DAVID L. MITCHELL
Associate Research Professor
Division of Atmospheric Sciences (DAS), Desert Research Institute (DRI)

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

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.

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 lead to a new treatment of ice cloud radiative properties which is used in (i) the GCM and operational forecast model at the Hadley Centre/U.K. Meteorological Office, (ii) in the new NCAR GCM (CCSM4), (iii) 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) at Atmospheric and Environmental Research (AER), Inc.

Regarding (3), a new method for estimating the amount of ice contained in clouds (i.e. the ice water path, or IWP) from satellite- or ground-based platforms has been developed, based on the heat emitted by the earth at discrete wavelengths. The method considers the details of the size distribution and ice particle shape and delivers IWP estimates accurate to within ± 15%.

Regarding (4), a new approach to understanding the Mexican monsoon has been pursued in terms of sea surface temperatures (SSTs) in the eastern tropical Pacific and the Gulf of California. Results from six monsoon seasons show that relatively heavy rainfall in Arizona commences once the SST in the northern Gulf of California exceeds 29 ^{o}C. Moreover, ten years of satellite altimeter observations of sea surface height in the eastern tropical Pacific indicate this threshold SST can be predicted 1-2 months in advance. Together these relationships provide a means of predicting the Arizona onset of the North American monsoon 1-2 months in advance.

PROFESSIONAL ACTIVITIES:

Member, Atmospheric Radiation Measurement Program Science Team
Member, GEWEX Cloud System Study, Cirrus Working Group
Committee Chairman, AMS Committee on Cloud Physics
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.

Mitchell, D.L. and R.D. Borys, 1991: A field instrument for examining in-cloud scavenging mechanisms by snow. In *Precipitation Scavenging and Atmosphere-Surface Exchange*, Vol. 1, Precipitation Scavenging Processes, Ed. S.E. Schwartz and W.G.N. Slinn, Hemisphere Publishing Corp., 239-253.

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.

Borys, R.D., D. Del Vecchio, J.L. Jaffrezo and D.L. Mitchell, 1994: Assessment of ice particle growth processes at Dye-3 Greenland. Atmos. Environ., 27A, 2815-2822.

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.

Macke, A., D.L. Mitchell, and L.V. Bremen, 1999: Monte Carlo radiative transfer calculations for inhomogeneous mixed phase clouds. *Phys. Chem. Earth (B)*, **24**, 237-241.

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, 1999: 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, Measurements and Applications*, AMS, August 28 - September 1, 2000, Halifax, Nova Scotia, Canada.

Mitchell, D.L., W. Patrick Arnott, C. Schmitt, A.J. Baran, S. Havemann and Q. Fu, 2001: Photon tunneling contributions to extinction for laboratory grown hexagonal columns. *J. Quant. Spectroscopy & Radiation Trans*., **70**, 761-776.

Ivanova, D.C., D.L. Mitchell, W. Patrick Arnott and M. Poellot, 2001: A GCM parameterization for bimodal size spectra and ice mass removal rates in mid-latitude cirrus clouds. *Atmos. Res.*, **59**, 89-113.

Mitchell, D.L., 2002: Effective diameter in radiation transfer: General definition, applications and limitations. *J. Atmos. Sci*, **59**, 2330-2346.

Platt, C.M.R., R.T. Austin, S.A. Young, and D.L. Mitchell, 2002: LIRAD observations of tropical cirrus clouds in MCTEX. Part I: Optical properties and detection of small particles in cold cirrus. *J. Atmos. Sci*., **59**, 3145-3162..

Mitchell, D.L., D. Ivanova, R. Rabin, K. Redmond, and T.J. Brown, 2002: Gulf of California sea surface temperatures and the North American monsoon: Mechanistic implications from observations. *J. Climate*, **15**, 2261-2281.

Mitchell, D.L., R.P. d'Entremont, D.H. DeSlover, and W.P. Arnott, 2002: Remote Sensing Answers for Ice Cloud Questions. *Bull. Amer. Meteor. Soc*., **83**, NOWCAST section, 845-846.

Mitchell, D.L., D. Ivanova, R. Rabin, K. Redmond, and T.J. Brown, 2002: Relating sea surface temperatures to the North American monsoon. *Bull. Amer. Meteor. Soc*., **83**, NOWCAST section, 1454.

Iacobellis, S.F., G.M. McFarquhar, D.L. Mitchell, and R.C.J. Somerville, 2003: On the sensitivity of radiative fluxes to parameterized cloud microphysics. *J. Climate*, **16**, 2979-2996.

Radel, G., C.J. Stubenrauch, R. Holz and D.L. Mitchell, 2003: Retrieval of effective ice crystal size in the infrared: Sensitivity study and global measurements from TIROS-N operational vertical sounder. *J. Geophys. Res*., **108**(D9), 4281, doi:10.1029/2002JD002801.

Mitchell, D.L., and A.J. Heymsfield, 2005: Refinements in the treatment of ice particle terminal velocities, highlighting aggregates. *J. Atmos. Sci*., **62**, 1637-1644.

Mitchell, D.L., A. Huggins, V. Grubisic, 2006: A new snow growth model with application to radar precipitation estimates. *Atmos. Research*., in press.

Mitchell, D.L., A.J. Baran, W.P. Arnott and C. Schmitt, 2006: Testing and comparing the modified anomalous diffraction approximation. Accepted for publication in *J. Atmos. Sci*.

CONFERENCE PUBLICATIONS:

Lamb, D., D. Mitchell and R. Blumenstein, 1986: Snow chemistry in relation to precipitation growth forms. Preprints, AMS Conference on Cloud Physics, Snowmass, Colorado, 77-80.

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.

Mitchell, D.L., K. Sassen, W.P. Arnott, Y. Dong and J. Hallett, 1993: Are tropical cirrus brighter than mid-latitude cirrus? FIRE Cirrus Science Results 1993, NASA Conference Publication 3238. Proceedings of a conference held in Breckenridge, Colorado, June 14-17, 1993, 205-208.

Mitchell, D.L., J.E. Kristjansson and M.J. Newman, 1994: Sensitivity of cirrus cloud radiative properties to ice crystal size and shape in GCM simulations, Preprints, Eighth Conference on Atmospheric Radiation, AMS, Nashville, Tennessee, January 23-28, 1994, 552-554.

Mitchell, D.L., 1995: A simple expression for accurately calculating precipitation fallspeeds for any particle type. Preprints, Conference on Cloud Physics, AMS, Dallas, Texas, January 15-20, 1995, 46-49.

Mitchell, D.L., 1995: Predicting the radiative properties of cirrus clouds. ECMWF/GEWEX Cloud System Study workshop proceedings, *Modelling, Validation and Assimilation of Clouds*, Reading, England, Oct. 31 - Nov. 4, 1994, 361-374.

Mitchell, D.L., 1995: How appropriate is Mie theory for predicting the radiative properties of atmospheric particles? GEWEX News, World Climate Research Programme, **5**, No. 1 (February), 7-11.

Baran, A.J., D.L. Mitchell, and J.S. Foot, 1995: Interpreting HIRS level 1B observations of cirrus using the 8.3 μm channel: Mie or ADT? Proceedings, 8th International TOVS Study Conference, 5-11 April 1995, Queenstown, New Zealand, 21-31.

Baran, A.J., S.J. Brown, D.L. Mitchell, J.S. Foot and A. Macke, 1995: Cirrus properties using ATSR and the potential of ATSR-2/AATSR. Conf. on Remote Sensing - details forthcoming.

Mitchell, D.L., D. Koracin, and E. Carter, 1995: Radiative properties of ice clouds. ARM Science Meeting, San Diego, March 27-30, 1995. In press.

Kristjansson, J.E., P.J. Rasch, D.L. Mitchell, 1995: GCM Simulations using prognostic cloud water with a special focus on cirrus clouds. Workshop on *Cloud Microphysics Parameterizations in Global Atmospheric Circulation Models*, October, 1995, WCRP-90, WMO/TD-No. 713, 189-198.

Baran, A.J., S.J. Brown, D.L. Mitchell, J.S. Foot and A. Macke, 1995: Cirrus properties using ATSR and the potential of ATSR-2/AATSR. In proceedings, *Passive Remote Sensing of Clouds and the Atmosphere III*, 25-27 September 1995, Paris, France, Ed. D.K. Lynch and E.P. Shettle, 110-121.

Mitchell, D.L. and T.J. Brown, 1996: The role of the eastern Pacific "warm pool" in the Mexican monsoon. Preprints, *Symposium on Global Ocean-Atmosphere-Land-System (GOALS)*, 28 January - 2 February, 1996, Atlanta, Georgia, 352-353.

Mitchell, D.L. and Macke, A., 1996: A new treatment of cirrus cloud radiative properties. Preprints, Second International Scientific Conference on the Global Energy and Water Cycle, 17-21 June 1996, Washington D.C., 342-343.

Baran, A.J., P.D. Watts, J.S. Foot and D. Mitchell, 1996: Crystal size, shape and IWP retrieval using Along Track Scanning Radiometer observations of tropical anvil cirrus. Proc. International Radiation Symposium, 19-24 August 1996, Fairbanks, Alaska.

Kristjansson, J.E., D.L. Mitchell, P.J. Rasch, 1996: On the impact of sizes and shapes of ice crystals on the results of GCM simulations. Second International Scientific Conference on the Global Energy and Water Cycle, 17-21 June 1996, Washington, D.C., 400-401.

Baran, A.J., D.L. Mitchell, and J.S. Foot, 1996: Interpreting high resolution infrared sounder (HIRS) observations of cirrus using the 8 and 11 μm channels: Mie or ADT? In *IRS '96: Current Problems in Atmospheric Radiation*, Proceedings of the International Radiation Symposium, Fairbanks, Alaska, 19-24 August 1996, Ed. by William L. Smith and Knut Stamnes, 510-513.

Baran, A.J., P.D. Watts, J.S. Foot and D.L. Mitchell, 1996: Crystal size, shape and IWP retrieval using Along Track Scanning Radiometer observations of tropical anvil cirrus at 0.87 and 1.6 μm. In *IRS '96: Current Problems in Atmospheric Radiation*, Proceedings of the International Radiation Symposium, Fairbanks, Alaska, 19-24 August 1996, Ed. by William L. Smith and Knut Stamnes, 476-479.

Mitchell, D.L., and A. Macke, 1996: A new treatment of cirrus cloud radiative properties. In *IRS '96: Current Problems in Atmospheric Radiation*, Proceedings of the International Radiation Symposium, Fairbanks, Alaska, 19-24 August 1996, Ed. by William L. Smith and Knut Stamnes, 163-166.

Brown, T.J., and D.L. Mitchell, 1997: The role of eastern Pacific sea surface temperatures in the Mexican monsoon. Seventh Conference on Climate Variations, 2-7 February 1997, Long Beach, California, 103-107.

Mitchell, D.L., J.M. Edwards and P.N. Francis, 1997: GCM sensitivity of globally averaged albedo and OLR to ice crystal shape. ARM Science Meeting, San Antonio, Texas, 3-7 March 1997.

Mitchell, D.L., and S.K. Chai, 1998: The potential dependence of ice nucleation rates on crystal shape. Preprints, *Conf. on Cloud Physics and 14th Conf. on Planned and Inadvertent Weather Modification*, 17-21 August 1998, Everett, Washington, 60-63.

Mitchell, D.L., and S.K. Chai, 1998: A new cloud seeding conceptual model. Preprints, *Conf. on Cloud Physics and 14th Conf. on Planned and Inadvertent Weather Modification*, 17-21 August 1998, Everett, Washington, 612-615.

Mitchell, D.L., and C.M.R. Platt, 1998: Microphysical interpretation of LIRAD extinction/absorption ratios using a microphysics-radiation scheme. Proceedings of the 8th ARM Science Team Meeting, Tucson, Arizona, 495-498.

Mitchell, D.L., D. Ivanova, G.M. McFarquhar, and A. Macke, 1998: Testing a cirrus radiation scheme with in situ microphysical and radiometric measurements from a tropical cirrus anvil. Proceedings of the 8th ARM Science Team Meeting, Tucson, Arizona, 499-502.

Mitchell, D.L. 1998: Parameterizing the extinction and absorption coefficients in ice clouds: A process oriented approach. Preprints, *Conf. on Light Scattering by Nonspherical Particles: Theory, Measurements and Applications*. 29 Sept.-1 Oct. 1998, New York, New York , 40-43.

Mitchell, D.L., G.M. McFarquhar, D. Ivanova and A. Macke, 1998: Testing an ice cloud radiation scheme with tropical anvil and mid-latitude case studies: Scattering implications. Preprints, *Conf. on Light Scattering by Nonspherical Particles: Theory, Measurements and Applications*. 29 Sept.-1 Oct. 1998, New York, New York, 313-316.

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, Wisconson.

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.

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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).

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Mitchell, D.L., A. Huggins and V. Grubisic, 2004: A new snow growth model with applicationto radar precipitation estimates. Proceedings, Vol. 1, 14th International Conference on Clouds and Precipitation, Bologna, Italy, 19-23 July 2004, 313-316.

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 catagories: 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. Lavín, 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. Lavín, 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. Lavín, 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.

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, Pennsylvannia State University*, January, University Park, Pennsylvannia.

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.

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