14, 2018, Washington, D.C.

- **He, J.**, V. Naik, and L. Horowitz, 2018: Investigating Methane Trends and Variability Using the GFDL-AM4 Model and NOAA GMD Observations, poster presentation at the 46<sup>th</sup> Global Monitoring Annual Conference, May 22-23, 2018, Boulder, CO.
- **He, J.**, K. Alapaty, and J. A. Herwehe, 2017: A Generalized Simple Formulation of Convective Adjustment Timescale for Cumulus Convection Parameterizations, poster presentation at the 97<sup>th</sup> AMS annual meeting, January 22-26, 2017, Seattle, WA.
- **He, J.**, K. Alapaty, T. Glotfelty, X.-L. Song, G. Zhang, S.-C. Yu, and D.-W. Kang, 2016: Studying Aerosol Indirect Effects on Grid and Subgrid Scale Clouds Using the Two-Way Coupled WRF-CMAQ, poster presentation at 15<sup>th</sup> CMAS conference, October 24-26, 2016, Chapel Hill, NC.
- **He, J.**, T. Glotfelty, K. Yahya, K. Alapaty, and S.-C. Yu, 2016: Does Temperature Nudging Overwhelm Aerosol Radiative Effects in Regional Integrated Climate Models?, oral presentation at the 17<sup>th</sup> WRF workshop, June 27-July 1, 2016, Boulder, CO.
- **He, J.**, K. Wang, Y. Chen, X. Zhang, Y. Zhang, J-W. Fan, and L. R. Leung, 2015, Multi-Year Comprehensive Evaluation of WRF-CAM5 over East Asia, poster presentation at the Air & Waste Management Association for the 108<sup>th</sup> Annual Conference & Exhibition, June 22-25, 2015, Raleigh, NC.
- **He, J.**, Y. Zhang, J.-F. Lamarque, S. Tilmes, L. Emmons, A. Hodzic, T. Glotfelty, and F. Vitt, 2015, CESM/CAM5 Improvement and Application: Comparison and Evaluation of Updated CB05\_GE and MOZART-4 Gas-Phase Mechanisms and Associated Impacts on Global Air Quality and Climate, poster presentation at the 20<sup>th</sup> Annual CESM Workshop, June 16-19, 2015, Breckenridge, CO.
- **He, J.**, Y. Zhang, and R. He, 2014, Impacts of Air-Sea Interactions on Regional Air Quality Predictions: U.S. East Coast Example, oral presentation at 2014 Hydrology, Ocean, and Atmosphere Conference, December 25-28, 2014, Suzhou, China.
- **He, J.**, Y. Zhang, J.-F. Lamarque, S. Tilmes, L. Emmons, A. Hodzic, C. Knote, and T. Glotfelty, 2014, Evaluation of CESM/CAM5.2 with Advanced Representations of Gas-Phase Chemistry, Aerosol Microphysics, and Aerosol-Cloud Interactions, poster presentation at 2014 CESM Workshop, June 16-19, 2014, Breckenridge, CO.
- **He, J.**, T. Glotfelty, and Y. Zhang, 2013, Decadal Simulation and Comprehensive Evaluation of CESM/CAM5 with Advanced Chemistry, Aerosol microphysics, and Aerosol-Cloud Interactions, poster presentation at the 46<sup>th</sup> American Geophysical Union Annual Fall Meeting, December 9-13, 2013, San Francisco, CA.
- **He, J.** and Y. Zhang, 2013, CESM/CAM5-CB05\_GE-MAM7: Ion-Mediated Nucleation and Thermodynamics Involving Nitrate and Chloride, poster presentation at 2013 CESM Workshop, June 17-20, 2013, Breckenridge, CO.
- **He, J.** and Y. Zhang, 2013, Improvement of Inorganic Aerosol Treatments in CESM/CAM5, poster presentation at 2013 AMS meeting, January 6-10, 2013, Austin, TX.

### **Fellowships and Honors**

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Postdoc Fellowship from the National Research Council Research Associateship Programs, 2016-2017

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Postdoc Fellowship from the Oak Ridge Institute for Science and Education, 2015-2016

Advanced Study Program Fellowship from the National Center for Atmospheric Research, 2014