Nicholas C. Parazoo, Ph.D.
Jet Propulsion Laboratory
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Current Professions

- **Research Scientist IV (329G)**, Jet Propulsion Laboratory, 2016-present
- **Associate Project Scientist III (3392)**, Joint Institute for Regional Earth System Science and Engineering, University of California Los Angeles, 2014-present

Bio

Dr. Parazoo's main research interests include ecosystem physiology, carbon and water cycles and their interactions with the global terrestrial biosphere, and feedbacks between climate variability and ecosystem function. His research spans natural and managed ecosystems in the Arctic, tropics, and in urban areas. His current research combines carbon cycle models with tower, airborne and satellite observations in a data integration approach to quantify exchanges of carbon, water, and energy between the land and atmosphere, to better understand and predict changes in the Earth's climate, and to provide actionable information to help mitigate climate change impacts on vegetation and water resources.

Dr. Parazoo currently serves as Acting Deputy Project Scientist for both the OCO-2 and OCO-3 missions and is a member of the Land Surface Imaging Virtual Constellation (LSI-VC), Committee of Earth Observing Satellites (CEOS). These positions recognize his long-standing and critical contributions to development and utilization of the serendipitous Solar-Induced Fluorescence (SIF) products that extended the project science envelope beyond atmospheric composition and into biosphere and ecosystem health. Dr. Parazoo has led multiple seminal efforts to define research and applications areas enabled by the OCO SIF products. Dr. Parazoo recently served as discipline program manager for JPL's carbon cycle and ecosystems portfolio where he led a Decadal Survey study to identify a community vision for next generation Greenhouse Gas observations to support carbon management needs.

Research Summary

My main research interests include ecosystem physiology, carbon and water cycles and their interactions with the global terrestrial biosphere, and feedbacks between climate variability and ecosystem function. My research spans natural and managed ecosystems in the Arctic, tropics, and in urban areas. My current research combines carbon cycle models with tower, airborne and satellite observations in a data integration approach to quantify exchanges of carbon, water, and energy between the land and atmosphere, to better understand and predict changes in the Earth's climate, and to provide actionable information to help mitigate climate change impacts on vegetation and water resources.

Education

Ph.D., Department of Atmospheric Science, Colorado State University, Fort Collins, CO (2007-2011)

Concentration: Land-Atmosphere Interactions

Thesis: Moist Synoptic Transport of CO2 along Midlatitude Storm Tracks, Transport Uncertainty, and Implications for CO2 Flux Estimation

Advisor: A. Scott Denning

Committee members: David A. Randall, Eric D. Maloney, Randy Kawa & Keith Paustian

M.Sc., Department of Atmospheric Science, Colorado State University, Fort Collins, CO (2004-2007)

Concentration: Land-Atmosphere Interactions

Thesis: Investigating Synoptic Variations in Atmospheric CO2 Using Continuous Observations and a Global Transport Model

Advisor: A. Scott Denning

Committee members: David A. Randall, Niall Hanan

B.S., College of Oceanic and Atmospheric Science, Oregon State University, Corvallis, OR (2000-2004)

Concentration: Environmental Science, Atmospheric Processes (Magna Cum Laude)

Advisor: Steve Esbenson

Professional Experience

- **Member, Land Surface Imaging Virtual Constellation (LSI-VC**), Committee of Earth Observing Satellites (CEOS), 2026-present
- **Research Affiliate**, Joint Institute for Regional Earth System Science and Engineering, University of California Los Angeles, 2014-2016
- **Postdoctoral Research Scientist**, Joint Institute for Regional Earth System Science and Engineering, University of California Los Angeles (2011-2014)
- **Graduate Research Assistant**, Department of Atmospheric Science, Colorado State University (2004-2011)
- **Research Assistant**, Coastal Imaging Lab, Oregon State University (2002-2004)
- **Undergraduate Internship**, Oregon Climate Service, Oregon State University (2001-2002)

Honors/Awards

- JPL Team Award: CARDAMOM Development Framework (2025)
- JPL Team Award: JPL CASI Report Team (2025)
- NASA Early Career Achievement Medal, Fluorescence Product (2023)
- NASA Group Achievement Award, OCO-2 Science Team (2020)

- NASA Group Achievement Award, OCO-2 Science Team (2018)
- Herbert Riehl Memorial Award, Best Paper Submitted for Publication, Colorado State University (2008)
- NASA Center for the Earth Atmosphere Studies (CEAS) Fellowship, Colorado State University (2007-2010)
- Programs of Research and Scholarly Excellence (PRSE) Fellowship, Colorado State University (2005)

External Grants/Projects

- **NASA: LCLUC**

  Title: *Land Cover and Land Use Feedbacks to the Development of Flash Drought*

  Grant Number: 24-LCLUC24_2-0029

  POP: May 2025 – Apr 2028

  Award Amount and Effort: $0.823M/3yr, 0.10 FTE

  Objective: This aim of this project is to determine land cover and land use impacts on short-range and sub-seasonal weather. Our main objectives are to (1) Develop a prototype land digital twin for land cover and land use impacts on flash drought development, (2) Perform and evaluate land cover and land use sensitivity experiments, and (3) Identify dominant atmospheric and land cover and land use flash drought drivers across different case studies and irrigation scenarios.

  Principal Investigator

- **NASA: Ocean Biology and Biogeochemistry (OBB)**

  Title: *Quantifying Marine Ecosystem Tipping Points*

  Grant Number: 24-OBB_24-0012

  POP: Jan 2025 – Dec 2027

  Award Amount and Effort: $0.920M/3yr, 0.16 FTE

  Objective: This project uses ocean model experiments and spaceborne remote sensing data to test the hypothesis that cascading regional-scale tipping points have disruptively altered Arctic marine ecosystems and that this transformation — and additional tipping points — will continue as Arctic marine environments transition to an ice-free state.

  Co Investigator (PI Charles Miller, JPL)

- **NSF Macrosystems Biology (MSB)**

  Climate legacies and timescales of influence on carbon cycle processes in drylands

  Sep 2022 – Aug 2027, 5M/5yr, 0.18 FTE

  Co Investigator (PI Kiona Ogle, NAU)

Internal Grants/Projects

- **JPL: Strategic RTD**

  Title: *A Carbon Cycle Reanalysis for Improved Understanding, Monitoring, and Prediction of Carbon Climate Feedbacks*

  Grant Number: 01STRS-R.25.342.027

  POP: Oct 2024 – Sep 2026 (In Year 2; Renewable up to 3 years)

  Award Amount and Effort: 150K Y1 / 120K Y2 / TBD Y3, 0.15 FTE

  Objective: Develop a data constrained carbon-water cycle reanalysis to answer the following question: How accurately are models capturing carbon climate feedbacks under changing emissions

  Initiative Lead: Joao Teixeira; **Carbon Task Lead**: Nicholas Parazoo

PEER REVIEWED PUBLICATIONS

In Review (3)

Madani, N., N. C. Parazoo, A. Chatterjee, Intercomparison of Global Solar Induced Chlorophyll Fluorescence Products, Earth and Space Science, In Review

Ruehr, S., Z. A. Pierrat, N. Parazoo, T. Keenan, Harnessing solar-induced fluorescence for on-farm agricultural research and management: Recent advances and outstanding needs, Environmental Research Letters (Perspective), In Review

Madani, N., **N. C. Parazoo**, C. Miller, A. Chaterjee, L. Berner, The Impact of Warming on Arctic Land Carbon Uptake, Environmental Research: Ecology, In Review

In Press (2)

Forster, L., M. T. Richardson, A. B. Davis et al incl **N. C. Parazoo**, Scientific Applications of Multi-Angle Measurements to Reconstruct Earth's Atmosphere through Tomography, Bulletin of the American Meteorological Society, In Press.

Parazoo, N. C., D. Carroll, et al. A U.S. scientific community review of carbon cycle science gaps and opportunities to better support earth system science and carbon management, Earth Science Reviews, In Press. Preprint: https://www.sciencedirect.com/science/article/abs/pii/S0012825226001042

Published (~100)

2026 (2 citable)

Zeraati, M., A. Farahmand, R. Seager, et al incl **N. C. Parazoo**, Assessing Flash Drought Development and Propagation Across the Contiguous United States Using Remote Sensing, Earth's Future, 14 (3), e2025EF007037. **https://doi.org/10.1029/2025EF007037**

Li, S., D. Yang, Y. He, **N. Parazoo**, W. Liu (2026) The impact of land cover change-climate interactions on ecosystem productivity in the Arctic-Boreal region, Agicultural and Forest Meteorology, 383, 11137. https://doi.org/10.1016/j.agrformet.2026.111137

2025 (11 citable)

Parazoo, N.C., D. Carroll, J. B. Abshire, Y. M. Bar-On, R. A. Birdsey, A. A. Bloom et al. (2025) A US scientific community vision for sustained earth observations of greenhouse gases to support local to global action, AGU Advances, 6(6), e2025AV001914. **https://doi.org/10.1029/2025AV001914** (Editor's highlight on Eos: https://eos.org/editor-highlights/managing-carbon-stocks-requires-an-integrated-view-of-the-carbon-cycle)

Carroll, D., **N.C. Parazoo**, H. Nesser, Y. Bar-On, and Z. Pierrat (2025) A better way to monitor greenhouse gases, Eos, 106, https://doi.org/10.1029/2025EO250395

Carroll, D. **N. C. Parazoo**, N. S. Lovenduski, M. Keller, D. S. Schimel, A. A. Bloom (2025), Observing system needs for understanding carbon-climate feedbacks, Environmental Research Letters, 20(11), 111002, http://doi.org/10.1088/1748-9326/ae0ae8

Parazoo, N. C., B. Fuchs. Solar Induced fluorescence as an application ready early warning indicator of flash drought, Geophysical Research Letters, 52(23), e2025GL119408, **https://doi.org/10.1029/2025GL119408**

Svoboda, M.., O. Kira, Y. Sun, W. K. Smith, T. Magney, J. D. Wood, **N. C. Parazoo**, Monitoring the pulse of America's natural resources from the Orbiting Carbon Observatory Missions, AGU Advances, 6, e2025AV002063. https://doi.org/10.1029/2025AV002063

Bilir, E., et al. Satellite-constrained reanalysis reveals CO2 versus climate process compensation across the global land carbon sink, AGU Advances, 6(5), e2025AV001689. *https://doi.org/10.1029/2025AV001689* (Editor's highlight on Eos: https://eos.org/editor-highlights/rising-co2-and-climate-change-reorganize-global-terrestrial-carbon-cycling)

Worden, M., T. Bilir, A. Bloom et al Combining observations and models: a review of the CARDAMOM framework for data-constrained terrestrial ecosystem modeling, Global Change Biology, 31(8), e70462. **https://doi.org/10.1111/gcb.70462**.

Li, S., Yang, D., He, Y., Parazoo, N. C., & Liu, W. (2025). The biogeophysical impacts of land cover change on climate extremes in the Arctic and Boreal regions. Environmental Research Letters.

Johny, M., Hobbs, J., Yadav, V., Johnson, M., **Parazoo, N**., Nguyen, H., & Braverman, A. (2025). A Bayesian hierarchical framework for fusion of remote sensing data: An example with solar-induced fluorescence. *arXiv preprint arXiv:2503.03901*.

Muccio, D., Keppel-Aleks, G., & **Parazoo, N**. (2025). Contrasting temperature sensitivity of boreal forest productivity in North America and Eurasia. *Journal of Geophysical Research: Biogeosciences*, *130*(6), e2024JG008634.

Doughty, R., Wimberly, M. C., Wanyama, D., Peiro, H., **Parazoo, N**., Crowell, S., & Cho, M. A. (2025). Seasonality and synchrony of photosynthesis in African forests inferred from spaceborne chlorophyll fluorescence and vegetation indices. *Biogeosciences*, *22*(8), 1985-2004.

2024 (7 citable)

Kim, Y., Kimball, J. S., Parazoo, N., Xu, X., Colliander, A., Reichle, R. .. & Li, X (2024) Diagnosing spring onset across the North American Arctic-boreal region using complementary satellite environmental data records, JGR-Biogeosciences, 129(8), e2023JG007977.

Pierrat, Z., T. Magney, A. Maguire, L. Brissette, R. Doughty, D. Bowling, B. Logan, N. Parazoo, J. Stutz, Seasonal timing of fluorescence and photosynthetic yields at needle and canopy scales in evergreen needleleaf forests, Ecology, 105(10), e4402

Madani, N, N. C. Parazoo, M. Manizza, A. Chatterjee, D. Carroll, D. Menemenlis, V. le Fouest, A. Matsuaka, K. Luis, C. Serra-Pompei, C. Miller, 2024. A machine learning approach to produce a continuous solar-induced chlorophyll fluorescence over the Arctic Ocean, JGR-Machine Learning and Computation, 1(4), e2024JH000215.

Liu, Z, B. Rodgers, G. Keppel-Aleks et al (inc N Parazoo), 2024, Seasonal CO2 amplitude in northern high latitudes, Nature Reviews Earth & Environment, 5, 802-817. https://doi.org/10.1038/s43017-024-00600-7

Joiner, J., Y Yoshida, L Guanter, L Lamsal, C. Li, Z Fasnacht, P Kohler, C Frankenberg, Y Sun, N Parazoo, Noise reduction for solar-induced fluorescence retrievals using machine learning and principal component analysis: simulations and applications to GOME-2 satellite retrievals, Artificial Intelligence for the Earth Systems (AIES), https://doi.org/10.1175/AIES-D-23-0085.1

Parazoo, N., G. Keppel-Aleks, S. Sander, B. Byrne et al, More frequent spaceborne sampling of XCO2 improves detectability of carbon cycle seasonal transitions in Arctic-Boreal Ecosystems, Geophysical Research Letters, https://doi.org/10.1029/2023GL107158

Parazoo, N. C., M. Osman, M. Pascolini-Campbell, B. Byrne (2024). Antecedent conditions mitigate carbon loss during flash drought events, Geophysical Research Letters, 51, e2024GL108310. https://doi.org/10.1029/2024GL108310

2023 (5 citable, 1 newsletter)

Levine, P., A. Bloom, K. Bowman J. T.Reager, J. R. Worden, J. Liu, N. C. Parazoo, V. Meyer, A. G. Konings, M. Longo (2023). Water stress dominates 21st-century land carbon uptake, GBC, 37 (12), e2023GB007702

Ma, S, A. A. Bloom, G. R. Quetin, J. D. Watts, Z. Donatella, E. S. Euskirchen, A. J. Norton, Y. Yin, P. A. Levine, R. K. Braghiere, **N. C. Parazoo**, J. R. Worden, D. S. Schimel, C. E. Miller. (2023) Resolving the carbon-climate feedback potential of high-latitude wetland CO_2 and CH_4 exchange, Global Biogeochemical Cycles, 37 (9), e2022GB007524

Au, J, A. Bloom, N. C. Parazoo, et al, Forest productivity recovery or collapse? Model-data integration insights on drought-induced tipping points, Global Change Biology, doi:10.1111/gcb.16867

Parazoo, N.C., A. Norton, J. Johnson. The need for SIF within Integrated Carbon-Water Cycle Assessments, GEWEX Quarterly, 33(2), p 5-7

Madani, N., Parazoo, N.C., Miller, C., Climate change is enforcing physiological changes in Arctic ecosystems, Environmental Research Letters, 18, 074027, https://doi.org/10.1088/1748-9326/acde92

Norton, A. J., A.A. Bloom, N. C. Parazoo, P. Levine, S.Ma, R. Braghiere, Smallman, T.L. (2023). Improved process representation of leaf phenology significantly shifts climate sensitivity of ecosystem carbon balance, Biogeosciences, 20 (12): 2455-2484.

2022 (14)

Pierrat, Z, J. Bortnik, B. Johnson, A. Barr, T. Jagney, D. Bowling, **N. Parazoo**, C. Frankenberg, U. Seibt, J. Stutz, Forests for Forests: Combining vegetation indices with solar-induced chlorophyll fluorescence in random forest models improves gross primary productivity prediction in the Boreal Forest, Environmental Research Letters, 17 (12), 125006, http://doi.org/10.1088/1748-9326/aca5a0

Byrne, B., J. Liu, Y. Yi, A. Chatterjee, S. Basu, R. Cheng, R. Doughty, F. Chevallier, K. W. Bowman, N. C. Parazoo, D. Crisp, X. Li, J. Xiao, X. Sitch, B. Guenet, F. Deng, M. S. Johnson, S. Philip, P. C. McGuire, C. E. Miller, 2022: Multi-year observations reveal a larger than expected autumn respiration signal across northeast Eurasia, Biogeosciences, 19, 4779-4799, https://doi.org/10.5194/bg-19-4779-2022, 2022.

Liu, Z, J. S. Kimball, A. P. Ballentayne, **N. C. Parazoo**, W. J. Wang, N. Madani, S. M. Natali, J. D. Watts, B. M. Rogers, A. Bastos, P. Ciais, K. Yu, A-M Virkkala, F. Chevallier, 2022: Permafrost regions contribute to an increasing net carbon sink in the northern high latitudes, Nature Communications, 13, 5626, https://doi.org/10.1038/s41467-022-33293-x.

Wen, J., J. B. Fisher, N. C. Parazoo, L. Hu, M. E. Litvak, Y. Sun. Resolve the clear-sky continuous diurnal cycle of high-resolution ECOSTRESS Evapotranspiration and Land Surface Temperature, Water Research and Resources, 58 (9), e2022WR032227.

Kuai, L., N. C. Parazoo, M. Shi, C. Miller, I. Baker, A. A. Bloom, K. Bowman, M. Lee, Z.-C.Zeng, J. Berry, R. Commane, S. Montzka, C. Sweeney, J. Miller, Y. Yung. Quantifying northern high latitude gross primary productivity (GPP) using carbonyl sulfide (OCS), Global Biogeochemical Cycles, 36 (9), e2021GB007216.

Stinecipher, J. R., Cameron-Smith, P., Kuai, L., Glatthor, N., Höpfner, M., Baker, I., … Campbell, J. E. (2022). Remotely Sensed Carbonyl Sulfide Constrains Model Estimates of Amazon Primary Productivity. *Geophysical Research Letters*. https://doi.org/10.1029/2021gl096802

Doughty, R., T. Kurosu, **N. C. Parazoo**, P. Kohler, Y. Wang, Y. Sun, C. Frankenberg, Global GOSAT, OCO-2 and OCO-3 Solar Induced Chlorophyll Fluorescence Datasets, Earth System Science Data, 14(4), 1513-1529.

Yang, Y., A. Bloom, S. Ma, P Levine, A. Norton, N. Parazoo, J. T. Reager, J. Worden, G. R. Quetin, L. Smallman, M. Williams, L. Xu, S. Saatchi, CARDAMOM-FluxVal Version 1.0: a FLUXNET-based validation system for CARDMOM carbon and water flux estimates, Geosci. Model Dev, 15(4), 1789-1802. http://doi.org/10.5194/gmd-2021-190

Li, R., D. Lombadozzi, M. Shi, C. Frankenberg, **N. Parazoo**, P. Kohler, X. Yang, Representation of leaf-to-canopy radiative transfer processes improves simulation of far-red solar-induced chlorophyll fluorescence in the Community Land Model version 5, Journal of Advances in Modeling Earth Systems, 14(2), e2021MS002676.

Norton, A. J., P. J. Rayner, Y.-P. Wang, N. C Parazoo, L. Baskaran, R. Doughty, K. Cawse-Nicholson, Hydrologic connectivity drives extremes and high variability in vegetation productivity across Australian arid and semi-arid ecosystems, Remote Sensing of Environment, 272, p. 112937, 2022. https://doi.org/10.1016/j.rse.2022.112937

Fisher, J.B., M. Sikka, G. L. Block, C. R. Schwalm, N. C. Parazoo et al, The Terrestrial Biosphere Model Farm, Journal of Advances in Modeling Earth Systems, 14(2): e2021MS002676, 1-16p, 2022.

Pierrat, Z, J. Stutz, T. Magney, N. C. Parazoo, K. Grossmann, D. Bowling, U. Seibt, B. Johnson, W. Helgason, A. Barr, J. Bortnik, A. Norton, A. Maguire, C. Frankenberg, Diurnal and seasonal dynamics of solar-induced chlorophyll fluorescence, vegetation indices, and gross primary productivity in the boreal forest, JGR-Biogeosciences, p. e2021JG006588, 2022. https://doi.org/10.1029/2021JG006588

Stettz, S. G., N. C. Parazoo, A. A. Bloom, P. D. Blanken, D. R. Bowling, S. P. Burns, C. Bacour, F. Maignan, B. Raczka, A. J. Norton, I. Baker, M. Williams, M. Shi, Y. Zhang, B. Qiu, Resolving temperature limitation on spring productivity in an evergreen conifer forest using a model-data fusion framework, Biogeosciences, 19, 541-558, 2022. https://doi.org/10.5194/bg-19-541-2022

Field Code Changed

Parazoo, N. C., R. W. Coleman, V. Yadav, E. N. Stavros, G. Hulley, L. Hutyra, 2021, Diverse biosphere influence on carbon and heat in mixed urban Mediterranean landscape revealed by high resolution thermal and optical remote sensing, Science of the Total Environment, 806, P. 151335.

2021 (12)

Parazoo, N. C., K. Bowman, B. Baier, J. Liu, M. Lee, L. Kuai, Y. Shiga, I. Baker, M. Whelan, S. Feng, M. Krol, C. Sweeney, B. Runkle, E. Tajfar, K. J. Davis, Covariation of airborne biogenic tracers (CO2, COS, and CO) supports stronger than expected growing season photosynthetic uptake in the southeast US, Global Biogeochemical Cycles, 35 (10), p.e2021GB006956. https://doi.org/10.1029/2021GB006956

Maguire, A. J., J. U. H. Eitel, T. S. Magney, C. Frankenberg, E. L. Orcutt, **N. C. Parazoo**, R. Pavlick, A. Pierrat, P A. Townsend, 2021. Spatial covariation between solar-induced fluorescence and vegetation indices from Arctic-Boreal landscapes, Environmental Research Letters, 16(9), p. 095002.

Xiao, J., J. B. Fisher, H. Hashimoto, K. Ichii, **N. C. Parazoo**, Emerging satellite observations for studying diurnal cycles of ecosystem processes, *Nature Plants*, 2021. https://doi.org/10.1038/s41477-021-00952-8

Wu, D., J. C. Lin, H. F. Duarte, V. Yadav, **N. C. Parazoo**, T. Oda, E. A. Kort, A model for urban biogenic CO2 fluxes: Solar-induced fluorescence for modeling urban biosphere fluxes (SMUrFv1), Geophysical Model Development, 14, 3633-3661, 2021. https://doi.org/10.5194/gmd-14-3633-2021.

Yadav, V., S. Ghosh, K. Mueller, A. Karion, G. Roest, S. Gourdji, I. Lopez-Coto, K. Gurney, K. Verhlust, **N. C. Parazoo**, J. Kim, M. Stock, E. DiGangi, S. Prinzivalli, C. Fain, R. Keeling, R. Weiss, R. Duren, J Henderson, C. Miller, J. Whetstone, The impact of COVID-19 on CO2 emissions in the Los Angeles and Washington DC/Baltimore metropolitan areas, Geophysical Research Letters, 48, e2021GL092744, 2021. http://10.1029/2021GL092744

Madani, N., **N.C. Parazoo,** J. S. Kimball, A. Chatterjee, J. D. Watts, S. Saatchi, Z. Liu, A. Endsley, T. Tagesson, B. M. Rogers, A. Xu, J. A. Wang, T. Magney, C. E Miller. The impacts of climate and wildfire on gross primary productivity in Alaska, Journal of Geophysical Research Biogeoscience, 126, e2020JG006078, 2021. **https://doi.org/10.1029/2020JG006078**.

Pierrat, Z., M. F. Nehemy, A. Roy, T. Magney, **N. Parazoo**, C. Laroque, C. Pappas, O. Sonnentag, K. Grossman, D. R. Bowling, U. Seibt, A. Ramirez, B. Johnson, W. Helgason, A. Barr, J. Stutz, 2021. Tower-based remote sensing reveals mechanisms behind two-phased spring transition in a

mixed species boreal forest, Journal of Geophysical Research: Biogeosciences, 126, e2020JG006191. https://doi.org/10.1029/2020JG006191.

Famiglietti, Caroline A., T. L Smallman, P. A. Levine, S. Flack-Prain, G. R. Quetin, V. Meyer, **N. C. Parazoo**, S. G. Stettz, Y. Yang, D. Bonal, A. A. Bloom, M. Williams, and A. G. Konings: Optimal model complexity for terrestrial carbon cycle prediction, Biogeosciences, 18, 2727-2754, 2021. https://doi.org/10.5194/bg-18-2727-2021

He, W., W. Ju, F. Jiang, **N. C. Parazoo**, P. Gentine et al, Peak growing-season patterns of climate extremes-driven responses of gross primary production estimated by satellite and process based models over North America, Agr. For. Met., V298-299, 15 March 2021, 108292

Worden, J., S. Saatchi, M. Keller A. Bloom, R. Fu, J. Liu, **N. C. Parazoo**, J. B. Fisher, H. Worden, Y. Yin, et al, Satellite observations of the Tropical Terrestrial Carbon Balance and Interactions with the Water Cycle During the 21st Century, Reviews of Geophysics, 59, e2020RG000711, https://doi.org/10.1029/2020RG000711.

Liu, J., Baskarran, L., Bowman, K., Schimel, D., Bloom, A. A., **Parazoo, N. C**., Oda, T., Carroll, D., Menemenlis, D., Joiner, J., Commane, R., Daube, B., Gatii, L. V., McKain, K., Miller, J., Stephens, B. B., Sweeney, C., and Wofsy, S.: Carbon Monitoring System Flux Net Biosphere Exchange 2020 (CMS-Flux NBE 2020), Earth Syst. Sci. Data, 13, 299-330, 2021. https://doi.org/10.5194/essd-13-299-2021.

Jin, Y., R. F. Keeling, E. J. Morgan, E. Ray, **N. C. Parazoo**, and B. B. Stephens, A mass-weighted atmospheric isentropic coordinate for mapping chemical tracers and computing inventories, Atmos. Chem. Phys., 21, 217-238, 2021. https://doi.org/10.5194/acp-21-217-2021.

2020 (17 citable, 1 chapter)

Bloom, A. A., K. W. Bowman, J. Liu, A. G. Konings, J. R. Worden, **N. C. Parazoo** et al, 2020: Lagged effects dominate the inter-annua variability of the 2010-2015 tropical carbon balance, Biogeosciences, 17, 6393-6422. https://doi.org/10.5194/bg-17-6393-2020

Coleman, R.W., N. Stavros, G. Hulley, **N. Parazoo**, 2020: Comparison of thermal infrared-derived maps of irrigated and non-irrigated vegetation in urban and non-urban areas of Southern California, Remote Sensing, 12 (24), p. 4102. Doi:10.3390/rs12244102.

Liu, J. L., P. Wennberg, **N. C. Parazoo**, Y. Yin, C. Frankenberg, 2020 Thermal fertilization of high-latitude northern forests, AGU Advances, 1, e2020AV000228. **https://doi.org/10.1029/2020AV000228**

Madani, N., **N. C. Parazoo**, J. S. Kimball, A. P. Ballantyne, S. Saatchi, P. I. Palmer, Z. Liu, T. Tagesson, A. Bloom, Recent amplified global gross primary productivity due to temperature increase is offset by reduced productivity due to water constraint, AGU Advances, 2, e2020AV000180. https://doi.org/10.1029/2020AV000180.

Byrne, B., J. Liu, A. A. Bloom, K. W. Bowman, Z. Butterfield, T. F. Keenan, G. Keppel-Aleks, **N. C. Parazoo**, Y Yin (2020): Contrasting Regional Carbon Cycle Responses to Seasonal Climate Anomalies Across the East-West Divide of Temperate North America, Global Biogeochemical Cycles, 34, e2020GB006598, https://doi.org/10.1029/2020GB006598.

Whelan, M, L Anderegg, G. Badgley, J. Elliott Campbell, R. Commane, C. Frankenberg, T. W. Hilton, L. Kuai, **N. C. Parazoo**, Y. Shiga, Y. Wang, J. R. Worden, 2020: Two scientific

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Teaching and Advising

Center for Multiscale Modeling of Atmospheric Processes (CMMAP) Summer Internship Mentor

- **Kyle Hemes** (Summer 2010)

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Taught how to use vegetation models to examine environmental and climatic drivers of surface carbon exchange

AGU Poster Title: Vegetation Phenology as a Constraint on Global Surface Atmosphere Exchange

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- **Lance Vanden Boogart** (Summer 2009)

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  Taught how to use atmospheric models to examine land-atmosphere tracer interactions

  CMMAP Poster Title: Frontal Passage Effects on PCTM CO2 Concentration in Continental North America

  Currently: PhD Candidate in Atmospheric Science at Colorado State University

- **Parker Kraus** (Summer 2008)

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  Taught how to use vegetation and atmospheric models together with flux tower data to examine carbon and water cycles in Africa

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Teachers Assistant

- **Colorado State University, Introduction to Global Climate Change** (ATS 150, Fall 2010)

  Taught several lectures, designed and graded homework assignments, collaborated with Little Shop of Physics in designing and demonstrating simple classroom physics experiments

- **Colorado State University, Climatology** (ATS 606, Fall 2008)

  Taught several lectures, designed and graded homework assignments, designed radiative-convective equilibrium class project