

## Fred Lee Moore

Education:	Ph.D., Physics, University of Washington	1989
	M.S., Physics, University of Washington	1983
	B.S., Physics, University of Oregon	1979
Employment:	CIRES Supervisor / Research Scientist III, Physicist, Global Monitoring Division (formerly, CMDL), NOAA, Boulder, CO	1996-present
	Research Fellow and Lecturer, University of Texas at Austin	1992-95
	National Research Council Post-doctoral Fellowship at NIST	1989-92

### *Scientific Honors, Awards, Activities:*

CIRES Superior Service Award, NOAA Bronze Medal GLOBAL Hawk for Climate Goal	2013
CIRES Outstanding Science Award	2009
CIRES Superior Service Award for NOAA Bronze Medal Team for NOAA UAS Demo	2007
CIRES Members' Council Award of Excellence (with Hurst, Ray, and Romashkin)	2000
NASA Group Achievement Award for TC4 campaign	2009
NASA Group Achievement Award for SOLVE campaign	2000
NASA Group Achievement Award for POLARIS campaign	1998
Co-Pi or investigator of NSF START08 and HIPPO campaign (PANTHER, UCATS)	2007
Co-investigator of NASA Instrument Incubator Program "Airborne Measurements of New and Important Trace Gases in Support of Chemical Studies"	1999-2002
Co-investigator and or participation in NASA Upper Atmospheric Research Programs: ATTREX, GloPac, NOAA UAS Demo, NASA UAS Fire Mission (UCATS)	2005-2013
CRYSTAL-FACE, AVE-Houston, pre-AVE, CRAVE, SOLVE-II, TC4 (PANTHER)	2002-2007
STRAT, POLARIS, OMS, ACCENT, SOLVE, BOS (LACE + ACATS-IV)	1996-2004
Designing, constructing, and operating Airborne Instrumentation: UCATS ()	1999-present
PANTHER (PAN and Trace Hydrohalocompounds ExpeRiment), GC-MS + GC-ECD	
LACE (Lightweight Airborne Chromatograph)	

### *Selected Relevant Publications:*

- Moore, F.L., E. A. Ray, K. H. Rosenlof, J. W. Elkins, P. Tans, A. Karion, and C. Sweeney, 2013: **A cost effective trace gas measurement program for long term monitoring of the stratospheric circulation**, *Bull. Amer. Meteor. Soc., In press*.
- Hossaini, R, MP Chipperfield, W Feng, TJ Breider, E Atlas, SA Montzka, BR Miller, F Moore and J Elkins (2012), **The contribution of natural and anthropogenic very short-lived species to stratospheric bromine**. *Atmos. Chem. Phys.*, 12 (1) 371-380, issn: 1680-7316, ids: 892XZ.
- Kort, EA, SC Wofsy, BC Daube, M Diao, JW Elkins, RS Gao, EJ Hints, DF Hurst, R Jimenez, FL Moore, JR Spackman and MA Zondlo (2012), **Atmospheric observations of Arctic Ocean methane emissions up to 82 degrees north**. *Nat. Geosci.*, 5 (5) 318-321, issn: 1752-0894, ids: 934RP.
- Hall, BD, GS Dutton, DJ Mondeel, JD Nance, M Rigby, JH Butler, FL Moore, DF Hurst and JW Elkins (2011), **Improving measurements of SF6 for the study of atmospheric transport and emissions**. *Atmos. Meas. Tech.*, 4 (11) 2441-2451, issn: 1867-1381, ids: 863AS.
- Kort, EA, PK Patra, K Ishijima, BC Daube, R Jimenez, J Elkins, D Hurst, FL Moore, C Sweeney and SC Wofsy (2011), **Tropospheric distribution and variability of N2O: Evidence for strong tropical emissions**. *Geophys. Res. Lett.*, 38 , Art. No. L15806, issn: 0094-8276, ids: 804JZ.
- Wofsy, S., B.C. Daube, R. Jimenez, E. Kort, J.V. Pittman, S. Park, R. Commane, Bin Xiang, G. Santoni, D. Jacob, J. Fisher, C. Pickett-Heaps, H. Wang, K. Wecht, Q.-Q. Wang, B.B. Stephens, S. Shertz, P. Romashkin, T. Campos, J. Haggerty, W.A. Cooper, D. Rogers, S. Beaton, R. Hendershot, J.W. Elkins, D.W. Fahey, R.S. Gao, F. Moore, S.A. Montzka, J.P. Schwarz, D. Hurst, B. Miller, C. Sweeney, S. Oltmans, D. Nance, E. Hints, G. Dutton, L.A. Watts, J.R. Spackman, K.H. Rosenlof, E.A. Ray, M.A. Zondlo, Minghui Diao, R. Keeling, J. Bent, E.L. Atlas, R. Lueb, M.J. Mahoney, M. Chahine, E. Olson, P. Patra, K. Ishijima, R. Engelen, J. Flemming, R. Nassar, D.B.A. Jones, S.E. Mikaloff Fletcher (2011),

- HIAPER Pole-to-Pole Observations (HIPPO): Fine-grained, global scale measurements of climatically important atmospheric gases and aerosols.** *Phil. Trans. R. Soc. A*, 369 (1943) 2073-2086.
- Ray, EA, FL Moore, KH Rosenlof, SM Davis, H Boenisch, O Morgenstern, D Smale, E Rozanov, M Hegglin, G Pitari, E Mancini, P Braesicke, N Butchart, S Hardiman, F Li, K Shibata and DA Plummer (2010), **Evidence for changes in stratospheric transport and mixing over the past three decades based on multiple data sets and tropical leaky pipe analysis.** *J. Geophys. Res.-Atmos.*, 115, Art. No. D21304, issn: 0148-0227, ids: 676VD.
- Engel, A, T Mobius, H Bonisch, U Schmidt, R Heinz, I Levin, E Atlas, S Aoki, T Nakazawa, S Sugawara, F Moore, D Hurst, J Elkins, S Schauffler, A Andrews and K Boering (2009), **Age of stratospheric air unchanged within uncertainties over the past 30 years.** *Nat. Geosci.*, 2 (1) 28-31, issn: 1752-0894, ids: 397CB.
- Wilson, JC, SH Lee, JM Reeves, CA Brock, HH Jonsson, BG Lafleur, M Loewenstein, J Podolske, E Atlas, K Boering, G Toon, D Fahey, TP Bui, G Diskin and F Moore (2008), **Steady-state aerosol distributions in the extra-tropical, lower stratosphere and the processes that maintain them.** *Atmos. Chem. Phys.*, 8 (22) 6617-6626, issn: 1680-7316, ids: 389FP.
- Ridley, B., E. Atlas, H. Selkirk, L. Pfister, D. Montzka, S. Donnelly, V. Stroud, E. Richard, K. Kelly, A. Tuck, T. Thompson, C. Brock, C. Wilson, D. Baumgardner, T. Rawlins, M. Mahoney, R. Herman, R. Friedl, J. Elkins, F. Moore, E. Ray, M. Ross, and D. Anderson, **Convective transport of reactive constituents to the tropical and mid-latitude tropopause region: I. Observations,** *Atmos. Environ.*, 38, 1259-1274, 2004.
- Robinson, A. G. Millard, F. Danis, M. Guirlet, N. Harris, A. Lee, J. McIntyre, J. Pyle, J. Arvelius, S. Dagnesjo, S. Kirkwood, H. Nilsson, D. Toohey, T. Deshler, F. Goutail, J.-P. Pommereau, J. Elkins, F. Moore, E. Ray, U. Schmidt, A. Engel, M. Mueller (2004), **Ozone loss derived from balloon-borne tracer measurements and the SLIMCAT CTM.** *Atmos. Chem. and Phys. Disc.*, 4 7089-7120
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Ray, E. A., F. L. Moore, J. W. Elkins, G. S. Dutton, D. W. Fahey, H. Vomel, S. J. Oltmans and K. H. Rosenlof, Transport into the northern hemisphere lowermost stratosphere revealed by in situ tracer measurements, *J. Geophys. Res.*, 104, 26,565-26,580, 1999.

Hurst, DF, GS Dutton, PA Romashkin, PR Wamsley, FL Moore, JW Elkins, EJ Hintsa, EM Weinstock, RL Herman, EJ Moyer, DC Scott, RD May and CR Webster (1999), **Closure of the total hydrogen budget of the northern extratropical lower stratosphere**. *J. Geophys. Res.-Atmos.*, 104 (D7) 8191-8200, issn: 0747-7309, ids: 187NV.