Todd Ringler

Los Alamos National Laboratory, Theoretical Division, Fluid Dynamics and Solid Mechanics Group
MS B216, Los Alamos, New Mexico 87545
(505) 667-7744 ringler@lanl.gov http://public.lanl.gov/ringler.html

Education

- Doctor of Philosophy in Atmospheric Science,
  Cornell University, May 1996.
  Dissertation title: *Effects of Mechanical and Thermal Forcing by Orography on the Climate.*
- Master of Science in Aerospace Engineering,
  Cornell University, May 1992.
- Bachelor of Science in Aerospace Engineering, *Summa Cum Laude*
  West Virginia University, May 1990.

Research Interests

- numerical methods for multi-scale simulation of the climate system
- using coupled climate models for regional climate change prediction
- understanding the intersection of science and policy

Professional Experience

- 2012 : Microsoft Research Distinguished Visiting Fellow,
  Isaac Newton Institute for Mathematical Sciences, Cambridge University.
  Research: development of multi-scale numerical methods for global atmosphere and ocean simulation.
- 2006- : Scientist, Theoretical Division, Fluid Dynamics and Solid Mechanics Group,
  Los Alamos National Laboratory, Los Alamos, New Mexico.
  Research: ocean modeling, regional climate change prediction, multi-scale numerical methods.
- 1996-2005: Research Scientist III, Department of Atmospheric Science,
  Colorado State University, Fort Collins, Colorado.
  Research: climate dynamics, atmosphere-land-ocean interactions, numerical methods.
- 1992-1992: NASA Global Climate Change Fellow, Atmospheric Sciences Program,
  Cornell University, Ithaca, NY.
  Research: Impact of mountain ranges on climate
- 1990-1992: Graduate Research Assistant, Aerospace Engineering,
  West Virginia University, Morgantown, West Virginia.
- 1989-1990: NSF sponsored Undergraduate Researcher, West Virginia University.

Current Funding

- 2010- : Development of Frameworks for Robust Regional Climate Modeling, LANL PI, DOE Biological and Environmental Research, $5M per year.
- 2012-2016: Multiscale Methods for Accurate, Efficient, and Scale-Aware Models of the Earth System, LANL PI, DOE Scientific Discovery through Advanced Computing, $20.5M.

- 2011-2014: Developing a Next-Generation Approach to Regional Climate Prediction at High Resolution, LANL PI, DOE Biological and Environmental Research and National Science Foundation, $3.5M.

Past Funding

- 2008-2011: Water Security and Climate Change, Co-PI, LANL Institute of Geophysics and Planetary Physics, $175K.
- 2007-2009: A visionary new approach to assess regional climate impacts on vegetation survival and mortality, Co-PI, LANL LDRD, $900K.
- 2007-2010: New grid and discretization technologies for ocean and ice simulations, co-PI, DOE Scientific Discovery Through Advanced Computing: Climate Change Prediction Program, $750K.

Selected Refereed Publications

- T. Ringler, M. Petersen, R.L. Higdon, D.W. Jacobsen, P.W. Jones and M. Maltrud, 2012: A Multiresolution Approach to Global Ocean Modeling, Ocean Modelling, revised.
- J. Pietarila Graham and T. Ringler, 2012: A framework for the evaluation of turbulence closures used in mesoscale ocean large-eddy simulations, Ocean Modelling, accepted.
- Rauscher, S. A., T. Ringler, W.C. Skamarock and A.A. Mirin, 2012: Exploring a Global Multi-Resolution Modeling Approach Using Aquaplanet Simulations, Journal of Climate, accepted.
- Chen, Q., T. Ringler, and M. Gunzburger, 2012: A co-volume scheme for the rotating shallow water equations on conforming non-orthogonal grids, Journal of Computational Physics, accepted.
- Chen, Q., M. Gunzburger and T. Ringler, 2012: A Scale-Aware Anticipated Potential Vorticity Method on Variable-resolution Meshes, Monthly Weather Review, accepted.
- Jiang, X., S. Rauscher, T. Ringler, D. Lawrence, A. Williams, C. Allen, A. Steiner, D. Cai, and N. McDowell, 2012: Projected Future Changes in Vegetation in Western North America in the 21st Century. J. Climate. doi:10.1175/JCLI-D-12- 00430.1, in press.
- Skamarock, W.C., J. B. Klemp, M. G. Duda, L. Fowler, S. Park, and T. Ringler, 2012: A Multiscale Nonhydrostatic Atmospheric Model Using Centroidal Voronoi Tesselations and C-Grid Staggerin, accepted, Monthly Weather Review.
- Leng, W., L. Ju, M. Gunzburger, S. Price, and T. Ringler, 2011: A Parallel High-Order Accurate Finite Element Nonlinear Stokes Ice Sheet Model and Benchmark Experiments, Journal of Geophysical Research, in press.
- Zhang, H., L. Ju, M. Gunzburger, T. Ringler and S. Price, 2011: Coupled Models and Parallel Simulations for Three-Dimensional Full-Stokes Ice Sheet Modeling, Numer. Math. Theor. Meth. Appl., 4, 359-381.
- Jacobsen, D.W., M. Gunzburger, T. Ringler, J. Burkardt, J. Peterson, 2011: Parallel Algorithm for Spherical Delaunay Triangulations and Spherical Centroidal Voronoi Tessellations, Journal of Computational Geometry: Theory and Applications, submitted.
- Ringler, T., D.W. Jacobsen, M. Gunzburger, L. Ju, M. Duda and W. Skamarock, 2011: Exploring a Multi-Resolution Modeling Approach within the Shallow-Water Equations, Monthly Weather Review, DOI: 10.1175/MWR-D-10-05049
- Chen, Q., M. Gunzburger and T. Ringler, 2011: A scale-invariant formulation of the anticipated potential vorticity method, Monthly Weather Review, 39, 2614-2629. DOI: 10.1175/MWR-D-10-05004.1

- Ringler, T. and P. Gent, 2011: An eddy closure for potential vorticity, Ocean Modelling, 39, 125-134, doi:10.1016/j.ocemod.2011.02.003
- Ringler, T., J. Thuburn, J. Klemp and W. Skamarock, 2010: A unified approach to energy conservation and potential vorticity dynamics on arbitrarily structured C-grids, Journal of Computational Physics, doi:10.1016/j.jcp.2009.12.007
- Thuburn, J., T. Ringler, J. Klemp and W. Skamarock, 2009: Numerical representation of geostrophic modes on arbitrarily structured C-grids, Journal of Computational Physics, 2009: 228 (22), 8321-8335. doi:10.1016/j.jcp.2009.08.006
- Ringler, T., L. Ju and M. Gunzburger, 2008, A multiresolution method for climate system modeling: application of spherical centroidal Voronoi tessellations, Ocean Dynamics, 58 (5-6), 475-498. doi:10.1007/s10236-008-0157-2
- Zupanski, M, S.J. Fletcher, I.M. Navon, B. Uzunoglu, R. Heikes, D. Randall, T.D. Ringler, and D. Daescu, 2006, Initiation of ensemble data assimilation, Tellus, 58, 159-170. doi:10.1111/j.1600-0870.2006.00173.x
- Lipscomb, W.H. and T. D. Ringler, 2005: An Incremental Remapping Transport Scheme on a Spherical Geodesic Grid, Monthly Weather Review, 133, 2335-2350. doi10.1175/MWR2983.1
- Bonaventura, L. and T. D. Ringler, 2005: Analysis of Discrete Shallow-Water Models on Geodesic Delaunay Grids with C-Type Staggering. Monthly Weather Review, 133, 2351-2373. doi:10.1175/MWR2986.1
- Randall, D.A., T.D. Ringler, R. Heikes, P. Jones, and J. Baumgardner, 2002: Climate Modeling with Spherical Geodesic Grids, Computing in Science and Engineering, 4, 32-41.
- Ringler, T.D., and D.A. Randall, 2002: A potential enstrophy and energy conserving numerical scheme for solution of the shallow-water equations on a geodesic grid, Monthly Weather Review, 130, 1397-1410.
- Ringler, T.D., and D.A. Randall, 2002: The ZM-grid: An alternative to the Z-grid, Monthly Weather Review,130, 1411-1422.
- Ringler, T.D., R. Heikes, and D.A. Randall, 2000: Modeling the atmospheric general circulation using a spherical geodesic grid: A new class of dynamical cores, Monthly Weather Review, 128, 2471-2489.
- Ringler, T.D., and K.H. Cook, 1999: Understanding the seasonality of orographically-forced stationary waves: Interaction between mechanical and thermal forcing. Journal of Atmospheric Sciences, 56, 1154-1171.
- Ringler, T.D., and K.H. Cook, 1997: Importance of nonlinearity in orographically-forced stationary waves. Journal of Atmospheric Sciences, 54, 2612-2629.
- Lenters, J.D., K.H. Cook, and T.D. Ringler, 1995: Comments on On the influence of the Andes on the general circulation of the Southern Hemisphere. Journal of Climate, 8, 2113-2115.
- Ringler, T.D., and K.H. Cook, 1995: Orographically-induced stationary waves: Dependence on latitude. Journal of Atmospheric Sciences, 52, 2548-2560.

Book Chapters

- Ringler, T.D., 2010: Momentum, vorticity and transport: Considerations in the design of a finite-volume dynamical core. In: P. Lauritzen (Ed.), Numerical Techniques for Global Atmospheric Models, Springer, to appear.
- Ju, L., T. Ringler and M. Gunzburber, 2009, Voronoi tessellations and their application to climate and global modeling. In: P. Lauritzen (Ed.), Numerical Techniques for Global Atmospheric Models, Lecture Notes in Computational Science, to appear.

- Randall, D.A., T.D. Ringler, and R. Heikes, 2000: Global atmospheric modeling using a geodesic grid and an isentropic vertical coordinate. In: D.A. Randall (Ed.), General Circulation Model Development, International Geophysics Series, vol. 90, Academic Press, New York, 509-536.
- Ringler, T.D., R. Heikes, and D.A. Randall, 1998: Solving the primitive equations on a spherical geodesic grid: A technical report to a new class of dynamical cores. Atmospheric Science Paper No. 665. Colorado State University. 62 pp.

Selected Presentations

- Ringler, T.D., 2012: A Multi-Resolution Modeling Approach to Global Climate Simulation, Grantham Institute for Climate Change, Imperial University, November 21, 2012.
- Ringler, T.D., 2012: Bridging Scales in Global Climate System Modeling, Department of Physics, Oxford University, October 18, 2012.
- Ringler, T.D. and R. Lowrie, 2012: A High-Order Transport Scheme for Unstructured Atmosphere and Ocean Climate Models, 8th International Conference on Scientific Computing and Applications, Las Vegas, NV, April 4, 2012.
- Ringler, T.D., 2011: Approaching the Problem of Regional Climate Simulation through a Global, Multi-Resolution Modeling Approach: Successes and Challenges, Invited Talk, American Geophysical Union Meeting, San Francisco, CA, December 8, 2011.
- Ringler, T.D., 2011: Why We Need to Develop a Multi-Resolution Approach to Global Earth System Modeling, Presented to Panel for a National Strategy for Advancing Climate Modeling, National Academy of Sciences, Washington, D.C., October 3, 2011.
- Ringler, T.D., 2011: Multi-Resolution Global Climate Modeling based on Spherical Centroidal Voronoi Tessellations, IMUM 2011, Bremerhaven, Germany, August 22-25, 2011.
- Ringler, T.D., 2011: Anthropogenic Climate Change: What We Know, What We Think We Know and What We Wish We Knew, Presented to Leadership Los Alamos, Environmental Session, Valle Caldera, New Mexico, April 15, 2011.
- Ringler, T.D., 2011: Analysis of the MPAS Hydrostatic Dynamical Core in Aqua-Planet Mode, NCAR CCSM Atmosphere Modeling Working Group, Boulder, Colorado, February 15, 2011.
- Ringler, T.D., 2010: Toward Multi-Scale Simulation of the Ocean and Atmosphere, Earth System Modeling Symposium, Tsinghua University, Beijing China, July 23, 2010.
- Ringler, T.D. and D. Jacobsen, 2010 : Exploring a Multi-Resolution Approach within the Shallow-Water System. Numerical Hierarchies in Climate Modeling, Institute for Pure and Applied Mathematics, Los Angeles, California, April 14, 2010.
- Ringler, T.D., 2010: Model for Prediction Across Scales: A Multi-Resolution Approach to Climate System Modeling. DOE Integrated Climate Change Modeling Science Team Meeting, Gaithersburg, Maryland, March 29, 2010.
- Ringler, T.D., 2009: An Ocean Dynamical Core with Local Mesh Refinement, NCAR CCSM Ocean Modeling Working Group, Boulder, Colorado, December 10, 2009.
- Ringler, T.D., 2009: A Consideration of Two-Time Level Schemes, NCAR CCSM Ocean Modeling Working Group, Boulder, Colorado, December 10, 2009.
- Ringler, T.D., 2009: Numerical Treatment of Energy and Potential Vorticity on Arbitrarily Structured C-grid, PDEs on the Spheres, Santa Fe, New Mexico, April 30, 2009.

- Ringler, T.D., 2009: Overview of Regional Climate Impacts in the Southwest: The Known, The Uncertain and The Unknown, Climate Change Adaptation Workshop for Natural Resource Managers in the Jemez Mountains Landscape, Los Alamos, New Mexico, April 21, 2009.
- Ringler, T.D., 2009: Bridging Scales in Climate System Modeling, Next Generation Models on Climate Change and Sustainability for Advanced High Performance Computing Facilities, Oak Ridge, Tennessee, March 16, 2009.
- Ringler, T.D., 2008: Uncertainty in the Simulation of Future Climate Conditions, LANL Workshop on Uncertainty Quantification, Los Alamos, New Mexico, December 11, 2008.
- Ringler, T.D., 2008: Variouis forms of F=ma: building a discrete model of force balance that does what we want it to do, Keynote Presentation, NCAR ASP 2008 Summer Colloquium: Numerical Techniques for Global Atmospheric Models, Boulder, Colorado, June 9, 2008.
- Ringler, T.D., 2007: Part I: Regional Climate Prediction: Prospects and Challenges. The Nature Conservancy Climate Change Science Conference, Portland, Oregon, September 5, 2007.
- Ringler, T.D., 2006: Complex Systems: Energy, Climate, Environment, and Risk Assessment, LANL Grand Challenges Workshop, Los Alamos, November 1, 2006.
- Ringler, T.D., 2006: Grids for Climate System Modeling, TSC Workshop on Meshing Challenges for LANL Simulations, Los Alamos, New Mexico, October 30, 2006.
- Ringler, T.D., 2006: Risk Analysis and Climate Change, Presented to the PARADIGM Decisions Applications Group, Los Alamos, New Mexico, October 10, 2006.
- Ringler, T.D., 2006: New numerical methods in ocean general circulation modeling: Voronoi tessellations and floating vertical coordinates, Monterey, California, June 26, 2006.
- Ringler, T.D., 2005: Challenges in Coupled Climate Model Development, Presented to the Coupled Ocean Sea-Ice Modeling Group, Los Alamos, New Mexico, May 16, 2005.
- Ringler, T.D., D. Randall, and J. Baumgardner, 2003: A Global Ocean Model based on Icosahedral-Hexagonal Grids with a Hybrid Vertical Coordinate, Presented at the American Geophysical Union Conference, San Fransico, December 11, 2003.
- Ringler, T.D., 2003: Comparing Truncation Error to PDE Solution Error on Spherical Voronoi Tessellations. Presented at the Workshop on Current Development of Shallow-Water Models on the Sphere, March 10, 2003, Munich, Germany.
- Ringler, T.D., 2003: An Integrated Approach to Coupled Climate Modeling based on Geodesic Grids and Quasi-Lagrangian Vertical Coordinates. Invited Presentation at the Max Planck Institute for Meteorology, February 27, 2003, Hamburg, Germany.
- Ringler, T.D., 2002: Geodesic grids for ocean modeling. Presented at the MIT Ocean Modeling Meeting, August 21-23, 2002, Cambridge, Massachusetts. Ringler, T.D., M. Branson, and D.A. Randall, 2002: Impact of an energy conserving scheme in the CSU AGCM. Presented at the 2002 PDEs on the Sphere Workshop, August 12-15, 2002, Toronto, Canada.
- Ringler, T.D. and D.A. Randall, 2002: Development of an energy conserving numerical scheme suitable for geodesic grids. Presented at the CCSR Workshop for the Next Generation Climate Models, March 4-8, 2002, Awaji-Yumebutai, Japan.
- Ringler, T.D., D.A. Randall, J. Baumgardner, and B. Semtner, 2002: Our strategy for designing a geodesic grid ocean GCM with a hybrid vertical coordinate. Presented at the Layered Ocean Modeling Workshop, February 6-8, 2002, Miami, Florida.

- Ringler, T.D. and D.A. Randall, 2002: An integrated approach to coupled climate modeling based on geodesic grids and quasi-Lagrangian vertical coordinates. Presented at the 13th Symposium on Global Change and Climate Variations, January 14, 2002, Orlando Florida.
- Ringler, T.D. and D.A. Randall, 2002: Interactions of monsoons and anticyclones. Presented at the 13th Symposium on Global Change and Climate Variations, January 14, 2002, Orlando Florida.
- Ringler, T.D. and D.A. Randall, 2001: Geodesic Grids and Data Analysis. Presented at the Earth Observing System Working Group Meeting, November 1, 2001, San Antonio, Texas
- Ringler, T.D. and D.A. Randall, 2001: Energy, geostrophic adjustment, and a momentum analog to the Z-grid. Presented at 7th Workshop on the Solution of Partial Differential Equations on the Sphere, May 16-18, 2001, Montreal, Canada.
- Ringler, T.D., R. Heikes, and D.A. Randall, 1999: Modeling the Atmospheric General Circulation Using a Spherical Geodesic Grid. Presented at 8th Workshop on the Solution of Partial Differential Equations on the Sphere, November 30 - December 3, 1999, San Francisco, California.
- Ringler, T.D., R. Heikes, and D.A. Randall, 1999: Modeling the Atmospheric General Circulation Using a Spherical Geodesic Grid: A New Class of Dynamical Cores. Invited Presentation, NCAR CGD Seminar Series. May 6, 1999, Boulder, Colorado.
- Dazlich, D.A., T.D. Ringler, and D.A. Randall, 1998: High resolution surface flux calculations with the Colorado State University general circulation model. Presented at the 9th Conference on Interaction of the Sea and Atmosphere, January 11-16, 1998, Phoenix, Arizona.
- Ringler, T.D. and K.H. Cook, 1997: Nonlinearly-forced stationary waves by orography: Interaction between mechanical and thermal forcing. Presented at the 11th Conference on Atmospheric and Oceanic Fluid Dynamics, June 23-27, 1997, Tacoma, Washington.
- Ringler, T.D. and K.H. Cook, 1995: Nonlinear forcing of stationary waves. Presented at the 10th Conference on Atmospheric and Oceanic Waves and Stability, June 5-9, 1995, Big Sky, Montana.

Policy Experience

- 2005: Bighorn Center for Public Policy Fellow, Resource Sustainability Program,
  Developed policy and legislation related to sustainability and the environment.
- 2003- : Collaborating with TNC Climate Change Initiative,
  How can we use climate change simulations to inform TNC decision-making process?
- 2005: Colorado Institute for Leadership Training,
  What is the interplay between science and policy?

Positions

- 2008-2011: Editor, Monthly Weather Review
- 2008- : External Advisory Committee Member, Cornell University, Dept. of Earth and Atmospheric Science
- 2006-2007: Associate Editor, Monthly Weather Review, 2006-2007

Teaching Experience

- 2004-2005: Developed and taught *The Science of Climate Change*, a Freshman Seminar Course at Colorado State University

- 1996-2002: Instructor for Colorado State University Outdoor Adventure Program. Taught courses ranging from Ice Climbing, Mountaineering, to Advanced Rock Climbing.
- 1992-1996: Senior Instructor for Cornell Outdoor Education Program. Taught courses ranging from Natural History to Outdoor Leadership.