Curriculum Vitae (March 28, 2017)

CHRISTOPHER STEPHEN BRETHERTON

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Education

Ph. D., Massachusetts Institute of Technology, Mathematics, September 1984
Thesis Title: *A Mathematical Model of Moist Convection*
B. S., California Institute of Technology, Applied Mathematics, June 1980

Professional Experience

1996-present	Professor of Atmospheric Science and Applied Mathematics, University of Washington.
2010-2012	Boeing Endowed Professor of Applied Mathematics, University of Washington
2006-2011	Director, University of Washington Program for Climate Change
2007-2008	Gastprofessor, Institute for Atmosphere and Climate, ETH-Zürich
2002-2005	Affiliate Scientist, Climate and Global Dynamics Division National Center for Atmospheric Research
2000-2001	Visiting Scientist, Climate and Global Dynamics Division National Center for Atmospheric Research
1989-1996	Associate Professor of Atmospheric Science and Applied Mathematics, University of Washington.
1992, 1994	Scientific consultant, European Center for Medium Range Weather Forecasting, Reading, England
1993	Visiting Scientist, Mesoscale and Microscale Meteorology Division, National Center for Atmospheric Research
1992	Houghton Visiting Professor, Department of Earth, Atmospheric Planetary Sciences, Massachusetts Institute of Technology.
1988-1989	Assistant Professor of Applied Mathematics and

	Atmospheric Science, University of Washington.
1985-1988	Assistant Professor of Applied Mathematics, University of Washington.
1984-1985	Postdoctoral Fellow, Advanced Study Program, National Center Atmospheric Research.

Professional Duties and Societies

Editor, *Journal of the Atmospheric Sciences*, 1/95-12/99.
Associate Editor, *Journal of Advances in Modeling Earth Systems*, 1/16-present

Member and Fellow, American Meteorological Society. Have served on AMS Committees on Waves and Stability (1989-1991, 1996-1998, as chair and conference chair 1997-8), Mesoscale Meteorology conference co-chair in 1992, Haurwitz Prize Selection Committee, 1993-1994, Fellows Selection Committee 2006-2009 and on the program committee of the AMS-sponsored Second International Air-Sea Interaction Conference, Lisbon, September 1994, AMS Research Awards Committee 2014-2017

Member and Fellow, American Geophysical Union. AGU Atmospheric Sciences Junior/Ascent Awards Committee, 1/17-present.

IPCC WG1 Fifth Assessment Lead Author, Chapter 7, Clouds and Aerosols (2013)

National Research Council study chair: *A National Strategy for Advancing Climate Modeling* (2012)

National/International Committees and Science Teams (only current activities listed)

Co-Chair, Cloud Feedbacks Model Intercomparison Project (CFMIP), 6/13-present.
University Corporation for Atmospheric Research (UCAR) Board of Trustees, 10/14-present.
UMAC (UCAR Community NCEP Modeling Advisory Committee), 3/15-present
AMS Research Awards Committee 2014-present.
Southern Ocean (SOCRATES) Scientific Steering Group, 5/13-present

Honors and Fellowships

Fellow, Mesoscale Meteorology Summer Program	
National Center for Atmospheric Research	1984
Postdoctoral Fellow, Advanced Study Program	
National Center for Atmospheric Research	1984-1985
National Science Foundation Presidential Young Investigator in Atmospheric Science	1988-1994
American Meteorological Society Editor's Award	
UW Department of Atmospheric Sciences Annual Teaching Award	2001-2002
Elected Fellow of the American Meteorological Society	Jan. 2004
American Meteorological Society Jule G. Charney Award	Jan. 2012
American Geophysical Union Reviewer Award (for *JAMES*)	Mar. 2015

Elected Fellow of the American Geophysical Union Jul. 2015

Refereed Papers and Book/Monograph Chapters

Bretherton, C. S., 1983: Intermittency through modulational instability. *Phys. Lett.* **96A**, 152-156.

Bretherton, C. S., and A. O. Steinhardt, 1983: Some new results on Butterworth filters. *IEEE Trans. Acoustics, Speech, Signal Proc.*, **31**, 1576-1577.

Bretherton, C. S., 1987: A theory for nonprecipitating moist convection between two parallel plates. Part I: Thermodynamics and 'linear' solutions. *J. Atmos. Sci.*, **44**, 1809-1827.

Bretherton, C. S., 1987: A note on linear propagating nonprecipitating convection. *J. Atmos. Sci.*, **44**, 1869-1874.

Pfeffer, W. T., and C. S. Bretherton, 1987: The effect of crevasses on the solar heating of a glacier surface. *The Physical Basis of Icesheet Modelling* (Proceedings of the Vancouver Symposium, August, 1987) IAHS Publication 170, 191-205.

Bretherton, C. S., 1987: Analytical solutions to Emanuel's model of precipitating convection. *J. Atmos. Sci.*, **44**, 3355-3362.

Levy, G. , and C. S. Bretherton, 1987: Comments on a theory of the evolution of an observed cold front. *J. Atmos. Sci.*, **44**, 3413-3418.

Bretherton, C. S., 1988: Group velocity and the linear response of stratified fluids to internal heat or mass sources. *J. Atmos. Sci.*, **45**, 81-93.

Bretherton, C. S., 1988: A mathematical model of nonprecipitating convection between two parallel plates. Part II: nonlinear theory and cloud organization. *J. Atmos. Sci.*, **45**, 2391-2415.

Bretherton, C. S., and P. K. Smolarkiewicz, 1989: Gravity waves, compensating subsidence and detrainment around cumulus clouds. *J. Atmos. Sci.*, **46**, 740-759.

Siems, S. T., C. S. Bretherton, M. B. Baker, S. Shy and R. T. Breidenthal, 1990: Buoyancy reversal and cloudtop entrainment instability. *Quart. J. Roy. Meteor. Soc.*, **116**, 705-739.

Bretherton, C. S., 1991: Modelling the Lagrangian evolution of cloud-topped boundary layers. In *Physical Processes in Atmospheric Models*, D. R. Sikka and S. S. Singh, eds., 97-119 (book chapter, not peer reviewed)

Bretherton, C. S., C. Smith, and J. M. Wallace, 1992: An intercomparison of methods for finding coupled patterns in climate data. *J. Climate*, **5**, 541-560.

Wallace, J. M., C. Smith and C. S. Bretherton, 1992: Singular value decomposition of wintertime sea surface temperature and 500 mb height anomalies. *J. Climate*, **5**, 561-576.

Siems, S. T., and C. S. Bretherton, 1992: A numerical investigation of cloud-top entrainment instability and related experiments. *Quart. J. Roy. Meteor. Soc.*, **118**, 787-818.

Rand, H. A., and C. S. Bretherton, 1993: The relevance of the mesoscale entrainment instability to the marine cloud-topped atmospheric boundary layer. *J. Atmos. Sci.*, **50**, 1152-1158.

Bretherton, C. S., and C. Schär, 1993: Potential vorticity flux. A simple derivation and comments about uniqueness. *J. Atmos. Sci.*, **50**, 1834-1836.

Bretherton, C. S., 1993: Understanding Albrecht's model of trade-cumulus cloud fields. *J. Atmos. Sci.*, **50**, 2264-2283.

Siems, S. T., D. H. Lenschow, and C. S. Bretherton, 1993: A numerical study of the interaction between stratocumulus and the air overlying it. *J. Atmos. Sci.*, **50**, 3663-3676.

Pandya, R., D. Durran and C. S. Bretherton, 1993: Comments on 'Thermally forced gravity waves at rest'. *J. Atmos. Sci.*, **50**, 4097-4101.

Bretherton, C. S., 1993: The nature of adjustment in cumulus cloud fields. *Meteorological Monographs*, **24**, 63-74 (monograph chapter, peer-reviewed).

Emanuel, K. A., J. D. Neelin and C. S. Bretherton, 1994: On large-scale circulations in convecting atmospheres. *Quart. J. Roy. Meteor. Soc.*, **120**, 1111-1143.

Brown, R., and C. S. Bretherton, 1995: Tropical wave instabilities: Convective interaction with dynamics using the Emanuel cumulus parameterization. *J. Atmos. Sci.*, **52**, 67-82.

Albrecht, B. A., C. S. Bretherton, D. Johnson, W. Schubert and A. S. Frisch, 1995: The Atlantic Stratocumulus Transition Experiment (ASTEX), *Bull. Amer. Meteor. Soc.*, **76**, 889-903.

Bretherton, C. S., and R. Pincus, 1995: Cloudiness and marine boundary layer dynamics in the ASTEX Lagrangian experiments. Part I: Synoptic setting and vertical structure. *J. Atmos. Sci.*, **52**, 2707-2723.

Bretherton, C. S., Austin, P., and S. T. Siems, 1995: Cloudiness and marine boundary layer dynamics in the ASTEX Lagrangian experiments. Part II: Cloudiness, drizzle, surface fluxes and entrainment. *J. Atmos. Sci.*, **52**, 2724-2735.

Bretherton, C. S., E. Klinker, J. Coakley and A. K. Betts, 1995: Comparison of ceilometer, satellite and synoptic measurements of boundary layer cloudiness and the ECMWF diagnostic cloud parameterization scheme during ASTEX. *J. Atmos. Sci.*, **52**, 2736-2751.

Betts, A. K., C. S. Bretherton and E. Klinker, 1995: Relation between mean boundary layer structure and cloudiness at the R/V Valdivia during ASTEX. *J. Atmos. Sci.*, **52**, 2752-2762.

Emanuel, K., D. Raymond, A. Betts, L. Bosart, C. Bretherton, K. Droegemeier, B. Farrell, J. M. Fritsch, R. Houze, Jr., M. LeMone, D. Lilly, R. Rotunno, M. Shapiro, R. Smith and A. Thorpe, 1995: Report of the First Prospectus Development Team of the U. S. Weather Research Program to NOAA and the NSF. *Bull. Amer. Meteor. Soc.*, **76**, 1194-1208.

Noone, K. J., R. D. Schillawski, G. L. Kok, C. S. Bretherton and B. J. Huebert, 1996: Ozone in the marine atmosphere observed during the Atlantic Stratocumulus Transition Experiment/ Marine Aerosol and Gas Exchange. *J. Geophys. Res.*, **101**, 4485-4499.

Moeng, C.-H., W. R. Cotton, C. S. Bretherton, A. Chlond, M. Khairoutdinov, S. Krueger, W. S. Lewellen, M. K. MacVean, J. R. M. Pasquier, H. A. Rand, A. P. Siebesma, R. I. Sykes, and B. Stevens, 1996: Simulation of a stratocumulus-topped PBL: Intercomparison among different numerical codes. *Bull. Amer. Meteor. Soc.*, **77**, 261-278.

Grinnell, S. A., C. S. Bretherton, D. E. Stevens and A. M. Fraser, 1996: Vertical mass flux observations in Hawaiian trade cumulus clouds by Doppler radar. *J. Atmos. Sci.*, **53**, 1870-1886.

Stevens, D. E., and C. S. Bretherton, 1996: A new forward-in-time advection scheme and adaptive multilevel flow solver for nearly incompressible atmospheric flow. *J. Comp. Phys.*, **129**, 284- 295.

Bretherton, C. S., and M. C. Wyant, 1997: Moisture transport, lower tropospheric stability and decoupling of cloud-topped boundary layers. *J. Atmos. Sci.*, **54**, 148-167.

Wyant, M. C., C. S. Bretherton, H. A. Rand, and D. E. Stevens, 1997: Numerical simulations and a conceptual model of the stratocumulus to trade cumulus transition. *J. Atmos. Sci.*, **54**, 168-192.

Brown, R., and C. S. Bretherton, 1997: A test of the strict quasi-equilibrium theory on long time and space scales. *J. Atmos. Sci.*, **54**, 624-638.

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Sobel, A. H., and C. S. Bretherton, 1999: Development of synoptic-scale disturbances over the summertime tropical northwest Pacific. *J. Atmos. Sci.*, **56**, 3106-3217.

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Bretherton, C. S., and D. S. Battisti, 2000:. An interpretation of the results from atmospheric general circulation models forced by the time history of the observed sea surface temperature distribution. *Geophys. Res. Lett.*, **27**, 767-770.

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Moskowitz, B. M., and C. S. Bretherton, 2000: An analysis of frictional feedback in the Madden-Julian Oscillation. *J. Atmos. Sci.*, **57**, 2188-2206.

Widmann, M., and C. S. Bretherton, 2000: Validation of mesoscale precipitation in the NCEP reanalysis using a new gridpoint dataset for the northwestern US. *J. Climate*, **13**, 1936-1950.

Beesley, T. A., C. S. Bretherton, C. Jakob, E. L Andreas, J. M. Intrieri, and T. A. Uttal, 2000: A comparison of the ECMWF forecast model with observations at SHEBA, *J. Geophys. Res.,* **105**, 12337-12349.

Coakley, J.A., P.A. Durkee, K. Nielsen, J.P. Taylor, S. Platnick, B.A. Albrecht, D. Babb, F-L. Chang, W.R. Tahnk, C.S. Bretherton, and P.V. Hobbs, 2000: The appearance and disappearance of ship tracks on large spatial scales. *J. Atmos. Sci.*, **57**, 2765-2778.

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Grenier, H. and C. S. Bretherton, 2001: A moist PBL parameterization for large-scale models and its application to subtropical cloud-topped marine boundary layers. *Mon. Wea. Rev.*, **129**, 357-377.

Carr, M. T., and C. S. Bretherton, 2001 Budget calculations of convective momentum transport over the tropical Pacific. *J. Atmos. Sci.*, **58**, 1673-1693.

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Wood, R., C. S. Bretherton, and D. L. Hartmann, 2002: Diurnal cycle of liquid water path over the subtropical and tropical oceans. *Geophys. Res. Lett.*, **29**(23),,2092, doi:10.1029/2002GL015371.

Cullen, A. C., and C. S. Bretherton, 2002: Progressing toward environmental sustainability. In *Making Progress: Essays in Progress and Public Policy*, J. Looney and C. L. Anderson, Eds., Lexington Books, 379-407.

Stevens, D. E., A. S. Ackerman, and C. S. Bretherton, 2002: Effects of domain size and numerical resolution on the simulation of shallow cumulus convection. *J. Atmos. Sci.*, **59**, 3285-3301.

Bretherton, C. S., 2003: Data analysis: Empirical orthogonal functions, singular vectors, time series analysis. *Enclopedia of Atmospheric Sciences*, Eds. J. R. Holton, J. Pyle, J. A. Curry, Academic Press, pp. 617-620.

Bretherton, C. S., 2003: Wave-CISK. *Enclopedia of Atmospheric Sciences*, Eds. J. R. Holton, J. Pyle, J. A. Curry, Academic Press, pp. 1019-1022

Bretherton, C. S., and A. H. Sobel, 2003: The Gill model and the Weak Temperature Gradient approximation. *J. Atmos. Sci.*, **60**, 451-460.

Sobel, A. H., and C. S. Bretherton, 2003: Large-scale waves interacting with deep convection in idealized mesoscale model simulations. *Tellus*, **55A**, 45-60.

Widmann, M., C. S. Bretherton, and E. P. Salathe, 2003: Statistical precipitation downscaling over the Northwestern United States using numerically simulated precipitation as a predictor. *J. Climate*, **16**, 799-816.

Zhang, M., W. Lin, C. S. Bretherton, J. J. Hack, and P. J. Rasch, 2003: A modified formulation of fractional stratiform condensation rate in the Community Atmosphere Model CAM2. *J. Geophys. Res.*, **108(D1)**, 4035, doi:10.1029/2002JD002523.

Randall, D. A., and 11 coauthors, 2003: Confronting models with data. The GEWEX Cloud Systems Study. *Bull. Amer. Meteor. Soc.*, **84**, 455-469.

Siebesma, A. P., C. S. Bretherton, and 11 coauthors, 2003: A large-eddy simulation intercomparison study of shallow cumulus convection. *J. Atmos. Sci.*, **60**, 1201-1219.

Stevens, B., and 31 coauthors, 2003: Dynamics and Chemistry of Marine Stratocumulus -- DYCOMS-II. *Bull. Amer. Meteor. Soc.*, **84**, 579-593.

Raymond, D. J., G. Raga, C. S. Bretherton, S. DeSzoeke, J. Molinari, C. Lopez-Carillo, and Zeljka Fuchs, 2003: Convective forcing in the intertropical convergence zone of the East Pacific. *J. Atmos. Sci.*, **60**, 2064-2082.

Boville, B. O., and C. S. Bretherton, 2003: Heating and dissipation in the NCAR Community Atmosphere Model. *J. Climate*, **16**, 3877-3887.

Sobel, A. H., S. E. Yuter, C. S. Bretherton, and G.N. Kiladis, 2004: Large-scale meteorology and deep convection during TRMM KWAJEX. *Mon. Wea. Rev.*, **132**, 422-444.

Bretherton, C. S., J. R. McCaa, and H. Grenier, 2004: A new parameterization for shallow cumulus convection and its application to marine subtropical cloud-topped boundary layers. Part I: Description and 1-D results. *Mon. Wea. Rev.*, **132**, 864-882.

McCaa, J. R., and C. S. Bretherton, 2004: A new parameterization for shallow cumulus convection and its application to marine subtropical cloud-topped boundary layers. Part II: Regional simulations of marine boundary layer clouds. *Mon. Wea. Rev.*, **132**, 883-896.

Bretherton, C. S., M. E. Peters, and L. E. Back, 2004: Relationships between water vapor path and precipitation over the tropical oceans. *J. Climate*, 17, 1517-1528.

Bretherton, C. S., R. Ferrari, and S. Legg, 2004: Climate Process Teams: A new approach to improving climate models. *U.S. CLIVAR Variations*, Vol. 2, No. 1, 1-6.

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Wood, R., and C. S. Bretherton, 2004: Boundary layer depth, entrainment and decoupling in the cloud-capped subtropical and tropical marine boundary layer. *J. Climate*, **17**, 3575-3587.

Raymond, D. J., and coauthors, 2004: EPIC2001 and the coupled ocean-atmosphere system of the tropical East Pacific. *Bull. Amer. Meteor. Soc.*, **85**, 1341-1354.

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Kuang, Z., and C. S. Bretherton, 2004: Convective influence of the heat balance of the tropical tropopause layer: A cloud-resolving model study. *J. Atmos. Sci.*, **23**, 2919–2927.

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DeSzoeke, S. P., C. S. Bretherton, N. A. Bond, M. F. Cronin, and B. M. Morley, 2005: EPIC 95W observations of the eastern Pacific atmospheric boundary layer from the cold tongue to the ITCZ. *J. Atmos. Sci.*, **62**, 426-442.

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Collins, W. D., and coauthors, 2006: The Community Climate System Model: CCSM3. *J. Climate*, **19**, 2122-2143.

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