Hannah Nesser

EDUCATION

HARVARD UNIVERSITY
Cambridge, MA
Ph.D. Candidate, School of Engineering and Applied Sciences
2017 - present

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

YALE UNIVERSITY
New Haven, CT
B.S., Environmental Engineering, with Distinction
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
Cambridge, MA
Advisor: Daniel Jacob
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.

YALE UNIVERSITY — New Haven, CT
Advisor: Drew Gentner — 2015 - 2016

- 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

High-resolution 2019 North American methane emissions inferred from TROPOMI satellite observations of atmospheric methane, invited presentation at the NASA Jet Propulsion Laboratory's (JPL's) Carbon Club seminar, Remote, February 17, 2021.

High-resolution 2019 North American methane emissions inferred from TROPOMI satellite observations of atmospheric methane, poster at the 2019 American Geophysical Union (AGU) Fall Meeting, New Orleans, LA, December 17, 2021.

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

Varon, D.J., D.J. Jacob, M. Sulprizio, L.A. Estrada, W.B. Downs, L. Shen, S.E. Hancock, H. Nesser, Z. Qu, E. Penn, Z. Chen, X. Lu, A. Lorente, A. Tewari, and C.A. Randles, <i>Integrated Methane Inversion (IMI 1.0): A user-friendly, cloud-based facility for inferring high-resolution methane emissions from TROPOMI satellite

observations, submitted to Geophys. Model Dev., 2022.

Shen, L., R. Gautam, M. Omara, D. Zavala-Araiza, J.D. Maasakkers, T.R. Scarpelli, A. Lorente, D. Lyon, J. Sheng, D. Varon, H. Nesser, Z. Qu, X. Lu, M.P. Sulprizio, S.P. Hamburg, and D.J. Jacob, Satellite quantification of national emissions from oil/gas production in the US and Canada including contributions from individual basins, submitted to PNAS, 2022.

Lu, X., D. J. Jacob, H. Wang, J.D. Maasakkers, Y. Zhang, T.R. Scarpelli, L. Shen, Z. Qu, M.P. Sulprizio, H. Nesser, A. A. Bloom, S. Ma, J.R. Worden, S. Fan, R. J. Parker, H. Boesch, R. Gautam, D. Gordon, M.D. Moran, F. Reuland, C.A.O. Villasana, and A. Andrews, Methane emissions in the United States, Canada, and Mexico: Evaluation of national methane emission inventories and sectoral trends by inverse analysis of in situ (GLOBALVIEWplus CH_4 ObsPack) and satellite (GOSAT) atmospheric observations, Atmos. Chem. Phys., 22, 395-418, https://doi.org/10.5194/acp-22-395-2022, 2022.

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., 21, 14159-14175, https://doi.org/10.5194/acp-21-14159-2021, 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_4 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-lead, Harvard Atmospheric Chemistry Modeling Group Diversity, Inclusion, and Belonging (DIB) subgroup
- Graduate Student Representative, Harvard Earth and Planetary Sciences and Environmental Science and Engineering Diversity, Inclusion, and Belonging (DIB) Committee

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