

# Andreas Muschinski

Curriculum Vitae, August 31, 2016

Dr. Andreas Muschinski  
NorthWest Research Associates, Inc. (NWRA)  
3380 Mitchell Lane  
Boulder, CO 80301  
Email andreas@cora.nwra.com  
URL nwra.com  
Tel. (303) 415-9701x228

Andreas Muschinski  
158 Sandy Drive  
Boulder, CO 80302  
Tel. (303) 443-1692

## Overview

Dr. Muschinski received his master's degree in physics (Diplom-Physiker or Dipl.-Phys.) from the Technische Universität Braunschweig, Germany, in 1990 and his Dr. rer. nat. (Doctor rerum naturalium) and habilitation degrees, both in meteorology, from the Universität Hannover, Germany in 1992 and 1998, respectively. From Dec. 1996 through Nov. 1997, he was a visiting scientist at the Atmospheric Technology Division of the National Center for Atmospheric Research (NCAR) in Boulder, CO. From 1998 through 2004, he was a research scientist at the Cooperative Institute for Research in Environmental Sciences (CIRES), which is operated jointly by the National Oceanic and Atmospheric Administration (NOAA) and the University of Colorado (CU) at Boulder. During that time, he was affiliated with the NOAA Environmental Technology Laboratory (the former NOAA Wave Propagation Laboratory and the current NOAA/ESRL Physical Sciences Division). In 2004, he joined the Dept. of Electrical and Computer Engineering of the University of Massachusetts (UMass) Amherst as an associate professor. In 2008, he was promoted to full professor, and he held the Jerome M. Paros Professorship in Measurement Sciences from 2007 through 2010. In 2011, he joined the Boulder Office of NorthWest Research Associates, a principal-investigator owned, small research company that has its headquarters in Redmond, WA. He holds adjunct professorships at the UMass Dept. of Mechanical and Industrial Engineering and at the CU Dept. of Electrical, Computer and Energy Engineering.

Dr. Muschinski has 24 years of post-doctoral, basic and applied research experience in turbulence physics, boundary-layer meteorology, micrometeorology, atmospheric measurement science (both *in situ* and remote), and the theory of optical, acoustic (including infrasound), and radio-wave propagation through the turbulent atmosphere. In many of his papers, he has integrated observational, theoretical and computational methodologies, often with the goal of identifying and overcoming misconceptions that prevent progress in our ability to understand, observe, simulate and predict the atmosphere and its effects on imaging and remote sensing.

Dr. Muschinski has made several innovative contributions to atmospheric measurement science, such as a similarity theory of LES-generated turbulence (1996), the first observations of upper-level Kelvin-Helmholtz billows with a VHF radar operating in a frequency-domain interferometer mode (1997); the first in-situ observations of co-existing submeter temperature and humidity sheets in the free troposphere (1998); the first synthesis of clear-air radar windprofiler signals by means of a large-eddy simulation (1999); the first observations of large-scale vertical motion with a VHF radar

equipped with frequency-domain interferometry (2001); the first implementations of clear-air radar range imaging (RIM) at a VHF radar (2001) and at a UHF radar (2003); the first observations of ocean-generated, atmospheric infrasound (“microbaroms”) with single, absolute barometers (2011); and the first direct numerical simulation of the Navier-Stokes equations to investigate the “Hill bump” in scalar turbulence spectra based on first principles of fluid mechanics (2015).

During his years at NOAA/ETL and CU/CIRES, he worked with Ben Balsley and Rod Frehlich on the development of the University of Colorado’s Tethered Lifting System (TLS) and on the analysis of TLS fine-wire turbulence measurements, and he was the leader of the NOAA-ETL/CIRES Profiler Development Group. After joining UMass, he initiated the 2006 Meteor Crater Experiment (METCRAX) and was its lead Principal Investigator. The purpose of METCRAX was to use the Arizona Meteor Crater as a natural laboratory to study mesoscale and microscale phenomena of the stably stratified boundary layer in a small, closed basin. Since 2004, Dr. Muschinski’s research focus has been on atmospheric turbulence and its effects on electromagnetic propagation, imaging, and remote sensing.

During his years at the University of Hannover, Germany, Dr. Muschinski taught courses in basic meteorology, in atmospheric instrumentation, and in atmospheric turbulence. At UMass Amherst, he taught five regular courses at the undergraduate and graduate levels: Signals and Systems (ECE 313); Probability and Statistics (ECE 314); Digital Signal Processing (ECE 565); Electromagnetic Field Theory (ECE 606); and Signal Theory (ECE 608). Also at UMass, he developed and taught three Special Topic courses: Energy, Weather and Climate; Electromagnetic Scintillation and Turbulence; and Atmospheric Sensing, Modeling and Prediction.

In October 2011, Dr. Muschinski joined the Boulder, CO office (formerly known as Colorado Research Associates, or CoRA) of NorthWest Research Associates, Inc. as a Senior Research Scientist. Since then, he has mentored and financially supported several graduate students. Dr. Muschinski’s research remains centered around atmospheric turbulence and its effects on electromagnetic propagation, imaging, and remote sensing.

Since 2000, Dr. Muschinski has received Federal research awards in the total amount of approximately \$5,000,000.

## Personal

- 1964 Born in Salzgitter, Germany
- 1991–present Married to Andrea Plünnecke. Four children: Thomas (1991), Jana (1994), Lisa (2000), and Peter (2002)

## Education

- 1990 M.S. in physics (Diplom-Physiker)  
Technische Universität Braunschweig, Germany
- 1992 Ph.D. (summa cum laude) in meteorology  
Universität Hannover, Germany
- 1998 Habilitation and privatdozent in meteorology  
Universität Hannover, Germany

## Employment and Visiting Scientist Appointments

- 2011–present Senior Research Scientist  
NorthWest Research Associates, Inc., Boulder, CO
- 2008–2011 Professor  
Dept. of Electrical and Computer Engineering, University of Massachusetts, Amherst, MA
- 2008–present Adjunct Professor  
Dept. of Mechanical and Industrial Engineering, University of Massachusetts, Amherst, MA
- 2007–2010 Jerome M. Paros Endowed Professor in Measurement Sciences  
Dept. of Electrical and Computer Engineering, University of Massachusetts, Amherst, MA
- 2001–present Adjunct Professor  
Dept. of Electrical and Computer Engineering, University of Colorado, Boulder, CO
- 2004–2008 Associate Professor  
Dept. of Electrical and Computer Engineering, University of Massachusetts, Amherst, MA
- 2006 (Jun-Aug) Visiting Scientist  
Institute for Atmospheric Physics, German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt)
- 2005 (Jun) Visiting Scientist  
Mesoscale and Microscale Meteorology Division, National Center of Atmospheric Research, Boulder, CO
- 1999–2004 CIRES Research Scientist III  
University of Colorado and NOAA Environmental Technology Laboratory, Boulder, CO

2002 (May-Aug)	Visiting Scientist Institute for Atmospheric Physics, German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt)
1998–1999	CIRES Research Scientist II University of Colorado and NOAA Environmental Technology Laboratory, Boulder, CO
1996 (Dec) –1997 (Nov)	Visiting Scientist Atmospheric Technology Division, National Center of Atmospheric Research, Boulder, CO
1992-1998	Wissenschaftlicher Assistent (C1) Institut für Meteorologie und Klimatologie, Universität Hannover, Germany
1990-1992	Wissenschaftlicher Mitarbeiter (BAT IIa) Institut für Meteorologie und Klimatologie, Universität Hannover, Germany
1990 (Jan–Mar)	Project Scientist Institut für Geophysik und Meteorologie, Technische Universität Braunschweig, Germany

## Honors and Awards

2007	Named the University of Massachusetts’ Jerome M. Paros Endowed Professor in Measurement Sciences (capital endowment \$2,000,000), University of Massachusetts Amherst, Amherst, MA
2005	Awarded United States Permanent Residency as an Alien Worker with Extraordinary Ability (I-140 A), self-petition
2001	Outstanding Seminar Award NOAA Environmental Technology Laboratory, Boulder, CO (for seminar “Adaptive Steering of Weather and Climate by Extraterrestrial Mirrors”)
1999	Outstanding Performance Award NOAA Environmental Technology Laboratory, Boulder, CO (“in recognition for undertaking the analysis of field data and model output to advance the understanding of the influence of the turbulent atmosphere on remote sensors”)
1996	Habilitation Stipend German Science Foundation (Habilitationstipendium, Deutsche Forschungsgemeinschaft)
1993	Young Scientist Award German Meteorological Society (Förderpreis der Deutschen Meteorologischen Gesellschaft), for Ph.D. dissertation (“Statistical Description of Turbulent Flows by Means of a Local Interpretation of Heisenberg’s Turbulence Theory”)

## Journal Publications

1. Muschinski, A., and R. Roth, 1993: A local interpretation of Heisenberg's transfer theory. *Contr. Atmos. Phys.*, **66**, 335-346.
2. Muschinski, A., 1994a: Reply. *Contr. Atmos. Phys.*, **67**, 164-166.
3. Muschinski, A., 1994b: Eine atomistische Deutung der Brunt Väisälä-Periode (An atomistic interpretation of the Brunt-Vaisala period). *Meteorol. Z.*, **3**, 94-95.
4. Muschinski, A., 1994c: Transport and diffusion in turbulent fields (book review). *Meteorol. Z.*, **3**, 252-253.
5. Muschinski, A., 1996a: Possible effect of Kelvin Helmholtz instability on VHF radar observations of the mean vertical wind. *J. Appl. Meteor.*, **35**, 2210-2217.
6. Muschinski, A., 1996b: A similarity theory of locally homogeneous and isotropic turbulence generated by a Smagorinsky type LES. *J. Fluid Mech.*, **325**, 239-260.
7. Muschinski, A., 1997: Turbulence and gravity waves in the vicinity of a midtropospheric warm front: A case study using VHF echo intensity measurements and radiosonde data. *Radio Sci.*, **32**, 1161-1178.
8. Chilson, P. B., A. Muschinski, and G. Schmidt, 1997: First observations of Kelvin Helmholtz billows in an upper level jet stream using VHF frequency domain interferometry. *Radio Sci.*, **32**, 1149-1160.
9. Muschinski, A., and C. Wode, 1998: First in situ evidence for co-existing sub-meter temperature and humidity sheets in the lower free troposphere. *J. Atmos. Sci.*, **55**, 2893-2906.
10. Muschinski, A., 1998: The mixing-angle hypothesis. *Contr. Atmos. Phys.*, **71**, 273-280.
11. Muschinski, A., P. B. Chilson, S. Kern, J. Nielinger, G. Schmidt, and T. Prenosil, 1999a: First frequency domain interferometry observations of large scale vertical motion in the atmosphere. *J. Atmos. Sci.*, **56**, 1248-1258.
12. Muschinski, A., P. P. Sullivan, D. B. Wuertz, R. J. Hill, S. A. Cohn, D. H. Lenschow, and R. J. Doviak, 1999b: First synthesis of wind-profiler signals on the basis of large-eddy simulation data. *Radio Sci.*, **34**, 1437-1453.
13. Chau, J. L., R. J. Doviak, A. Muschinski, and C. L. Holloway, 2000: Lower atmospheric measurements of turbulence and characteristics of Bragg scatterers, using the Jicamarca VHF radar. *Radio Sci.*, **35**, 179-193.
14. Chilson, P. B., R. D. Palmer, A. Muschinski, D. A. Hooper, G. Schmidt, and H. Steinhagen, 2001: SOMARE-99: A demonstrational field campaign for ultra-high resolution VHF atmospheric profiling using frequency diversity. *Radio Sci.*, **36**, 695-708.
15. Muschinski, A., P. B. Chilson, R. D. Palmer, D. A. Hooper, G. Schmidt, and H. Steinhagen, 2001a: Boundary-layer convection and diurnal variation of vertical-velocity characteristics in the free atmosphere. *Q. J. R. Meteorol. Soc.*, **127**, 423-443.
16. Muschinski, A., R. Frehlich, M. Jensen, R. Hugo, F. Eaton, and B. Balsley, 2001b: Fine-scale measurements of turbulence in the lower troposphere: an intercomparison between a kite-

- and balloon-borne, and a helicopter-borne measurement system. *Boundary-Layer Meteorol.*, **98**, 219-250.
17. Muschinski, A., and D. H. Lenschow, 2001: Future directions for research on meter- and submeter-scale, atmospheric turbulence. *Bull. Amer. Meteor. Soc.*, **82**, 2831-2843.
  18. Ostashev, V. E., S. F. Clifford, R. J. Latatits, A. Muschinski, and A. L. Fabrikant, 2001: Amplitude-modulated radio-acoustic sounding. *acta acustica - Acustica*, **87**, 717-720.
  19. Palmer, R. D., P. B. Chilson, A. Muschinski, G. Schmidt, T.-Y. Yu, and H. Steinhagen, 2001: SOMARE-99: Observations of tropospheric scattering layers using range imaging. *Radio Sci.*, **36**, 681-694.
  20. Siebert, H., and A. Muschinski, 2001: Relevance of a tuning-fork effect for temperature measurements with the Gill Solent HS ultrasonic anemometer/thermometer. *J. Atmos. Oceanic Technol.*, **18**, 1367-1376.
  21. Tatarskii, V. I., and A. Muschinski, 2001: The difference between Doppler velocity and real wind velocity in single scattering from refractive-index fluctuations. *Radio Sci.*, **36**, 1405-1424.
  22. Worthington, R. M., A. Muschinski, and B. B. Balsley, 2001: Bias in mean vertical wind measured by VHF radars: significance of radar location relative to mountains. *J. Atmos. Sci.*, **58**, 707-723.
  23. Balsley, B. B., M. L. Jensen, R. G. Frehlich, Y. Meillier, and A. Muschinski, 2003: Extreme gradients in the nocturnal boundary layer: structure, evolution, and potential causes. *J. Atmos. Sci.*, **60**, 2496-2508.
  24. Ince, T., S. J. Frasier, A. Muschinski, and A. L. Pazmany, 2003: An S band frequency-modulated continuous-wave boundary layer profiler: Description and initial results. *Radio Sci.*, **38**, 1075, doi: 10.1029/2001RS002586.
  25. Chilson, P. B., T.-Y. Yu, R. G. Strauch, A. Muschinski, and R. D. Palmer, 2003: Implementation and validation of range imaging on a UHF radar wind profiler. *J. Atmos. Oceanic Technol.*, **20**, 987-996.
  26. Muschinski, A., 2004: Local and global statistics of clear-air Doppler radar signals. *Radio Sci.*, **39**, doi:10.1029/2003RS002908.
  27. Muschinski, A., R. G. Frehlich, and B. B. Balsley, 2004: Small-scale and large-scale intermittency in the nocturnal boundary layer and residual layer. *J. Fluid Mech.*, **515**, 319-351.
  28. Muschinski, A., V. Lehmann, L. Justen, and G. Teschke, 2005: Advanced radar wind profiling. *Meteorol. Z.*, **14**, 609-626.
  29. Cheon, Y., V. Hohreiter, M. Behn, and A. Muschinski, 2007: Angle-of-arrival anemometry by means of a large-aperture Schmidt-Cassegrain telescope equipped with a CCD camera. *J. Opt. Soc. Am. A*, **24**, 3478-3492.
  30. Cheon, Y., and A. Muschinski, 2007: Closed-form approximations for the angle-of-arrival variance of plane and spherical waves propagating through homogeneous and isotropic turbulence. *J. Opt. Soc. Am. A*, **24**, 415-422.

31. Behn, M., V. Hohreiter, and A. Muschinski, 2008: A scalable data-logging system with serial interfaces and integrated GPS time-stamping. *J. Atmos. Oceanic Technol.*, **25**, 1568-1578.
32. Whiteman, C. D., A. Muschinski, S. Zhong, D. Fritts, S. W. Hoch, M. Hahnenberger, W. Yao, V. Hohreiter, M. Behn, Y. Cheon, C. B. Clements, T. W. Horst, W. O. J. Brown, and S. P. Oncley, 2008: METCRAX 2006 — Meteorological experiments in Arizona’s Meteor Crater. *Bull. Amer. Meteor. Soc.*, **89**, 1665-1680.
33. Subramanian, G. K., and A. Muschinski, 2011: First observations of microbaroms with single, absolute barometers. *J. Atmos. Oceanic Technol.*, **28**, 933-943.
34. Tichkule, S., and A. Muschinski, 2012: Optical anemometry based on the temporal cross-correlation of angle-of-arrival fluctuations obtained from spatially separated light sources. *Appl. Opt.*, **51**, 5272-5282.
35. Tichkule, S., and A. Muschinski, 2014: Effects of wind-driven telescope vibrations on measurements of turbulent angle-of-arrival fluctuations. *Appl. Opt.*, **53**, 4651-4660.
36. Muschinski, A., 2015: Temperature variance dissipation equation and its relevance for optical turbulence modeling. *J. Opt. Soc. Am. A*, **32**, 2195-2200.
37. Muschinski, A., and S. M. de Bruyn Kops, 2015: Investigation of Hill’s optical turbulence model by means of direct numerical simulation. *J. Opt. Soc. Am. A*, **32**, 2423-2430.
38. Muschinski, A., 2016: Optical propagation through non-overturning, undulating temperature sheets in the atmosphere. *J. Opt. Soc. Am. A*, **33**, 793-800.
39. Newman, J. F., P. M. Klein, S. Wharton, A. Sathe, T. A. Bonin, P. B. Chilson, and A. Muschinski, 2016: Evaluation of three lidar scanning strategies for turbulence measurements. *Atmos. Meas. Tech.*, **9**, 1993-2013.

## Theses and Technical Reports

1. Muschinski, A., 1990: Lage Bestimmung von Höhenforschungsraketen mit Sternsensor und Magnetometer Daten (Attitude reconstruction of research rockets using star sensor and magnetometer data). Master’s Thesis. *Geophysikalische Arbeiten sowie Mitteilungen aus Meteorologie und Astrophysik (GAMMA)*, **51**, Institut für Geophysik und Meteorologie der Technischen Universität Braunschweig, Germany, 101 pp.
2. Muschinski, A., 1992: Statistische Beschreibung turbulenter Strömungen mittels einer lokalen Interpretation der Heisenbergschen Turbulenztheorie (Statistical representation of turbulent flows using a local interpretation of Heisenberg’s turbulence theory). PhD dissertation. *Berichte des Instituts für Meteorologie und Klimatologie der Universität Hannover*, **41**, 101 pp.
3. Muschinski, A., 1998: The first moments of the variance and cross spectra of conventional and interferometric clear air Doppler radar signals. (Habilitation Thesis, English version). *NCAR Technical Note*, **TN-441+STR**, National Center for Atmospheric Research, Boulder, Colorado,  $x+102$  pp.
4. Muschinski, A., 2001: Adaptive steering of weather and climate by using extraterrestrial mirrors. *NOAA Technical Report OAR 458-ETL 68*, 10 pp.

## Conference Papers

1. Muschinski, A., and H. Lühr, 1989: High precision rocket attitude reconstruction using star sensor and magnetometer data. *Proc. Ninth ESA/PAC Symp. on European Rocket and Balloon Programmes and Related Research (Lahnstein, 3-7 April 1989)*, 111-116.
2. Voigt, H., A. Muschinski, R. Roth, and R. Rüter, 1991: Measurements of winds and turbulence in the troposphere and the stratosphere with the SOUSY MST radar in the Harz. XVI. EGS General Assembly (Wiesbaden, 22-26 April 1991), *Ann. Geophys.*, Suppl. to Vol. **9**, C607-C608.
3. Muschinski, A., 1992: Eine Gleichung zur Berechnung horizontal homogener und stationärer turbulenter Strömungen auf der Basis einer lokalen Interpretation der Heisenbergschen Turbulenztheorie. *Ann. Meteorol.*, **27**, 165-166.
4. Wode, C., A. Muschinski, and R. Roth, 1992: Projektierung einer flugzeuggestützten Vermessung der Richtcharakteristik des stationären SOUSY MST Radars bei Bad Lauterberg. *Kleinheubacher Berichte*, **35**, 757-765.
5. Muschinski, A., N. Eicke, C. Jacobi, A. H. Siemer, A. Knüüppel, P. Czechowsky, and R. Rüter, 1994: Temperature profiling in the troposphere using the SOUSY VHF Radar: first results of a calibration experiment. *Proc. 3rd Int. Symp. Troposph. Profiling (Hamburg, Germany, August 30 - September 2, 1994)*, 292-295.
6. Muschinski, A., 1995: On the filter shape dependence of LES subfilter turbulence closures from the viewpoint of a generalized Heisenberg type eddy viscosity model. *Preprints 11th Symp. Boundary Layers and Turbulence (Charlotte, North Carolina, March 27-31, 1995)*, 279-282.
7. Muschinski, A., C. Jacobi, A. Siemer, P. Czechowsky, and R. Rüter, 1995: Quasi-specular reflection observed with the SOUSY VHF Radar: comparison with aircraft and radiosonde measurements. *Preprints 9th Symp. Meteorological Observations and Instrumentation (Charlotte, North Carolina, March 27-31, 1995)*, 139-144.
8. Bange, J., S. Raasch, and A. Muschinski, 1995: Areally averaged surface fluxes in the convective boundary layer: a comparison between aircraft measurements and synthetical data obtained with LES. *Preprints 11th Symp. Boundary Layers and Turbulence (Charlotte, North Carolina, March 27-31, 1995)*, 37-38.
9. Muschinski, A., P. Czechowsky, and R. Rüter, 1996: Observations of a stationary front above northern Germany using the SOUSY VHF Radar, the research aircraft D IBUF and radiosondes. *Proc. 7th Workshop on Technical and Scientific Aspects of MST Radar (Hilton Head Island, South Carolina, November 5-11, 1995)*, 117-120.
10. Muschinski, A., P. B. Chilson, G. Schmidt, and R. Hollmann, 1996: FDI measurements with the SOUSY VHF Radar: a comparison between the time series of layer altitudes and Doppler shifts. *Proc. 7th Workshop on Technical and Scientific Aspects of MST Radar (Hilton Head Island, South Carolina, November 5-11, 1995)*, 407-410.
11. Chilson, P. B., A. Muschinski, and G. Schmidt, 1996: Simultaneous observations of a jet stream passage using VHF FDI and a microbarometer. *Proc. 7th Workshop on Technical and Scientific Aspects of MST Radar (Hilton Head Island, South Carolina, November 5-11, 1995)*, 113-116.



12. Muschinski, A., 1997: The concept of LES fluids and a similarity theory of LES generated turbulence. *Preprints 12th Symp. Boundary Layers and Turbulence (Vancouver, Canada, 28 July – 1 August 1997)*, 229-230.
13. Muschinski, A., and C. Wode, 1997: In situ observations of the submeter scale microstructure of wind, temperature, and humidity in the free troposphere. *Preprints 12th Symp. Boundary Layers and Turbulence (Vancouver, Canada, 28 July 1 – August 1997)*, 370-371.
14. Bange, J., A. Muschinski, and R. Roth, 1997: Spectral gaps at length scales of 10 m in a strongly sheared ground based inversion. *Preprints 12th Symp. Boundary Layers and Turbulence (Vancouver, Canada, 28 July – 1 August 1997)*, 138-139.
15. Chilson, P. B., A. Muschinski, and G. Schmidt, 1997: An investigation of Kelvin Helmholtz billows in an upper level jet stream using VHF frequency domain interferometry. *Extended Abstracts of the COST 76 Profiler Workshop 1997 (Engelberg, Switzerland, 12-16 May, 1997)*, 278-281.
16. Muschinski, A., 1997: The concept and design of LES fluids (extended abstract of invited lecture). *Proc. 24th Natl. Conf. Fluid Mech. Fluid Power (Bengal Engeneering College, Howrah, India, 26-28 Dec. 1997)*, Vol. 1, L32-L33.
17. Muschinski, A., D. H. Lenschow, and E. E. Gossard, 1998: Formation of horizontal refractive index discontinuities by differential advection. *Abstracts 8th Workshop on Technical and Scientific Aspects of MST Radar (Bangalore, India, December 15-20, 1997)*.
18. Muschinski, A., P. B. Chilson, J. Nielinger, S. Kern, G. Schmidt, and T. Prenosil, 1998: Frequency domain interferometry: A new observational technique for synoptical meteorology. *Abstracts 8th Workshop on Technical and Scientific Aspects of MST Radar (Bangalore, India, December 15-20, 1997)*.
19. Muschinski, A., P. Sullivan, D. H. Lenschow, S. Cohn, and R. J. Doviak, 1998: Using Large Eddy Simulation to simulate clear air Doppler radar measurements. *Abstracts 8th Workshop on Technical and Scientific Aspects of MST Radar (Bangalore, India, December 15-20, 1997)*.
20. Muschinski, A., 1998: General theory of the moments of standard and interferometric clear air Doppler radar spectra. *Abstracts 8th Workshop on Technical and Scientific Aspects of MST Radar (Bangalore, India, December 15-20, 1997)*.
21. Muschinski, A., P. Sullivan, D. H. Lenschow, S. Cohn, and R. J. Doviak, 1998: Using Large Eddy Simulation (LES) to simulate clear air Doppler radar measurements. *Proc. 4th Int. Symp. Troposph. Profiling (Snowmass, Colorado, 20-25 September 1998)*, Vol. 2, 225-227.
22. Muschinski, A., P. B. Chilson, R. D. Palmer, D. A. Hooper, G. Schmidt, and H. Steinhausen, 2000: SOMARE-99: Boundary-layer convection and diurnal variation of vertical-velocity characteristics in the free troposphere. *9th International Workshop on Technical and Scientific Aspects of MST Radar (mst9 combined with COST-76 Final Profiler Workshop), March 13-18, 2000, Toulouse, France*. [Presented by David Hooper]
23. Chilson, P. B., R. D. Palmer, A. Muschinski, D. A. Hooper, G. Schmidt, and H. Steinhausen, 2000: SOMARE-99: A demonstrational field campaign for ultra-high resolution VHF atmospheric profiling using frequency diversity. *Proc. 9th International Workshop on Technical and Scientific Aspects of MST Radar (mst9 combined with COST-76 Final Profiler Workshop, Toulouse, France, March 13-18, 2000)*, 39-42.

24. Palmer, R. D., P. B. Chilson, A. Muschinski, G. Schmidt, T.-Y. Yu and H. Steinhagen, 2000: Range imaging using frequency diversity: theory and application. *Proc. 9th International Workshop on Technical and Scientific Aspects of MST Radar (mst9 combined with COST-76 Final Profiler Workshop, Toulouse, France, March 13-18, 2000)*, 43-46.
25. Muschinski, A., 2000: Self-consistency of turbulence spectra measured with the helicopter-borne turbulence measurement system HELIPOD during PHELIX. *14th Symp. Boundary Layers and Turbulence, August 2000, Aspen, Colorado*.
26. Muschinski, A., R. M. Worthington, R. G. Frehlich, M. L. Jensen, and B. B. Balsley, 2000: Turbulence spectra and vertical profiles of energy dissipation rate and temperature structure parameter in thin turbulent layers embedded in a stably stratified environment. *14th Symp. Boundary Layers and Turbulence, August 2000, Aspen, Colorado*.
27. Jensen, M. L., B. B. Balsley, R. G. Frehlich, R. M. Worthington, A. Muschinski, and R. Rodriguez, 2000: The TLS (Tethered Lifting System) used to measure in situ turbulence during the CASES-99 campaign. *14th Symp. Boundary Layers and Turbulence, August 2000, Aspen, Colorado*.
28. Frehlich, R. G., M. L. Jensen, A. Muschinski, and B. B. Balsley, 2000: Calibration of fine-wire turbulence sensors for the CIRES TLS (Tethered Lifting System) at CASES-99. *14th Symp. Boundary Layers and Turbulence, August 2000, Aspen, Colorado*.
29. Worthington, R. M., R. Banta, R. K. Newsom, M. L. Jensen, A. Muschinski, R. G. Frehlich, and B. B. Balsley, 2000: Combined lidar and in-situ measurements of waves in the stable night-time boundary layer above Kansas. *14th Symp. Boundary Layers and Turbulence, August 2000, Aspen, Colorado*.
30. Siebert, H., and A. Muschinski, 2000: Performance of a three-dimensional ultrasonic anemometer/thermometer for turbulence measurements. *14th Symp. Boundary Layers and Turbulence, August 2000, Aspen, Colorado*.
31. Balsley, B. B., M. L. Jensen, R. G. Frehlich, and A. Muschinski, 2000: In situ profiling of wind, temperature, water vapor, turbulence, and trace gases in the lower troposphere: the TLS technology. *Proc. 5th Int. Symp. Troposph. Profiling (Adelaide, Australia, 4-8 Dec. 2000)*, 11-13.
32. Jensen, M. L., B. B. Balsley, R. G. Frehlich, R. M. Worthington, and A. Muschinski, 2000: Tethered lifting systems and lightweight instrumentation for multi-level in situ turbulence sensing. *Proc. 5th Int. Symp. Troposph. Profiling (Adelaide, Australia, 4-8 Dec. 2000)*, 81-83.
33. Tatarskii, V. I., and A. Muschinski: The difference between Doppler and real radial velocity in single volume scattering from refractive index fluctuations. *Proc. 5th Int. Symp. Troposph. Profiling (Adelaide, Australia, 4-8 Dec. 2000)*, 287.
34. Muschinski, A. R. J. Lataitis, E. E. Gossard, S. A. McLaughlin, B. B. Stankov, D. B. Wuertz, D. E. Wolfe, and T. L. Wilfong, 2000: The Profiler-HELIPOD Intercomparison Experiment (PHELIX). *Proc. 5th Int. Symp. Troposph. Profiling (Adelaide, Australia, 4-8 Dec. 2000)*, 289-291.
35. Frehlich, R. G., M. L. Jensen, R. M. Worthington, B. B. Balsley, and A. Muschinski, 2000: Turbulent structures associated with interfaces in the nocturnal boundary layer observed with

- the CIRES Tethered Lifting System. *Proc. 5th Int. Symp. Troposph. Profiling (Adelaide, Australia, 4-8 Dec. 2000)*, 301-303.
36. Muschinski, A., R. G. Frehlich, M. L. Jensen, and B. B. Balsley, 2000: In situ, fine-wire turbulence measurements in the night-time lower troposphere: connection between energy dissipation rate and temperature structure parameter. *Proc. 5th Int. Symp. Troposph. Profiling (Adelaide, Australia, 4-8 Dec. 2000)*, 347-349.
  37. Ostashev, V. E., S. F. Clifford, R. J. Latatits, A. Muschinski, and A. Fabrikant, 2001: Amplitude modulated radio acoustic sounding of the turbulent atmosphere. *Proc. Int. Workshop: Tomography and Acoustics: Recent developments and methods (Leipzig, Germany, 2001)*, 126-129.
  38. Muschinski, A., F. M. Dickey, and A. W. Doerry, 2005: Possible effects of clear-air refractive-index perturbations on SAR images. Radar Sensor Technology IX (Orlando, FL, 29 March - 2 April, 2005), edited by R. N. Trebits, J. L. Kurtz, *Proc. SPIE*, **5788**, pp. 25-33, doi:10.1117/12.605651.
  39. Cheon, Y., and A. Muschinski: Closed-form approximations for the variance of angle-of-arrival fluctuations, averaged over a circular aperture, of plane and spherical waves propagating through homogeneous and isotropic turbulence. *Proc. 7th Int. Symp. Troposph. Profiling (Boulder, Colorado, June 11-17, 2006)*, 7/22-7/23.
  40. Muschinski, A., K. Hu, L. M. Root, S. Tichkule, and S. N. Wijesundara: Angle-of-arrival fluctuations of light propagating through the intermittent nocturnal surface layer. *AGU Fall Meeting 2010 (San Francisco, California, 13-17 December, 2010)*.
  41. Muschinski, A., and S. J. Frasier: Vertical fluxes of local clear-air radar and sodar reflectivity in the convective boundary layer. *USNC/URSI National Radio Science Meeting (Boulder, Colorado, 5-8 January, 2011)*.
  42. Hu, K., L. Root, S. Tichkule, S. Wijesundara, and A. Muschinski: Optical and sonic observations of fluctuations of the vertical temperature gradient in the intermittent nocturnal atmospheric surface layer. *USNC/URSI National Radio Science Meeting (Boulder, Colorado, 5-8 January, 2011)*.
  43. Tichkule, S., K. Hu, L. M. Root, S. N. Wijesundara, and A. Muschinski: Estimation of beam-transverse wind velocity using angles of arrival from spatially separated light sources. *USNC/URSI National Radio Science Meeting (Boulder, Colorado, 5-8 January, 2011)*.
  44. Tichkule, S., and A. Muschinski: Optical anemometry based on the temporal cross-correlation of angle-of-arrival fluctuations obtained from spatially separated light sources. *Proceedings of the 2012 IEEE Int. Geoscience Remote Sens. Symp. (IGARSS), Munich, Germany, July 22-27, 2012*, pp. 1980-1983.
  45. Muschinski, A., and S. Tichkule: Optical angle-of-arrival fluctuations observed with two closely spaced telescopes in the atmospheric surface layer. *Proceedings of the 15th Annual Directed Energy Symposium (26-30 November 2012, Albuquerque, New Mexico)*, 9 pp.
  46. Muschinski, A., and S. Tichkule: The Colorado Peaks Experiment. *Proceedings of the OSA Imaging and Applied Optics Congress, Topical Meeting "Propagation through and Characterization of Distributed Volume Turbulence" (24-26 June 2013, Washington, DC)*, 2 pp.

47. Tichkule, S., and A. Muschinski: An optical stereoscopic method for range-resolved retrieval of the cross-path wind velocity. *Proceedings of the 2013 IEEE Int. Geoscience Remote Sens. Symp. (IGARSS), Melbourne, Australia, July 21-26, 2013*, 4 pp.

## Research Grants and Other Support

1. Muschinski, A. (P.I.): Several low-budget field experiments using radiosondes, aircraft, and the SOUSY VHF radar, 1992-1996. Co-sponsored by Univ. Hannover, Tech. Univ. Braunschweig, and Max-Planck-Institut für Aeronomie. Amount: ca. **\$20,000**.
2. Muschinski, A. (P.I.): Conference travel, 7th MST Radar Workshop, Hilton Head Island, SC, USA. Nov. 1995. Sponsored by Deutsche Forschungsgemeinschaft (German Science Foundation). Amount: **\$2,500**.
3. Muschinski, A. (P.I.): 12-month long habilitation stipend at the National Center of Atmospheric Research, Boulder, CO. Dec. 1996 – Nov. 1997. Sponsored by Deutsche Forschungsgemeinschaft. Grant amount: ca. **\$40,000**.
4. Muschinski, A. (P.I.), and R. G. Lataitis (Co-P.I.): Profiler-HELIPOD Intercomparison Experiment (PHELIX). Co-sponsored by NOAA/ETL, Univ. Hannover, NCAR, US Army, US Air Force, Aerodata, and NOAA/FSL. Total amount: ca. **\$100,000**.
5. Muschinski, A. (P.I.): Conference travel: 8th MST Radar Workshop (Bangalore, India, Dec. 1997). Sponsored by NCAR. Amount: ca. **\$4,000**.
6. Muschinski, A. (Co-convener), and D. H. Lenschow, (Co-convener): Workshop on Atmospheric Finestructure on Meter- and Submeter Scales (Boulder, CO, Aug 1999). Co-sponsored by Univ. of Colorado, NCAR/GTP, and NOAA/ETL. Amount: **\$12,500**.
7. Muschinski, A. (P.I.): Analysis of PHELIX data and presentation at an international conference. 2000. Sponsored by Aerodata Flugmesstechnik GmbH. Amount: **\$10,000**.
8. Balsley, B. B. (P.I.), R. G. Frehlich (Co-P.I.), and A. Muschinski (Co-P.I.): Analysis of fine-wire measurements from CASES-99. 1999-2001. Sponsored by National Science Foundation. Awarded amount: **\$431,000**.
9. Muschinski, A. (P.I.), and J. C. Wyngaard (subaward): Internal consistency of meteorological data obtained with a volume-imaging radar wind profiler. 2000-2004. Sponsored by U. S. Army Research Office. Awarded amount: **\$264,500**.
10. Balsley, B. B. (P.I.), R. G. Frehlich (Co-P.I.), and A. Muschinski (Co-P.I.): Studies of high-resolution turbulence, stratification, and instabilities in the nighttime boundary layer. 2001-2003. Sponsored by National Science Foundation. Awarded amount: \$300,766.
11. Muschinski, A. (P.I.): Joint statistics of mixed-layer characteristics observed with a volume-imaging radar wind profiler. 2005-2008. Sponsored by U.S. Army Research Office. Awarded amount: **\$298,187**.
12. Muschinski, A. (Lead P.I.), D. C. Fritts (P.I.), C. D. Whiteman (P.I.), and S. Zhong (P.I.): Collaborative Research: Structure and Evolution of Diurnal Cold-Air Pools and Seiches in Small, Closed Basins. 2005-2008. Sponsored by National Science Foundation (NSF). Awarded amount: **\$1,197,011**.

13. Muschinski, A. (Lead P.I.), D. C. Fritts (P.I.), C. D. Whiteman (P.I.), and S. Zhong (P.I.): Field Support for Collaborative Research: Structure and Evolution of Diurnal Cold-Air Pools and Seiches in Small, Closed Basins. 2005-2008. Sponsored through NCAR/NSF Deployment Pool. Awarded amount: **\$310,556**.
14. Muschinski, A. (P.I.), and S. J. Frasier (Co-I): Supplement to the grant “Joint statistics of mixed-layer characteristics observed with a volume-imaging radar wind profiler”. 2006-2008. Sponsored by U.S. Army Research Office (ARO). Awarded amount: **\$110,000**.
15. Muschinski, A.: Jerome M. Paros Professorship in Measurement Sciences. University of Massachusetts at Amherst. 2007-2010. Total capital endowment: \$2,000,000. Total payout to endowed professor: **ca. \$240,000**.
16. Muschinski, A. (P.I.): 4th and Final Year added to the grant “Joint statistics of mixed-layer characteristics observed with a volume-imaging radar wind profiler”. 2009-2010. Sponsored by U.S. Army Research Office (ARO). Awarded amount: **\$109,000**.
17. Muschinski, A. (P.I.): Measurement science of the intermittent atmospheric boundary layer. Performance period: 2010-2013. Sponsored by U.S. Army Research Office (ARO). Awarded amount: **\$480,000**.
18. Muschinski, A. (P.I.) and A. J. Gasiewski (Co-P.I.): Optical tomography of the atmospheric surface layer. Sponsored by the National Science Foundation (NSF). Performance period: 2012-2015. Awarded amount: **\$594,122**.
19. Muschinski, A. (P.I.): Effects of corrugated temperature sheets on optical propagation along quasi-horizontal paths in the stably stratified atmosphere. Sponsored by the U.S. Air Force Office of Scientific Research (AFOSR). Performance period: 2012-2015. Awarded amount: **\$635,217**.
20. Muschinski, A. (Co-P.I.): Multiscale interactions in stratified turbulence. Frontier Project sponsored by the U.S. High Performance Computing Modernization Program (HPCMP). Performance period: 2013-2018. Amount awarded to A. M.: **\$221,926**.
21. Muschinski, A. (P.I.): Passive optical remote sensing of wind velocities and turbulence by spatiotemporal analysis of image distortions of random scenes. Sponsored by the National Science Foundation (NSF), Physical and Dynamic Meteorology Program. Performance period: 2016-2019. Awarded amount: **\$599,959**.

### Invited Talks and Lectures

1. Boulder, Colorado: Seminar at the NOAA Wave Propagation Laboratory Interactive Seminar Series, November 1992.
2. Hamburg, Germany: Kolloquium des Zweigvereins der Deutschen Meteorologischen Gesellschaft, Seewetteramt, April 1995.
3. Karlsruhe, Germany: Institut für Meteorologie und Klimaforschung der Universität Karlsruhe, seminar talk, October 1995.
4. Frankfurt am Main, Germany: Institut für Geophysik und Meteorologie der Goethe-Universität, Meteorologisches Kolloquium, October 1995.
5. Geesthacht, Germany: GKSS Forschungszentrum, seminar talk, December 1995.

6. Los Alamos, New Mexico: Los Alamos National Laboratory, seminar talk, October 1996.
7. Boulder, Colorado: National Center for Atmospheric Research, seminar talk, October 1996.
8. Katlenburg-Lindau, Germany: Max-Planck-Institut für Aeronomie, seminar talk, November 1996.
9. Hannover, Germany: Universität Hannover, Physikalisches Kolloquium, May 1997.
10. Kiruna, Schweden: Swedish Institute of Space Physics, series of four lectures, October 1997.
11. Calcutta, India: Indian Statistical Institute, two lectures, December 1997.
12. Howrah, India: 24th National Conference on Fluid Mechanics and Fluid Power, invited review talk, December 1997.
13. Calcutta, India: International Symposium on Mathematical Physics in memory of S. Chandrasekhar with a special session on Abdus Salam, invited review talk, December 1997.
14. Leipzig, Germany: Institut für Troposphärenforschung, Meteorologisches Kolloquium, April 1998.
15. Hannover, Germany: Universität Hannover, private docent inauguration lecture, April 1998.
16. Boulder, Colorado: Lecture at the NCAR Workshop "Observations, Experiments and LES: A Triad for Geophysical Turbulence Studies", August 1998.
17. Boulder, Colorado: Seminar, NOAA Environmental Technology Laboratory, October 1998.
18. Lindenberg, Germany: Meteorological Observatory Lindenberg, seminar talk, May 1999.
19. Braunschweig, Germany: Aerodata Flugmesstechnik GmbH, seminar talk, July 1999.
20. Boulder, Colorado: NCAR, NASA/NCAR/FAA workshop on turbulence detection, Sep. 1999.
21. Leipzig, Germany: Institut für Troposphärenforschung, Meteorologisches Kolloquium, 9 Nov. 1999.
22. Kiruna, Sweden: Swedish Institute of Space Physics, seminar talk, Nov. 1999.
23. Lindenberg, Germany: Meteorological Observatory Lindenberg, seminar talk, Dec. 1999.
24. Toulouse, France: 9th MST Radar Workshop, invited presentation (presented by R. J. Lataitis), Mar. 2000.
25. Boulder, Colorado: Presentation at invited NCAR Workshop on Fine Scale Turbulence and Cloud Microphysics, 9-11 November 2000.
26. State College: Pennsylvania, Seminar at the Meteorological Department, PennState University, 26 February 2001.
27. Amherst, Massachusetts: Seminar at the Microwave Remote Sensing Laboratory, University of Massachusetts, 1 March 2001.
28. Boulder, Colorado: NOAA Environmental Technology Laboratory Seminar, 30 April 2001.
29. Oberpfaffenhofen, Germany: Seminar at the Institute for Physics of the Atmosphere, German Aerospace Center (DLR), 3 December 2001.

30. Karlsruhe, Germany, Seminar: Institute for Meteorology and Climate Research, University and Research Center Karlsruhe, 13 March 2002.
31. Amherst, Massachusetts: Seminar, Electrical and Computer Engineering Department, University of Massachusetts, 20 April 2004.
32. Amherst, Massachusetts: Seminar, Mechanical and Industrial Engineering Department, University of Massachusetts, 21 April 2004.
33. Amherst, Massachusetts: Seminar, Electrical and Computer Engineering Department, University of Massachusetts, 13 December 2005.
34. Berne, Switzerland: Seminar, Institute for Applied Physics, University of Bern, 27 January 2006.
35. Lindenberg, Germany: Meteorological Observatory Lindenberg, seminar talk, July 2006.
36. Orlando, Florida: Invited talk at the 135th TMS Annual Meeting, 2 Mar. 2007.
37. Amherst, Massachusetts: Jerome M. Paros Professorship inauguration lecture, 7 May 2007.
38. Boulder, Colorado: Keynote Lecture on “Turbulence Measurements to Support Phenomenological Studies” at the NCAR Geophysical Turbulence Program (GTP) Workshop *Observing the Turbulent Atmosphere: Sampling Strategies, Technology, and Applications*, 28-30 May, 2008.
39. Amherst, Massachusetts: Waves in the atmosphere. Seminar presentation, ECE Dept., Univ. of Massachusetts Amherst, 20 October, 2008.
40. Research Triangle Park, North Carolina: Turbulence and wave propagation in the lower atmospheric boundary layer. Invited presentation, *U.S. Army Atmospheric Sciences Overview, Army Research Office, Research Triangle Park, NC, 3-4 Feb., 2009.*
41. Saint Louis, France: Turbulence and wave propagation in the lower atmospheric boundary layer. Seminar presentation, French-German Research Institute Saint Louis, France, 16 March, 2009.
42. State College, Pennsylvania: Measurement of waves and turbulence in the atmospheric boundary layer. Seminar presentation, Dept. of Meteorology, The Pennsylvania State University, State College, PA, 23 April, 2009.
43. Kühlungsborn, Germany: Wave propagation in the turbulent atmosphere. Seminar presentation, Leibniz-Institut für Atmosphärenphysik, Kühlungsborn, Germany, 23 June, 2009.
44. Seattle, Washington: Wave propagation in the turbulent atmosphere. Invited presentation, Nano-Resolution Workshop, Talaris Conference Center, Seattle, WA, 23 July, 2009.
45. Toulouse, France: Measurement of waves and turbulence in the atmospheric boundary layer. Seminar presentation, Laboratoire d’Aérodynamique, Université Paul Sabatier Toulouse, France, 7 January 2010.
46. Hanover, New Hampshire: Measurement science of the intermittent boundary layer. Invited presentation, US Army Environmental Sciences Coordinating Group, Cold Regions Research and Engineering Laboratory (CRREL), Hanover, New Hampshire, 10 February 2010.

47. State College, Pennsylvania: A random walk through atmospheric turbulence and wave propagation. Invited presentation, John C. Wyngaard Symposium, The Pennsylvania State University, State College, PA, 24-25 June 2010.
48. Vienna, Austria: Vertical fluxes of local turbulence structure parameters in the convective boundary layer. Presentation at international invited workshop “Models versus physical laws/first principles, or why models work”, Wolfgang Pauli Institute, Vienna, Austria, 2-5 February 2011.
49. Boulder, Colorado: Doppler velocities resulting from clear-air reflectivity fluxes. Seminar presentation, Dept. of Electrical, Computer and Energy Engineering and Center for Environmental Technology, University of Colorado at Boulder, Boulder, CO, 8 March 2011.
50. Boulder, Colorado: Optical and ultrasonic observations of the nocturnal atmospheric surface layer. MMM Seminar, National Center for Atmospheric Research, Boulder, CO, 10 March 2011.
51. Kühlungsborn, Germany: VHF/UHF radio-wave backscatter from corrugated sheets in the stably stratified atmosphere. Invited presentation at the 13th International Workshop on Technical and Scientific Aspects of MST Radar (MST13), Kühlungsborn, Germany, 19-23 March, 2012.
52. Braunschweig, Germany: Optical angle-of-arrival fluctuations in the atmospheric surface layer. Seminar, Institut für Geophysik und Extraterrestrische Physik. Technische Universität Braunschweig, Germany, 21 June, 2013.
53. Boulder, Colorado: A testbed for optical propagation studies in the atmospheric surface layer. National Institute of Standards and Technology (NIST), Boulder, CO, 12 July, 2013.

### **Service as Reviewer for Technical Journals**

1. AIAA Journal
2. Acta Acustica
3. Annales Geophysicae
4. Atmospheric Measurement Techniques
5. Applied Optics
6. Atmospheric Chemistry and Physics
7. Atmospheric Measurement Techniques
8. Boundary-Layer Meteorology
9. Bulletin of the American Meteorological Society
10. Contributions to Atmospheric Physics / Beiträge zur Physik der Atmosphäre
11. Environmental Fluid Mechanics
12. Geophysical Research Letters
13. IEEE Sensors Journal



14. IEEE Transactions on Aerospace and Electronic Systems
15. Infrared Physics and Technology
16. Journal of Applied Meteorology / Journal of Applied Meteorology and Climatology
17. Journal of Atmospheric and Oceanic Technology
18. Journal of Atmospheric and Solar-Terrestrial Physics
19. Journal of Geophysical Research
20. Journal of Optics A: Pure and Applied Optics
21. Journal of the Acoustical Society of America
22. Journal of the Atmospheric Sciences
23. Journal of the Optical Society of America A
24. Journal of Theoretical and Computational Fluid Dynamics
25. Meteorologische Zeitschrift
26. Meteorology and Atmospheric Physics
27. Monthly Weather Review
28. Optical Letters
29. Optics Communications
30. Optics Express
31. Physics of Fluids
32. Radio Science
33. Remote Sensing
34. Terrestrial Atmospheric and Oceanic Science Journal (Taiwan)
35. Theoretical and Applied Climatology
36. Waves in Random and Complex Media.

### **Service as Reviewer for Sponsor Agencies**

1. Army Research Office (ARO), U.S. Department of Defense
2. Air Force Office of Scientific Research (AFOSR), U.S. Department of Defense
3. Civilian Research and Development Foundation (CRDF), U.S. State Department
4. Defense Threat Reduction Agency (DTRA), U.S. Department of Defense, USA
5. German Israeli Foundation for Scientific Research and Development
6. German Weather Service (Deutscher Wetterdienst, DWD), Offenbach, Germany
7. National Science Foundation (NSF), USA

8. National Center for Atmospheric Research (NCAR), Boulder, Colorado, USA
9. Natural Environment Research Council, United Kingdom
10. Natural Sciences and Engineering Research Council, Canada
11. NOAA Environmental Technology Laboratory (ETL), Boulder, Colorado, USA
12. Qatar National Research Fund (NSRF), Qatar
13. URSI.

### Service to the Profession

- |      |   |
|------|---|
| 1999 | Member of the NOAA Environmental Technology Laboratory's <i>Millennium Committee</i>  |
| 1999 | Co-organizer (with D. H. Lenschow) of the NCAR/University of Colorado/NOAA workshop on Atmospheric Turbulence on Meter and Submeter Scales (see Muschinski and Lenschow, 2001: <i>Bull. Amer. Meteor. Soc.</i> , <b>82</b> , 2831-2843) |
| 2000 | Member of the Planning Committee of the <i>5th International Symposium on Tropospheric Profiling</i> (Adelaide, Australia, Dec. 2000)   |
| 2000 | Member of the NOAA Environmental Technology Laboratory's <i>Strategic Planning Team</i>   |
| 2002 | Session Chair at the NCAR Geophysical Turbulence Program Workshop on <i>New Developments in Sub Filter Scale (SFS) Closure</i> (National Center of Atmospheric Research, Boulder, Colorado, 7-9 August 2002)                            |
| 2003 | Session Convener at the <i>10th International Workshop on Technical and Scientific Aspects of MST Radar</i> (Piura, Peru, May 2003)   |
| 2006 | Main Session Organizer at the <i>11th International Workshop on Technical and Scientific Aspects of MST Radar</i> (Tirupati/Gadanki, India, December 2006)  |
| 2009 | Session Convener at the <i>12th International Workshop on Technical and Scientific Aspects of MST Radar</i> (London, Ontario, May 2009)   |
| 2011 | Co-Chair of Session F-1 at the <i>USNC/URSI National Radio Science Meeting</i> (Boulder, Colorado, 5-8 January 2011)  |
| 2012 | Chair of Session 1 ("Scattering, calibration and microscale processes") of the <i>13th International Workshop on Technical and Scientific Aspects of MST Radar</i> (Kühlungsborn, Germany, 19-23 March 2012)                            |
| 2013 | Session Chair at the <i>USNC/URSI National Radio Science Meeting</i> (Boulder, Colorado, 9-12 January 2013).  |

## Courses Taught

1. Meteorology I, undergraduate<sup>1</sup> (University Hannover, Germany)
2. Meteorology II, undergraduate (University Hannover, Germany)
3. Radar Meteorology, undergraduate (University Hannover, Germany)
4. Meteorological Instruments, undergraduate (University Hannover, Germany)
5. Atmospheric Turbulence, undergraduate (University Hannover, Germany)
6. Clear-Air Radar Windprofiling, graduate (University of Colorado at Boulder)
7. ECE 313: Signals and Systems (UMass, ECE Dept.)
8. ECE 314: Probability and Statistics (UMass, ECE Dept.)
9. ECE 565: Digital Signal Processing (UMass, ECE Dept.)
10. ECE 606: Electromagnetic Field Theory (UMass, ECE Dept.)
11. ECE 697CC: Energy, Weather and Climate (UMass, ECE Dept.)
12. ECE 697EE: Scintillation and Turbulence (UMass, ECE Dept.)
13. ECE 596UU/697UU: Atmospheric Sensing, Modeling and Prediction (UMass, ECE Dept.)
14. ECE 608EE: Signal Theory (UMass, ECE Dept.)

## Advised Graduate Students

1. Wode, Christian, graduated 1992, M.S., physics, University of Hannover, Germany (as of June 2009 Project Leader, Audi AG, Ingolstadt, Germany.)
2. Danne, Olaf, graduated 1992, M.S., meteorology, University of Hannover, Germany (earned Dr. rer. nat.<sup>2</sup> degree later from GKSS Forschungszentrum Geesthacht)
3. Eicke, Nils, graduated 1993, M.S., physics, University of Hannover, Germany
4. Schlueter, Martin, graduated 1993, M.S., physics, University of Hannover, Germany
5. Heinke, Michael, graduated 1994, M.S., meteorology, University of Hannover, Germany (earned Dr. med. dent. degree later and became a dentist)
6. Klocke, Britta, graduated 1994, M.S., meteorology, University of Hannover, Germany (earned Dr. rer. nat. degree later)
7. Wehner, Birgit, graduated 1994, M.S., meteorology, University of Hannover, Germany (earned Dr. rer. nat. degree later and is now a research scientist at the Institut für Troposphärenforschung in Leipzig, Germany)

---

<sup>1</sup>At that time, the first degree in the German academic system was the *Diplom*, the German equivalent of the M.S. in the U.S. system. Because M.S. students in the U.S. system count as graduate students, some of my Hannover undergraduate courses would count as graduate courses in the U.S. system.

<sup>2</sup>The Doctor rerum naturalium, or Dr. rer. nat., is the German equivalent of the Ph.D. in the US system.

8. Hollmann, Rainer, graduated 1995, M.S., meteorology, University of Hannover, Germany (earned Dr. rer. nat. degree later and is now a research scientist at the Research Department of the German Weather Service in Offenbach, Germany)
9. Steffen, Michael, graduated 1995, M.S., physics, University of Hannover, Germany (earned Dr. rer. nat. degree later, of June 2009 a senior software engineer at Hewlett-Packard, Germany)
10. Kern, Stefan, graduated 1997, M.S., meteorology, University of Hannover, Germany (earned Dr. rer. nat. later and is now a research scientist in the Remote Sensing Division of the Institute for Oceanography, University of Hamburg, Germany)
11. Behn, Mario, M.S., graduated 2006, M.S., ECE, University of Massachusetts, Amherst, MA (is now a Federal employee at the Technical Center for Ships and Naval Weapons, Naval Technology and Research, a research institution operated by the German Army)
12. Cheon, Yonghun, Ph.D., graduated Feb. 2008, ECE, University of Massachusetts, Amherst, MA (is now a senior engineer at the Advanced CAE Lab., DMC R&D Center, Samsung Electronics Co. Ltd., Suwon, Korea)
13. Subramanian, Ganesh Kumar, M.S., graduated Sep. 2009, ECE, University of Massachusetts, Amherst, MA
14. Tichkule, Shiril, M.S., graduated in Sep. 2011, ECE, University of Massachusetts, Amherst, MA; currently PhD candidate at the Dept. of Electrical, Computer and Energy Engineering, University of Colorado at Boulder, Boulder, CO.
15. Pearse, Scott, M.S., graduated in May 2013, Computer Science, Univ. Colorado at Boulder, Boulder, CO.
16. Ayvazian, Justin, since Fall 2013 PhD student at the Dept. of Electrical, Computer and Energy Engineering, University of Colorado at Boulder, Boulder, CO.
17. Root, Lucas, since Fall 2013 PhD student at the Dept. of Electrical, Computer and Energy Engineering, University of Colorado at Boulder, Boulder, CO.

### **Service on M.S. and Ph.D. committees at UMass (2004-2011)**

Zeynep Culcuoglu, M.S. (Member)  
 Elizabeth Kerr, M.S. (Member)  
 Dragana Perkovich, Research Qualifying Exam (Member)  
 Ninoslav Majurec, Research Qualifying Exam (Member)  
 Mario Behn, M.S. (Chair)  
 Yonghun Cheon, Ph.D. (Chair)  
 Dazhen Gu, Research Qualifying Exam (Chair)  
 Daniel Jaynes, MIE, M.S. (Member)  
 Matthew Lackner, MIE, Ph.D. (Member)  
 Jorge Trabal, Research Qualifying Exam (Chair)  
 Mauricio Sanchez-Barbettey, Research Qualifying Exam (Chair)  
 Nathan Mesick, M.S. (Member)  
 Ganesh Kumar Subramanian, M.S. (Chair)  
 Shiril Tichkule, M.S. (Chair)

## Undergraduate Research Assistants

1. Justin Ayvazian, undergraduate student, ECE, University of Massachusetts, Amherst, MA (graduated May 2010)
2. Brennan Burns, undergraduate student, ECE, University of Massachusetts, Amherst, MA (graduated May 2010, now PhD student at Stanford University)
3. Andrew Hills, undergraduate student, ECE, University of Massachusetts, Amherst, MA (graduated May 2010)
4. Lucas Root, undergraduate student, ECE, University of Massachusetts, Amherst, MA (graduated May 2010, now a solar engineer at Tioga Energy, California)
5. Sahil Shanghavi, undergraduate student, ECE, University of Massachusetts, Amherst, MA (graduated May 2010)
6. Steven Stanvick, undergraduate student, ECE, University of Massachusetts, Amherst, MA (graduated May 2010)
7. Brandon Thorpe, undergraduate student, ECE, University of Massachusetts, Amherst, MA (graduated May 2010)
8. Fadi Zoghzy, undergraduate student, ECE, University of Massachusetts, Amherst, MA (graduated May 2010, now PhD student at Stanford University)
9. Shanka Wijesundara, undergraduate student, ECE, University of Massachusetts, Amherst, MA (graduated May 2011, now at MIT Lincoln Labs).

## Memberships

- American Meteorological Society
- American Geophysical Union
- International Union of Radio Science (URSI), Commission F (Wave Propagation and Remote Sensing)
- Optical Society of America
- Deutsche Physikalische Gesellschaft (German Physical Society)
- Deutsche Meteorologische Gesellschaft (German Meteorological Society).