Curriculum Vitae

Robert L. Jacob

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TITLES:

Computational Climate Scientist, Mathematics and Computer Science Division, Argonne National Laboratory (2005 – present)
Fellow, University of Chicago/Argonne Computation Institute (2001 – present)

EDUCATION:

Undergraduate Institution:

University of Texas at Austin	Physics	B.Sc.	1990
University of Texas at Austin	Mathematics	B.Sc.	1990

Graduate Institution:

University of Wisconsin-Madison	Atmospheric Science	Ph.D.	1997

PROFESSIONAL EXPERIENCE:

2000 – 2005	Assistant Computational Scientist, Argonne National Laboratory, Mathematics and Computer Science Division
1999 – 2000	Postdoctoral Researcher, University of Chicago, Department of the Geophysical Sciences
1998 – 1999	Postdoctoral Researcher, University of Wisconsin-Madison, Space Science and Engineering Center
1992 – 1997	Research Assistant, University of Wisconsin-Madison, Space Science and Engineering

AWARDS:

American Meteorological Society/Cray Research Graduate Fellowship, 1991

PROFESSIONAL ACTIVITIES:

- Member of:
  - American Geophysical Union
  - Society for Industrial and Applied Mathematics
  - American Meteorological Society
- Software Engineering co-lead and Council member for Accelerated Climate Model for Energy
- Main developer of the Model Coupling Toolkit, a Fortran90 toolkit for coupling parallel multi-physics models. http://www.mcs.anl.gov/research/projects/mct/
- Main developer of Fast Ocean Atmosphere Model, a low-resolution, parallel coupled

GCM http://www.mcs.anl.gov/research/projects/foam/

- Reviewed proposals for NSF, DOE, Argonne LDRD.
- Reviewed papers for *Concurrency and Computation: Practice and Experience, Environmental Modeling and Software, Nature Communications, Geophysical Model Develoment.*

PUBLICATIONS:

(Peer-reviewed journal publications)

Liu, Y., Z. Liu, S. Zhang, X. Rong, R. Jacob, S. Wu, F. Lu, 2014: Ensemble-Based Parameter Estimation in a Coupled GCM Using the Adaptive Spatial Average Method. *J. Climate*, **27**, 4002–4014.

Castruccio, S., D.J. McInerney, M.L. Stein, F. Liu, R.L. Jacob, and E.J. Moyer, 2014: "Statistical emulation of climate model projections based on precomputed GCM runs", *J. Climate*, **26(5),** pp. 1829-1844.

Robert Jacob, Jayesh Krishna, Xiabing Xu, Tim Tautges, Iulian Grindeanu, Rob Latham, Kara Peterson, Pavel Bochev, Mary Haley, David Brown, Richard Brownrigg, Dennis Shea, Wei Huang, Don Middleton, 2013, "ParNCL and ParGAL: Data-parallel Tools for Postprocessing of Large-scale Earth Science Data", *Procedia Computer Science*, Volume **18**, Pages 1245–1254

Valcke, S., Balaji, V., Craig, A., DeLuca, C., Dunlap, R., Ford, R. W., Jacob, R., Larson, J., O'Kuinghttons, R., Riley, G. D., and Vertenstein, M.: Coupling technologies for Earth System Modelling, *Geosci. Model Dev*., 5, 1589-1596, doi:10.5194/gmd-5-1589-2012, 2012.

A. P. Craig, M. Vertenstein, R. Jacob, "A New Flexible Coupler for Earth System Modeling Developed for CCSM4 and CESM1", 2011, *Int. J. of High Performance Computing*, 26, 31-42, 2012

J. Dennis, Jim Edwards, Ray Loy, Robert Jacob, Arthur A. Mirin, Anthony P. Craig, and Mariana Vertenstein, "An Application Level Parallel I/O Library for Earth System Models, *Int. J. of High Performance Computing Applications*, 26, 43-53, 2012.

J. Dennis, M. Vertenstein, P. Worley, A. Mirin, A. Craig, R. Jacob, S. Mickelson, "Computational Performance of Ultra-High-Resolution Capability in the Community Earth System Model", *Int. J. of High Performance Computing Applications*, 26, 5-16, 2012.

J. McClean, David Bader, Frank O. Bryan, Mathew E. Maltrud, John M. Dennis, Arthur A. Mirin, Philip W. Jones, Mariana Vertenstein, Datelina P. Ivanova, Yoo Yin Kim, James S. Boyle, **Robert L. Jacob**, Nancy Norton, Anthony Craig and Patrick H. Worley, 2011: "A Prototype Two-Decade Fully Coupled Fine Resolution CCSM Simulation", *Ocean Modeling*, 39, p. 10-30, 209:10.1016/j.ocemod.2011.02.011.

M. Tobis, M. Steder, J.W. Larson, **R.L. Jacob**, E.T. Ong, and R.T. Pierrehumbert, "PyCCSM: Prototyping a python-based community climate system model," *ANZIAM J.*, 48, C1112-C1130 (2010)

Z. Liu, B.L. Otto-Bliesner, F. He, E. Brady, R. Tomas, P.U. Clark, A. E. Carlson, J. Lynch-Stieglitz, W. Curry, E. Brook, D. Erickson, **R. Jacob**, J. Kutzbach, J. Cheng, 2009: "Transient Simulation of Last Deglaciation with A New Mechanism for Bølling-Allerød Warming." (17 July 2009) *Science* 325 (5938), 310. [DOI: 10.1126/science.1171041]

Y. Zhong, Z. Liu and R. Jacob, 2008, "Origin of Pacific Multidecadal Variability in Community Climate System Model Version 3 (CCSM3): A Combined Statistical and Dynamical Assessment", *Journal of Climate*. **21(1),** 114-133.

E.T. Ong, J. Walter Larson, B. Norris, **R. L. Jacob**, M. Tobis, M. Steder, 2008, "A Multilingual Programming Model for Coupled Systems." *International Journal for Multiscale Computational Engineering*, **6(1),** 39-51, DOI: 10.1615/IntJMultCompEng.v6.i1.40

Z. Liu, Y., Y. Liu, L. X. Wu, R. Jacob, 2007 "Seasonal and long-term atmospheric responses to reemerging North Pacific ocean variability: A combined dynamical and statistical assessment,"*J. Climate*, **20(6)**,:955-980

Y. Donnadieu, R. Pirrehumbert, R. Jacob, F. Fluteau, 2006: "Modelling the primary control of paleogeography on Cretaceous climate", *Earth and Planetary Science Letters*, **248(1-2)**, 15 August 2006, 426-437.

R. Jacob, J. Larson, and E. Ong, 2005: "MxN Communication and Parallel Interpolation in CCSM3 Using the Model Coupling Toolkit. *Int. J. High Perf. Comp. App*. **19(3)** , 293-307.

R. Gallimore, J. E. Kutzbach, R. Jacob, 2005: "Coupled Atmosphere-Ocean-Vegetation Simulations for Modern and Mid-Holocene Climates: Role of Extratropical Vegetation Cover Feedbacks", *Climate Dynamics*, **25**, 755-756, doi: 10.1007/s00382-005-0054-z.

J. Larson, R. Jacob, and E. Ong, 2005: "The Model Coupling Toolkit: A New Fortran90 Toolkit for Building Multi-Physics Parallel Coupled Models", *Int. J. High Perf. Comp. App.,* **19(3)** , 277-292.

T. Craig, R. Jacob, B. Kauffman, T. Bettge, J. Larson, E. Ong, C. Ding, H. Ye: 2005: "Cpl6: The New Extensible High-Performance Parallel Coupler for the Community Climate System Model", *Int. J. High Perf. Comp. App.,* **19(3)** , 309-327.

M. Notaro, Z. Liu, R. Gallimore, S. J. Vavrus, J. E. Kutzbach, I. C. Prentice, R. L. Jacob, 2005: "Simulated and Observed Pre-Industrial to Modern Vegetation and Climate Changes", *J. Climate*, **18**, 3650-3671.

C. Poulsen and R. Jacob, 2004: "Factors that inhibit Snowball Earth simulation", *Paleoceanography*, 19, PA4021, doi:10.1029/2004PA001056.

J. Lewis, M. Eby, A. Weaver, S. Johnson, R. Jacob 2004: "Global glaciation in the Neoproterozoic: Reconciling previous modeling results?", *Geophys. Res. Lett.*, 31(8), L08201.

L. Wu, Z. Liu, R. Gallimore, R. Jacob, D. Lee, Y. Zhoung, 2003: "A Coupled modeling study of Pacific Decadal variability: the Tropical Pacific mode and the North Pacific mode." *Journal of Climate*, **16(8),** 1101-1129.

C. Poulsen, J., Gendaszek, A.S., and Jacob, R.L., 2003: "Did the rifting of the Atlantic Ocean cause the Cretaceous thermal maximum?" *Geology*, v.**31**, 115-118.

C. Poulsen, R.Jacob, R. Pierrehumbert, T. Huyhn, 2002: " Testing paleogeographic Controls on a Neoproterozoic snowball Earth", *Geophys. Res. Lett*., **29(11)**

Z. Liu, R. Gallimore, R. Jacob, 2002: "Search for the origins of Pacific decadal climate variability", *Geophys. Res. Lett*., **29(10).**

C. Poulsen, R. Pierrehumbert, R. Jacob, 2001: "Impact of Ocean Dynamics on the Neoproterozoic Snowball Earth,", *Geophys. Res. Lett.*, 28(8), 1575.

C. Delire, M. Coe, J. Foley, R. Jacob, P. Behling, J. Kutzbach, Z. Liu, and S. Vavrus, 2001: "Simulated Response of the Atmosphere-Ocean System to Deforestation in the Indonesian Archipelago," *Geophys. Res. Lett.* **28(10),** 2081.

D. Archer, G. Eshel, A. Winguth, W. Broecker, R. Pierrehumbert, M. Tobis, and R. Jacob, 2000: "Atmospheric pCO2 Sensitivity to the Biological Pump in the Ocean," *Global Biogeochemical Cycles*, **14(4),** 1219-1230.

B. Benson, J. Magnuson, R. Jacob, S. Fuenger, 2000: "Response of Lake Ice Breakup in the Northern Hemisphere to the 1976 Interdecadal Shift in the North Pacific," *Verh. Inernat. Verein. Limnol.*, 27, 2770-2774.

W. L. Hibbard, J. Anderson, I. Foster, B. E. Paul, R. Jacob, C. Schafer, M.K. Tyree, 1996: "Exploring Coupled Atmosphere-Ocean Models Using Vis5D," *Int. J. of Supercomputer*

App. and High Performance Computing, 10, 211.

(Book Chapters)

Jacob, R. and J. Larson, "The Model Coupling Toolkit," *Earth System Modeling Volume 3 – Coupling Software and Strategies*, Ed. Sophie Valcke, R. Redler, R. Budich, 2012, 13-21. In *Springer Briefs in Earth System Sciences*, Ed. Kevin Hamilton et al., Hiedelberg, Springer, 2012. DOI 10.1007/978-3-642-23360-9

Craig, T, M. Vertenstein and R. Jacob, "CCSM," *Earth System Modeling Volume 1 – Recent Developments and Projects*, Ed. Kamal Puri, R. Redler, R. Budich, 2013, 47-52. In *Springer Briefs in Earth System Sciences*, Ed Kevin Hamilton et al., Hiedelberg, Springer, 2013, ISBN: 978-3-642-3659-6 .

(Refereed Conference Proceedings)

Washington, W.M.; Drake, J.; Buja, L.; Anderson, D.; Bader, D.; Dickinson, R.; Erickson, D.; Gent, P.; Ghan, S.; Jones, P.; Jacob, R. "The use of the climate-science computational end station (CCES) development and grand challenge team for the next IPCC assessment: an operational plan", *Journal of Physics: Conference Series*, Vol. 125, 2008. SciDAC 2008

J. Dennis, R. Jacob, et al., 2007: "Toward an ultra-high resolution community climate system model for the Blue Gene platform", *J. Phys.: Conf. Ser.* **78** 012030 (5pp) doi:10.1088/1742-6596/78/1/012030

E. Ong, J. Larson and R. Jacob, 2003. "A Real Application of the Model Coupling Toolkit," *Proc. 2002 International Conference on Computational Science,* eds. P. Sloot, C. J. K. Tan, J. J. Dongarra,A. Hoekstra, Springer-Verlag.

J. Larson, R. Jacob, I. Foster, J. Guo, 2001: "The Model Coupling Toolkit." *Proc. 2001 International Conference on Computational Science,* eds. V. N. Alexandrov, J.J. Dongarra, C. J. K. Tan, Springer-Verlag.

R. Jacob, C. Schafer, I. Foster, M. Tobis and J. Anderson, 2001: "Computational Design and Performance of the Fast Ocean Atmosphere Model." *Proc. 2001 International Conference on Computational Science,* eds. V. N. Alexandrov, J.J. Dongarra, C. J. K. Tan, Springer-Verlag

(Other Publications)

Z. Liu, R. Jacob, J. Kutzbach, S. Harrison and J. Anderson, 1999: "Monsoon Impact on El Nino in the Early Holocene," *PAGES Newsletter* 7(2), p. 16 – 17

Robert Jacob and John Anderson, 1992: "DIY Massively Parallel Supercomputer Does Useful Physics," *Computers in Physics*, 6, 244.

PRESENTATIONS:

(Invited Talks and posters)

"Climate and Community Codes", Argonne Training Program on Extreme Scale Computing, St. Charles, IL, August 13, 2014.

"ParVis: Bringing HPC to Climate Model Analysis", Ultrascale Visualization Workshop at SC13, Denver, CO, November 17, 2013.

"Challenges in Next Generation Model Coupling", 2012 KIAPS International Symposium on Global NWP System Modeling, Seoul, South Korea, November 12, 2012

"Exascale Issues in Climate Model Coupling", at IS-ENES First Workshop on Dynamical Cores for Climate Models, Carlo V Castle, Lecce, Italy, Dec 14-16, 2011.

"Parallel Computing in Climate Models", at DIMACS Workshop on Parallelism: A 2020 Vision, Rutgers University, Piscataway, NJ, March 15, 2011

(poster)"Current Challenges in Climate Model Coupling", Current Challenges in Computing 2010: Climate Modeling (sponsored by LLNL), Napa, CA, August 30- Sept 1, 2010

"Predicting Regional Climate Change for the Next Several Decades", First Annual Research Meeting of the DOE Office of Science Graduate Fellowship (DOE SCGF) Program, Argonne, IL, August 8, 2010

"From Climate Models to Earth System Models," 14th International Conference on Computing in Economics and Finance, Sorbonne, Paris, June 28, 2008.

"Flexible parallel coupling with the Model Coupling Toolkit", SIAM Conference on Parallel Processing for Scientific Computing, Atlanta, GA, March 12-14, 2008.

"Recent and near-future development of the Community Climate System Model," Workshop on Ocean Circulation and Climate, Ocean University of China, Qingdao, China, July 21st, 2006.

(Seminars and Colloquia)

"The DOE Accelerated Climate Modeling for Energy Project", Dept of Earth, Atmospheric and Planetary Sciences, Purdue University, September 11, 2014

"Climate Modeling," Argonne Energy Showcase, Argonne, IL, September 15, 2012.

"Climate Modeling", UChicago Environmental Policy Association Lunch, Chicago, IL, April 16, 2008.

"A Climate Modeling Primer", LANS Seminar, Argonne, IL, May 9, 2007

"Building Earth System Models with the Model Coupling Toolkit", Chinese Academy of Meteorological Sciences, Beijing, China, July 13th, 2006.

"From Climate Models to Earth System Models", Department of Applied Mathematics and Statistics, State University of New York, Stony Brook, NY, October 12, 2005

"Parallel Data Transfer in CCSM," Department of the Geophysical Sciences, University of Chicago, Chicago, IL, March 12, 2004

(Contributed Conference/Meeting Talks)

"ParNCL and ParGAL: Data-parallel tools for postprocessing of large-scale Earth science data" 3rd Int. Workshop on Advances in High-Performance Computational Earth Sciences: Applications and Frameworks, part of ICCS 2013, Barcelona, Spain, June 5, 2013.

"The Model Coupling Toolkit", Second Workshop on Coupling Technologies for Earth System Models, NCAR, Boulder, CO, February 20, 2013

"Bringing Parallelism to Large Scale Data Analysis and Visualization", 2nd IS-ENES Workshop on High Performance Computing for Climate Models, Toulouse, France, February 1, 2013

"Climate Modeling and Challenges of Exascale", INRIA-Illinois-Argonne Petascale Computing Joint Lab Workshop, Argonne, IL, Nov 19, 2012.

"Climate Modeling as Data Intensive Science", CsCADS: Scientific Data and Analytics for Extreme Scale Computing, Snowbird, UT, July 30, 2012.

"Software Engineering and the Parallel Climate Analysis Library", UCAR SEA Software Engineering Conference, Boulder, CO, Feb 21-24, 2012.

"Introducing data parallelism into climate model post-processing through a parallel version of the NCAR Command Language (NCL)", American Geophysical Union Fall Meeting, San Francisco, CA, Dec 4-9, 2011.

"Bringing Parallelism to Large-Scale Climate Data Analysis and Visualization," BER Earth System Modeling PI's Meeting, Washington, D.C., Sept 23, 2011

"Introducing ParVis", 16th Annual CESM Workshop, Breckenridge, CO, June 23, 2011.

"The Model Coupling Toolkit and the Future of Model Coupling," w/ Jay Larson at Coupling Technologies for Earth System Modeling: Today and Tomorrow, CERFACS, Toulouse, France, Dec 15-17, 2010.

"IO for High Resolution Climate Models", (co-presentation with Karen Schuchardt) Workshop on High Resolution Global Modeling, Fort Collins, CO, June 15-17, 2010

"Climate Models and Visualization", CScADS Scientific Data and Analytics for Petascale Computing Workshop, Lake Tahoe, CA, August, 3rd, 2009.

"Update on PIO: The Parallel I/O Library", 14th Annual CCSM Workshop, Breckenridge, CO, June 17, 2009.

"PIO: The parallel I/O library", Scientific Software Days, University of Texas, Austin, TX, May 15, 2008.

"Software design for sequential/hybrid time integration in the Community Climate System Model", American Geophysical Union, San Francisco, CA, December 11, 2007.

"On the road to a Sequential CCSM", CCSM Software Engineering Working Group Meeting, Boulder, CO, March 16, 2007.

"Software Engineering for the Earth System Model", DOE/BER Climate Change Prediction Program Science Team Meeting, Boston, MA, April 24th, 2006.

"CPL6 and MCT: Coupling Software for the Community Climate System Model", European Geophysical Union General Assembly, Vienna, AU, April 4th, 2006.

"CPL6: Software for Building Parallel Coupled Climate Models", SIAM Parallel Processing for Scientific Computing, San Francisco, CA, February 22nd, 2006.