

Curriculum Vitae of Anne E. Perring, PhD

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EDUCATION

2009 - PhD, Chemistry University of California-Berkeley, Berkeley, CA.

“The Atmospheric Chemistry of Isoprene- and Other Multifunctional-Nitrates”

2003 - ScB with honors, Chemistry, Brown University, Providence, RI.

RESEARCH INTERESTS

Investigation of atmospheric chemistry, air quality and climate, from local to global scales, through *in-situ*, laboratory and remote measurements of particles and gases.

PROFESSIONAL EXPERIENCE

3/2012 – present Research Scientist II, CIRES/NOAA, Boulder, CO.

Supervisor: David. W Fahey and Ru-Shan Gao

- Project lead for bioaerosol research in the Chemical Sciences Division.
- Evaluate and modify new instrumentation for the detection of biological aerosol.
- Continue measurements of black carbon aerosol from airborne platforms.
- Perform SP2 modifications as required to meet objectives of upcoming campaigns.

8/2009 – 3/2012 Research Scientist I, CIRES/NOAA, Boulder, CO.

Supervisor: David W Fahey.

- Atmospheric measurements of black carbon aerosol from airborne platforms.

2003 – 2009 Graduate student researcher, UC-Berkeley, College of Chemistry.

Supervisor: Ronald C. Cohen

- Airborne, ground-based and laboratory investigations of atmospheric oxidized nitrogen.
- Studied impacts of alkyl-nitrate formation on ozone production and NO_y transport.
- Collaborated with colleagues on satellite validation and modeling studies.

2001 - 2002 Undergraduate Researcher, Department of Geology, Brown University.

Supervisor: Yongsong Huang.

- Radiocarbon dating of terrestrial plant compounds to assess paleoclimate.

2001 Visiting Researcher, UNAM, Mexico City, Mexico, Aquatic Biology Department

Supervisor: Patricia Ramirez-Romero

- Examined water quality in the Ocoyoacac river, Mexico.

2000 Undergrad Researcher, WHOI, Marine Biological Laboratory, Woods Hole, MA.

Supervisor: Michael Williams

- Effects of land use on in-stream chemical processing in the Ipswich River Basin.

SCIENTIFIC EXPERTISE

- Design, operation and modification of instruments for detection of particles and gases:
 - New technology for in situ detection of biological aerosol including the Wide Band Integrated Bioaerosol Sensor (WIBS)
 - A single-particle soot- photometer (SP2) for measurements of black carbon aerosol in laboratory applications and airborne field deployments.
 - The Berkeley Thermal Dissociation –Laser Induced Fluorescence (TD-LIF) instrument for detection of atmospheric oxidized nitrogen species.

- Analysis of atmospheric measurements to address climate and air quality issues including photochemistry, radiative forcing, model validation and satellite observations.
- Construction of control software in LabView
- Construction of data analysis programs in Igor and Matlab.
- Written and oral communication of atmospheric science results.

AWARDS AND FELLOWSHIPS

- 2012: Colorado Governors Award
 2011: CIRES Outstanding Performance Award
 2009: Atmospheric Chemistry Colloquium for Emerging Senior Scientists X (ACCESS-X)
 Research Colloquium participant, Brookhaven, NY.
 2008: Berkeley Atmospheric Sciences Center Graduate Student Fellowship
 2006-2009: NASA Earth Systems Science Graduate Student Fellowship
 2005: Air & Waste Management Association scholarship
 2001: Luce Fellowship, Watson Institute for International Relations, Brown University

GRANTS

Funded

- 2016-2019: NASA Airborne Science, PI: JP Schwarz, Co-I: AE Perring, \$300,500
 "Measurements of Black Carbon Mass and Mixing State, and the Hygroscopicity of Internally Mixed Materials During KORUS-AQ"
 2013: CIRES Innovative Research Program, Co-PIs: Perring and Fierer, \$20,000
 "Are microbes a significant component of free tropospheric aerosol?"
 2011-2014: NASA Airborne Science, PI: RS Gao, Co-I: AE Perring, \$392,800
 "Measurements of Black Carbon Mass and Mixing State, and the Hygroscopicity of Coexisting Materials in DC3 and SEAC4RS"

TEACHING EXPERIENCE

UC Berkeley, College of Chemistry, graduate student instructor:

- 2005 - Advanced quantum mechanics for graduate students
- 2004 - Introduction to Chemistry for majors
- 2003 - Introduction to Chemistry for non-majors

Brown University, Center for Environmental Studies, Undergrad TA

- 2002 - International Environmental Policy
- 2001 - Introduction to Environmental Studies

MEMBERSHIPS

- 2003-present: American Geophysical Union
- 2014-present: American Association for Aerosol Research

PROFESSIONAL SERVICE

- 2015-present: Co-editor for Atmospheric Chemistry and Physics
- 2013-present: CIRES Members Council Representative, CU Boulder
- 2013: Reviewer for NOAA Climate Change, Earth System Science, AC4 proposals.
- 2009-present: Manuscript reviewer for: Atmospheric Chemistry and Physics, Atmospheric Measurements and Technologies, Geophysical Research Letters, Journal of Geophysical Research - Atmospheres, Aerosol Science and Technology, Atmospheric Environment, Environmental Research Letters, Physics and Chemistry of the Earth.
- 2012-2013: Reviewer of NOAA Hollings scholarship applications.

2011: Contributor to the Joint Sub-Committee on Ocean Science and Technology Deepwater Horizon Oil Spill workshop.

2009: Small Business Innovative Research (SBIR) proposal reviewer.

OUTREACH

2015-present: Mentor for female undergrads in geoscience with the PROMoting Geoscience Research Education & Success (PROGRESS) program.

2014: Earth Explorers Scientist with local middle school children.

2012-present: Content reviewer, Climate Literacy & Energy Awareness Network (CLEAN).

2011-2015: NOAA 8th grade science day presenter climate change research.

2011: Presenter at the NCAR Research Experience for Teachers Institute.

PUBLICATIONS (H index = 27)

* Denotes supervising author

*55. Robinson ES, Schwarz JP, Gao RS, Fahey DW and **Perring AE**, Calibration Methods for Use with Fluorescent Particle Detection Technologies, *in preparation*, July 2016.

54. **Perring AE** et al., Water Uptake by Black-Carbon Containing Aerosol in Wildfire Plumes, *submitted to JGR Atmospheres*, July 2016.

53. Hernandez MT, **Perring AE**, et al., Chamber catalogues of optical and fluorescent signatures distinguish bioaerosol classes, *Atmos. Meas. Tech.*, **9**, 3283-3292, 2016.

52. Kim **et al.**, Source, seasonality and trends of southeast US aerosol: an integrated analysis of surface, aircraft, and satellite observations with the GEOS-Chem chemical transport model, *Atmos. Chem. Phys.*, **15** (18), 2015.

51. Liu J., **et al.**, Brown carbon aerosol in the North American continental troposphere: sources, abundance, and radiative forcing, *Atmos. Chem. Phys.*, **15** (14), 2015.

50. Forrister, H. **et al.**, Evolution of brown carbon in wildfire plumes, *Geophysical Research Letters*, **42** (11), 4623-4630, 2015.

49. Saide PE, **et al.**, Revealing important nocturnal and day-to-day variations in fire smoke emissions through a multiplatform inversion, *Geophysical Research Letters*, **42** (9), 3609-3618, 2015.

48. Wagner NL, **et al.**, In situ vertical profiles of aerosol extinction, mass and composition over the southeast United States during SENEX and SEAC4RS: observations of a modest aerosol enhancement aloft, *Atmos. Chem. Phys.*, **15** (14), 2015.

47. Schwarz JP, **Perring AE**, et al., Technique and theoretical approach for quantifying the hygroscopicity of black-carbon-containing aerosol using a single particle soot photometer, *J. Aerosol Sci*, **81**, pp110-126, 2015.

46. **Perring AE**, et al., Airborne observations of regional variation in fluorescent aerosol across the United States, *J. Geophys. Res.—Atm.*, **120** (3), 2015.

45. Wang QQ, **et al.**, Global budget and radiative forcing of black carbon aerosol: Constraints from pole-to-pole (HIPPO) observations across the Pacific, *J. Geophys. Res.—Atm.*, **119** (1), 2014.

44. Wang X, **et al.**, Exploiting simultaneous observational constraints on mass and absorption to estimate the global direct radiative forcing of black carbon and brown carbon, *Atmos. Chem. Phys.*, **14** (20), 2014.

43. Fast JD, **et al.**, Modeling regional aerosol and aerosol precursor variability over California and its sensitivity to emissions and long-range transport during the 2010 CalNex and CARES campaigns, *Atmos. Chem. Phys.*, **14** (18), 2014.

42. Schwarz JP, **et al.**, Global-scale seasonally resolved black carbon vertical profiles over the Pacific, *Geophys. Res. Lett.*, **40** (20), 2013.
41. **Perring AE**, et al, Evaluation of a flat plate inlet for airborne sampling of interstitial aerosol, *Aerosol Sci. Tech.*, **47** (10), 1066-1072, 2013.
40. **Perring AE**, Pusede SE and Cohen RC, An observational perspective on the atmospheric impacts of alkyl and multifunctional nitrates on ozone and secondary organic aerosol, *Chem. Rev.*, **113** (8), 5848-5870, 2013.
39. Kipling Z, **et al.**, Constraints on aerosol processes in climate models from vertically-resolved aircraft observations of black carbon, *Atmos. Chem. Phys.*, **13**, 5969-5986, 2013.
38. Bertram T, **Perring AE**, et al., On the Export of Reactive Nitrogen from Asia: NO_x partitioning and Effects on Ozone, *Atmos. Chem. Phys.*, **13**, 4617-4630, 2013.
37. Schwarz JP, **et al.**, Black carbon aerosol size in snow, *Nature Sci. Rep.*, **3**, 1356, 2013.
36. Gao RS, **Perring AE**, et al., A High-Sensitivity Low-Cost Optical Particle Counter Design, *Aerosol Sci. Tech.*, **47** (2), 137-145, 2013.
35. Peischl J, **et al.**, Airborne observations of methane emissions from rice cultivation in the Sacramento Valley of California, *J. Geophys. Res.–Atm.*, **117**, D00V25, 2012.
34. Schwarz JP, **et al.**, Assessing Single Particle Soot Photometer and Integrating Sphere/Integrating Sandwich Spectrophotometer measurement techniques for quantifying black carbon concentration in snow, *Atmos. Meas. Tech.*, **5**, 2581-2592, 2012.
33. Bahreini R, **et al.**, Gasoline emissions dominate over diesel in formation of secondary organic aerosol mass, *Geophys. Res. Lett.*, **39**, L06805, 2012.
32. Langridge JM, **et al.**, Evolution of aerosol properties impacting visibility and direct climate forcing in an ammonia-rich urban environment, *J. Geophys. Res.–Atm.*, **117**, (D00V11), 2012.
31. Neuman JA, **et al.**, Ozone and alkyl nitrate formation from the Deepwater Horizon oil spill atmospheric emissions, *J. Geophys. Res.–Atm.*, **117**, (D09305), 2012.
30. Moore RH, **et al.**, CCN Spectra, Hygroscopicity, and Droplet Activation Kinetics of Secondary Organic Aerosol Resulting from the 2010 Gulf Oil Spill, submitted to *Env. Sci. Tech.*, **46** (6), 3093-3100, 2012.
29. Pollack IB, **et al.**, Airborne and ground-based observations of a weekend effect in ozone, precursors, and oxidation products in the California South Coast Air Basin, *J. Geophys. Res. – Atm.*, **117**, (D00V05), 2012.
28. Middlebrook AM, **et al.**, Air Quality Implications of the Deepwater Horizon Oil Spill, *Proc. Nat. Acad. Sci.*, doi:10.1073/pnas.1110052108, 2011.
27. Fried A, **et al.**, Detailed comparisons of airborne formaldehyde measurements with box models during the 2006 INTEX-B and MILAGRO campaigns: potential evidence for significant impacts of unmeasured and multi-generation volatile organic carbon compounds, *Atmos. Chem. Phys.*, **11**, 11867-11894, 2011.
26. Lack DA, **et al.**, Impact of Fuel Quality Regulation and Speed Reductions on Shipping Emissions: Implications for Climate and Air Quality, *Env. Sci. Tech.*, **45**, (20), 9052-9060, 2011.
25. **Perring AE**, et al., Characteristics of black carbon aerosol from a surface oil burn during the Deepwater Horizon oil spill, *Geophys. Res. Lett.*, **38**, (L17809), 2011.
24. Ryerson TB, **et al.**, Atmospheric emissions from the Deepwater Horizon spill constrain air-water partitioning, hydrocarbon fate, and leak rate, *Geophys. Res. Lett.*, **38**, (L07803), 2011.

23. de Gouw JA, **et al.**, Organic Aerosol Formation Downwind from the Deepwater Horizon Oil Spill, *Science*, **331** (6022), 1295-1299, 2011.
22. Russell AR, **Perring AE**, et al., A high spatial resolution retrieval of NO₂ column densities from OMI: method and evaluation, *Atmos. Chem. Phys.*, **11** (16), 8543-8554, 2011.
21. Browne EC, **Perring AE**, et al., Global and regional effects of the photochemistry of CH₃O₂NO₂: evidence from ARCTAS, *Atmos. Chem. Phys.*, **11** (9), 4209-4219, 2011.
20. Farmer DK, **Perring AE**, et al., Impact of organic nitrates on urban ozone production, *Atmos. Chem. Phys.*, **11** (9), 4085-4094, 2011.
19. Alvarado MJ, **et al.**, Nitrogen oxides and PAN in plumes from boreal fires during ARCTAS-B and their impact on ozone: an integrated analysis of aircraft and satellite observations, *Atmos. Chem. and Phys.*, **10** (20), 9739-9760, 2010.
18. **Perring AE**, et al., The production and persistence of RONO₂ in the Mexico City plume, *Atmos. Chem. Phys.*, **10** (15), 7215-7229, 2010.
17. Wooldridge PJ, **Perring AE**, et al., Total Peroxy Nitrates (Sigma PNs) in the atmosphere: the Thermal Dissociation-Laser Induced Fluorescence (TD-LIF) technique and comparisons to speciated PAN measurements, *Atmos. Meas. Tech.*, **3** (3), 593-607, 2010.
16. Buscelsa EJ, **et al.**, Lightning-generated NO_x seen by the Ozone Monitoring Instrument during NASA's Tropical Composition, Cloud and Climate Coupling Experiment (TC⁴), *J. Geophys. Res.-Atm.*, **115** (D00J10), 2010.
15. Schwarz JP, **et al.**, The Detection Efficiency of the Single Particle Soot Photometer, *Aerosol Sci. Tech.*, **44** (8), 612-628, 2010.
14. Hains JC, **et al.**, Testing and improving OMI DOMINO tropospheric NO₂ using observations from the DANDELIONS and INTEX-B validation campaigns, *J. Geophys. Res.-Atm.*, **115** (D05301), 2010.
13. MacNaughton CS, **et al.**, Observations of heterogeneous reactions between Asian pollution and mineral dust over the Eastern North Pacific during INTEX-B, *Atmos. Chem. Phys.*, **9** (21), 8283-8308, 2009.
12. **Perring AE**, et al., A product study of the Isoprene+NO₃ reaction, *Atmos. Chem. Phys.*, **9** (14), 4945-4956, 2009.
11. **Perring AE**, et al., Airborne observations of total RONO₂: New constraints on the yield and lifetime of isoprene nitrates, *Atmos. Chem. Phys.*, **9** (4), 1451-1463, 2009.
10. Cooper OR, **et al.**, Summertime buildup and decay of lightning NO_x and aged thunderstorm outflow above North America, *J. Geophys. Res.-Atm.*, **114** (D1), 2009.
9. Boersma KF, **et al.**, Validation of OMI tropospheric NO₂ during INTEX-B and application to constrain NO_x emissions over the eastern United States and Mexico, *Atmos. Env.*, **42** (19): 4480-4497, 2008.
8. Buscelsa EJ, **Perring AE**, et al., Comparison of Tropospheric NO₂ from in situ aircraft observations with near-real-time standard product data from OMI, *J. Geophys. Res.-Atm.*, **113** (D16), 2008.
7. Horowitz LW, **et al.**, Observational constraints on the chemistry of isoprene nitrates over the eastern United States, *J. Geophys. Res.-Atm.*, **112** (D12), 2007.
6. Singh HB, **et al.**, Reactive nitrogen distribution and partitioning in the North American troposphere and lowermost stratosphere, *J. Geophys. Res.-Atm.*, **112** (D12), 2007.
5. Kim S, **et al.**, Measurement of HO₂NO₂ in the free troposphere during the intercontinental chemical transport experiment - North America 2004, *J. Geophys. Res.-Atm.*, **112** (D12), 2007.

4. Bertram TH, **Perring AE**, et al., Direct measurements of the convective recycling of the upper troposphere, *Science*, **315** (5813), 816-820, 2007.
3. Hudman RC, **et al.**, Surface and lightning sources of nitrogen oxides over the United States: Magnitudes, chemical evolution, and outflow, *J. Geophys. Res.-Atm.*, **112** (D12), 2007.
2. Cooper OR, **et al.**, Large upper tropospheric ozone enhancements above midlatitude North America during summer: In situ evidence from the IONS and MOZAIC ozone measurement network, *J. Geophys. Res.-Atm.*, **111** (D24), 2006.
1. **Perring AE**, et al., Solute Dynamics in Storm Flow of the Ipswich River Basin: effects of land use, *Biol. Bull.*, **199**, 219-221, 2000.

SELECTED LECTURES

- 2014: CU Boulder, Environmental Engineering Department, **Seminar speaker**: “Fluorescent particle populations in the atmosphere”, Boulder CO.
- 2014: NOAA Chemical Sciences Division, **Seminar speaker**: “Bioaerosol research at CSD: One year of laboratory evaluations and field measurements”, Boulder, CO.
- 2013: Physical Research Laboratory, **Seminar speaker**: “From urban centers to the remote atmosphere: airborne observations of black carbon aerosol”, Ahmedabad India.

SELECTED CONFERENCE ACTIVITIES

- 2015 Sloan Conference on the Microbiology of the Built Environment, **Invited Oral Presentation**: Real-Time Optical Particle Recognition of Bioaerosol for Environmental Studies, Boulder, CO.
- 2014 American Association for Aerosol Research, **Oral Presentation**: Airborne Measurements of Bioaerosol Across the Southern U.S., Orlando, FL.
- 2012 American Geophysical Union Fall Meeting, **Oral Presentation**: An analysis of black carbon in the northern Pacific, San Francisco, CA.
- 2011 American Geophysical Union Fall Meeting, **Oral Presentation**: Characteristics of Black Carbon Aerosol from a Surface Oil Burn During the Deepwater Horizon Oil Spill, San Francisco, CA.
- 2011 Deepwater Horizon Oil Spill Principal Investigator Conference One Year Update Workshop, Sponsored by the National Science and Technology Council’s (NSTC) Joint Subcommittee on Ocean Science and Technology (JSOST): **Invited Speaker** - Characteristics of Black Carbon Aerosol from a Surface Oil Burn During the Deepwater Horizon Oil Spill, St. Petersburg, FL.
- 2010 American Geophysical Union Fall Meeting, **Oral Presentation**: Aircraft observations of black carbon during CalNex 2010, San Francisco, CA, December 2010.
- 2009 Atmospheric Chemistry Colloquium for Emerging Senior Scientists X (ACCESS-X) Research Colloquium, **Oral Presentation**: On the importance of ANs to global O₃ production and NO_y distributions, Brookhaven National Lab, August 2009.
- 2008 American Geophysical Union Fall Meeting, **Oral Presentation**: On the use of Boundary Layer NO₂ Observations from and Airborne Platform for Satellite Validation, San Francisco, CA, December 2008.
- 2008 Atmospheric Chemical Mechanisms Conference, **Oral Presentation**: Reactive Nitrogen Partitioning and Ozone Production in the Mexico City Urban Plume, University of California-Davis.
- 2008 IGAC International Conference, **Oral Presentation**: Reactive Nitrogen Partitioning and Ozone Production in the Mexico City Urban Plume, Annecy, France.