

William J. Sacks

National Center for Atmospheric Research
CGD / CSEG
P.O. Box 3000
Boulder, CO 80307-3000

sacks@ucar.edu
Ph: (303) 497-1762

With a background in earth system science and computer science, I have a passion for bringing software engineering best practices to scientific software development.

EDUCATION

Ph.D., Environment & Resources, University of Wisconsin-Madison, Madison, WI (Aug 2010)
Dissertation research investigated interactions between agricultural management and climate, through climate and land surface modeling and data analysis. Advisors: Jon Foley & Chris Kucharik. Coursework focused on atmospheric sciences. GPA: 4.0.

B.A., Computer Science, Williams College, Williamstown, MA (June 2003)
Graduated Summa Cum Laude; concentration with highest honors in Environmental Studies. GPA: 4.05; in major: 4.29 (A+).

PROFESSIONAL EXPERIENCE

National Center for Atmospheric Research, Software Engineer, Boulder, CO (5/11 – present)
Design and implement software infrastructure to enable new scientific capabilities in the Community Terrestrial Systems Model (CTSM) and the ice sheet component of the Community Earth System Model (CESM). Recent projects include adding water isotopes to CTSM, re-engineering CTSM hydrology code to facilitate incorporating alternative science parameterizations, and providing technical guidance and mentoring in the development of a new coupler between CTSM and atmospheric models. Previous work included coupling a parallel ice sheet model to CESM, including implementing two-way coupling between the model's ice sheet and land components.

National Center for Atmospheric Research & National Ecological Observatory Network, Postdoctoral Fellow, Boulder, CO (10/10 – 6/11)
Helped develop a data assimilation system for NCAR's Community Land Model.

IBM & The Nature Conservancy, Consultant, Madison, WI (2/09 – 9/09)
Assisted with the development of a decision support system for understanding the effects of land use on ecosystem services.

National Center for Atmospheric Research, Research Assistant, Boulder, CO
(10/03 – 5/05)

Major projects included data assimilation in a terrestrial carbon flux model, and modeling and measurement work related to the Airborne Carbon in the Mountains Experiment.

NASA/Goddard, Research & Discover Intern, Greenbelt, MD (6/03 – 8/03)

Conducted land surface modeling and remote sensing research on the effects of an insect outbreak on local climate in the Siberian boreal forest.

University of New Hampshire, Research & Discover Intern, Durham, NH (6/02 – 8/02)

Constructed a terrestrial carbon flux model and conducted research on parameter optimization using eddy covariance data.

University of Pennsylvania, SUNFEST Research Assistant, Philadelphia, PA (5/01 – 8/01)

An NSF Research Experiences for Undergraduates program. Conducted computer science research on vision and obstacle avoidance in robot soccer.

SOFTWARE PROJECTS

Projects for which I am a lead or substantial contributor:

- **Community Terrestrial Systems Model** (<https://github.com/ESCOMP/CTSM>)
- **Community Earth System Model** (<https://github.com/ESCOMP/CESM>)
- **Community Ice Sheet Model** (<https://github.com/ESCOMP/CISM> and <https://github.com/ESCOMP/CISM-wrapper>)
- **Common Infrastructure for Modeling the Earth** (<https://github.com/ESMCI/cime>)
- **manage_externals** (https://github.com/ESMCI/manage_externals)
- **Light-weight Infrastructure for Land-Atmosphere Coupling** (<https://github.com/NCAR/lilac>)

Other contributions to open source software:

- <https://github.com/scipy/scipy>
- <https://github.com/PecanProject/sipnet>
- <https://github.com/jacktasia/dumb-jump>
- <https://github.com/lcosmin/boardgamegeek>

ADVISORY COMMITTEES

Community Terrestrial Systems Model Scientific Steering Group (2018 – present)

One of the two software development advisors on this steering group.

TUTORIALS AND TEACHING

CESM Summer Tutorial: Land Ice Component, Boulder, CO (8 annual tutorials, 2012 – 2019)

Helped design and lead a land ice-focused section of the annual CESM summer tutorial for early-career scientists.

CLM/CTSM Tutorial: Modifying code in the CLM, Boulder, CO (9/15/16, 2/6/19)

Designed and led half-day tutorial on modifying CLM/CTSM code. Developed and delivered two versions of this tutorial, each with about 50 participants.

Using git and GitHub with CTSM, Boulder, CO (4/18/18, 5/30/18)

Designed and led this two-part tutorial on collaborative development with git and GitHub, delivered to about 50 on-site and remote participants.

Regional Biogeochemistry Summer Colloquium: Ecological Model Optimization Tutorial, Boulder, CO (6/13/07)

Designed and led half-day tutorial on parameter optimization in ecological models, with about 25 participants. Part of a two-week workshop for graduate students sponsored by the Advanced Study Program of the National Center for Atmospheric Research.

University of Wisconsin-Madison, Environmental Studies Teaching Assistant, Madison, WI (fall 2006)

Redesigned, taught and graded computer-based lab section for introductory graduate-level course, "Modeling and Analysis of Environmental Systems".

Williams College, Computer Science Teaching Assistant, Williamstown, MA (fall 2000, fall 2001, fall 2002)

Helped instruct labs, graded student work, and conducted weekly help sessions for "Data Structures & Advanced Programming" and "Computer Organization".

PUBLICATIONS

- Lawrence DM et al. (2019). The Community Land Model version 5: Description of new features, benchmarking, and impact of forcing uncertainty. *Journal of Advances in Modeling Earth Systems*, doi: 10.1029/2018MS001583
- van Kampenhout L, Rhoades AM, Herrington AR, Zarzycki CM, Lenaerts JTM, **Sacks WJ**, van den Broeke MR (2019). Regional grid refinement in an Earth system model: impacts on the simulated Greenland surface mass balance. *Cryosphere*, 13: 1547-1564, doi: 10.5194/tc-13-1547-2019.
- Lipscomb WH et al. (2019). Description and evaluation of the Community Ice Sheet Model (CISM) v2.1. *Geoscientific Model Development*, 12: 387-424, doi: 10.5194/gmd-12-387-2019.
- van Kampenhout L, Lenaerts JTM, Lipscomb WH, **Sacks WJ**, Lawrence DM, Slater AG, van den Broeke MR (2017). Improving the representation of polar snow and firn in the Community Earth System Model. *Journal of Advances in Modeling Earth Systems*, 9: 2583-2600.
- Fyke JG, **Sacks WJ**, Lipscomb WH (2014). A technique for generating consistent ice sheet initial conditions for coupled ice sheet/climate models. *Geoscientific Model Development*, 7: 1183-1195.
- Vizcaino M, Lipscomb WH, **Sacks WJ**, van den Broeke M (2014). Greenland Surface Mass Balance as Simulated by the Community Earth System Model. Part II: Twenty-First-Century Changes. *Journal of Climate*, 27: 215-226.
- Leng GY, Huang MY, Tang QH, **Sacks WJ**, Lei HM, Leung LR (2013). Modeling the effects of irrigation on land surface fluxes and states over the conterminous United States: Sensitivity to

- input data and model parameters. *Journal of Geophysical Research – Atmospheres*, 118: 9789-9803.
- Lipscomb WH, Fyke JG, Vizcaino M, **Sacks WJ**, Wolfe J, Vertenstein M, Craig A, Kluzek E, Lawrence DM (2013). Implementation and initial evaluation of the Glimmer Community Ice Sheet Model in the Community Earth System Model. *Journal of Climate*, 26: 7352-7371.
- Oleson KW et al. (2013). Technical Description of version 4.5 of the Community Land Model (CLM). NCAR Technical Note NCAR/TN-503+STR, National Center for Atmospheric Research, Boulder, CO, 422 pp, doi: 10.5065/D6RR1W7M.
- Vizcaino M, Lipscomb WH, **Sacks WJ**, van Angelen JH, Wouters B, van den Broeke MR (2013). Greenland surface mass balance as simulated by the Community Earth System Model. Part I: Model evaluation and 1850-2005 results. *Journal of Climate*, 26: 7793-7812.
- Levis S, Bonan GB, Kluzek E, Thornton PE, Jones A, **Sacks WJ**, Kucharik CJ (2012). Interactive crop management in the Community Earth System Model (CESM1): Seasonal influences on land-atmosphere fluxes. *Journal of Climate*, 25: 4839-4859.
- Deryng D, **Sacks WJ**, Barford CC, Ramankutty N (2011). Simulating the effects of climate and agricultural management practices on global crop yield. *Global Biogeochemical Cycles*, 25.
- Lee E, **Sacks WJ**, Chase TN, Foley JA (2011). Simulated impacts of irrigation on the atmospheric circulation over Asia. *Journal of Geophysical Research – Atmospheres*, 116.
- Sacks WJ**, Kucharik CJ (2011). Crop management and phenology trends in the U.S. Corn Belt: impacts on yields, evapotranspiration and energy balance. *Agricultural and Forest Meteorology*, 7: 882-894.
- Sacks WJ** (2010). *Improving the representation of agricultural management in land surface models*. Ph.D. thesis, Environment & Resources, University of Wisconsin-Madison, Madison, WI, 219 pp.
- Sacks WJ**, Deryng D, Foley JA, Ramankutty N (2010). Crop planting dates: An analysis of global patterns. *Global Ecology and Biogeography*, 19: 607-620.
- Sun J et al. (2010). A multiscale and multidisciplinary investigation of ecosystem-atmosphere CO₂ exchange over the Rocky Mountains of Colorado. *Bulletin of the American Meteorological Society*, 91: 209-230.
- Sacks WJ**, Cook BI, Buening N, Levis S, Helkowski JH (2009). Effects of global irrigation on the near-surface climate. *Climate Dynamics*, 33: 159-175.
- Moore DJP, Hu J, **Sacks WJ**, Schimel DS, Monson RK (2008). Estimating transpiration and the sensitivity of carbon uptake to water availability in a subalpine forest using a simple ecosystem process model informed by measured CO₂ and H₂O fluxes. *Agricultural and Forest Meteorology*, 148: 1467-1477.
- Zobitz JM, Moore D, **Sacks WJ**, Monson RK, Bowling DR, Schimel DS (2008). Integration of process-based soil respiration models with whole-ecosystem CO₂ measurements. *Ecosystems*, 11: 250-269.
- Sacks WJ**, Schimel DS, Monson RK (2007). Coupling between carbon cycling and climate in a high-elevation, subalpine forest: a model-data fusion analysis. *Oecologia*, 151: 54-68.
- Sacks WJ**, Schimel DS, Monson RK, Braswell BH (2006). Model-data synthesis of diurnal and seasonal CO₂ fluxes at Niwot Ridge, Colorado. *Global Change Biology*, 12: 240-259.
- Braswell BH, **Sacks WJ**, Linder E, Schimel DS (2005). Estimating diurnal to annual ecosystem parameters by synthesis of a carbon flux model with eddy covariance net ecosystem exchange observations. *Global Change Biology*, 11: 335-355.

Sacks WJ (2003). *Parameter optimization in a forest model using hourly eddy flux measurements.*

Senior thesis, Environmental Studies, Williams College, Williamstown, MA, 91 pp.

Chitta S, **Sacks W**, Ostrowski JP, Das AK, Mishra PK (**2001**). The University of Pennsylvania

RoboCup Legged Soccer Team. In: *RoboCup 2001: Robot Soccer World Cup V*, A. Birk, S. Coradeschi, and S. Tadokoro (Eds.), Springer-Verlag.

TECHNICAL SKILLS

Programming languages:

- Substantial experience with modern Fortran and Python
- Some experience with C, C++, Perl, NCL, R, Java and AppleScript

Scientific packages & tools:

- Substantial experience programming in a Unix environment, including shell scripting and tools such as *sed* and *make*
- Substantial experience with NetCDF data, including Fortran libraries and netCDF operators
- Substantial experience with version control and project management using git, GitHub and subversion
- Some experience with the CMake build system

Parallel programming:

- Substantial experience working in high performance computing environments
- Substantial experience with thread-based parallelization using OpenMP
- Some experience with task-based parallelization using MPI

Desktop software:

- Substantial experience with the productivity tools Things and Evernote
- Substantial experience with Microsoft Excel, Word and PowerPoint, and Apple Keynote
- Substantial experience with STELLA modeling software