

ALEXANDER J. TURNER

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EDUCATION

- Ph.D., Harvard University** 2012 – 2017
Atmospheric Chemistry (Advisor: Daniel J. Jacob)
- B.S., University of Colorado at Boulder** 2008 – 2012
Mechanical Engineering (Advisor: Daven K. Henze)

PROFESSIONAL EXPERIENCE

- University of California at Berkeley** 2017 – Present
Miller Postdoctoral Fellow with Inez Fung and Ronald C. Cohen
- Developing a methodology to incorporate meteorological parameters and transport error in GHG flux inversions.
 - Estimating methane and CO₂ fluxes at high spatio-temporal resolution (~1 km²) using dense observations.
 - Investigating the processes controlling the OH burden on decadal-to-centennial timescales.
- Harvard University** 2012 – 2017
Graduate Research Assistant with Daniel J. Jacob
- Developed an efficient radial basis function-based method for designing multi-scale state vectors.
 - Estimated global and North American methane emissions at high resolution using GOSAT satellite observations.
 - Identified a potential increase in US methane emissions over the past decade.
 - Demonstrated how changes in the OH burden or methane emissions can explain recent trends in methane.
 - Quantified the magnitude of sources that could be detected with different types of satellite observations.
- DOE Lawrence Berkeley National Lab/University of California at Berkeley** Summer 2014, Spring 2016
Visiting Graduate Student with Ronald C. Cohen
- Quantified the tradeoff between measurement network density and observation error for estimating urban fluxes.
 - Compiled an hourly carbon dioxide emission inventory at 1 km resolution for California's Bay Area.
 - Developed a WRF-STILT based inverse model for the BEACO₂N carbon dioxide measurement network
- University of Colorado at Boulder** 2010 – 2012
Undergraduate Research Assistant with Daven K. Henze
- Developed an adjoint-based method for assessing the influence of non-local emissions on a satellite column.
 - Demonstrated that the common practice of neglecting atmospheric transport and assuming a local relationship between satellite observations and emissions could lead to considerable biases in the estimation of emissions.
- NOAA Geophysical Fluid Dynamics Lab** Summer 2011
Undergraduate Research Assistant with Arlene M. Fiore
- Examined the long-term cyclone frequency and air quality impacts in the Northeastern U.S.
 - Found statistically significant decreasing mid-latitude cyclone frequencies in future climate scenarios.
 - Demonstrated that the relationship between air quality and cold fronts is weaker than previously thought.
- DOE Lawrence Berkeley National Lab** Summer 2010
Undergraduate Research Assistant with Marc L. Fischer
- Used WRF-STILT to calculate footprints and improve California's methane emission estimates.
 - Found a discrepancy in the WRF PBL heights due to a misrepresentation of irrigation in the model.

TEACHING EXPERIENCE

- Harvard University** Spring 2014
Teaching Assistant
- Spring 2014: Atmospheric Chemistry (21 students)
- University of Colorado at Boulder** 2010 – 2011
Teaching Assistant
- Fall 2011: Numerical Methods (~100 students) – *Outstanding Teaching Assistant Award*
 - Fall 2010: Numerical Methods (~100 students)
 - Spring 2010: First-Year Engineering Projects (25 students)

AWARDS AND FELLOWSHIPS

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|---------------------------------------------------------|--------------------------------------------------|-------------|
| Miller Fellowship at UC Berkeley | (Postdoctoral Fellowship, <i>11 Recipients</i>) | 2017 – 2020 |
| Department of Energy CSGF Fellowship | (National Fellowship, <i>10 Recipients</i>) | 2013 – 2017 |
| Department of Defense NDSEG Fellowship, <i>declined</i> | (National Fellowship, <i>200 Recipients</i>) | 2013 |
| CU Boulder "Outstanding Graduate for Research" | (College Award, <i>Sole Recipient</i>) | 2012 |
| Sigma Xi Undergraduate Research Award | (University Award, <i>6 Recipients</i>) | 2011 |
| Vestas Mechanical Engineering Student of the Year | (National Award, <i>Sole Recipient</i>) | 2010 |
| NOAA Ernest F. Hollings Scholar | (National Scholarship, <i>100 Recipients</i>) | 2010 – 2012 |

- *18. Sheng, J. X., D. J. Jacob, **A. J. Turner**, J. D. Maasakkers, J. Benmergui, A. A. Bloom, C. Arndt, R. Gautam, D. Zavala-Araiza, S. P. Hamburg, H. Boesch, R. J. Parker (submitted), 2010–2015 methane trends over Canada, the United States, and Mexico observed by the GOSAT satellite: contributions from different source sectors, *submitted*.
17. Bloom, A. A., K. Bowman, M. Lee, **A. J. Turner**, R. Schroeder, J. R. Worden, R. J. Weidner, K. McDonald, and D. J. Jacob (2017), A global wetland methane emissions and uncertainty dataset for atmospheric chemical transport models (WetCHARTs version 1.0), *Geosci. Mod. Dev.*, *10*, 2141–2156, doi:10.5194/gmd-10-2141-2017.
16. Buchwitz, M., O. Schneising, M. Reuter, J. Heymenn, S. Krautwurst, H. Bovensmann, J. P. Burrows, H. Boesch, R. J. Parker, P. Somkuti, R. G. Detmers, O. P. Hasekamp, I. Aben, A. Butz, C. Frankenberg, and **A. J. Turner** (2017), Satellite-derived methane hotspot emission estimates using a fast data-driven method, *Atmos. Chem. Phys.*, *17*, 5751–5744, doi:10.5194/acp-17-5751-2017.
15. **Turner, A. J.**, C. Frankenberg, P. O. Wennberg, and D. J. Jacob (2017), Ambiguity in the causes for decadal trends in atmospheric methane and hydroxyl, *Proc. Natl. Acad. Sci.*, *114*, 5367–5372, doi:10.1073/pnas.1616020114.
14. Tzompa-Sosa, Z. A., E. V. Fischer, E. Mahieu, B. Franco, C. A. Keller, **A. J. Turner**, D. Helmig, A. Fried, D. Richter, P. Weibring, J. Walega, T. I. Yacovitch, S. C. Herndon, D. R. Blake, F. Hase, J. Hannigan, S. Conway, K. Strong, and M. Schneider (2017), Revisiting global fossil fuel and biofuel emissions of ethane, *J. Geophys. Res.*, *122*, 2493–2512, doi:10.1002/2016JD025767.
13. Bader, W., B. Bovy, S. Conway, K. Strong, D. Smale, **A. J. Turner**, T. Blumenstock, C. Boone, M. C. Coen, A. Coulon, O. Garcia, D. W. T. Griffith, F. Hase, P. Hausmann, N. Jones, P. Krummel, I. Murata, I. Morino, H. Nakajima, S. O’Doherty, C. Paton-Walsh, J. Robinson, R. Sandrin, M. Schneider, C. Servais, R. Sussmann, and E. Mahieu (2017), The recent increase of atmospheric methane from 10 years of ground-based NDACC FTIR observations since 2005, *Atmos. Chem. Phys.*, *17*, 2255–2277, doi:10.5194/acp-17-2255-2017.
12. Maasakkers, J. D., D. J. Jacob, M. Sulprizio, **A. J. Turner**, M. Weitz, T. Wirth, C. Hight, M. DeFigueiredo, M. Desai, R. Schmeltz, L. Hockstad, A. A. Bloom, K. W. Bowman, S. Jeong, and M. L. Fischer (2016), A gridded national inventory of US methane emissions, *Env. Sci. Technol.*, *50*, 13123–13133, doi:10.1021/acs.est.6b02878.
11. Jacob, D. J., **A. J. Turner**, J. D. Maasakkers, J. Sheng, K. Sun, X. Liu, K. Chance, I. Aben, J. McKeever, and C. Frankenberg (2016), Satellite observations of atmospheric methane and their application to constrain emissions, *Atmos. Chem. Phys.*, *16*, 14371–14396, doi:10.5194/acp-16-14371-2016.
10. **Turner, A. J.**, A. A. Shusterman, B. C. McDonald, V. Teige, R. A. Harley, and R. C. Cohen (2016), Network design for quantifying urban CO₂ emissions: assessing trade-offs between precision and network density, *Atmos. Chem. Phys.*, *16*, 13465–13475, doi:10.5194/acp-16-13465-2016.
9. Shusterman, A. A., V. Teige, **A. J. Turner**, C. Newman, J. Kim, and R. C. Cohen (2016), The BERkeley Atmospheric CO₂ Observation Network: Initial Evaluation, *Atmos. Chem. Phys.*, *16*, 13449–13463, doi:10.5194/acp-16-13449-2016.
8. Tan, Z., Q. Zhuang, D. K. Henze, C. Frankenberg, E. Dlugokencky, C. Sweeney, **A. J. Turner**, M. Sasakawa, and T. Machida (2016), Inverse modeling of pan-Arctic methane emissions at high spatial resolution: What can we learn from assimilating satellite retrievals and using different process-based wetland and lake biogeochemical models?, *Atmos. Chem. Phys.*, *16*, 12649–12666, doi:10.5194/acp-16-12649-2016.
7. Bousserez, N., D. K. Henze, B. Rooney, A. Perkins, K. J. Wecht, **A. J. Turner**, V. Natraj, and J. R. Worden (2016), Constraints on methane emissions in North America from future geostationary remote sensing measurements, *Atmos. Chem. Phys.*, *16*, 6175–6190, doi:10.5194/acp-16-6175-2016.
6. **Turner, A. J.**, D. J. Jacob, J. Benmergui, S. C. Wofsy, J. D. Maasakkers, A. Butz, O. Hasekamp, and S. C. Biraud (2016), A large increase in U.S. methane emissions over the past decade inferred from satellite data and surface observations, *Geophys. Res. Lett.*, *43*, doi:10.1002/2016GL067987.
5. Worden, J. R., **A. J. Turner**, A. Bloom, S. S. Kulawik, J. Liu, M. Lee, R. Weidner, K. Bowman, C. Frankenberg, R. J. Parker, and V. H. Payne (2015), Quantifying Lower Tropospheric Methane Concentrations Using Near-IR and Thermal IR Satellite Measurements: Comparison to the GEOS-Chem model, *Atmos. Meas. Tech.*, *8*, 3433–3445, doi:10.5194/amt-8-3433-2015.
4. **Turner, A. J.**, D. J. Jacob, K. J. Wecht, J. D. Maasakkers, E. Lundgren, A. E. Andrews, S. C. Biraud, H. Boesch, K. W. Bowman, N. M. Deutscher, M. K. Dubey, D. W. T. Griffith, F. Hase, A. Kuze, J. Notholt, H. Ohyama, R. Parker, V. H. Payne, R. Sussmann, C. Sweeney, V. A. Velazco, T. Warneke, P. O. Wennberg, and D. Wunch (2015), Estimating global and North American methane emissions with high spatial resolution using GOSAT satellite data, *Atmos. Chem. Phys.*, *15*, 7049–7069, doi:10.5194/acp-15-7049-2015.

3. **Turner, A. J.** and D. J. Jacob (2015), Balancing aggregation and smoothing errors in inverse models, *Atmos. Chem. Phys.*, *15*, 7039–7048, doi:10.5194/acp-15-7039-2015.
2. **Turner, A. J.**, A. M. Fiore, L. W. Horowitz, and M. Bauer (2013), Summertime cyclone frequencies over the Great Lakes Storm Track from 1860–2100: variability, trends, and association with ozone pollution, *Atmos. Chem. Phys.*, *13*, 565–578, doi:10.5194/acp-13-565-2013.
1. **Turner, A. J.**, D. K. Henze, R. V. Martin, and A. Hakami (2012), The spatial extent of source influences on modeled column concentrations of short-lived species, *Geophys. Res. Lett.*, *39*, L12806, doi:10.1029/2012GL051832.

SELECTED ORAL CONFERENCE PRESENTATIONS

- 2017 **Turner, A. J.**: Ambiguity in the causes for decadal trends in atmospheric methane and hydroxyl, *ACCESS XIV Meeting*, Brookhaven National Laboratory.
- 2016 **Turner, A. J.**, C. Frankenberg, *et al.*: Ambiguity in the causes for decadal trends in atmospheric methane and hydroxyl, *2016 AGU fall meeting*, San Francisco, CA.
- 2015 **Turner, A. J.**, D. J. Jacob, *et al.*: An increasing trend in US methane emissions inferred from satellite observations, *11th International workshop on greenhouse gas measurements from space*, Caltech.
- 2015 **Turner, A. J.**, D. J. Jacob, *et al.*: Estimating North American methane emissions with high spatial resolution using GOSAT, *7th International GEOS-Chem meeting*, Harvard University.
- 2015 **Turner, A. J.**, D. J. Jacob, *et al.*: Estimating North American methane emissions with high spatial resolution using GOSAT, *5th North American carbon program meeting*, Washington, DC.
- 2014 **Turner, A. J.**, R. C. Cohen, *et al.*: Estimating urban carbon dioxide fluxes at high spatial resolution from *in situ* observations, *2014 AGU fall meeting*, San Francisco, CA.
- 2013 **Turner, A. J.**, D. J. Jacob, *et al.*: Optimal estimation of North American methane emissions using GOSAT data: A contribution to the NASA Carbon Monitoring System, *2013 AGU fall meeting*, San Francisco, CA.
- 2011 **Turner, A. J.**, A. M. Fiore, *et al.*: Quantifying the impact of a warming world on Northeast air quality via changing cyclone frequency: past, present, and future, *2011 AGU fall meeting*, San Francisco, CA.
- 2011 **Turner, A. J.**, D. K. Henze, *et al.*: Assessing the range of modeled source influences on column concentrations of short-lived species using adjoint sensitivities, *5th International GEOS-Chem meeting*, Harvard University.

INVITED SEMINARS

- 2017 Japanese Aerospace Exploration Agency (JAXA)
- 2017 California Institute of Technology (Caltech)
- 2016 Massachusetts Institute of Technology (MIT)
- 2016 NASA Jet Propulsion Laboratory
- 2016 NOAA Earth System Research Laboratory
- 2016 IBM Thomas J. Watson Research Center
- 2014 DOE Lawrence Livermore National Laboratory
- 2014 NOAA Earth System Research Laboratory

TECHNICAL SKILLS

- Reviewer for: Nature Geosci., GRL, JGR, ACP, AMT, GMD, and Atmos. Environ.
- Graduate Coursework: Inverse Methods, Partial Differential Equations, Stochastic Optimization, Parallel Computing, Environmental Modeling, Atmospheric Chemistry, Aerosols, Spectroscopy, Physics of Climate, Computing Foundations, Classical Thermo., Stat. Thermo., and Fluid Dynamics.
- Programming: Matlab, Python, Julia, R, IDL, Fortran 77/90, Shell Scripting, Mathematica, EES, html.
- Computing Tools: MPI, CUDA, OpenMP, MapReduce, Unix, Amazon EC2, ANSYS Fluent, SolidWorks, L^AT_EX.

RESEARCH GRANTS AND COMPUTING ALLOCATIONS

On the utility of satellite observations for constraining fine-scale methane fluxes and super-emitters
 400,000 CPU hours, Alexander J. Turner (PI)

- NCAR/CISL Allocation Number: UHAR0006
- 05/19/2017 – 05/18/2018

Estimating urban carbon dioxide fluxes at high resolution from in situ observations
 650,000 CPU hours & 400,000 Storage Units, Alexander J. Turner (PI)

- NERSC ERCAP Grant 87628
- 01/12/2014 – 01/09/2017