Jacob K. Hedelius

Earth, Atmospheric and Planetary Physics, University of Toronto

60 St George St 416-946-0896
Toronto, ON M5S 1A7 jacob.hedelius@utoronto.ca
Canada

EDUCATION

Ph.D. in Chemistry (Atmospheric/Physical/Analytical) 2017
Dissertation: What can we infer about the atmospheric composition within the SoCAB from remote sensing?
California Institute of Technology, Pasadena, CA

B.S. in Chemistry, *cum laude* 2012
Minor Studies in Physics, and Mathematics
Brigham Young University, Provo, UT

A.S. in General Studies, *summa cum laude* 2007
Snow College, Ephraim, UT

RESEARCH EXPERIENCE

Postdoctoral Fellow, University of Toronto 2017–present
Advisor: Debra Wunch

- Performing QA/QC on large (>1 TB) dataset of CO observations from the MOPITT satellite. Providing feedback to algorithm team for improvements.
- Quantifying when and where MOPITT observations differ from ground-based TCCON observations.
- Using MOPITT with other space-based sensors (e.g., MODIS, OCO-2, VIIRS) to analyze gas plumes from 100 largest urban areas.

Graduate Research Assistant, California Institute of Technology 2012–2017
Advisor: Paul O. Wennberg

- Devised error budget for retrievals from mobile solar-viewing Fourier transform spectrometers (FTS).
- Quantified and determined sources of bias among different greenhouse gas (GHG) remote sensing network sites (TCCON).
- Worked with large atmospheric datasets, esp. remote sensing. Ran Lagrangian transport model (HYSPLIT), and worked with WRF-Chem model results.
- Designed and implemented strategy to measure emissions from Los Angeles using ground and satellite observations.

Undergraduate Research Assistant, Brigham Young University 2010–2012

Advisor: David V. Dearden

Modeled a gas phase ion exchange reaction involving cucurbiturils

RESEARCH FUNDING

Caltech Division of Chem & Chem Engr – Dow Chemical Graduate Fellowship	2014
Keck Institute for Space Studies – Graduate Student Fellowship, Caltech	2013
ORCA Undergraduate Research Grant, Brigham Young University	2012

PEER-REVIEWED PUBLICATIONS

Accepted

7. **Hedelius, J. K.**, Liu, J., Oda, T., Maksyutov, S., Roehl, C. M., Iraci, L. T., Podolske, J. R., Hillyard, P. W., Liang, J., Gurney, K. R., Wunch, D., and Wennberg, P. O.: Southern California megacity CO_2, CH_4, and CO flux estimates using ground- and space-based remote sensing and a Lagrangian model, Atmos. Chem. Phys., 18, 16271-16291, doi:10.5194/acp-18-16271-2018, 2018**.**

6. **Hedelius, J. K.**, Feng, S., Roehl, C. M., Wunch, D., Hillyard, P. W., Podolske, J. R., Iraci, L. T., Patarasuk, R., Rao, P., O'Keeffe, D., Gurney, K.R., Lauvaux, T., and Wennberg, P.O.: Emissions and topographic effects on column CO_2 (X_{CO2}) variations, with a focus on the Southern California Megacity, J. Geophys. Res. Atmos., 122, doi:10.1002/2017JD026455, 2017.

5. Viatte, C., Lauvaux, T., **Hedelius, J. K.**, Parker, H., Chen, J., Jones, T., Franklin, J. E., Deng, A. J., Gaudet, B., Verhulst, K., Duren, R., Wunch, D., Roehl, C., Dubey, M. K., Wofsy, S., and Wennberg, P. O.: Methane emissions from dairies in the Los Angeles Basin, Atmos. Chem. Phys., 17, 7509-7528, doi:10.5194/acp-17-7509-2017, 2017.

4. **Hedelius, J. K.**, Parker, H., Wunch, D., Roehl, C. M., Viatte, C., Newman, S., Toon, G. C., Podolske, J. R., Hillyard, P. W., Iraci, L. T., Dubey, M. K., and Wennberg, P. O.: Intercomparability of X_{CO2} and X_{CH4} from the United States TCCON sites, Atmos. Meas. Tech , 10, 1481-1493, doi:10.5194/amt-10-1481-2017, 2017.

3. Wunch, D., Toon, G. C., **Hedelius, J. K.**, Vizenor, N., Roehl, C. M., Saad, K. M., Blavier, J.-F. L., Blake, D. R., and Wennberg, P. O.: Quantifying the loss of processed natural gas within California's South Coast Air Basin using long-term measurements of ethane and methane, Atmos. Chem. Phys., 16, 14091-14105, doi:10.5194/acp-16-14091-2016, 2016.

2. **Hedelius, J. K.,** Viatte, C., Wunch, D., Roehl, C. M., Toon, G. C., Chen, J., Jones, T., Wofsy, S. C., Franklin, J. E., Parker, H., Dubey, M. K., and Wennberg, P. O.: Assessment of errors and biases in retrievals of X_{CO2}, X_{CH4}, X_{CO}, and X_{N2O} from a 0.5 cm^{-1} resolution solar-viewing spectrometer, Atmos. Meas. Tech., 9, 3527-3546, doi:10.5194/amt-9-3527-2016, 2016.

1. Chen, J., Viatte, C., **Hedelius, J. K.**, Jones, T., Franklin, J. E., Parker, H., Gottlieb, E. W., Wennberg, P. O., Dubey, M. K., and Wofsy, S. C.: Differential column measurements using compact solar-tracking spectrometers, Atmos. Chem. Phys., 16, 8479-8498, doi:10.5194/acp-16-8479-2016, 2016.

PRESENTATIONS (Presenter only)

16. **Hedelius, J.**, He, T., Blumenstock, T., De Maziere, M., Dubey, M., Feist, D.G., Goo, T.-Y., Griffith, D., Hase, F., Iraci, L.T., Jones, D.B.A., Kiel, M., Kivi, R., Morino, I., Notholt, J., Pollard, D.F., Roehl, C., Schneider, M., Shiomi, K., Strong, K., Sussmann, R., Sweeney, C., Te, Y., Toon, G., Velazco, V., Warneke, T., Wennberg, P., and Wunch, D. Comparisons of MOPITT X_{CO} with TCCON. Presented at NDACC-IRWG/TCCON Meeting, Mexico City, Mexico; 11–15 June 2018.

15. **Hedelius, J.**, Liu, J., Oda, T., Maksyutov, S., Roehl, C., Iraci, L. T., Podolske, J., Hillyard, P., Wunch, D., and Wennberg, P. Southern California megacity CO_2, CH_4, and CO flux estimates using ground- and space-based remote sensing and a Lagrangian model. Presented at NDACC-IRWG/TCCON Meeting, Mexico City, Mexico; 11–15 June 2018.

14. **Hedelius, J.**, Toon, G., and Wennberg, P.: EM27/SUN GGG interferogram processing suite (EGI) updates. Poster presented at NDACC-IRWG/TCCON Meeting, Mexico City, Mexico; 11–15 June 2018.

13. **Hedelius, J.**, He, T., Blumenstock, T., De Maziere, M., Dubey, M., Feist, D.G., Goo, T.-Y., Griffith, D., Hase, F., Iraci, L.T., Jones, D.B.A., Kiel, M., Kivi, R., Morino, I., Notholt, J., Pollard, D.F., Roehl, C., Schneider, M., Shiomi, K., Strong, K., Sussmann, R., Te, Y., Velazco, V., Warneke, T., Wennberg, P., and Wunch, D. Comparisons of MOPITT X_{CO} with TCCON. Presented at International Workshop on Greenhouse Gas Measurements from Space (IWGGMS-14); Toronto, Canada; 8–10 May 2018. https://iwggms14.physics.utoronto.ca/documents/90/3.2_Jacob_Hedelius_win.pdf

12. **Hedelius, J.**, Liu, J., Wunch, D., Roehl, C., Podolske, J.R., Hillyard, P.W., Iraci, L.T., and Wennberg, P.O. What are the fluxes of greenhouse gases from the greater Los Angeles area as inferred from top-down remote sensing studies? Poster presented at American Geophysical Union Fall Meeting, New Orleans, LA; 11–15 December 2017, Abstract ID: A23G-1360.

11. **Hedelius, J.K.**, Roehl, C., Wennberg, P.O. Wunch, D., Hillyard, P.W., Podolske, J.R., and Iraci, L.T. Estimate of the SoCAB CO_2 flux using a Lagrangian-based method and TCCON and OCO-2 observations. Poster presented at International Workshop on Greenhouse Gas Measurements from Space (IWGGMS-13); Helsinki, Finland; 6–8 June 2017.

10. **Hedelius, J.K.**, Parker, H., Wunch, D., Roehl, C., Viatte, C., Newman, S., Toon, G.C., Podolske, J.R., Hillyard, P.W., Iraci, L.T., Dubey, M.K., and Wennberg, P.O. Intercomparability of X_{CO2} and X_{CH4} from the U.S. TCCON sites. Presented at NDACC-IRWG/TCCON Meeting, Paris, France; 29 May–2 June 2017.

9. **Hedelius, J.K.**, Toon, G.C., and Wennberg, P.O. Estimating AOD from an EM27/SUN. Poster presented at NDACC-IRWG/TCCON Meeting, Paris, France; 29 May–2 June 2017.

8. **Hedelius, J.K.** What are the direct net fluxes of greenhouse gases from the California South Coast Air Basin (as inferred using remote sensing platforms)? Presented at Technische Universität München Advanced Seminar for Environmental Sensing, Munich, Germany; 24 May 2017.

7. **Hedelius, J.**, Parker, H., Wunch, D., Roehl, C., Viatte, C., Toon, G.C., Podolske, J.R., Hillyard, P.W., Iraci, L.T., Dubey, M.K., and Wennberg, P.O. Intercomparability of USA TCCON sites X_{CO2} and X_{CH4} in 2015. Presented at NDACC-IRWG/TCCON Meeting, Jeju, South Korea; 30 May–3 June 2016.

6. **Hedelius, J.**, Viatte, C., Wunch, D., Roehl, C., Osterman, G., and Wennberg, P. EM27/SUN Mobile FT Spectrometers: Potential Supplemental OCO-2 Validation Measurement. Presented at OCO-2 Meeting, Pasadena, CA; 21–23 March 2016.

5. **Hedelius, J.K.**, Feng, S., Viatte, C., Wunch, D., Roehl, C., Podolske, J.R., Hillyard, P.W., Iraci, L.T., Patarasuk, R., Rao, P., O'Keeffe, D., Gurney, K.R., Lauvaux, T., Wennberg, P.O. Emissions, Topography, and Variation in X_{CO2} above the Southern California Megacity. Poster presented at American Geophysical Union Fall Meeting, San Francisco, CA; 14–18 December 2015, Abstract ID: A41I-0195.

4. **Hedelius, J.**, Viatte, C., Wunch, D., Roehl, C., Chen, J., Wofsy, S., Podolske, J., Hillyard, P., Iraci, L., Kort, E., Feng, S., Lauvaux, T., and Wennberg, P. Part 2: Spatial X_{CO2} studies in the Pasadena Area. Presented at the OCO-2 meeting, Pasadena, CA; 3–6 November 2015.

3. **Hedelius, J.**, Viatte, C., Wunch, D., Roehl, C., and Wennberg, P. Mobile-FTS Standardization and X_{CO2} measurements in the Greater Pasadena Area. Poster presented at NDACC-IRWG/TCCON Meeting, Toronto, Canada; 8–12 June 2015. Presented again at International Workshop on Greenhouse Gas Measurements from Space (IWGGMS-11); Pasadena, CA; 16–18 June 2015.
https://drive.google.com/file/d/0BxA3HC2mAmDheDRCcjdfb0JRMms/view

2. **Hedelius, J.**, Viatte, C., Wunch, D., Roehl, C., and Wennberg, P. LA Mobile FTS/Target mode studies. Presented at Los Angeles Megacities Carbon Project meeting, Pasadena, CA; 5–7 May 2015.

1. **Hedelius, J.**, and Dearden, D. Theoretical Modeling of a Gas Phase Ion Exchange Reaction. Presented at Brigham Young University Spring Research Conference, Provo, UT; 17 March 2012.

MANUAL REVISIONS

Hansen, L.S.; Wilson, B.J.; Nordmeyer, F.R.; Cannon, J.F. *Exploratory Chemistry Experiments*, 2013 ed.; Department of Chemistry and Biochemistry, Brigham Young University: Provo, UT, 2013.
http://www.chem.byu.edu/static/media/uploads/other/exploratory_lab_manual_2013.doc

SOFTWARE

Hedelius, J.K., Toon, G.C., and Wennberg, P.O. EM27/SUN GGG interferogram (EGI) processing suite Version 2014, Hosted on CaltechDATA data archive, California Institute of Technology, Pasadena, California, U.S.A., doi:10.22002/D1.306, 2017.
Add-in software to run FT and spectral fitting algorithm (GGG) for EM27/SUN spectrometers. Includes a beta algorithm to retrieve AOD. Used by 10+ collaborators at 8+ institutions in 4 countries.

SKILLS

Proficient: MATLAB, Python, Bash scripting, FTIR, remote sensing, data inversions (e.g., Bayesian), statistical analyses, working with atmospheric data (e.g., HDF, satellite, weather model products)
Intermediate: LaTeX, tcsh, Linux, revision control (Mercurial), parallel computing, automating software, machine learning, error analyses, analytic techniques, data visualization
Other: HTML, IDL, Fortran 77, SolidWorks, AutoCAD, LabVIEW

TEACHING EXPERIENCE

Teaching Assistant: Earth's Biogeochemical Cycles (ESE 103), Graduate 1 level, California Institute of Technology, Winter 2016

Teaching Assistant: Physical Chemistry Laboratory (Ch 6), Junior level, California Institute of Technology, Winter 2013, Spring 2014

Teaching Assistant: Chemical Equilibrium and Analysis (Ch 14), Sophomore level, California Institute of Technology, Spring 2013

Teaching Assistant: Chemical Equilibrium and Analysis Laboratory (Ch 15), Junior level, California Institute of Technology, Spring 2013

Laboratory Manager: Exploratory Laboratory (Chem 101, 102, 105), Freshman level, Brigham Young University, July 2011–June 2012

Teaching Assistant: Quantitative and Qualitative Chemical Analysis (Chem 223), Sophomore level, Brigham Young University, Spring 2011

Mathematics and Science Tutor, Freshman & Sophomore Level, Snow College, August 2006–May 2008

OUTREACH ACTIVITIES

- University of Toronto Physics and Atmospheric Science outreach (2018)
- Tour guide for Linde-Robinson LEED Platinum Environmental Research building on Caltech campus (2014–2017)
- Event Supervisor, Southern California State and Regional Science Olympiads. (2014–2017)

VOLUNTEER/COMMUNITY INVOLVMENT

- Friends of the LA river annual cleanup (2013–2016)
- Musical accompanist (2013–2017)
- Wikipedia editor (2012–ongoing)