

# NATASHA L. MACBEAN

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## RESEARCH INTERESTS

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My research focuses on understanding climate-carbon-vegetation interactions in response to climate change, rising CO<sub>2</sub>, and land use and land cover change. I use two main approaches: 1) developing, testing, and optimizing process-based terrestrial biosphere models; and 2) spatiotemporal data analysis to interpret field and satellite observations. My work spans scales from ecosystems to the globe, from boreal to tropical forests, and from temperate to semi-arid grasslands.

## EDUCATION

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**PhD in Land Surface Modelling and Remote Sensing** 2007 – 2011

Department of Geography, University College London, UK

Thesis Title: “Using Earth Observation Data to Improve Modelling of Peatland Carbon Fluxes”

**MESci in Earth Sciences** 2003 – 2007

Department of Earth Sciences, University of Oxford, UK

Bachelor’s (2006) and Master’s (2007) degrees – Upper Second Class with Honors (2.1)

2004: Elected to a Scholarship at Worcester College, University of Oxford.

## PROFESSIONAL EXPERIENCE

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**Assistant Professor** 2018 – present

Department of Geography, Indiana University - Bloomington.

Affiliate Faculty, Environmental Resilience Institute, Indiana University - Bloomington.

**Research Associate** 2016 – 2018

School of Natural Resources and the Environment, University of Arizona.

**Postdoctoral Research Scientist** 2011 – 2016

Laboratoire des Sciences du Climat et de l’Environnement (LSCE), France.

## PUBLICATIONS

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Google Scholar: citations = 1071; h-index = 19; i10-index = 24.

### *Published*

2020

[31] **MacBean, N.**, R.L. Scott, J.A. Biederman, C. Otlé, N. Vuichard, A. Ducharne, T. Kolb, S. Dore, M. Litvak and D.J.P. Moore (2020), Testing water fluxes and storage from two hydrology configurations within the ORCHIDEE land surface model across US semi-arid sites, *Hydrology and Earth System Sciences*, 24, 5203-5230.

[30] Walker, A. P., M. G. De Kauwe, A. Bastos, S. Belmecheri, K. Georgiou, R. Keeling, S. McMahon, B. E. Medlyn, D. J. P. Moore, R. J. Norby, S. Zaehle, K. J. Anderson-Teixeira, G. Battipaglia, R. J. W. Brienen, K. Cabugao, M. Cailleret, E. Campbell, J. Canadell, P. Ciais, M. E. Craig, D. Ellsworth, G. Farquhar, S. Faticchi, J. B. Fisher, D. Frank, H. Graven, L. Gu, V. Haverd, K. Heilman, M. Heimann, B. A. Hungate, C. M. Iversen, F. Joos, M. Jiang, T. F. Keenan, J. Knauer, W. K. Smith, C. Körner, V. O. Leshyk, S. Leuzinger, Y. Liu, **N. MacBean**, Y. Malhi, T. McVicar, J. Penuelas, J. Pongratz, A. Shafer Powell, T. Riutta, M. E. B. Sabot, J. Schleucher, S. Sitch, B. Sulman, B. Taylor, C. Terrer, M. Torn, K. Treseder, A. T. Trugman, S. Trumbore, P. J. van Mantgem, S. L. Voelker, M. Whelan, and P. Ziadema (2020), Integrating evidence for a terrestrial carbon sink caused by increasing atmospheric CO<sub>2</sub>, *New Phytologist*, doi: 10.1111/nph.16866.

[29] Parazoo, N., T. Magney, A. Norton, B. Raczka, C. Bacour, F. Maignan, I. Baker, Y. Zhang, B. Qiu, M. Shi, **N. MacBean**, D. Bowling, S. Burns, P. Blanken, J. Stutz, K. Grossman, and C. Frankenberg (2020), Wide Discrepancies in the Magnitude and Direction of Modelled SIF in Response to Light Conditions, *Biogeosciences*, 17, 3733-3755.

[28] Smith, W.K., A. Fox, **N. MacBean**, D.J.P. Moore and N. Parazoo (2020) Constraining estimates of terrestrial carbon uptake: New opportunities using long-term satellite observations and data assimilation. *New Phytologist*, 225, 105-112, doi: 10.1111/nph.16055. (Invited Tansley Insight).

## 2019

[27] Smith, W.K., M. Dannenberg, D. Yan, S. Herrmann, M.L. Barnes, G.A. Barron-Gafford, J.A. Biederman, S. Ferrenberg, A.M. Fox, A.R. Hudson, J.F. Knowles, **N. MacBean**, D.J.P. Moore, P.L. Nagler, S.C. Reed, W.A. Rutherford, R.L. Scott, X. Wang and J. Yang (2019), Remote sensing of dryland ecosystem structure and function: Progress, challenges and opportunities, *Remote Sensing of Environment*, 233, 111401.

[26] Bacour, C., F. Maignan, P. Peylin, **N. MacBean**, V. Bastrikov, J. Joiner, P. Köhler, L. Guanter, and C. Frankenberg (2019), Differences between OCO<sub>2</sub> and GOME2 SIF products from a model-data fusion perspective, *Journal of Geophysical Research Biogeosciences*, 124, doi: 10.1029/2018JG004938.

[25] Bacour, C., F. Maignan, **N. MacBean**, A. Porcar-Castell, J. Flexas, C. Frankenberg, P. Peylin, F. Chevallier and N. Vuichard (2019), Improving estimates of Gross Primary Productivity by assimilating solar-induced fluorescence satellite retrievals in a terrestrial biosphere model using a mechanistic SIF model, *Journal of Geophysical Research Biogeosciences*, 124, doi: 10.1029/2019JG005040.

[24] Duncanson, L., J. Armston, M. Disney, V. Avitabile, N. Barbier, K. Calders, S. Carter, J. Chave, M. Herold, T. Crowther, M. Falkowski, J. Kellner, N. Labrière, R. Lucas, **N. MacBean**, R.E. McRoberts, V. Meyer, E. Næsset, J.E. Nickeson, K.I. Paul, O.L. Phillips, M. Réjou-Méchain, M. Román, S. Roxburgh, S. Saatchi, D. Schepashenko, K. Scipal, P.R. Siqueira, M. Williams, and A. Whitehurst (2019), The Importance of Consistent Global Forest Aboveground Biomass Product Validation. *Surveys in Geophysics*, 40, 979-999, doi: 10.1007/s10712-019-09538-8.

[23] Exbrayat, J.-F., A. A. Bloom, N. Carvalhais, R. Fischer, A. Huth, **N. MacBean** and M. Williams (2019), Understanding the land carbon cycle with space data: current status and prospects. *Surveys in Geophysics*, 40, 735-755. doi: 10.1007/s10712-019-09506-2.

## 2018

[22] Bastrikov, V., **N. MacBean**, C. Bacour, D. Santaren, S. Kuppel and P. Peylin (2018), Land surface model parameter optimisation using in-situ flux data: comparison of gradient-based versus random search algorithms. *Geoscientific Model Development*, 11, 4739-4754.

[21] Fox, A.M., T.J. Hoar, J.L. Anderson, A.F. Arellano, W.K. Smith, M.E. Litvak, **N. MacBean**, D.S. Schimel, and D.J.P. Moore (2018), Evaluation of a Data Assimilation System for Land Surface Models using CLM4.5. *Journal of Advances in Modeling Earth Systems*, 10, 2471–2494.

[20] **MacBean, N.**, F. Maignan, C. Bacour, P. Lewis, P. Peylin, L. Guanter, P. Köhler, J. Gomez-Dans and M. Disney (2018), Strong constraint on modeled global carbon uptake using solar-induced chlorophyll fluorescence data. *Scientific Reports*, 8, 1973, doi:10.1038/s41598-018-20024-w.

[19] Li, W., **N. MacBean**, P. Ciais, P. Defourny, C. Lamarche, S. Bontemps, R. A. Houghton and S. Peng (2018), Gross and net land cover changes in the main plant functional types derived from the annual ESA CCI land cover maps (1992–2015). *Earth System Science Data*, 10, 219–234. <https://doi.org/10.5194/essd-10-219-2018>.

[18] Smith, W.K., J.A Biederman, R.L. Scott, D.J.P. Moore, M. He, J.S. Kimball, D. Yan, A. Hudson, M.L. Barnes, **N. MacBean**, A. Fox and M.E. Litvak (2018), Chlorophyll fluorescence better captures seasonal and interannual gross primary productivity dynamics across dryland ecosystems of southwestern North America. *Geophysical Research Letters*, 45, 748–757.

[17] Liu, D., Y. Li, T. Wang, P. Peylin, **N. MacBean**, P. Ciais, G. Jia, M. Ma, Y. Ma, M. Shen, X. Zhang and S. Piao (2018), Contrasting responses of grassland water and carbon exchanges to climate change between the Tibetan Plateau and Inner Mongolia. *Agricultural and Forest Meteorology*, 249, 163–175.

## 2017

[16] Hartley, A., **N. MacBean**, G. Georgievski and S. Bontemps (2017), Uncertainty in plant functional type distributions and its impact on land surface models. *Remote Sensing of Environment*, 203, 71–89.

[15] Montané, F., A. Fox, A. Arellano, **N. MacBean**, R. Alexander, A. Dye, D. Bishop, V. Trouet, F. Babst, A. Hessel, N. Pederson, P. Blanken, G. Bohrer, C. Gough, M. Litvak, K. Novick, R. Phillips, J. Wood and D. Moore (2017), Evaluating the effect of alternative carbon allocation schemes in a land surface model on carbon fluxes, pools and turnover in temperate forests. *Geoscientific Model Development*, 10, 3499–3517.

[14] Li, Y., H. Yang, T. Wang, **N. MacBean**, C. Bacour, P. Ciais, Y. Zhang, G. Zhou and S. Piao (2017), Reducing parameter uncertainty of modeled carbon-water dynamics: impact on the sensitivity of Chinese forest ecosystems to climate change. *Global Biogeochemical Cycles*, 31, doi:10.1002/2017GB005714.

[13] Walker, A. P., T. Quaipe, P. M. van Bodegom, M. G. De Kauwe, T. F. Keenan, J. Joiner, M. R. Lomas, **N. MacBean**, C. Xu, X. Yang and F. I. Woodward (2017), The impact of alternative trait-scaling hypotheses for the maximum photosynthetic carboxylation rate ( $V_{\text{cmax}}$ ) on global gross primary production. *New Phytologist*, 215, 1370–1386.

[12] Thum, T., **N. MacBean**, P. Peylin, C. Bacour, D. Santaren, B. Longdoz, D. Loustau and P. Ciais (2017), The potential of forest biomass data in addition to carbon and water flux measurements to constrain ecosystem model parameters: Case studies at two temperate forest sites. *Agricultural and Forest Meteorology*, 234, 48–65.

## 2016

[11] **MacBean, N.**, P. Peylin, F. Chevallier, M. Scholze and G. Schürmann (2016), Consistent assimilation of multiple data streams in a carbon cycle data assimilation system. *Geoscientific Model Development*, 9, 3569–3588. (Invited Submission).

[10] Peylin, P., C. Bacour, **N. MacBean**, S. Leonard, P.J. Rayner, S. Kuppel, E.N. Koffi, A. Kane, F. Maignan, F. Chevallier, P. Ciais and P. Prunet (2016), A new step-wise Carbon Cycle Data Assimilation

System using multiple data streams to constrain the simulated land surface carbon cycle. *Geoscientific Model Development*, 9, 3321-3346.

[9] Li, W., P. Ciais, **N. MacBean** and S. Peng (2016), Major forest changes and land cover transitions based on plant functional types derived from the ESA CCI Land Cover product. *International Journal of Applied Earth Observation and Geoinformation*, 47, 30-39.

## 2015

[8] **MacBean, N.**, F. Maignan, P. Peylin, C. Bacour, P. Ciais and F.-M. Bréon (2015), Using satellite data to improve the leaf phenology of a global Terrestrial Biosphere Model. *Biogeosciences*, 12, 7185-7208.

[7] Bacour, C., P. Peylin, **N. MacBean**, P. Rayer, F. Delage and D. Santaren (2015), Joint assimilation of eddy-covariance flux measurements and satellite observations within a process-oriented biosphere model. *Journal of Geophysical Research Biogeosciences*, 120, 1839–1857.

[6] Poulter, B., **N. MacBean**, A. Hartley, I. Khlystova, O. Arino, R. Betts, S. Bontemps, M. Boettcher, C. Brockmann, P. Defourny, S. Hagemann, M. Herold, G. Kirches, C. Lamarche, D. Lederer, C. Ottlé, M. Peters, and P. Peylin (2015), Plant functional type classification for Earth System Models: results from the European Space Agency's Land Cover Climate Change Initiative. *Geoscientific Model Development*, 8, 2315-2328.

[5] Naudts, K., J. Ryder, M. J. McGrath, J. Otto, Y. Chen, A. Valade, V. Bellasen, G. Berhongaray, G. Bönisch, M. Campioli, J. Ghattas, T. De Groot, V. Haverd, J. Kattge, **N. MacBean**, F. Maignan, P. Merilä, J. Penuelas, P. Peylin, B. Pinty, H. Pretzsch, E. D. Schulze, D. Solyga, N. Vuichard, Y. Yan, and S. Luyssaert (2015) A vertically discretised canopy description for ORCHIDEE (SVN r2290) and the modifications to the energy, water and carbon fluxes. *Geoscientific Model Development*, 8, 2035-2065.

[4] Wang, X., S. Piao, X. Xu, P. Ciais, **N. MacBean**, R.B. Myneni and L. Li (2015) Has the advancing onset of spring vegetation green-up slowed down or changed abruptly over the past three decades? *Global Ecology and Biogeography*, 24, 621-631.

## 2014

[3] **MacBean, N.** and P. Peylin (2014), Biogeochemistry: Agriculture and the Global Carbon Cycle. *Nature (News and Views)*, 515, 351-352. (Invited Submission).

[2] Traore, A., P. Ciais, N. Vuichard, **N. MacBean**, C. Dardel, B. Poulter, S. Piao, J.B. Fisher, N. Viovy, M. Jung and R. Myneni (2014) 1982-2010 Trends of Light use Efficiency and Inherent Water use Efficiency in African vegetation: Sensitivity to Climate and Atmospheric CO<sub>2</sub> Concentrations. *Remote Sensing*, 6, 8923-8944.

## Pre-2014

[1] Walker, R.T., M. Talebian, S. Saiffori, R.A. Sloan, A. Rasheedi, **N. MacBean** and A. Ghassemi (2010) Active faulting, earthquakes, and restraining bend development near Kerman city in southeastern Iran. *Journal of Structural Geology*, 32, 1046-1060.

**Submitted, Under Review, or In Revision**

## RESEARCH GRANTS

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- 2016 – 2020:** **European Union Horizon 2020 Programme MULTIPLY Project:** Platform for retrieval of multiscale land surface information from SENTINEL satellite data.  
*€90,000 – Led LSCE contribution to proposal; Co-supervise LSCE Postdoctoral Scientist on project.*
- 2015 – 2017:** **French CNES Space Agency FLuOR Project** (Fluorescence in ORCHIDEE): Development of new fluorescence model in the ORCHIDEE terrestrial biosphere model, CNES Centre National d'Etudes Spatiales) TOSCA (Terre solide, Océan, Surfaces Continentale, Atmosphère) Programme.  
*€56,000 – Contributed to proposal and implementation of the work for the project.*
- 2014 – 2017:** **European Space Agency Climate Change Initiative Land Cover Project:** Derivation of a new Land Cover mapping algorithm from satellite data.  
*€120,000 – Led LSCE contribution to proposal and managed/ carried out work for the project as a climate model user.*
- 2014 – 2015:** **European Space Agency Earth Explorer 8 FLEX/Sentinel 3 Tandem Mission FLEX Bridge Study:** Preparatory scientific study for Solar Induced Fluorescence retrieval from satellites and applications in assessment of photosynthesis and stress status in terrestrial vegetation.  
*€5,000 – Led LSCE contribution to the proposal and managed/ carried out data assimilation work as land surface model user.*

## PRESENTATIONS (INVITED)

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**MacBean, N.** (2020) “Model-Data Fusion for Reducing Uncertainty in Global Carbon Cycle Predictions: How Far Have We Come and How Far Do We Have To Go?”, *NASA Global Modeling and Assimilation Office Virtual Seminar Series on Earth System Science*, Online, USA.

**MacBean, N.** (2020) “Constraining Global Land Surface Model Carbon Budgets: Past Successes, Current Challenges and Future Opportunities”, *University of Wisconsin-Madison Center for Climate Research Climate, People, and Environment Program Seminar Series*, Madison, USA.

**MacBean, N.**, C. Bacour, F. Maignan, P. Peylin, V. Bastrikov, N. Raoult and J. Gomez-Dans (2019) “How can we best constrain terrestrial biosphere model carbon cycle predictions using satellite remote sensing data?”, *American Geophysical Union Annual Fall Meeting*, San Francisco, USA.

**MacBean, N.**, R.L. Scott, J.A. Biederman, P. Peylin and D.J.P. Moore (2019) “Terrestrial biosphere models underestimate the mean and inter-annual variability of net CO<sub>2</sub> fluxes in semi-arid ecosystems”, *American Geophysical Union Annual Fall Meeting*, San Francisco, USA.

**MacBean, N.** and the ORCHIDEE LSM Data Assimilation Team (2019) “Quantifying and reducing uncertainty in global carbon budget projections: Lessons learned from 10 years of ORCHIDEE LSM Data Assimilation studies”, *American Geophysical Union Chapman Conference on Understanding Carbon-Climate Feedbacks*, Scripps Institution of Oceanography, La Jolla, USA.

**MacBean, N.** (2018) “1.5, 2, 4 Degrees, Or More? The Urgent Need To Constrain Carbon Cycle Uncertainty In Future Climate Projections”, *School of Public and Environmental Affairs Environmental Science Seminar*, Indiana University, Bloomington, USA.

**MacBean, N.** (2018) “A Simple Data Assimilation Approach For Constraining Global Scale Modeled GPP Using GOME2 SIF Data”, *OCO-2 Solar Induced Chlorophyll Fluorescence (SIF) Science Team Monthly Webinar*, Hosted by the NASA Jet Propulsion Laboratory, USA.

**MacBean, N.** (2018) “Interpreting Satellite Greening Trends”, *Workshop on Integrating CO<sub>2</sub> Fertilization Evidence Streams and Theory (ICOFE<sub>ST</sub>): Global Terrestrial C Sink*”, University of Arizona Biosphere 2, Tucson, USA.

**MacBean, N.** (2018) “Multi-Purpose, Modularized, Testable, and Fully Constrained Against Multiple Datasets: A Vision for the Future of Land Surface Model Development”, *Workshop on “The Future of Earth System Modeling: Biosphere and Land Surfaces*”, California Institute of Technology, Pasadena, USA.

**MacBean, N.** (2017) “Untangling Spaghetti: Confronting Models With Data To Constrain Terrestrial Carbon Sink Projections”, *NASA Jet Propulsion Laboratory Carbon Club Seminar*, Pasadena, USA.

**MacBean, N.** (2017) “Capturing Vegetation And Carbon Dynamics In Semi-Arid Ecosystems”, *US Geological Survey Noon Seminar*, Tucson, USA.

**MacBean, N.** (2016) “Improving Vegetation Dynamics In Global Terrestrial Biosphere Models”, *National Phenology Network Lunchtime Seminar*, Tucson, USA.

**MacBean, N.** (2015) “How Will Your Garden Grow? Building Better Models Of Terrestrial Biosphere Dynamics Under A Changing Climate”, *Department of Atmospheric Sciences Dynamics Series Seminar*, University of Washington, Seattle, USA.

**MacBean, N.** (2015) In-Situ And Satellite Data Assimilation, *Integrated Carbon Observation System (ICOS) France – Annual General Meeting*, Paris, France.

**MacBean, N.** and the ORCHIDEE data assimilation group (2015) A Carbon Cycle Data Assimilation System At LSCE Using Multiple Data Streams, *Integrated Carbon Observation System Model-Data Fusion Workshop*, Paris, France.

**MacBean, N.** (2014) The Need For Soil Moisture Data For Evaluation And Optimisation Of A Global Land Surface Model, *European Space Agency Workshop: Understanding the Carbon and Water Cycles using SMOS Data and Models*, Toulouse, France.

**MacBean, N.** and the ORCHIDEE data assimilation group (2014) How Best To Optimize A Global Process-Based Carbon Land Surface Model? *TERENO Terrestrial Environmental Observatories International Conference*, Bonn, Germany.

**MacBean, N.** (2014) Using Satellite Data To Improve The Leaf Phenology Of A Global Land Surface Model, *Department of Ecology, Montana State University*, Bozeman, USA.

**MacBean, N.** (2014) Data Assimilation with the ORCHIDEE Terrestrial Biosphere Model, *European Space Agency Data Assimilation Project Workshop on Data Assimilation for Land Surface Models*, London, UK.

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**PRESENTATIONS (CONTRIBUTED)** Student (†) and Postdoc (‡) advisees are underlined

‡Mahmud K., J. A. Biederman, R. L. Scott, M. Litvak, T. Kolb, T. P. Meyers, P. Krishnan, V. Bastrikov, **N. MacBean** (2020) “Photosynthesis and Phenology Parameter Optimization Alleviates Terrestrial Biosphere Model Underestimate of Net CO<sub>2</sub> Flux Interannual Variability at Semiarid Sites”, *American Geophysical Union Annual Fall Meeting*, Virtual Online (poster).

Parazoo, N., T. Magney, A. Norton, B. M. Raczka, C. Bacour, F. Maignan, I. T. Baker, Y. Zhang, M. Shi, **N. MacBean**, D. R. Bowling, S. P. Burns, P. Blanken, J. Stutz, K. Grossmann, C. Frankenberg, Z. Pierrat,

S. G. Stettz and A. A. Bloom (2020) “Modeling the Magnitude and Direction of SIF and GPP in Response to Light Conditions Across Evergreen Forests”, *American Geophysical Union Annual Fall Meeting*, Virtual Online (poster).

Novick, K. A., K. J. Davis, D. L. Ficklin, T. A. Ghezzehei, A. G. Konings, **N. MacBean**, Shawn Naylor, R. L. Scott, Y. Shi and B. Sulman (2020) “Plant hydraulics: A theory-rich but data-poor field”, *American Geophysical Union Annual Fall Meeting*, Virtual Online (oral).

<sup>‡</sup>**Mahmud K.**, J. A. Biederman, R. L. Scott, M. Litvak, T. Kolb, T. P. Meyers, P. Krishnan, V. Bastrikov, **N. MacBean** (2020) “Parameter Optimization at Multiple AmeriFlux Semi-arid Sites Improves Terrestrial Biosphere Model Prediction of CO<sub>2</sub> Exchange”, *2020 AmeriFlux Annual Meeting*, Virtual Online (poster).

<sup>†</sup>**Pervin, R.**, S. Robeson, S. Roy and **N. MacBean** (2019) “Multi-Source Remote Sensing Data Fusion for Detecting Changes in Shrub Cover in Semi-Arid Regions”, *American Geophysical Union Annual Fall Meeting*, San Francisco, USA (oral).

Moore, D.J.P., A. Hudson, **N. MacBean**, W. K. Smith and K. Novick (2019) “Examining the effects of state factors on ecosystem carbon fluxes in North America”, *American Geophysical Union Annual Fall Meeting*, San Francisco, USA (oral).

**MacBean, N.**, R.L. Scott, J.A. Biederman and D.J.P. Moore (2019) “Coupled vegetation-carbon-water processes responsible for uncertainties in terrestrial biosphere model predictions of semi-arid SW US inter-annual carbon source-sink dynamics”, *American Geophysical Union Chapman Conference on Understanding Carbon-Climate Feedbacks*, Scripps Institution of Oceanography, La Jolla, USA (poster).

Smith, W. K., A.M. Fox, D.J.P. Moore, **N. MacBean** and N. Parazoo (2019) “Constraining the terrestrial CO<sub>2</sub> fertilization effect using satellite observations: Opportunities and challenges” *American Geophysical Union Chapman Conference on Understanding Carbon-Climate Feedbacks*, Scripps Institution of Oceanography, La Jolla, USA (oral).

**MacBean, N.**, R. Scott, J. Biederman, T. Kolb, S. Dore, N. Vuichard, A. Ducharne, P. Peylin and D.J.P. Moore (2018) What impact do plant and soil hydrologic schemes of varying complexity have on simulated water and carbon fluxes across semi-arid sites in the southwestern US?, *American Geophysical Union Annual Fall Meeting*, Washington D.C., USA (poster).

Bacour, C., F. Maignan, **N. MacBean**, A. Porcar-Castell, J. Flexas, C. Frankenberg, P. Peylin, F. Chevallier and N. Vuichard (2018) Calibration of global scale gross primary productivity simulated with the ORCHIDEE model by assimilating OCO-2 SIF products, *American Geophysical Union Annual Fall Meeting*, Washington D.C., USA (poster).

Moore, D.J.P., A. Dawson, J. Peters, C. Paciorek, J. Steinkamp, N. Pederson, A.W. D’Amato, A.M. Fox, **N. MacBean** and S. Goring (2018) Regional loss of long-lived tree species reduces the capacity of the biosphere to store carbon over centuries, *American Geophysical Union Annual Fall Meeting*, Washington D.C., USA (poster).

Barnes, M., K. Novick, D. Breshears, D.J.P. Moore, R. Scott, J. Biederman, G. Ponce-Campos and **N. MacBean** (2018) Lessons from the semi-arid West: drought controls carbon uptake dynamics in mesic Eastern US forests, *American Geophysical Union Annual Fall Meeting*, Washington D.C., USA (poster).

**MacBean, N.**, R. Scott, J. Biederman, T. Kolb, S. Dore, N. Vuichard, A. Ducharne and D.J.P. Moore (2018) Testing conceptual and mechanistic soil hydrology model simulations against observed water and carbon fluxes across semi-arid sites in the southwestern US, *2018 AmeriFlux PI Meeting*, Bloomington, USA

(oral).

Peylin, P., C. Bacour, **N. MacBean**, V. Bastrikov, N. Raoult, C. Ottlé and F. Maignan (2018) Multiple data stream assimilation with the ORCHIDEE land surface model to improve regional to global simulated carbon and water budgets, *European Geosciences Union General Assembly*, Vienna, Austria (oral).

Maignan, F., C. Bacour, **N. MacBean**, P. Peylin, V. Bastrikov, M. Disney, J. Flexas, C. Frankenberg, J. Gomez-Dans, L. Guanter, J. Joiner, P. Köhler, P. Lewis and A. Porcar-Castell (2018) Assimilation of fluorescence products to constrain gross primary production in the terrestrial biosphere model ORCHIDEE, *European Geosciences Union General Assembly*, Vienna, Austria (oral).

**MacBean**, N., R. Scott, J. Biederman, N. Vuichard, M. Barnes, A. Hudson, A. Fox, W. Kolby-Smith, P. Peylin, F. Maignan and D. Moore (2017) CMIP5 land surface models systematically underestimate inter-annual variability of net ecosystem exchange in semi-arid southwestern North America, *American Geophysical Union Fall Meeting*, San Francisco, USA (poster).

C. Bacour, F. Maignan, **N. MacBean**, P. Köhler, M. Vountas, N. Khosravi, L. Guanter, J. Joiner, C. Frankenberg, P. Somkuti and P. Peylin (2017) Comparison of several satellite-derived Sun-Induced Fluorescence products, *American Geophysical Union Fall Meeting*, San Francisco, USA (poster).

J. Biederman, R. Scott, W. Kolby-Smith, M. Litvak and **N. MacBean** (2017) Expanding dryland ecosystem flux datasets enable novel quantification of water availability and carbon exchange in Southwestern North America, *American Geophysical Union Fall Meeting*, San Francisco, USA (oral, invited).

P. Peylin, C. Bacour, **N. MacBean**, F. Maignan, V. Bastrikov and F. Chevallier (2017) Ten years of multiple data stream assimilation with the ORCHIDEE land surface model to improve regional to global simulated carbon budgets: synthesis and perspectives on directions for the future, *American Geophysical Union Fall Meeting*, San Francisco, USA (oral).

W.K. Smith, J. Biederman, R. Scott, D. Moore, J. Kimball, M. He, D. Yan, A. Hudson, M. Barnes, **N. MacBean**, A. Fox and M. Litvak (2017) Evidence of a robust relationship between solar-induced chlorophyll fluorescence and gross primary productivity across dryland ecosystems of southwestern North America *American Geophysical Union Fall Meeting*, San Francisco, USA (oral).

M. Barnes, D. Moore, R. Scott, **N. MacBean**, G. Ponce-Campos and D. Breshears (2017) Upscaling Ameriflux observations to assess drought impacts on gross primary productivity across the Southwest, *American Geophysical Union Fall Meeting*, San Francisco, USA (oral).

**N. MacBean**, D.J.P. Moore, R. Scott, J. Biederman, W. Kolby-Smith, M. Barnes and A. Richardson (2017) Untangling the dominant controls on seasonal vegetation dynamics and carbon uptake in semi-arid ecosystems of the southwestern US, *Joint Ameriflux and NACP Principal Investigators Meeting*, Bethesda, USA (poster).

Peylin, P., **N. MacBean**, C. Bacour, F. Maignan, V. Bastrikov and F. Chevallier (2017) Multiple data stream assimilation in a Land Surface Model to improve regional to global simulated carbon budgets: synthesis and prospective with the ORCHIDEE model, *10<sup>th</sup> International Carbon Dioxide Conference*, Interlaken, Switzerland (poster).

Bacour, C., F. Maignan, A. Porcar-Castell, **N. MacBean**, Y. Goulas, J. Flexas, L. Guanter, J. Joiner and P. Peylin (2016) Potential of satellite derived SIF products to constrain GPP simulated by the new ORCHIDEE-FluOR terrestrial model at the global scale, *American Geophysical Union Fall Meeting*, San Francisco, USA (oral).



Bastrikov, V., **N. MacBean**, P. Peylin, C. Bacour, D. Santaren and S. Kuppel (2016) Land surface model parameter optimization using FluxNet data: gradient-based versus Monte Carlo algorithms, *Workshop on Data Assimilation in Terrestrial Systems*, Bonn, Germany, (poster).

Hartley, A., **N. MacBean**, G. Georgievski, S. Bontemps, P. Peylin, S. Hagemann, C. Ottlé (2016) Sensitivity of land surface models to uncertainties in satellite derived land cover mapping and fractional plant functional type translation, *European Space Agency Living Planet Symposium*, Prague, Czech Republic, (oral).

Defourny, P., F. Achard, M. Boettcher, S. Bontemps, C. Brockmann, J. Eberenz, P. Gamba, G. Georgievski, M. Herold, S. Hagemann, A. Hartley, G. Kirches, C. Lamarche, G. Lisini, **N. MacBean**, I. Moreau, C. Ottlé, P. Peylin, T. Riedel, A. Salentinig, M. Santoro, C. Schmullius, M. Vittek, F. Ramoino, and O. Arino (2016) Global and regional land cover mapping and characterization for climate modelling: current achievements of the Land Cover component of the ESA Climate Change Initiative, *European Space Agency Living Planet Symposium*, Prague, Czech Republic, (oral).

Peylin, P., **N. MacBean**, T. Launois, S. Belviso, P. Cadule and F. Maignan (2016) Atmospheric COS measurements and satellite-derived vegetation fluorescence data to evaluate the terrestrial gross primary productivity of CMIP5 models, *European Geosciences Union General Assembly*, Vienna, Austria (oral).

Georgievski, G., A. Hartley, **N. MacBean** and S. Hagemann (2016) Evaluation of the uncertainty due to land cover observation and conversion into plant functional types, *European Geosciences Union General Assembly*, Vienna, Austria (poster).

**MacBean, N.**, F. Maignan, P. Lewis, C. Bacour, P. Peylin, L. Guanter, P. Köhler, J. Gomez-Dans, M. Disney and F. Chevallier (2015) A Model-Data Fusion Approach for Constraining Modeled GPP at Global Scales Using GOME2 SIF Data, *American Geophysical Union Fall Meeting*, San Francisco, USA (poster).

Carvalhais, N., M. Forkel, M. van Oijen, T. F. Keenan, **N. MacBean**, S. Rolinski, P. Peylin, G. J. Schuermann, S. Zaehle and M. Reichstein (2015) Enhanced understanding of the terrestrial carbon cycle through multiple constraints in model-data-integration approaches, *American Geophysical Union Fall Meeting*, San Francisco, USA (oral, invited).

Peylin, P., **N. MacBean**, P. Cadule, T. Launois, S. Belviso, V. Bastrikov, L. Guanter and P. Köhler (2015) Atmospheric OCS measurements and satellite-derived vegetation fluorescence data to evaluate the terrestrial gross primary productivity of CMIP5 models, *Joint WCRP – EU FP7 EMBRACE Project Workshop on CMIP5 Model Analysis and Scientific Plans for CMIP6*, Dubrovnik, Croatia (poster).

Naudts, K., J. Ryder, M. J. McGrath, J. Otto, Y. Chen, A. Valade, V. Bellasen, J. Ghattas, V. Haverd, **N. MacBean**, F. Maignan, P. Peylin, B. Pinty, D. Solyga, N. Vuichard and S. Luyssaert (2015) Forest management in Earth system modelling: a vertically discretised canopy description for ORCHIDEE and the modifications to the energy, water and carbon fluxes, *European Geosciences Union General Assembly*, Vienna, Austria (oral).

**MacBean, N.**, F. Maignan, P. Peylin and C. Bacour (2014) Optimising the prognostic leaf phenology of a land surface model at a global scale: perspectives and challenges, *European Geosciences Union General Assembly*, Vienna, Austria (oral).

Defourny, P., H. Verbeeck, I. Moreau, M. De Weirdt, A. Verhegghen, J.-P. Kibambe-Lubamba, Q. Jungers, F. Maignan, N. Najdovski, B. Poulter, **N. MacBean** and P. Peylin (2014) Integrating SPOT-VEGETATION 13-yr time series and land-surface modelling to forecast the terrestrial carbon dynamics

in a changing climate – The VEGECLIM project: achievements and lessons learned, *European Geosciences Union General Assembly*, Vienna, Austria (oral).

Najdovski, N., B. Poulter, P. Defourny, I. Moreau, F. Maignan, P. Ciais, A. Verhegghen, J.-P. Kibambe Lubamba, Q. Jungers, M. De Weirtdt, H. Verbeeck, **N. MacBean** and P. Peylin (2014) A modelling approach to estimate carbon emissions from DRC deforestation, *European Geosciences Union General Assembly*, Vienna, Austria (poster).

Peylin, P., C. Bacour, **N. MacBean**, S. Leonard, F. Maignan, T. Thum, F. Chevallier, P. Ciais, P. Cadule and D. Santaren (2014) How best to optimize a global process-based carbon land surface model?, *European Geosciences Union General Assembly*, Vienna, Austria (oral).

Moreau, I., P. Defourny, A. Verhegghen, H. Verbeeck, M. De Weirtdt, F. Maignan Fabienne, N. Najdovski, B. Poulter, **N. MacBean** and P. Peylin (2014) 13-Yr SPOT-VEGETATION time series to detect the vegetation phenology in tropical rainforest of the Congo Basin, *EGU General Assembly*, Vienna, Austria (poster).

**MacBean, N.**, F. Maignan, P. Peylin and C. Bacour (2013) Using satellite data to constrain leaf phenology of the terrestrial biosphere model ORCHIDEE, *Global Vegetation Monitoring and Modelling Conference*, Avignon, France (oral).

Bacour, C., P. Peylin, P. Rayner, F. Delage, **N. MacBean**, M. Weiss, J. Demarty and F. Baret (2014) Coupled assimilation of in-situ flux measurements and satellite FAPAR time series to optimize a process-based vegetation model, *Global Vegetation Monitoring and Modelling Conference*, Avignon, France (poster).

Defourny, P., F. Achard, J. Andrew, Hartley, R. Betts, M. Boettcher, S. Bontemps, C. Brockmann, P. Carsten, O. Danne, P. Gamba, L. Garcia-Carreras, S. Hagemann, I.G. Khlystova, G. Kirches, S. Kloster, C. Lamarche, G. Lisini, A. Loew, **N. MacBean**, P. Mayaux, M. Paperin, D. Parker, P. Peylin, B. Poulter, J. Radoux, T. Riedel, M. Santoro, C. Schmullius, S. Smollich, E. Van Bogaert, A. Verhegghen, U. Wegmüller, M. Zuehlke, V. Kalogirou, F.-M. Seifert, O. Arino (2014) Multiyear 300m global land cover database assessed by three climate models: current achievements of the land cover component of the ESA climate change initiative, *Global Vegetation Monitoring and Modelling Conference*, Avignon, France (oral).

Poulter, B., **N. MacBean**, A. Hartley, I. Khlystova, O. Arino, R. Betts, S. Bontemps, C. Brockmann, P. Defourny, S. Hagemann, V. Kalogirou, G. Kirches, C. Lamarche, D. Lederer, P. Peylin (2014) Does consistency in land cover improve model comparisons? Results from ESA's land cover climate change initiative, *Global Vegetation Monitoring and Modelling Conference*, Avignon, France (oral).

Peylin, P. C. Bacour, **N. MacBean**, S. Leonard, F. Maignan, F. Chevallier (2014) Additional information brought by NDVI data to constrain the parameters of a land surface model (ORCHIDEE) in comparison to FluxNet and atmospheric CO<sub>2</sub> data, *Global Vegetation Monitoring and Modelling Conference*, Avignon, France (poster).

Carvahalais, N., M. Van Oijen, T. Keenan, **N. MacBean**, et al. (2013) Evaluating the predictability of terrestrial ecosystem carbon fluxes integrating long term eddy-covariance and biometric observations with multi-model ensembles, *American Geophysical Union Fall Meeting*, San Francisco, USA (oral).

**MacBean, N.**, F. Maignan, P. Peylin and C. Bacour (2013) Using Earth Observation (EO) data to constrain leaf phenology of the land surface model ORCHIDEE, *9<sup>th</sup> International Carbon Dioxide Conference*, Beijing, China (oral).

Peylin, P., **N. MacBean**, C. Bacour, S. Leonard, F. Maignan, S. Kuppel, F. Chevallier, P. Ciais, F.M. Bréon, P. Cadule, P. Prunet, A. Klonecki and members of the EU FP7 CARBONES Project (2013) A 20-

year land carbon flux and stocks reanalysis from a Carbon Cycle Multi-Data Assimilation System using in-situ FluxNet, satellite NDVI, and atmospheric CO<sub>2</sub> observations to optimize a process-based model, 9<sup>th</sup> *International Carbon Dioxide Conference*, Beijing, China (oral, invited).

Peylin, P., **N. MacBean**, C. Bacour, S. Leonard, F. Maignan, S. Kuppel, F. Chevallier, P. Ciais T. Thum (2013) Optimization of the process-based global model, ORCHIDEE, using multiple data streams (in-situ FluxNet NEE, LE and biomass, satellite NDVI, and atmospheric CO<sub>2</sub> data), *European Geosciences Union General Assembly*, Vienna, Austria (oral).

**MacBean, N.**, M. Disney, P. Lewis, J. Gomez-Dans and P. Ineson (2010) Using satellite observations to improve model estimates of CO<sub>2</sub> and CH<sub>4</sub> flux: a Metropolis Hastings Markov Chain Monte Carlo approach, *iLeaps–European Geosciences Union–European Space Agency Joint Conference on “Earth Observation for Land-Atmosphere Interaction Science”*, Frascati, Italy (oral).

**MacBean, N.**, M. Disney, P. Ineson and P. Lewis (2010) Using satellite measurements of surface soil moisture to improve estimates of CO<sub>2</sub> and CH<sub>4</sub> fluxes from peatlands, *European Space Agency Living Planet Symposium*, Bergen, Norway (poster).

Stockdale, J. and **N. MacBean** (2010) Estimating methane fluxes at a landscape scale, *European Geosciences Union General Assembly*, Vienna, Austria (oral).

**MacBean, N.**, M. Disney, P. Lewis and P. Ineson (2010) Using satellite observations to improve model estimates of CO<sub>2</sub> and CH<sub>4</sub> flux: a Metropolis Hastings Markov Chain Monte Carlo approach, *European Geosciences Union General Assembly*, Vienna, Austria (oral).

## CONFERENCE PROCEEDINGS

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Kato, T., F. Maignan, **N. MacBean**, P. Peylin, N. Vuichard, Y. Goulas, F. Daumard, I. Moya, A. Porcar-Castell and C. Nicol (2014) Relationship of the model-simulated productivity with the in-situ fluorescence measurements at two flux sites, 5<sup>th</sup> *International Workshop on Remote Sensing of Fluorescence*, Paris, France.

**MacBean, N.**, M. Disney, J. Gomez-Dans, P. Lewis and P. Ineson (2010) Using satellite measurements of surface soil moisture to improve estimates of CO<sub>2</sub> and CH<sub>4</sub> from peatlands, *European Space Agency Living Planet Symposium*, Bergen, Norway.

## STUDENT MENTORING

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### *Doctoral Student Committee Chair*

**Rubaya Pervin** (PhD *In Progress*) **2018 – Present**  
Thesis Topic: *Identifying Drivers of Vegetation and Land Cover Change Using Satellite Remote Sensing*.  
Department of Geography, Indiana University.

### *Doctoral Student Committee Member*

**Ruhui Chai** (PhD *In Progress*) **2020 – Present**  
Department of Geography, Indiana University.

**Josie Arcuri** (MSc *In Progress*) **2020 – Present**  
Department of Earth and Atmospheric Sciences, Indiana University.

**Michael Benson** (PhD *In Progress*) **2019 – Present**  
School of Public and Environmental Affairs, Indiana University.

**Justin Peters** (PhD *In Progress*) 2019 – Present  
School of Informatics, Computing and Engineering, Indiana University.

**Tsun Fung Au** (PhD *In Progress*) 2018 – 2019  
Department of Geography, Indiana University.

***Undergraduate Student Advisor***

**Heidi Takada** (IU 2020 Sustainability Scholars Program) Oct. 2018 – May 2019  
Research Project Topic: *Developing a GIS Database of Past Mangrove Change*.

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**TEACHING EXPERIENCE**

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**Course Leader/Instructor** FA18, SP19, SP20, SP21  
GEOG-G185 “Environmental Change: The End Of The World As We Know It?”  
Department of Geography, Indiana University, Bloomington, IN, USA.

**Course Leader/Instructor** Spring 2020  
GEOG-G481/581 Terrestrial Ecosystem Modeling (Topics in Environmental Geography).  
Department of Geography, Indiana University, Bloomington, IN, USA.

**Course Leader/Instructor** Fall 2019  
GEOG-G489/589 Advanced Geospatial Data Analysis in Python.  
Department of Geography, Indiana University, Bloomington, IN, USA.

**Course Leader/Instructor** Spring 2019  
GEOG-G440/540 Python Programming (Topics in Environmental Geography).  
Department of Geography, Indiana University, Bloomington, IN, USA.

**Course Leader/Co-Instructor** Spring 2018  
Spring Seminar Class (RNR 696A-005): “Controversies in Global Change Ecology”  
School of Natural Resources and the Environment, University of Arizona, Tucson, AZ, USA.

**Course Leader/Co-Instructor** Spring 2017  
Spring Seminar Class (RNR 696A-005): “Current State of Our Knowledge on the Global Carbon Cycle”  
School of Natural Resources and the Environment, University of Arizona, Tucson, AZ, USA.

**Workshop Leader (invited)** April 2014  
European Space Agency Data Assimilation Project Workshop on Data Assimilation for Land Surface  
Process Models, University College London, UK.  

- Tutorial on Data Assimilation with the ORCHIDEE Terrestrial Biosphere Model  
(<https://orchidas.lsce.ipsl.fr/tutorials/esa-da/>).

**Teaching Assistant** 2008 – 2011  
Department of Geography, University College London, UK.  

- Computing practical sessions associated with the MSc in Remote Sensing
- Environmental modelling practical sessions within the BSc in Geography.

**Tutorial Instructor** 2008 – 2010  
Department of Geography, University College London, UK.  

- Led small-group tutorials for 2<sup>nd</sup> year BSc Geography students each week during the fall and spring semesters.

## Sabbatical Lecturer in Remote Sensing

Fall Semester 2008

School of Geography, Geology and the Environment, Kingston University, UK.

- Instructor of record for two classes:
  - i. Remote Sensing of the Environment (2<sup>nd</sup> year BSc Geography students)
  - ii. Applications of Remote Sensing (3<sup>rd</sup> year BSc Geography students)
- Led weekly classes, took weekly practical sessions and set and marked coursework and exams at the end of the semester.

## SERVICE

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### Professional Activities – National and International

2020–present: Member of the AmeriFlux Management Project Data Advisory Committee.

2019–present: Member of the Joint US DOE RUBISCO (“Reducing Uncertainty in Biogeochemical Interactions Through Synthesis and Computation”) Scientific Focus Area and AmeriFlux Working Group focused on using data to improve process understanding and land models.

2019–present: Member of the NASA Surface Biology and Geology (SBG) “Designated Observable” Modeling Working Group.

2018–present: Member of the Scientific Steering Committee for the Analysis, Integration and Modelling of the Earth System (AIMES) Project – one of 20 global research projects of the Future Earth 10-year international research program.

2017–present: Member of the NASA Committee on Earth Observation (CEOS) Land Product Validation (LPV) Biomass Focus Area Subgroup.

### Professional Activities – Journal Editorial Boards

2020–present: Journal of Advances in Modeling Earth Systems (JAMES) Associate Editor (AGU).

2019–present: Remote Sensing Journal Biogeosciences Section Editorial Board Member (MDPI).

2014–present: GEO Geography and Environment Journal Editorial Board Member (Wiley).

### Professional Activities – Journal Special Issue Guest Editor

2019–2020: Guest Editor for a Special Issue in the journal *Remote Sensing* on “Remote Sensing of Vegetation Phenology”.

### Professional Activities – Conference and Workshop Organization

- Program Committee for AIMES Workshop on Degradation of Tropical Forests: Observation, Modeling and Socio-Environmental Implications, INPA, Manaus, Brazil (November, 2019).
- Program Committee for AGU Chapman Conference on “Understanding Carbon-Climate Feedbacks” (August, 2019).
- Primary Convener/Chair for the following sessions at the American Geophysical Union Annual Fall Meetings:
  - i. “Interpretation and Uncertainty Quantification of Climate, Earth System, and Integrated Assessment Models, and Observations” (2019)
  - ii. “Past, Present, and Future of Water-Limited Ecosystems: Local Trends to Global Impacts” (2018)
  - iii. “Advances and Opportunities in Forecasting and Data-Model Integration: Approaches for Reducing Complexity and Improving Predictive Understanding in Biogeochemical Models of the Earth System” (2017)
  - iv. “Past, present and future of dryland ecosystems: local trends to global impacts” (2017)
- Co-convener for the following sessions at the European Geosciences Union General Assembly:
  - i. “Developments in terrestrial biogeochemical models using model-data integration” (2018)

### **Professional Activities – Proposal Review Panels**

2017: NASA Earth and Space Science Fellowship Review Panel.

### **Professional Activities – Journal Articles Reviewed**

Nature, Nature Climate Change, Ecology Letters, Biogeosciences, Global Biogeochemical Cycles, Agricultural and Forest Meteorology, Journal of Geophysical Research-Biogeosciences, Geophysical Research Letters, Global Change Biology, New Phytologist, Remote Sensing of Environment, Climate of the Past, GEO: Geography and Environment, and Remote Sensing in Ecology and Conservation.

### **Departmental Service – Indiana University**

2021–present: Department Committee on Diversity, Equity and Inclusion.

2021: Ad hoc committee on departmental nominations for the IU College of Arts and Sciences Dissertation Fellowship.

2020: Ad hoc committee on departmental nominations for the Ostrom Fellowship.

2019–present: Department Colloquium Committee.

2019: Department Ad Hoc Committee on Equitable AI Responsibilities.

2019: Department Ad Hoc Committee on Faculty Mentoring Policy.

2019: Department Salary Committee.

### **University Service – Indiana University**

2019: Proposal Reviewer for the Prepared for Environmental Change Grand Challenge funding call.

2018: Chair of the Search Committee for the Position of “Data Scientist/Software Engineer” for the IU Environmental Resilience Institute.

### **University Service – University of Arizona**

2017–2018: Member of the University of Arizona Postdoctoral Association Executive Board.

### **Professional Societies**

Member: American Geophysical Union (AGU)

Member: American Association of Geographers (AAG)

Member: European Geosciences Union (EGU)

### **Outreach**

- Member of 500 Women Scientists Bloomington Pod (September 2018 – Present).
- Member of 500 Women Scientists Tucson Pod (January 2017 – July 2018).
- Member of Ask the Women of Tucson (<https://www.askwot.org>), through which I participated in events aimed at mentoring female high school students (May 2017 – July 2018).
- Seminar on “Climate change and Earth System Modeling” for the NASA Space Grant Event: “Hands-on, inquiry-based STEM curriculum development with high school teachers” – University of Arizona, Tucson, AZ (June 2017).
- Science Fair Judge and “Meet a Scientist” Panelist – St. Michael’s School, Tucson, AZ (February 2017).