

# HANNAH NESSER

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## EDUCATION

### HARVARD UNIVERSITY

Ph.D. Candidate, School of Engineering and Applied Sciences

CAMBRIDGE, MA

2017 - present

Researches high-resolution, analytic inversions satellite observations of atmospheric methane concentrations.

### YALE UNIVERSITY

B.S., Environmental Engineering, with Distinction

NEW HAVEN, CT

2012 - 2016

Led a senior research team to develop an operational prototype of a portable air quality monitor that measured concentrations of critical pollutants for an EPA SEARCH Center.

### SCHOOL FOR INTERNATIONAL TRAINING

FORT DAUPHIN, MADAGASCAR

August - December 2014

Conducted research on the mechanical and social feasibility of using biogas as a fuel source for an essential oils still in two remote communities.

## AWARDS

- National Science Foundation Graduate Research Program Fellowship (2017 - 2022)
- Harvard University Department of Earth and Planetary Sciences Graduate Teaching Award, awarded in recognition of superior service and excellence in teaching (Spring 2020)
- Special Commendation for Extraordinary Teaching in Extraordinary Times (COVID-19), awarded to 10% of Harvard instructors based on nomination by students (Spring 2020)
- Bok Center Certificate of Distinction in Teaching, awarded to Harvard Teaching Fellows who received an average score of 4.5 or above (2019)
- D. Allan Bromley Prize in Environmental Engineering, awarded to a Senior who has exhibited superior accomplishment and scholarly achievement in Environmental Engineering (2016)
- Richter Summer Fellowship (2015)

## RESEARCH

### HARVARD UNIVERSITY

Advisor: Daniel Jacob

CAMBRIDGE, MA

2017 - present

- Works to improve constraints on the magnitude and distribution of methane emission sources using high-resolution analytic inversions of observations from the TROPOMI instrument aboard the Sentinel-5 Precursor satellite.
- Develops and applies methods to conduct high-resolution analytic inversions at reduced computational cost while preserving information content.
- Implements those methods to improve estimates of methane emission sources at high resolution over North America using TROPOMI observations.

- Served as Design Lead for a senior research team developing a first-generation operational prototype of portable and stationary air quality monitors measuring concentrations of greenhouse gases and EPA criteria pollutants using low-cost sensors. The sensors were designed for deployment in Baltimore, MD as part of an EPA SEARCH Center.

## **TEACHING**

**HARVARD UNIVERSITY | DEPARTMENT OF EARTH AND PLANETARY SCIENCES** **CAMBRIDGE, MA**  
**Atmospheric Chemistry, Teaching Fellow** **Spring 2020**

Taught weekly section and office hours, including material preparation. Created and graded homework assignments. Developed and taught midterm review session. Helped lead the transition to remote learning following COVID-19 adjustments.

**HARVARD UNIVERSITY | DEPARTMENT OF EARTH AND PLANETARY SCIENCES** **CAMBRIDGE, MA**  
**Atmospheric Chemistry, Teaching Fellow** **Spring 2019**

Taught weekly section and office hours, including material preparation. Created and graded homework assignments. Contributed to exam development and graded exams. Developed and taught midterm and final review sessions.

## **PRESENTATIONS**

Reduced-Cost Construction of Jacobian Matrices for High-Resolution Inversions of Satellite Observations of Atmospheric Composition, presentation at the North American Carbon Project (NACP) 7th Open Science Meeting, Remote, March 12, 2021.

Reduced-Cost Construction of Jacobian Matrices for High-Resolution Inverse Modeling, presentation at the 2020 American Meteorological Society (AMS) Annual Meeting, Boston, MA, January 17, 2020.

Reduced Cost Construction of Jacobian Matrices for High-Resolution Inverse Modeling, poster at the 2019 American Geophysical Union (AGU) Fall Meeting, San Francisco, CA, December 12, 2019.

Decreasing the computational cost of analytic inversions of high-resolution satellite observations, presentation at the Netherlands Institute for Space Research (SRON), Utrecht, Netherlands, June 11, 2019.

## **PUBLICATIONS**

Qu, Z. D.J. Jacob, L. Shen, X. Lu, Y. Zhang, T.R. Scarpelli, H. Nesser, M.P. Sulprizio, J.D. Maasakkers, A.A. Bloom, J.R. Worden, R.J. Parker, and A.L. Delgado, Global distribution of methane emissions: a comparative inverse analysis of observations from the TROPOMI and GOSAT satellite instruments, *Atmos. Chem. Phys. Discuss.*, <https://doi.org/10.5194/acp-2021-309>, in review, 2021.

Nesser, H., D.J. Jacob, J.D. Maasakkers, T.R. Scarpelli, M.P. Sulprizio, Y. Zhang, and C.H. Rycroft, Reduced-cost construction of Jacobian matrices for high-resolution inversions of satellite observations of atmospheric composition, *Atm. Meas. Tech.*, 14, 5521–5534, <https://doi.org/10.5194/amt-14-5521-2021>, 2021.

Maasakkers, J.D., D.J. Jacob, M.P. Sulprizio, T.R. Scarpelli, H. Nesser, J. Sheng, Y. Zhang, X. Lu, A.A. Bloom, K.W. Bowman, J.R. Worden, and R.J. Parker, 2010-2015 North American methane emissions, sectoral

contributions, and trends: a high-resolution inversion of GOSAT satellite observations of atmospheric methane, *Atmos. Chem. Phys.*, 21, 4339–4356, <https://doi.org/10.5194/acp-21-4339-2021>, 2021.

Lu, X., D.J. Jacob, Y. Zhang, J.D. Maasakkers, M.P. Sulprizio, L. Shen, Z. Qu, T.R. Scarpelli, H. Nesser, R.M. Yantosca, J. Sheng, A. Andrews, R.J. Parker, H. Boesch, A.A. Bloom, S. Ma, Global methane budget and trend, 2010-2017: complementarity of inverse analyses using in situ (GLOBALVIEWplus CH<sub>4</sub> ObsPack) and satellite (GOSAT) observations, *Atmos. Chem. Phys.*, 21, 4637–4657, <https://doi.org/10.5194/acp-21-4637-2021>, 2021.

Zhang, Y., P. Sadavarte, R. Gautam, M. Omara, J.D. Maasakkers, S. Pandey, D. Lyon, H. Nesser, M.P. Sulprizio, R. Zhang, S. Houweling, D. Zavala-Araiza, R.A. Alvarez, A.L. Delgado, S.P. Hamburg, I. Aben, and D.J. Jacob, Quantifying methane emissions from the largest oil producing basin in the U.S. from space, *Science Advances*, 6, eaaz5120, <https://doi.org/10.7910/DVN/NWQGHU>, 2020.

Maasakkers, J.D., D.J. Jacob, M.P. Sulprizio, T. Scarpelli, H. Nesser, J.-X. Sheng, Y. Zhang, M. Hersher, A.A. Bloom, K.W. Bowman, J.R. Worden, G. Janssens-Maenhout, and R.J. Parker, Global distribution of methane emissions, emission trends, and OH concentrations and trends inferred from an inversion of GOSAT satellite data for 2010-2015, *Atmos. Chem. Phys.*, 19, 7859-7881, <https://doi.org/10.5194/acp-19-7859-2019>, 2019.

## ACTIVITIES

Co-President, Graduate Environmental Action Team (GrEAT); Volunteer, Harvard Law School Emmet Environmental Law and Policy Clinic.