

BETH DREWNIAK

Earth Scientist

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CURRICULUM VITAE (2019)

Degrees Attained

- PhD (2019), Biological Sciences, University of Illinois, Chicago
- MS (2006), Atmospheric Sciences, University of Illinois, Urbana
- BS (2002), Physics and Astronomy, University of Illinois, Urbana

Positions Held

- **Argonne National Laboratory**, Environmental Science Division (United States)
2019-present

Earth Scientist

Work to develop and validate land surface models used in Earth system models. Conducted studies of the impact of agriculture management in climate models, including the integration of a climate-driven plant date simulator. Contributed research on processes driving biogeochemistry and biogeophysics in related models. Lead agricultural model development in the Energy Exascale Earth System Model (E3SM).

- **Argonne National Laboratory**, Environmental Science Division (United States)
2014-present

Assistant Climate Scientist

Designated task lead for DOE Energy Exascale Earth System Model (E3SM) project to expand the crop model within the E3SM Land Model (ELM) with additional crop types and farming management practices. Integrated dynamic roots into the E3SM. Provided support for analyzing regional model output of temperature and precipitation extremes for the Regional Resiliency Assessment Program. Helped compare observed vs. modeled iron deposition and dissolved iron content in the ocean.

- **Argonne National Laboratory**, Environmental Science Division (United States)
2009-2014

Computational Associate

Investigated the impact on soil organic carbon and crop productivity from farming practices including plant date, residue management, fertilizer use, and land cover change with a land surface model, CLM, updated to include agriculture. Developed crop features are included in CLM4.5. Worked on dynamic land use capability in CLM to allow changes in land type over time such that carbon, water, and energy balance are maintained across multiple soil columns. Interests for this work also include adding additional management practices (e.g., tillage and irrigation) and crop

types (including managed grasses) to the CLM framework. Organized a workshop on Urban Landscapes and Climate Change; worked on methodology for permanent sensor deployment to create an urban observatory. Assisting the Air Force with the development of a Presumed to Conform List of activities to maintain compliance of criteria pollutants with air quality regulations.

- **Argonne National Laboratory**, Environmental Science Division (United States)
2006-2009

Predoctoral Appointee

Integrated agriculture land representation, including maize, soybean, and spring wheat into the Carbon-Nitrogen version of the Community Land Model (CLM-CN). Incorporated dynamic roots, management practices, and a separate growth scheme with carbon and nitrogen allocation. Evaluated U.S. mercury contributions from China with the Chemical Transport Model (CTM), Model for Ozone and Related Chemical Tracers (MOZART). Provided support to Air Force Material Command (AFMC) for various projects including biodiesel emissions estimates, greenhouse gas inventory development, and technical support related to Aerospace Residual Risk. Evaluated air quality compliance in the Environmental Compliance Assessment and Management Program (ECAMP) audits at various AFMC bases. Participated in development of air quality and noise impact sections of energy-related Environmental Impact Statements (EIS).

- **University of Illinois at Champaign-Urbana**, Atmospheric Sciences Department (United States)
2004-2006

Graduate Research Assistant

Evaluated the influence of climate on land cover and biogenic volatile organic carbon emissions from vegetation and nitrogen oxides from soil, with a modified version of the dynamic vegetation model, Integrated Biosphere Simulator, agricultural version (Agro-IBIS). Modified Agro-IBIS to include biogenic volatile organic carbon emissions from vegetation and NO_x emissions from soil. Worked with the Global Biosphere Emissions and Interactions System (GloBEIS) model to estimate spatial changes in isoprene emissions from a new plant species distribution in the northern US forests.

Honors and Awards

- **Graduate Research Award, University of Illinois at Chicago 2015 and 2018**

Publications, Presentations, and Other Evidence of Achievement

Referred Journal Articles

- [1] Drewniak, B., "Simulating dynamic roots in the Energy Exascale Earth System Land Model", *Journal of Advances in Modeling Earth Systems*, 11, 338-359, doi:10.1029/2018MS001334 (2019).
- [2] Wang, J., Bessac, J., Kotamarthi, R. Constantinescu, E., and Drewniak, B., "Internal variability of a dynamically downscaled climate over North America", *Climate Dynamics*, doi:10.1007/s00382-017-3889-1, (2017).
- [3] Drewniak, B., Gonzalez-Meler, M. A., "Earth System Model needs for including the interactive representation of nitrogen deposition and drought effects on forested ecosystems", *Forests*, 8, doi:10.3390/f8080267 (2017).
- [4] Levis, S., A. Badger, B. Drewniak, C. Nevinson, and X. Ren, "CLMcrop yields and water requirements: Avoided impacts by choosing RCP 4.5 over 8.5", *Climatic Change*, doi:10.1007/s10584-016-1654-9 (2016).

- [5] Mishra, U., B. Drewniak, J. D. Jastrow, R. M. Matamala, and U. W. A. Vitharana, "Spatial representation of organic carbon and active-layer thickness of high latitude soils in CMIP5 earth system models", *Geoderma*, <http://dx.doi.org/10.1016/j.geoderma.2016.04.017> (2016).
- [6] Drewniak, B. A., U. Mishra, J. Song, J. Prell, and V. R. Kotamarthi, "Modeling the impact of agricultural land use and management on US carbon budgets," *Biogeosciences*, 12: 2119-2129 (2015).
- [7] Billionis, I., B. A. Drewniak, and E. M. Constantinescu, "Crop physiology calibration in the CLM", *Geoscientific Model Development*, 8:1071-1083 (2015).
- [8] Drewniak, B., P. Snyder, A. L. Steiner, T. Twine, D. Wuebbles, "Simulated changes in biogenic VOC emissions and ozone formation from habitat expansion of *Acer Rubrum* (Red Maple)," *Environmental Research Letters*, 9:doi: 10.1088/1748-9326/9/1/014006 (2014).
- [9] Zeng, X., B. Drewniak, and E. Constantinescu, "Calibration of the Crop Model in the Community Land Model," *Geoscientific Model Development Discussion*, 6:379-398 (2013).
- [10] Drewniak, B., J. Song, J. Prell, R. Kotamarthi, and R. Jacob, "Modeling Agriculture in the Community Land Model," *Geoscientific Model Development*, 6: 495-515 (2013).
- [11] Drewniak, B., V. Kotamarthi, D. Streets, M. Kim, and D. Crist, "Estimates of Mercury Flux into the United States from Non-local and Global Sources: Results from a 3-D CTM Simulation," *Atmospheric Chemistry and Physics Discussion*, 8:19861-19890 (2008).

Publications in Published Refereed Proceedings

- [1] A. Mametjanov, B. Norris, X. Zeng, B. Drewniak, J. Utke, M. Anitescu, P. Hovland, "Applying Automatic Differentiation to the Community Land Model," *Proceedings of AD2012, the 6th International Conference on Automatic Differentiation, 2012*. Also Preprint ANL/MCS-P1993-0112, January 2012.

Technical Reports

- [1] Kotamarthi, V. R., Wang, J., and Drewniak, B.: *Climate Assessments: A Summary for the State of Maine*, Argonne National Laboratory, Lemont, IL, 2016.
- [2] Oleson, K.W., D.M. Lawrence, G.B. Bonan, B. Drewniak, M. Huang, C.D. Koven, S. Levis, F. Li, W.J. Riley, Z.M. Subin, S.C. Swenson, P.E. Thornton, A. Bozbiyik, R. Fisher, C.L. Heald, E. Kluzek, J.-F. Lamarque, P.J. Lawrence, L.R. Leung, W. Lipscomb, S. Muszala, D.M. Ricciuto, W. Sacks, Y. Sun, J. Tang, and Z.-L. Yang, 2013: *Technical description of version 4.5 of the Community Land Model (CLM)*, NCAR Technical Note NCAR/TN-503+STR, 434 pp.
- [3] Chang, Y., M. MacDonell, and B. Drewniak, *Review of Relevant Toxicity Data, Exposure Guidelines, and Environmental Pollution Cases to Support the Gwangyang Bay Area Project*, Argonne National Laboratory, prepared for Research Institute of Industrial Science and Technology, Gwangyang Environment Research Department (December 2007).

Invited Talks

- [1] Drewniak, B., "Updates to the crop model in ELM: roots, planting, and future directions", CBGC webinar, January 22, 2019.
- [2] Drewniak, B., "Establishing a planting date for crops in the ACME Land Model (ALM)", ACME Land Science Talk, April, 11, 2017.
- [3] Drewniak, B., J. Song, J. Prell, and V. R. Kotamarthi, "Integrating a dynamic root scheme in a land surface model," *Scaling Root Processes: Global Impacts Workshop*, Arlington, VA, March 6-9, 2012.

- [4] Drewniak, B., V. R. Kotamarthi, J. Prell, R. Jacob, and J. Song, "Agricultural impacts on soil carbon in CLM," Data Needs for Improving Model Representations of Soil Carbon Responses to Climate Change in Permafrost Regions Workshop, Argonne, IL, October 3-4, 2011.

Seminars and colloquia

- [1] Drewniak, B., "Biogeochemical Cycles in the Community Land Model", Argonne Biology Seminar, Argonne, IL, March 27, 2014.

Other presentations

- [1] Drewniak, B., Gonzalez-Meler, M., "Biomass partitioning using an optimization approach from economic theory", CLM Working Group Meeting, Boulder, CO, February 11-13, 2019.
- [2] Drewniak, B., Gonzalez-Meler, M., "An optimization approach for biomass partitioning in the Energy Exascale Earth System Land Model", American Geophysical Union Fall Meeting, Washington, D.C., December 10-14, 2018 (poster).
- [3] Drewniak, B., "Climate-driven crop planting date in the E3SM Land Model", DOE Modeling PI Meeting, Potomac, MD, November 5-8, 2018 (poster).
- [4] Drewniak, B., "Climate driven crop planting date in the ACME Land Model (ALM): Impacts on productivity and yield", AGU Fall Meeting, New Orleans, LA, December 11-15, 2017.
- [5] Drewniak, B., "Climate driven planting date in the ACME Land Model", CESM Workshop, Boulder, CO, June 19-22, 2017.
- [6] Feng, Y., Drewniak, B., and Ito, A., "Spatial and Seasonal Variability in Soluble Iron Deposition and Contribution to Sea-surface Iron Distributions", AGU Fall Meeting, San Francisco, CA, Dec. 12-16, 2016 (poster).
- [7] Drewniak, B., "New method to determine crop planting date in the ACME Land Model", AGU, San Francisco, CA, December 12-16, 2016 (poster).
- [8] Drewniak, B., "Climate driven planting date in ALM", ACME Fall Meeting, Denver, CO, November 9-11, 2016 (poster).
- [9] Drewniak, B., "New method to determine crop planting in ALM", CESM Workshop, Breckenridge, CO, June 20-23, 2016 (poster).
- [10] Drewniak, B., "New method to determine crop planting in ALM", ACME All Hands Meeting, Washington D.C., June 7-10, 2016 (poster).
- [11] Drewniak, B. A., "Dynamic root status and impacts on productivity and evapotranspiration", CLM Working Group Meeting, Boulder, CO, February 8-11, 2016.
- [12] Drewniak, B. A., "Dynamic Root Distribution in the Community Land Model", AGU, December 14-18, 2015.
- [13] Drewniak, B. A., "Dynamic Roots in ALM", ACME Fall Meeting, Albuquerque, NM, November 2-4, 2015.
- [14] Drewniak, B. A., "Dynamic Root Distribution in CLM", CESM Workshop, Breckenridge, CO, June 15-18, 2015.
- [15] Drewniak, B. A., "Dynamic Roots in CLM", CLM Working Group Meeting, Boulder, CO, March 3-5, 2015.
- [16] Billionis, I., B. A. Drewniak, and E. M. Constantinescu, "Calibrating Soybean Parameters using a Sequential Monte Carlo Scheme", AGU, December 15-19, 2014.
- [17] Billionis, I., B. Drewniak, and E. M. Constantinescu, "Calibration soybean parameters using a Sequential Monte Carlo scheme", CESM Workshop, Breckenridge, CO, June 16-19, 2014.
- [18] Drewniak, B., and U. Mishra, "Soil organic carbon response to cultivation in the Community Land Model", RCN FORECAST Workshop: Representing Soil Carbon Dynamics in Global Land Models to Improve Future IPCC Assessments, Breckenridge, CO, June 11-14, 2014.

- [19] Drewniak, B., and U. Mishra, "Soil carbon response to cultivation in the Community Land Model", DOE PI Meeting, Potomac, MD, May 12-14, 2014.
- [20] Drewniak, B., "CLM Crops", iESM Meeting, College Park, MD, March 24-25, 2014.
- [21] Drewniak, B., "Soil organic response to harvested crops: a comparison between biogeochemistry model versions", CESM Land Model, Biogeochemistry, and Societal Dimensions Working Group Meeting, Boulder, CO, February 24-27, 2014.
- [22] Drewniak, B. A. and U. Mishra, "Modeling cultivation impacts on soil organic carbon under different management practices with the Community Land Model", 2013 AGU Fall Meeting, San Francisco, CA, Dec. 9-13, 2012.
- [23] Drewniak, B., X. Zeng, E. Constantinescu, "Calibrating soybean parameters in CLM-Crop using an MCMC approach", CESM Workshop, Breckenridge, CO, June 17-20, 2013.
- [24] Drewniak, B. A., "Assessing the impacts of a new planting date scheme on crop productivity and yield in CLM-Crop", CESM Land Model, Biogeochemistry, and Societal Dimensions Working Group Meetings, Boulder, CO, February 19 - 22, 2013.
- [25] Drewniak, B., V. R. Kotamarthi, "Estimating the Sensitivity of CLM-Crop to Plant Date and Growing Season Length", 2012 AGU Fall Meeting, San Francisco, CA, Dec. 3-7, 2012. (Poster)
- [26] Constantinescu, E. M., B. A. Drewniak, X. Zeng, "Calibration of the crop processes in the climate community model", 2012 AGU Fall Meeting, San Francisco, CA, Dec. 3-7, 2012. (Poster)
- [27] Drewniak, B., X. Zeng, M. Anitescu, and V. R. Kotamarthi, "Parameter Sensitivity Evaluation of the CLM-Crop Model," CESM Workshop, Breckenridge, CO, June 18-21, 2012. (Poster)
- [28] Zeng, X., B. Drewniak, A. Mametjanov, M. Anitescu, B. Norris, and V.R. Kotamarthi, "Crop parameter evaluation in CLM-Crop". CESM Land/BGC/Chemistry Climate/Societal Dimensions Working Group Meeting, Boulder, CO, February 27 - March 2, 2012.
- [29] Drewniak, B., X. Zeng, A. Mametjanov, M. Anitescu, B. Norris, and V.R., Kotamarthi, "Parameter sensitivity evaluation of the CLM-Crop model," 2011 AGU Fall Meeting, San Francisco, CA, Dec. 5-9, 2011. (Poster)
- [30] Drewniak, B., "Transient Landunits in CLM," 16th Annual CESM Workshop, Breckenridge, CO, June 20-23, 2011. (Poster)
- [31] Drewniak, B., V. R. Kotamarthi, J. Prell, R. Jacob, and J. Song, "Estimating changes in soil organic carbon under selected agriculture residue and fertilizer management practices with the Community Land Model," 2010 American Geophysical Union Fall Meeting, San Francisco, CA, Dec. 13-17, 2010.
- [32] Drewniak, B., V. R. Kotamarthi, J. Prell, R. Jacob, and J. Song, "Agriculture land use in CLM : impacts of management on soil carbon," 15th Annual Community Climate System Model Workshop, Breckenridge, CO, June 28 - July 1, 2010.
- [33] Drewniak, B., V. R. Kotamarthi, R. Jacob, J. Prell, and J. Song, "Modeling Soil Organic Carbon for Agriculture Land Use Under Various Management Practices," 2009 American Geophysical Union Fall Meeting, San Francisco, CA, December 14-18, 2009. (Poster)
- [34] Drewniak, B., J. Song, J. Prell, R. Kotamarthi, and R. Jacob, "Modeling Impacts of Land Use Change and Agriculture Management on Soil Carbon," 14th Annual CCSM Workshop, Breckenridge, CO, June 15-18, 2009. (Poster)
- [35] Drewniak, B., J. Song, R. Kotamarthi, and R. Jacob, "Agriculture Land Surface Scheme and Dynamic Root Structure in CLM," 2009 Climate Change and Prediction Program Meeting, Bethesda, MD, April 6-9, 2009. (Poster)

- [36] Drewniak, B., V. R. Kotamarthi, R. Jacob, J. Prell, and J. Song, "Modeling Water and Carbon Budgets in Current and Future Agriculture Land Use," 2008 American Geophysical Union Fall Meeting, San Francisco, CA, December 15-19, 2008. (Poster)
- [37] Drewniak, B., V. R. Kotamarthi, R. Jacob, J. Song, I. Foster, "Agriculture Models in CLM," 13th Annual CCSM Workshop, Breckenridge, CO, June 17-20, 2008. (Poster)

Sponsor reports

- [1] Air Force Presumed to Conform Materials: Boilers, Runway Marking, Airfield Lighting, Signage, and Aerospace Ground Equipment; with Al Smith and Young-Soo Chang.
- [2] Drewniak, B., F. Cheng, R. Jacob, and C. Catlett, "Urban Landscapes and Climate Change: Workshop Report", 2014 AMS Annual Meeting, Atlanta, GA, Feb. 3-7, 2014.

Organization of Workshops

- [1] Urban Scale Processes and their Representation in High Spatial Resolution Earth System Models, Argonne, IL, May 22-24, 2019 (organizing committee)
- [2] Urban Landscapes and Climate Change: from measurements to modeling, Argonne, IL, August 27-28, 2013 (organizing committee chair)
- [3] Scaling Root Processes: Global Impacts Workshop, Arlington, VA, March 7-9, 2012 (organizing committee)