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

- **Research Scientist III (329G)**, Jet Propulsion Laboratory, 2016-present
- **Associate Project Scientist II (3392)**, Joint Institute for Regional Earth System Science and Engineering, University of California Los Angeles, 2014-present
- **Discipline Program Manager for Carbon Cycle and Ecosystems (8314),** Jet Propulsion Laboratory, 2023-present

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

- **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

- NASA Early Career Achievement Medal, Fluorescence Product (2022)
- 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)

Grants/Projects (Funded)

- **NSF Arctic Natural Sciences**

  Environmental and biological controls on C uptake phenology in permafrost affected boreal forests

  2020-2022, 3.0M/3yr, 0.15 FTE

  Co-Investigator (PI Jennifer Watts, WHRC)

- **NASA Interdisciplinary Science**

  Impacts of Changing Sea-Ice Regimes on Arctic Ocean Biology

  2020-2023, 2.0M/3yr, 0.12 FTE

  Co-Investigator (PI Charles Miller, JPL)

- **NASA Making Earth System Data Records for Use in Research Environments (MEaSURES)**

  A Multi-decadal Time Series of Vegetation Chlorophyll Fluorescence and Derived Gross Primary Production

  2018-2023, 4.2M/5yr, 0.5 FTE (In NCE)

Principal Investigator

- **NASA Carbon Cycle Science**

  COSIF: Combining Carbonyl Sulfide and Solar Induced Chlorophyll Fluorescence to scale the carbon cycle of tropical rainforests from leaf to landscape

  Jul 2021 – Jun 2024, 1M/3yr, 0 FTE (Funds sent to UC-Davis)

  Co Investigator (PI Ulrike Seibt)

- **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)

- **NASA Earth Surface and Interior**

  Measuring Heating in Urban Areas and its Impact – An Inherently Geological Problem

  Jan 2023 – Dec 2025, 0.7M/3yr, 0.1 FTE (Not charging currently)

  Co Investigator (PI Simon Hook, JPL)

- **NASA ECOSTRESS**

  An Investigation of Fire-Driven Changes in Landscape Water Use: A Diurnal, Multi-Ecoregon Perspective

  Jan 2023 – Dec 2025, 0.3M/3yr, 0 FTE

  Collaborator (PI Madeleine Pacolini-Campbell, JPL)

- **NASA ECOSTRESS**

  Remote sensing of urban ecosystem function in the megacity: Fine resolution characteristics of water stress in New York City urban forests with ECOSTRESS

  Jan 2023 – Dec 2025, 0.3M/3yr, 0 FTE

  Collaborator (PI Nick Steiner, CCNY)

Grants/Projects (Pending)

- **NASA: CMS**

  A Carbon Monitoring System for the Urban Biosphere

  Jun 2024 – May 2027, $1.1M/3yr, 0.15 FTE

  Principal Investigator

- **NASA: Earth System Explorer**

  OCO-neXt: The Next Generation Orbiting Carbon Observatory

  Co Investigator (PI Charles Miller)

  May 2024 – Apr 2033, $330M, 0.15 FTE

PEER REVIEWED PUBLICATIONS

In Review (5)

Liu, Z, B. Rodgers, G. Keppel-Aleks et al (inc N Parazoo), Trends and drivers of enhanced seasonal CO2 amplitude in northern high latitudes, In Review, Nature Reviews Earth & Environment

Kim, Y., Kimball, J. S. Diagnosing spring onset across the North American boreal-Arctic using complementary satellite environmental records from SMAP, AMSR2, OCO-2, and MODIS, JGR-Biogeosciences, In Review

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

Doughty, R, M. Wimberly, D. Wanyama, H. Peiro, N. Parazoo, S. Crowell, M. Cho, Synchrony of African rainforest solar induced chlorophyll fluorescence and environmental factors, BG, In Review

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, A machine learning approach to produce a continuous solar-induced chlorophyll fluorescence dataset for understanding ocean productivity, In Review, JGR-Machine Learning and Computation

In Press (2)

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, Accepted, Artificial Intelligence for the Earth Ssytems

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, Accepted, Geophysical Research Letters (DOI: 10.22541/essoar.170000369.94748519/v1)

Published (90 citable)

2024

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

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.

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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 communities striving for a common cause: innovations in carbon cycle science, BAMS, 101 (9): E1537-E1543. https://doi.org/10.1175/BAMS-D-19-0306.1

Byrne, B., J. Liu, M. Lee, I. Baker, K. W. Bowman, M. Kiel, J. S. Kimball, C. E. Miller, **N. C. Parazoo**, C. Petri, C. M. Roehl, M. K. Sha, K. Strong, V. A/ Velazco, P. O. Wennberg, and D. Wunch, 2020: Improved constraints on northern extratropical CO2 fluxes obtained by combining surface-based and space-based atmospheric CO2 measurements, JGR-Atmospheres, doi:10.1029/2019JD032029.

Joiner, J., Y. Yoshida, P. Kohler, C. Frankenberg, P. Campbell, C. van der Tol, P. Yang, **N. C. Parazoo**, L. Guanter, Y. Sun, 2020: Systematic orbital geometry-dependent variations in satellite solar-induced fluorescence (SIF) retrievals, Remote Sensing, 12 (15), 2346, https://doi.org/10.3390/rs12152346.

Coleman, R. W., N. Stavros, V. Yadav, **N. C. Parazoo**, 2020: A Simplified Framework for High-Resolution Urban Vegetation Classification with Optical Imagery in the Los Angeles Megacity, Remote Sensing, 12 (15), 2399, https://doi.org/10.3390/rs12152399.

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Jones, S., L. Rowland, P. Cox, D. Hemming, A. Wiltshire, K. Williams, **N. C. Parazoo**, J. Liu, A. C. L. da Costa, P. Meir, M. Mencuccini, A. Harper, 2020: The impact of a simple representation of non-structural carbohydrates on the simulated response of tropical forests to drought, Biogeosciences, 17, 3589-3612, https://doi.org/10.5194/bg-17-3589-2020

Zhang, Y., **N. C. Parazoo**, A. Park Williams, Zhao, P. Gentine, 2020: Large and projected strengthening moisture limitation on end-of-season photosynthesis, Proceedings of the National Academy of Sciences, 117, 17, 9216-9222.

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Madani, N., J. S. Kimball, **N. C. Parazoo**, A. P. Ballantyne, T. Tagesson, L. A. Jones, R. H. Reichle, P. I. Palmer, I. Velicogna, A. Anthony Bloom, S. Saatchi, Z. Liu, A. Geruo, 2019:

Below-surface water mediates the response of African forests to reduced rainfall, Environmental Research Letters, 15(3), https://doi.org/10.1088/1748-9326/ab724a

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Liu, Z., J. Kimball, **N. C. Parazoo**, A. Ballantyne, W. Wang, N. Madani, C. Pan, J. Watts, R. Reichle, et al, 2020: Increased high latitude photosynthetic carbon gain offset by respiration carbon loss during an anomalous warm winter to spring transition, Global Change Biology, https://doi.org/10.1111/gcb.14863

Kim, Y., Kimball, J. S., **Parazoo, N**., & Kirchner, P. (2021). Diagnosing Environmental Controls on Vegetation Greening and Browning Trends Over Alaska and Northwest Canada Using Complementary Satellite Observations. In D. Yang & D. L. Kane (Eds.), *Arctic Hydrology, Permafrost and Ecosystems* (pp. 583–613). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-50930-9_20

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Cui, E. et al. inc **N. C. Parazoo**, 2019: Vegetation functional properties determine uncertainty of simulated ecosystem productivity: a traceability analysis in the East Asian monsoon region, Global Biogeochemical Cycles, 33 (6), 668-689. **https://doi.org/10.1029/2018GB005909**

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Teaching and Advising

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

- **Kyle Hemes** (Summer 2010)

  Undergraduate from Colorado College

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

Currently: Research Associate in Carbon Forestry at Laos

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

  Undergraduate from University of Wisconsin

  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