

DAVID L. MITCHELL
Associate Research Professor
Division of Atmospheric Sciences
Desert Research Institute
2215 Raggio Parkway
Reno, NV 89512-1095

Tel: 775-674-7039
Fax: 775-674-7060
Email: Dave.Mitchell@dri.edu

EDUCATION:

Ph.D.	1995	Atmospheric Science	University of Nevada, Reno (Advisor: Dr. Jim Hudson)
M.Sc.	1986	Atmospheric Physics	University of Nevada, Reno (Advisor: Dr. Dennis Lamb)
B.Sc.	1981	Chemistry	California Polytechnical State University, San Luis Obispo

PROFESSIONAL EXPERIENCE:

2001-present	Associate Research Professor, Division of Atmospheric Sciences, Desert Research Institute, Reno, Nevada
1995-2001	Assistant Research Professor, DAS/DRI, Reno, Nevada
1989-1995	Atmospheric Research Scientist, Atmospheric Sciences Center, DRI, Reno, Nevada
1985-1989	Staff Cloud Chemist, DRI/ASC
1982-1985	Graduate Research Assistant, DRI/ASC
1981-1982	Research Chemist, Teledyne McCormick Selph, Hollister, California

PROFESSIONAL INTERESTS:

Dr. Mitchell's research has focused on the following areas: (1) theoretical understanding and modeling of the microphysical evolution within cirrus and frontal clouds, especially with regard to particle size spectra and crystal concentrations; (2) understanding and modeling the radiative properties of ice clouds; (3) remote sensing of cloud properties; (4) understanding and predicting the onset, strength and extent of the North American monsoon; (5) modification of cirrus clouds to reduce global warming.

- Accomplishments regarding (1) include the development of two models successfully predicting the evolution of ice particle size spectra. The input for one model consists of the ice water content and temperature profiles, while the other is driven by changes in super-saturation. These models are computationally efficient, utilizing analytical solutions for ice particle growth by vapor diffusion and aggregation, and can be easily used to improve radar estimates of precipitation at ground level.
- Regarding (2), the optical properties of ice clouds have been successfully described by parameterizing the absorption and scattering processes and rigorously treating their dependence on cloud microphysics. This treatment, the Modified Anomalous Diffraction Approximation (MADA), was formulated in terms of the size distribution and ice particle shape, and agrees with explicit electrodynamic solutions of ice crystal single scattering properties within 15%. These developments, along with parameterizing the asymmetry parameter for various crystal shapes, have led to a new treatment of ice cloud radiative properties which is used in (i) the Community Atmosphere Model

version 5 (CAM5) global climate model (GCM), (ii) in the Colorado State University GCM, (iv) in the Regional Atmospheric Modeling System (RAMS) at CIRES and (v) in the Rapid Radiation Transfer Model (RRTM) and the Paleoclimate version of RRTM developed at Atmospheric and Environmental Research (AER).

- Regarding (3), the MADA scheme (noted above) resolves the two main processes responsible for the absorption of thermal radiation in ice particles; Beer's law and wave resonance absorption. This led to two satellite retrieval algorithms that have been developed that estimate (1) the ice particle size distribution including the number concentration of small ($D < 60 \mu\text{m}$) ice crystals and (2) the percentage of liquid water relative to the total (ice + liquid) condensate in mixed phase clouds. Method (1) is of value due to the difficulty in measuring small ice crystal concentrations from aircraft (which help determine cirrus cloud optical properties) and method (2) is important since ice cloud optical properties strongly depend on the fraction of liquid water when present. Both methods were the first to retrieve the indicated cloud properties. This improved understanding of thermal radiation absorption by ice has also enabled the satellite retrieval of the N/IWC ratio, where N is ice particle number concentration and IWC is the cloud ice water content. This retrieval may allow us to identify whether cirrus clouds have been primarily formed through homo- or heterogeneous ice nucleation.
- Regarding (4), a new approach to understanding the North American monsoon (NAM) has been pursued in terms of sea surface temperatures (SSTs) in the eastern tropical Pacific and the Gulf of California (GC). Results from nine monsoon seasons show that relatively heavy rainfall in Arizona commences once the SST in the northern GC exceeds 29°C . Both observational and modeling research indicates that humid air overlying the GC is trapped by an inversion that breaks when SSTs exceed 29°C . Once the marine inversion is removed, the warm SSTs humidify a deep layer of free tropospheric air that can be advected over land to often produce thunderstorms. In addition, this mechanism along with climatological and reanalysis data suggest that NAM convection is initiated in central Mexico through the poleward propagation of warm tropical surface water along the Pacific coast, and that this convection contributes to the poleward propagation of the NAM anticyclone that eventually steers mid-level moisture into the NAM region, augmenting the NAM rainfall.
- Regarding (5), it is generally accepted that the mean increase in global surface temperatures (relative to pre-industrial times) should not exceed 2°C if mankind is to avoid "unacceptable" consequences of climate change. Recent research has led some scientists to conclude that exceeding this threshold may be unavoidable unless some type of climate intervention (CI) is invoked to remove CO_2 from the atmosphere and/or cool the planet (e.g. by reflecting more sunlight) while simultaneously and very rapidly converting to non-carbon based energy systems. A new type of CI has been proposed, based on the aircraft seeding of the coldest cirrus clouds to reduce their coverage and optical thickness, resulting in a significant global cooling by releasing more thermal radiation to space (instead of reflecting more sunlight). GCM simulations of this approach by others show that it has reduced or no side-effects (e.g. the hydrological cycle and ozone perturbation) relative to the most studied solar radiation management (SRM) CI approach (the injection of sulfate aerosols into the stratosphere to reflect more sunlight). Moreover, this cirrus CI method preferentially cools the Polar Regions where climate change is most severe, which is less easily achieved by the SRM methods.

RESEARCH AREAS:

- Cloud Microphysics
- Cloud Radiative Properties (especially ice clouds)
- Remote Sensing of Cloud Physical Properties
- Climate Dynamics
- Large-Scale and Mesoscale Dynamic Meteorology
- Precipitation Scavenging

PROFESSIONAL ACTIVITIES:

- Member, Atmospheric Systems Research (ASR) Program Science Team
- Member, Atmosphere Model Working Group (AMWG), NCAR GCM
- Member, American Meteorological Society (AMS)
- Committee Chairman, AMS Committee on Cloud Physics (2000-2006)
- Member, American Geophysical Union
- Member, European Geosciences Union
- Adjoint Professor appointment in October 2003 at Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE)

HONORS AND AWARDS:

- DOE-EPSCoR Traineeship Program, scholarship award
- Best Poster Award at the Fifth International Conference on Precipitation Scavenging and Atmosphere-Surface Exchange Processes, Richland, Washington, 15-19 July 1991.
 - AMS Editor's Award for the Journal of Atmospheric Sciences, 2000
 - Peter B. Wagner Medal of Excellence (for early career achievement by DRI scientists)
- NOWCAST section, Papers of Note, AMS Bulletin, October 2002: Relating sea surface temperatures to the North American monsoon, by Mitchell, D.L., D. Ivanova, R. Rabin, K. Redmond, and T.J. Brown

PEER REVIEWED PUBLICATIONS:

- Mitchell, D.L., 1988: Evolution of snow-size spectra in cyclonic storms. I: Snow growth by vapor deposition and aggregation. *J. Atmos. Sci.*, 45, 3431-3451.
- Mitchell, D.L., 1989: Influence of rime ice and snow in the central Sierra. Reviewed proceedings, International Mountain Watershed Symposium, 8-10 June, Lake Tahoe, Nevada, 401-415.
- Mitchell, D.L. and D. Lamb, 1989: Influence of riming on the chemical composition of snow in winter orographic storms. *J. Geophys. Res.*, 94, 14,831-14,840.
- Mitchell, D.L., R. Zhang and R.L. Pitter, 1990: Mass-dimensional relationships for ice particles and the influence of riming on snowfall rates. *J. Appl. Meteor.*, 29, 153-163.
- Mitchell, D.L., 1991: Evolution of snow-size spectra in cyclonic storms. II: Deviations from the exponential form. *J. Atmos. Sci.*, 48, 1885-1899.
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- Borys, R.D., D. Del Vecchio, J.L. Jaffrezo, J. Dibb and D.L. Mitchell, 1991: Field observations, measurements and preliminary results from a study of wet deposition processes influencing snow and ice chemistry at Summit, Greenland. 5th International Conference on Precipitation Scavenging and Atmospheric-Surface Exchange Processes, July, Vol 3, Application and Appraisals, Richland, Washington, 1705-1718.
- Hindman, E.E., E.J. Carter, R.D. Borys and D.L. Mitchell, 1992: Collecting supercooled cloud droplets as a function of droplet size. *J. Atmos. Ocean. Tech.*, 9, 337-353.

- Mitchell, D.L., 1994: A model predicting the evolution of ice particle size spectra and the radiative properties of cirrus clouds. Part I: Microphysics. *J. Atmos. Sci.*, **51**, 797-816.
- Mitchell, D.L. and W.P. Arnott, 1994: A model predicting the evolution of ice particle size spectra and the radiative properties of cirrus clouds. Part II: Dependence of absorption and extinction on ice crystal morphology. *J. Atmos. Sci.*, **51**, 817-832.
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- Mitchell, D.L., 1996: Use of mass- and area-dimensional power laws for determining precipitation particle terminal velocities. *J. Atmos. Sci.*, **53**, 1710-1723.
- Mitchell, D.L., S. Chai, Y. Liu, A.J. Heymsfield and Y.Y. Dong, 1996: Modeling cirrus clouds. Part I: Treatment of bimodal size spectra and case study analysis. *J. Atmos. Sci.*, **53**, 2952-2966.
- Mitchell, D.L., A. Macke, and Y. Liu, 1996: Modeling cirrus clouds. Part II: Treatment of radiative properties. *J. Atmos. Sci.*, **53**, 2967-2988.
- Baran, A.J., J.S. Foot and D.L. Mitchell, 1998: The question of ice crystal absorption: A comparison between T-matrix, Mie and anomalous diffraction theory and implications for remote sensing. *Appl. Opt.*, **37**, 2207-2215.
- Baran, A.J., S.J. Brown, J.S. Foot and D.L. Mitchell, 1999: Retrieval of tropical cirrus thermal optical depth, crystal size and shape using a dual-view instrument at 3.7 and 10.8 μm . *J. Atmos. Sci.*, **56**, 92-110.
- Kristjansson, J.E., J.M. Edwards, and D.L. Mitchell, 1999: A new parameterization scheme for the optical properties of ice crystals for use in general circulation models of the atmosphere. *Phys. Chem. Earth (B)*, **24**, 231-236.
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- Stubenrauch, C.J., R. Holz, A. Chedin, D.L. Mitchell, and A.J. Baran, 1999: Retrieval of cirrus ice crystal sizes from 8.3 and 11.1 μm emissivities determined by the improved initialization inversion of TIROS-N Operational Vertical Sounder observations. *J. Geophys. Res.*, **104** (No. D24), 31793-31808.
- Kristjansson, J.E., J.M. Edwards, and D.L. Mitchell, 2000: The impact of a new scheme for the optical properties of ice crystals on the climates of two GCMs. *J. Geophys. Res.*, **105**, 10,063-10,079.
- Borys, R.D., D.H. Lowenthal, and D.L. Mitchell, 2000: The relationships among cloud microphysics, chemistry, and precipitation rate in cold mountain clouds. *Atmos. Environ.*, **34**, 2593-2602.
- Mitchell, D.L., 2000: Parameterization of the Mie extinction and absorption coefficients for water clouds. *J. Atmos. Sci.*, **57**, 1311-1326.
- Yang, P., K.N. Liou, K. Wyser and D.L. Mitchell, 2000: Parameterization of the scattering and absorption properties of individual ice crystals. *J. Geophys. Res.*, **105**, 4699-4718.
- Mitchell, D.L., W. P. Arnott and C. Schmitt, 2000: Photon tunneling contributions for laboratory grown hexagonal columns. Proceedings, *5th Conference on Electromagnetic and Light Scattering by Nonspherical Particles: Theory, Measurements, and Applications*, AMS, August 28 - September 1, 2000, Halifax, Nova Scotia, Canada.
- Mitchell, D.L., and R.P. d'Entremont, 2000: Nighttime retrieval of ice water path. Proceedings, *5th Conference on Electromagnetic and Light Scattering by Nonspherical Particles: Theory,*

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- Mitchell, D. L., R. P. Lawson and B. Baker, 2011: Understanding effective diameter and its application to terrestrial radiation in ice clouds. *Atmos. Chem. Phys.*, **11**, 3417-3429.
- Mitchell, D. L., S. Mishra, and R. P. Lawson, 2011: Representing the ice fall speed in climate models: Results from Tropical Composition, Cloud and Climate Coupling (TC4) and the Indirect and Semi-Direct Aerosol Campaign (ISDAC), *J. Geophys. Res.*, **116**, D00T03, doi:10.1029/2010JD015433.
- Mitchell, D. L., S. Mishra and R. P. Lawson, 2011: Cirrus clouds and climate engineering: New findings on ice nucleation and theoretical basis. In: *Planet Earth 2011 - Global Warming Challenges and Opportunities for Policy and Practice*, Prof. Elias Carayannis (Ed.), ISBN 978-953-307-733-8, InTech, Available from <<http://www.intechopen.com/articles/show/title/cirrus-clouds-and-climate-engineering-new-findings-on-ice-nucleation-and-theoretical-basis>>
- Mitchell, D. L., 2011: Book review of “Geo-engineering Climate Change: Environmental Necessity or Pandora’s Box?”, Brian Launder and J. Michael T. Thompson (Eds.), 2010, 332 pp., Cambridge Univ. Press, ISBN 978-0-521-19803-5. *Bull. Amer. Meteorol. Soc.*, **92**, 1503-1504.
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- Mitchell, D.L., 1989: The effect of cloud seeding on snow-size spectra and cloud droplet removal. Preprints, 5th WMO Scientific Conference on Weather Modification and Applied Cloud Physics, Beijing, China, 217-220.
- Mitchell, D.L., 1990: Evolution of snow-size spectra predicted by the growth processes of diffusion, aggregation and riming. Preprints, AMS Conference on Cloud Physics, San Francisco, California, 270-277.
- Mitchell, D.L., 1990: Modeling the microphysical and radiative properties of cirrus clouds. Preprints, 7th AMS Conference on Atmospheric Radiation, San Francisco, California, J96-J102.
- Mitchell, D.L. and R. Rasmussen, 1992: Application of a new snow growth model to a WISP case study. WMO Report of the 3rd International Cloud Modeling Workshop.
- Mitchell, D.L., 1992: Modeling the microphysical and radiative properties of cirrus clouds. Proceedings, 11th Conference on Clouds and Precipitation, 17-21 August, Montreal, Canada, 529-532.
- Mitchell, D.L., S. Chai, Y. Dong, W.P. Arnott, J. Hallett and A.J. Heymsfield, 1993: Importance of aggregation and small ice crystals in cirrus clouds, based on observations and an ice particle growth model. FIRE Cirrus Science Results 1993, NASA Conference Publication 3238. Proceedings of a conference held in Breckenridge, Colorado, June 14-17, 1993, 177-180.
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- Stubenrauch, C.J., R. Holz, A. Chedin, D. Mitchell and A.J. Baran, 1998: Studying physical properties of cirrus clouds using satellite TIROS-N operational vertical sounder (TOVS) observations. Preprints, *Conf. on Light Scattering by Nonspherical Particles: Theory, Measurements and Applications*, AMS, 29 September - 1 October 1998, New York, New York, 47-50.
- Mitchell, D.L., D. Ivanova and Timothy J. Brown, 1999: SSTs and the Mexican monsoon: Mechanistic implications. Preprints, 10th Symposium on Global Change Studies, 79th AMS Annual Meeting, Dallas, Texas, January 10-15, 1999.
- Mitchell, D.L., W.P. Arnott, C. Schmitt, D. Lowenthal and J.M. Edwards, 1999: A fundamental difference between ice crystal and cloud droplet absorption: Photon tunneling effects. Preprints, 10th Conf. on Atmos. Radiation: A Symposium with Tributes to the Works of Verner E. Suomi, AMS, 28 June - 2 July 1999, Madison, Wisconsin.
- Ivanova, D., D.L. Mitchell, W.P. Arnott and M. Poellot, 2000: A GCM parameterization of bimodal size spectra for mid-latitude cirrus clouds. Preprints, *13th International Conference on Clouds and Precipitation*, 14-18 August, Reno, Nevada.
- Mitchell, D.L., D. Ivanova, A. Macke and G.M. McFarquhar, 2000: A GCM parameterization of bimodal size spectra for ice clouds. Proceedings of the 9th ARM Science Team Meeting, March 22-26, 1999, San Antonio Texas (<http://www.arm.gov/docs/documents/technical/conference.html>).
- Edwards, J.M., D.L. Mitchell, D. Ivanova and D.R. Wilson, 2000: The sensitivity of the radiation budget to cirrus microphysics: A GCM study. Proceedings of the International Radiation Symposium, St. Petersburg, Russia.
- Mitchell, D.L., R.P. d'Entremont, D.H. DeSlover, and W.P. Arnott, 2002: Multispectral thermal retrievals of size distribution shape, effective size, ice water path and photon tunneling contribution. 12th ARM Science Team Meeting, St. Petersburg, FL, 8-12 April 2002.
- Mitchell, D.L., A.J. Baran, W.P. Arnott and C. Schmitt, 2002: Testing of the modified anomalous diffraction approximation with T-matrix calculations for hexagonal columns. 12th ARM Science Team Meeting, St. Petersburg, FL, 8-12 April 2002.

- Mitchell, D.L., R.P. d'Entremont, D.H. DeSlover, and W.P. Arnott, 2002: Multispectral thermal retrievals of size distribution shape, effective size, ice water path and photon tunneling contribution. 11th Conf. On Atmos. Radiation, 3-7 June 2002, Ogden, Utah, J13-J16.
- Mitchell, D.L. and A.J. Baran, 2002: Testing of the modified anomalous diffraction approximation with T-matrix calculations for hexagonal columns. 11th Conf. On Atmos. Radiation, 3-7 June 2002, Ogden, Utah, J139-J144.
- Mitchell, D.L., R.P. d'Entremont, D.H. DeSlover, and W.P. Arnott, 2003: Multispectral thermal retrievals of size distribution shape, effective size, ice water path and photon tunneling contribution. 12th Conf. On Satellite Meteorology and Oceanography, AMS Annual Meeting, 9-13 February 2003, Long Beach, California (on CD).
- Mitchell, D.L., D.C. Ivanova and K. Redmond, 2003: Onset of the 2002 North American monsoon: Relation to Gulf of California sea surface temperatures. 12th Conference on Interactions of the Sea and Atmosphere, AMS Annual Meeting, 9-13 February 2003, Long Beach, California (on CD).
- Ivanova, D.C., and D.L. Mitchell, 2003: Sensitivity of the atmospheric boundary layer and circulation to sea surface temperatures in the Gulf of California: Results of a MM5 modeling study. 12th Conference on Interactions of the Sea and Atmosphere, AMS Annual Meeting, 9-13 February 2003, Long Beach, California (on CD).
- Mitchell, D.L., D.H. DeSlover and R.P. d'Entremont, 2003: Remote sensing of small ice crystal concentrations in relation to FSSP measurements. Proceedings of the DOE ARM Science Team Meeting, April 2003, Broomfield, Colorado (available at <http://www.arm.gov/docs/documents/technical/conference.html>).
- Ivanova, D.C., D.L. Mitchell and G.M. McFarquhar, 2004: Tropical cirrus parameterization for trimodal size spectra. Proceedings, Vol.2, 14th International Conference on Clouds and Precipitation, Bologna, Italy, 19-23 July 2004, 1337-1339.
- Mitchell, D.L., A. Huggins and V. Grubisic, 2004: A new snow growth model with application to radar precipitation estimates. Proceedings, Vol. 1, 14th International Conference on Clouds and Precipitation, Bologna, Italy, 19-23 July 2004, 313-316.
- Mitchell, D.L., P.J. Rasch, D. Ivanova, G. McFarquhar and T. Nousiainen, 2006: The impact of controversial small ice crystals on GCM simulations. 12th AMS Conference on Cloud Physics, 10-14 July 2006, Madison, Wisconsin, paper J2.9 (available on CD).
- Mitchell, D.L., R.P. d'Entremont and R.P. Lawson, 2006: Passive thermal retrievals of ice and liquid water path, effective size and optical depth and their dependence on particle and size distribution shape. 12th AMS Conference on Atmospheric Radiation, 10-14 July 2006, Madison, Wisconsin, paper 12.5 (on CD)
- Mitchell, D.L., R.P. d'Entremont and R.P. Lawson, 2007: Ice cloud microphysical properties and their application to satellite remote sensing. Hyperspectral Imaging and Sounding of the Environment (HISE), Optical Society of America (OSA), 12-15 February 2007, Santa Fe, New Mexico, on CD.
- Mishra, S., D.L. Mitchell, D. DeSlover and G. McFarquhar, 2008: Ground based remote sensing of small ice crystal concentrations in Arctic cirrus clouds. International Conference on Clouds and Precipitation, Cancun, Mexico, 7-11 July 2008. Available on CD.
- Mitchell, D.L., and R.P. d'Entremont, 2008: Satellite remote sensing of small ice crystal concentrations in cirrus clouds. International Conference on Clouds and Precipitation, Cancun, Mexico, 7-11 July 2008. Available on CD.

- d'Entremont, R.P., and D.L. Mitchell, 2009: A causal argument for the influence of contrail ice particle shape on thermal infrared radiance observations. AMS Annual Meeting, Phoenix, Arizona, January 2009.
- Mitchell, D.L., 2009: New understanding of split-window emissions provides insight on small ice crystal concentrations. Hyperspectral Imaging and Sensing of the Environment (HISE), *Technical Digest*, Optical Society of America.
- Mitchell, D.L., and R.P. d'Entremont, 2011: Satellite Retrieval of Percent Liquid Water in Tropical Clouds Between -20° and -38°C. Hyperspectral Imaging and Sensing of the Environment (HISE), *Technical Digest*, Optical Society of America.
- Erfani, E., and D. L. Mitchell, 2014: Mechanisms for the onset and evolution of North American Monsoon. Climate and Prediction S&T Digest, NWS Science and Technology Infusion Climate Bulletin Supplement, 38th NOAA Climate Diagnostics and Prediction Workshop Special Issue, February 2014, 13-15.

CONFERENCE PRESENTATIONS

- Mitchell, D.L., 1988: Microphysical description of the Elk Mountain cap cloud. Second International Cloud Modeling Workshop, 8-12 August, Toulouse, France.
- Mitchell, D.L., 1988: The dependence of chemical wet deposition on wind direction in the Lake Tahoe Basin. International Mountain Watershed Symposium, June, Lake Tahoe, Nevada.
- Mitchell, D.L., 1988: Snow chemistry in relation to fallspeed categories: Mechanisms for trace substance removal. American Geophysical Union Fall Meeting, San Francisco, California.
- Mitchell, D.L., R.D. Borys and E.W. Carter, 1989: The phase partitioning of chemical species within mixed phase clouds. American Association for Aerosol Research, October, Reno, Nevada.
- Mitchell, D.L. and S.K. Chai, 1991: Parameterization of microphysical properties in marine stratus clouds. IUGG Symposium on Aerosol-Cloud-Climate Interactions, August, Vienna, Austria.
- Mitchell, D.L., 1992: Modeling the microphysical and radiative properties of cirrus clouds. FIRE Cirrus Science Meeting, November, Fairfax, Virginia.
- Mitchell, D.L., 1992: Dependence of cloud liquid water content and precipitation rates on a CCN cloud feedback effect. FIRE ASTEX Science Meeting, November, Fairfax, Virginia.
- Mitchell, D.L., B. Hall, M.F. Lavin, D. Ivanova and K. Redmond, 2003: Predicting the onset of the North American monsoon and progress toward a mechanistic understanding. EPIC/PACS-GAPP workshop, Boulder, Colorado, March 2003.
- Mitchell, D.L., B. Hall, M.F. Lavin, D. Ivanova and K. Redmond, 2003: Predicting the onset of the North American monsoon and progress toward a mechanistic understanding. CCSM Workshop, Breckenridge, Colorado, June 2003.
- Mitchell, D.L., D. Ivanova, B. Hall, M.F. Lavin, and A.S. Mascarenhas, Jr., 2003: Predicting the onset of the North American monsoon and progress toward a mechanistic understanding. Climate Diagnostics and Prediction Workshop, Reno, Nevada, September 2003.
- Mitchell, D.L., D. Ivanova, 2004: Predicting the onset of the North American monsoon and progress toward a mechanistic understanding. Oceans Science Meeting, AGU, Portland, Oregon, 27 January 2004.

Mitchell, D.L., Miguel F. LavRn, Affonso S. Mascarenhas, Jr. and Beth Hall, 2004: Ocean processes implicated in the onset of the North American monsoon. Oceans Science Meeting, AGU, Portland, Oregon, 27 January 2004.

Stopped entering these after 2004, but a few exceptions beginning in 2007:

Mitchell, D.L., P.J. Rasch, D.C. Ivanova, R.P. Lawson, G.M. McFarquhar and T. Nousiainen, 2007: The impact of controversial small ice crystals on GCM simulations. IUGG Symposium on Cloud Microphysics, July, Perugia, Italy.

Mitchell, D.L., S. Mishra, B. Baker, R.P. Lawson, B. Pilon and Qixu Mo, 2007: Assessing the concentrations of small ice crystals in ice clouds: Combining in situ and IR remote sensing measurements. IUGG Symposium on Cloud Microphysics, July, Perugia, Italy.

Mitchell, D.L., A.J. Baran, W.P. Arnott and C. Schmitt, 2007: A flexible analytical interface between the microphysical and radiative properties of ice clouds. IUGG Symposium on Aerosol-Cloud-Climate Interactions, July, Perugia, Italy.

Mitchell, D.L., and R. P. d'Entremont, 2008: Supplying satellite estimates of IWP and cirrus size distribution retrievals to the GCM community. 13th Annual CCSM Workshop, Breckenridge, CO, 17-19 June 2008.

Mitchell, D.L., S. Mishra and R.P. Lawson, 2011: Modification of cirrus clouds to reduce global warming: New findings. American Geophysical Union, Fall Meeting, San Francisco, California, 5-9 December 2011.

Mitchell, D. L., Mejia, J. F., Xiao, M., Rasch, P. J., Kuebbeler, M., 2012: Cirrus Cloud Climate Engineering, International Conference on Clouds and Precipitation (ICCP): Leipzig, Germany, July 30, 2012-August 3, 2012.

Erfani, E., Mitchell, D. L., Ivanova, D. C., Lavin, M., 2012: Dependence of the North American monsoon on Pacific Ocean eastern boundary currents, Paper presented: AGU 2012 Fall Meeting: San Francisco, CA, December 3, 2012.

Mitchell, D. L., Mejia, J. F., Kuebbeler, M., Lohmann, U., Xiao, M., 2013: Seeding of Cirrus Clouds to Reduce Global Warming, 19th Conference on Planned and Inadvertent Weather Modification, 93rd American Meteorological Society Annual Meeting: Austin, TX, January 6, 2013.

Mitchell, D. L., Lance, S., Lawson, R. P., 2013: Improving the Ice Optics in CAM5: Treatment of the Asymmetry Parameter, Oral presentation, Atmosphere Model Working Group, NCAR: Boulder, CO, February 10, 2013.

Erfani, E., Mitchell, D. L., Ivanova, D., 2013: A Mechanism for the Impact of Gulf of California Sea Surface Temperature on North American Monsoon, Poster presentation, Atmospheric System Research (ASR) 2013 Science Team Meeting: Potomac, MD, March 18, 2013.

Erfani, E., Mitchell, D. L., Ivanova, D., 2013: North American Monsoon: Progress Toward a Mechanistic Understanding, Poster presentation, 18th Annual CESM Workshop: Breckenridge, CO, June 17, 2013.

Erfani, E., Mitchell, D. L., Ivanova, D., 2013: Mechanisms Governing the Onset, Extent and Strength of the North American Monsoon, Poster presentation, 14th Annual WRF Workshop: Boulder, CO, June 24, 2013.

Erfani, E., Mitchell, D. L., Ivanova, D., 2013: Toward a Mechanistic Understanding of the Onset and Extent of the North American Monsoon, Poster presentation, Gordon Research Conference and Gordon Research Seminar on Radiation and Climate: New London, NH, July 6, 2013.

- Mitchell, D. L., Mejia, J. F., Kuebbeler, M., Lohmann, U., Mishra, S., Comstock, J., 2013: Constraining the Negative Twomey Effect for Cirrus Clouds, Poster presentation, Gordon Research Conference: Radiation and Climate: New London, NH, July 6, 2013.
- Erfani, E., Mitchell, D. L., 2013: Mechanisms for the onset and evolution of North American monsoon, 38th NOAA Climate Diagnostics and Prediction Workshop Special Issue, Climate Prediction S & T Digest, NWS Science & Technology Infusion Climate Bulletin Supplement: College Park, MD, October 21, 2013.
- Erfani, E., Mitchell, D. L., 2013: Air-sea interaction in the Gulf of California and its effect on the North American Monsoon, Oral presentation, Atmospheric System Research (ASR) 2013 Fall Meeting: Rockville, MD, November 4, 2013.
- Mitchell, D. L., Mejia, J. F., Lohmann, U., Kuebbeler, M., Mishra, S., Comstock, J., Rasch, P., 2013: Microphysical and radiative impacts of the cirrus cloud negative Twomey effect in two GCMs based on SPARTICUS data, Oral presentation, Atmospheric System Research (ASR) 2013 Fall Working Groups, Washington, D.C., November 4, 2013.
- Erfani, E., Mitchell, D. L., Ivanova, D., Lavin, M., 2013: Poster presentation, AGU Fall Meeting: San Francisco, CA, December 9, 2013.
- Mitchell, D. L., Erfani, E., Mishra, S., 2013: Convergence on ice particle mass- and area-dimensional expressions for ice clouds, Poster presentation, AGU Fall Meeting: San Francisco, CA, December 9, 2013.
- Mitchell, D. L., S. Mishra, J. Comstock, U. Lohmann, M. Kuebbeler, J. Mejia, D. Turner and P. Rasch, 2014: Relevance of the negative Twomey effect for cirrus clouds. 94th Annual Meeting of the American Meteorological Society, Atlanta, Georgia, 6 February 2014.
- Mitchell, D. L., Erfani, E., 2014: Parameterizing Ice Particle Mass and Area in Ice Clouds: Towards a Self-consistent Treatment of Ice Microphysics and Radiation, Atmospheric Model Working Group, NCAR: Boulder, CO, February 10, 2014.
- Mitchell, D. L., Erfani, E., 2014: Ice particle mass- and area-dimensional expressions for cirrus clouds: A proposed strategy, ASR Annual Meeting: Potomac, MD, March 10, 2014.
- Mitchell, D. L., 2014: Globally mapping regions of homo- and heterogenous nucleation as a function of latitude and season: A potential strategy using CALIPSO, ASR Annual Meeting: Potomac, MD, March 10, 2014.
- Mitchell, D. L., Erfani, E., Mishra, S., 2014: Developing and bounding ice particle mass- and area-dimensional expressions for use in atmospheric models and remote sensing, ASR Annual Meeting: Potomac, MD, March 10, 2014.
- Erfani, E., Mitchell, D. L., 2014: Improving a Snow Growth Model with Application to Radar Quantitative Precipitation Estimates, AMS Conference on Cloud Physics: Boston, MA, July 6, 2014.
- Mitchell, D. L., Avery, M. A., Garnier, A., 2014: Inferred Differences in Ice Crystal Nucleation Rates between Continental and Maritime Deep Convective Clouds, Presentation, 2014 AGU Fall Meeting: San Francisco, CA, December 15, 2014.
- Erfani, E., Mitchell, D. L., 2015: Evolution of Snow-sized Spectra by the Growth Processes of vaport Deposition, Aggregation and Riming, Paper, 95th AMS Annual Meeting: Phoenix, AZ, January 5, 2015.
- Mitchell, D. L., 2015: On the ethics of climate engineering: An overlooked question?, Joint session on Human Alteration of Climate: Engineering, Ethics, and Politics, 95th AMS Annual Meeting,

- 20th Conference on Planned and Inadvertent Weather Modification, and the Seventh Symposium on Aerosol: Phoenix, AZ, January 5, 2015.
- Ivanova, D., Mitchell, D. L., 2015: WRF and MM5 Modeling of the 1999 North American Monsoon Onset and the Las Vegas Flood, Paper, 95th AMS Annual Meeting: Phoenix, AZ, January 7, 2015.
- Mitchell, D. L., Avery, M. A., Garnier, A., 2015: Inferred Differences in Ice Crystal Nucleation Rates between Continental and Maritime Deep Convective Clouds., Joint session on Human Alteration of Climate: Engineering, Ethics, and Politics, 95th AMS Annual Meeting and Seventh Symposium on Aerosol, Cloud, Climate Interactions: Phoenix, AZ, January 7, 2015.
- Mitchell, D. L., Garnier, A., Avery, M., 2015: Evidence of More Frequent Homogeneous Ice Nucleation During Arctic Winter, ASR Annual Meeting: Vienna, VA, March 16, 2015.
- Mitchell, D. L., Garnier, A., Avery, M., 2015: New Physical Understanding of Satellite Retrieved Effective Absorption Optical Depth Ratios, ASR Annual Meeting: Vienna, VA, March 16, 2015.
- Mitchell, D. L., Garnier, A., Avery, M., 2015: On the feasibility of cirrus cloud thinning: Dependence of homo- and heterogeneous ice nucleation as a function of latitude and season, Climate engineering: new insights from (Solar) Radiation Management studies, European Geosciences Union General Assembly: Vienna, Austria, April 12, 2015.
- Erfani, E., Mitchell, D. L., 2015: Progress in representing microphysical processes in a mixed-phase snow growth model, International Union of Geophysics and Geodesy (IUGG), 26th IUGG General Assembly: Prague, Czech Republic, June 22, 2015-July 2, 2015.
- Erfani, E., Mitchell, D. L., Avery, M., 2015: A partial mechanistic understanding of the North American monsoon, International Union of Geophysics and Geodesy (IUGG), 26th IUGG General Assembly: Prague, Czech Republic, June 22, 2015-July 2, 2015.
- Erfani, E., Mitchell, D. L., Avery, M., 2015: The role of coastal mid-latitude air-sea interactions in exporting tropical energy to N. America during summer, International Union of Geophysics and Geodesy (IUGG), 26th IUGG General Assembly: Prague, Czech Republic, June 22, 2015-July 2, 2015.
- Mitchell, D. L., Garnier, A., Avery, M., 2015: The seasonal dependence of climate on high latitude cirrus clouds, International Union of Geophysics and Geodesy (IUGG), 26th IUGG General Assembly: Prague, Czech Republic, June 22, 2015-July 2, 2015.
- Mitchell, D. L., Garnier, A., Avery, M., 2015: Cirrus cloud thinning: Do the right conditions exist, and how can it be tested with observations?, Our Common Future Under Climate Change International Scientific Conference: Paris, France, July 7, 2015.
- Mitchell, D. L., Garnier, A., Avery, M., Erfani, E., 2015: Satellite remote sensing of the dependence of homogeneous ice nucleation on latitude and season, 2015 AGU Fall Meeting: San Francisco, CA, December 14, 2015.
- Mitchell, D., A. Garnier, M. Avery and E. Erfani, 2016: The seasonal, latitude, temperature and surface roughness dependence of homogeneous ice nucleation. 96th AMS Annual Meeting, [Eighth Symposium on Aerosol-Cloud-Climate Interactions](#), session on “Aerosol Impacts on Cirrus Clouds”, New Orleans, Louisiana, 11-15 Jan. 2016.

INVITED SEMINARS

- Mitchell, D.L., 1993: Modeling the microphysical and radiative properties of cirrus clouds. *Earth and Environmental Sciences Division, Los Alamos National Laboratory, New Mexico, April.*

- Mitchell, D.L., 1993: The effect of ice crystal morphology on the radiative properties of cirrus clouds. *University of California's Institute for Cooperative Research Conference, Scripts Institute of Oceanography*, May, LaJolla, California.
- Mitchell, D.L., 1993: Ice crystal morphology and its effect on optical depth and albedo in cirrus clouds. *Meteorological Research Institute*, Tsukuba, Japan, July.
- Mitchell, D.L., 1994: Ice crystal morphology and its effect on the radiative properties of cirrus clouds. *Department of Meteorology, Pennsylvania State University*, January, University Park, Pennsylvania.
- Mitchell, D.L., 1994: Modeling the microphysical and radiative properties of cirrus clouds. *ECMWF/GEWEX Cloud System Study workshop*, Reading, England, Oct. 31 - Nov. 4, 1994.
- Mitchell, D.L., 1994: A new treatment for predicting the radiative properties of cirrus clouds, with application to remote sensing. *United Kingdom Meteorological Office*, Bracknell, England, November 1.
- Mitchell, D.L., 1994: Modeling the microphysical and radiative properties of cirrus clouds. *University of Uppsala*, Sweden, November.
- Mitchell, D.L., 1994: Modeling the microphysical and radiative properties of cirrus clouds. *Stockholm University*, Sweden, November.
- Mitchell, D.L., 1994: Modeling the microphysical and radiative properties of cirrus clouds. *University of Oslo*, Norway, November.
- Mitchell, D.L., M. Wetzell and A. Macke, 1995: New potentials in satellite remote sensing, using a unique treatment of cirrus cloud radiative properties. *International Association for Meteorology and Atmospheric Science (IAMAS)*, as part of the International Union of Geodesy and Geophysics (IUGG) XXI General Assembly, July 2-14, 1995. Title of session: ISCCP and Regional Experiments: Studies of Cloud Radiation Interaction. (Invited talk)
- Mitchell, D.L., J.E. Kristjansson and A. Macke, 1996: Advances in understanding cirrus cloud radiative properties and their potential impact on climate. *University of Oslo*, Norway, August.
- Mitchell, D.L., and A. Macke, 1996: Advances in understanding cirrus cloud radiative properties. *23rd October Royal Meteorological Society Physical Processes Group at the Royal Society, CIRRUS MODELLING AND CRYSTAL PROPERTIES.*, October, London, U.K.
- Mitchell, D.L., and A. Macke, 1996: Representing atmospheric ice in GCMs: Why should we care? *United Kingdom Meteorological Office, Hadley Centre for Climate Prediction and Research*, 17 September, Bracknell, U.K.
- Mitchell, D.L., and A.J. Baran, 1996: Remote sensing in the thermal infrared: Different physics for water and ice? *Laboratoire de Meteorologie Dynamique (LMD), Ecole Polytechnique, France*, November.
- Mitchell, D.L., and T. Brown, 1996: Role of the eastern Pacific warm pool in the Mexican Monsoon. *University of Reading*, United Kingdom, November.
- Mitchell, D.L., and A. Macke, 1996: Advances in understanding cirrus cloud radiative properties. *Institute of Atmospheric Physics, GKSS Forschungszentrum*, Germany, December.
- Mitchell, D.L., and A. Macke, 1996: Advances in understanding cirrus cloud radiative properties. *Institut fuer Meereskunde, Abteilung Maritime Meteorologie, Universitaet zu Kiel*, Germany, December.

- Mitchell, D.L., J.M. Edwards, and J.E. Kristjansson, 1997: Treatment of non-spherical ice in GCMs: Impact on global albedo, OLR and heating rates. *National Center for Atmospheric Research*, Boulder, Colorado, July.
- Mitchell, D.L., J.M. Edwards, P.N. Francis, and A.J. Baran, 1998: A comprehensive system for treating absorption and extinction in ice clouds, with application to satellite remote sensing and global climate modeling. *NASA Langley Research Center*, Hampton, Virginia, November.
- Mitchell, D.L., D. Ivanova and T. Brown, 1999: Sea surface temperatures and the North American Monsoon: Mechanistic Implications. *United Kingdom Meteorological Office, Hadley Centre for Climate Prediction and Research*, 20 July.
- Mitchell, D.L., D. Ivanova and W.P. Arnott, 1999: Parameterizing bimodal size spectra in large scale models: Possible radiative differences between tropical and mid-latitude cirrus. *European Centre for Medium Range Weather Forecasting*, 22 July.
- Mitchell, D.L., D. Ivanova, R. Rabin and K. Redmond, 2000: Sea surface temperatures and the North American Monsoon: Mechanistic Implications. *Scripps Institution of Oceanography*, 18 October.
- Mitchell, D.L., D. Ivanova, R. Rabin and K. Redmond, 2000: Sea surface temperatures and the North American Monsoon: Mechanistic Implications. *Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE)*, 20 October.
- Mitchell, D.L., R.P. d'Entremont, D.H. DeSlover, W.P. Arnott and A.J. Baran, 2002: Multi-spectral thermal retrievals of size distribution shape, effective size, ice water path and photon tunneling contribution to absorption. *University of Oslo, Norway*, 13 May 2002.
- Mitchell, D.L., D. Ivanova, Miguel Lavín and B. Hall, 2003: A possible ocean-atmosphere mechanism for the Arizona onset of the North American monsoon. Workshop on the North American Monsoon Experiment (NAME): Oceanographic Component. *Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE)*, 21 April 2003.
- Mitchell, D.L., D. Ivanova, B. Hall, Miguel Lavín and A. Mascarenhas, Jr., 2003. Predicting the onset of the North American monsoon and progress toward a mechanistic understanding. National Center for Atmospheric Research (NCAR), 27 June 2003.
- Mitchell, D.L., R.P. d'Entremont, D. DeSlover and A.J. Baran, 2005: Characterizing Particle Size, Water Path, and Photon Tunneling in Ice and Water Clouds. Invited talk for CIRA, 16 June 2005.
- Mitchell, D.L., D. DeSlover, P.J. Rasch and R.P. d'Entremont, 2005: Cirrus Cloud Size Distributions and the Impact of Measurement Uncertainties on Radiation. Invited talk for the Air Force, Hanscom AFB, Massachusetts, 27 May 2005.
- Mitchell, D.L., and Robert P. d'Entremont, 2007: Satellite remote sensing of controversial small ice crystals in cirrus clouds. Guest speaker at Dept. of Atmospheric Sciences, Texas A & M University, College Station, Texas.
- Mitchell, D.L., and S. Mishra, 2011: Engineering of cirrus clouds to reduce global warming. International Union of Geophysics and Geodesy (IUGG), IUGG XV General Assembly, "Earth on the edge: Science for a Sustainable Planet", 28 June – 7 July 2011, Melbourne, Australia. Invited by steering committee of Union Session U-06: Geoengineering: What are the Potentials for Climate Intervention, Carbon Scrubbing, and other Approaches to Moderate Climate Change and its Impacts?
- Mitchell, D.L., 2012: Manipulating cirrus clouds. IMPLICC Final Symposium: The Atmospheric Science and Economics of Climate Engineering via Aerosol Injections, Max Planck Institute for Chemistry, Mainz, Germany, 14-16 May 2012.

- Mitchell, D.L., E. Erfani, D. Ivanova, M. F. Lavin, and A. S. Mascarenhas, Jr., 2013: Progress towards a mechanistic understanding of the North American monsoon. Guest speaker for seminar program at the National Weather Center, Norman Oklahoma.
- Mitchell, D. L., 2014: An overview of cirrus cloud thinning and determining its scientific feasibility, Invited talk. Climate Engineering Conference 2014, Critical Global Discussions: Berlin, Germany, August 18, 2014
- Mitchell, D. L., 2014: Evolution of the North American monsoon: Potential large- and small-scale mechanism, Invited talk, Pennsylvania State University, Dept. of Meteorology seminar series: University Park, PA, December 10, 2014
- Mitchell, D. L., 2015: Dependence of global sustainability on the degree of fear and aspiration. A Mindset for the Anthropocene project, Invited talk. Institute for Advanced Sustainability Studies (IASS): Potsdam, Germany, July 14, 2015
- Mitchell, D. L., 2015: Local vs Large-Scale Forcing and NAM Variability, Invited talk, Panelist. 3rd Annual Regional Climate and Meteorology Meeting for Northwest Mexico and the Southwest U.S.: Centro de Ciencias de la Atmósfera, UNAM, Mexico City, June 4, 2015
- Mitchell, D. L., 2015: What do the models need to get right?, Invited talk, Panelist. 3rd Annual Regional Climate and Meteorology Meeting for Northwest Mexico and the Southwest U.S.: Centro de Ciencias de la Atmósfera, UNAM, Mexico City, June 4, 2015
- Mitchell, D. L., Erfani, E., Ivanova, D., Avery, M., 2015: Observational and Modeling Evidence for both Local- and Large-scale NAM Mechanisms, Invited talk. 3rd Annual Regional Climate and Meteorology Meeting for Northwest Mexico and the Southwest U.S.: Centro de Ciencias de la Atmósfera, UNAM, Mexico City, June 4, 2015
- Mitchell, D. L., Garnier, A., Avery, M., 2015: On the feasibility of cirrus cloud thinning: Dependence of homo- and heterogeneous ice nucleation on latitude and season, Invited talk. International Union of Geophysics and Geodesy (IUGG), 26th IUGG General Assembly: Prague, Czech Republic, June 22, 2015-July 2, 2015
- Mitchell, D. L., Garnier, A., Avery, M., 2015: Cirrus cloud thinning: Do the right conditions exist, and how can it be tested with observations?, Invited talk. Workshop 1. Solar Radiation Management: Foresight for Governance (SRM4G): Institute for Advanced Sustainability Studies (IASS), Potsdam, Germany, July 13, 2015.