Vineet Yadav
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Dr. Yadav's work centers on estimating and explaining trends and anomalies in complex systems, with a long-standing focus on inferring trace-gas emissions from atmospheric observations. For over fifteen years, he has designed algorithms that deliver spatially explicit flux estimates with minimal reliance on priors; built uncertainty-quantification frameworks to reconcile model differences; and developed inverse methods that disaggregate sectoral emissions from spatiotemporal covariance structures. Beyond this domain, he works at the intersection of optimization, simulation, time-series analysis and forecasting, geospatial analytics, and uncertainty modeling—paired with pragmatic data engineering. He has led research-to-production handoffs, run experiments, and delivered tools that inform real decisions. While much of his work has analyzed Earth systems, the same pattern—**ingest → model → explain → deploy**—translates directly to finance, operations, energy, logistics, and risk.

Work History

Data Scientist   Sept 2014-Present
Jet Propulsion Laboratory, Pasadena, CA, USA
Senior Research Associate   June 2011-Sept 2014
Carnegie Institution of Science, Stanford University, Stanford, CA USA
Research Fellow   May 2008-June 2011
Department of Civil and Environmental Engineering,
The University of Michigan, Ann Arbor, Michigan, USA

Education

Ph.D., *Geography*, the University of Iowa, Iowa City, USA (2008)
M. Phil (with Distinction), *GIS and Remote Sensing*, the University of Cambridge, Cambridge, UK (2003)

Funded Project Grants:

NIST, *LA Megacities*: JPL Sub-Contractor. Project Managed by Charles E. Miller (2015—ongoing)
NASA, A synthesis and reconciliation of greenhouse gas flux estimates across the ABoVE domain: JPL Co-Investigator 2021 (2023 – Ongoing)
NASA, Multi-scale Methane Analytic Framework: JPL Co-Investigator AIST 2019 (2019-2021)
NASA, Multi-tiered Carbon Monitoring System CMS 2019: JPL Co-Investigator (2020-2022)
NASA, Fluorescence Based Constraints on Urban Biogenic CO2 Fluxes from OCO-2, OCO-3, and CLARS, JPL Co-Investigator; OCO-2 STM 2017 (2018 – 2020)
NASA, Multi-decadal time series of vegetation chlorophyll fluorescence and derived gross primary production. JPL Co-Investigator; Total Funding ~ $3.7 Million (Measures 2017) (2018-ongoing)
NASA, Records of fused and assimilated satellite carbon dioxide observations and fluxes from multiple instruments JPL Principal Investigator; Total Funding ~ $3.7 Million (2018-ongoing)
NASA, Science Team for the OCO-2 Mission, JPL-Subcontract-Principal Investigator: Quantifying Global Megacity CO2 Emission; 2015-2017: Total Funding ~ $90, 000.

Carnegie Institution for Washington, Intelligent CO2 Data Assimilation System; JPL-Subcontract-Principal Investigator*: 2015-2016: Total Funding ~ $170,000*

NASA, ARCTIC-Boreal Vulnerability Experiment, Co-Investigator: Quantifying CO2 and CH4 Fluxes from Vulnerable Arctic-Boreal Ecosystems Across Spatial and Temporal Scales; 2015-2019

NASA, Science Team for the OCO-2 Mission, Co-Investigator: Extension of Data Assimilation and Mapping Projects to Ingest Data from OCO-2: Total Funding $265,949; 2011-2013

NSF, Software Infrastructure for Sustained Innovation, Co-Investigator: SI2-SSI: Real-Time Large-Scale Parallel Intelligent CO2 Data Assimilation System: Total Funding $1.9 Million; 2011-2014

NASA, Atmospheric Carbon Observations from Space, Co-Investigator: CO 2.0: Assessing the Impact of a Combined in Situ and Satellite CO2 Monitoring Network on Constraining Biospheric and Anthropogenic Fluxes for North America: Co-Investigator, Total Funding $754,760; 2010-2013

DoE, Sandia National Laboratories: Laboratory Directed Research and Development, Co-Investigator: Kalman-Filtered Compressive Sensing for High Resolution Estimation of Anthropogenic Greenhouse Gas Emissions From Sparse Measurements: Co-Investigator Total funding $183,900,0; 2010-2013

Relevant Algorithms and Software:

1. **Yadav, V**. (2013) An O($n^{2.5}$) Algorithm for Multiplication of Matrices Expressed as a Kronecker Product [see *Geoscientific Model Development* 6, 3325-3342].
2. **Yadav, V**. (2013) An O($n^{2.5}$) Algorithm for Uncertainity Quantification in Geostatistical Inverse Models [see *Geoscientific Model Development* 6, 3325-3342].
3. **Yadav, V**. (2016) Sparse-Sparse Matrix Multiplication Methods for Covariance Matrices in Atmospheric Inverse Problems [See *Geoscientific Model Development Discussions*, 204]

All the algorithms and software now are foundation of NOAA's software **CarbonTracker-Lagrange** available from https://gml.noaa.gov/ccgg/carbontracker-lagrange/.

Github: https://github.com/vineety

Software app; IOS Phone Device (search on App store). **TerraOorja**

Data Products:

1. Hai Nguyen, J Liu, S, Kulawik, D Baker, J Hobbs, M Katzfuss, and V Yadav (2022), *OCO-2 Gridded bias-corrected XCO2 and other select fields aggregated as Level 4 daily files*, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), 10.5067/582L7HTJ343N
2. Hai Nguyen, J Liu, S, Kulawik, D Baker, J Hobbs, M Katzfuss, and V Yadav (2022), *Multi-Instrument Fused bias-corrected XCO2 and other select fields aggregated as Level 4 daily files*, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), 10.5067/ZS346LH1NTIS
3. Hai Nguyen, Manju Johny, Junjie Liu, Susan Kulawik, David Baker, Jonathan Hobbs, Amy Braverman, Matthias Katzfuss, and Vineet Yadav (2024), OCO-2 Gridded bias-corrected XCO2, SIF, and other select fields aggregated as Level 3 daily files, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [Data Access Date], 10.5067/0QR48EPN1BVR

Reviewing Activity: (Paper) Journal of Geophysical Research: Atmospheres, Journal of Geophysical Research: Biogeosciences, Geophysical Research Letters, Water Resources Research, Atmospheric Chemistry and Physics, Geoscientific Model Development, Biogeosciences, Remote Sensing of Environment: (Proposals) NASA, DOE

Collaborators

Primary Internal: Charles E. Miller, Nicholas Parazoo, Kevin Bowman, Junjie Liu, Stanley Sanders

Primary External: Anna Michalak, Anna Karion, Kim Mueller, David Baker, Susan S. Kulawik, Scott Miller, Deborah Huntzinger, Ralph Keeling, John Miller, Jooil Kim, David Baker, James Whetstone and Subhomoy Ghosh.

Mentoring
Manju Johnny: Postdoc JPL (2021—2024)

Classes
Data Assimilation Summer School 2024, Colorado State University, Fort Collins, Colorado
Teaching Assistant, University of Iowa, 2004-2007

Awards & Scholarships:
1. 3 JPL Voyager Awards,
2. Ballard and Seashore Dissertation Fellowship, University of Iowa (2007-2008)
3. Cambridge Commonwealth Trust, the University of Cambridge, Cambridge, UK; Department of International Development-Cambridge Shared Scholarship (2001-2002)

Publications
1. Yadav, V., Hobbs, J., Nguyen, H. M., Kulawik, S. S., Liu, J., Baker, D. F., Morino, I., Ohyama, H., Velazco, V. A., Vrekoussis, M., & Dubey, M. K. (2025). An error model for evaluating the accuracy of satellite-based XCO_2 products. arXiv preprint arXiv:2509.16419. https://arxiv.org/abs/2509.16419
2. Mueller, Kimberly L., Anna Karion, Israel Lopez-Coto, Julia Marrs, Vineet Yadav, Genevieve Plant, Joseph Pitt, Zachary R. Barkley, and James Whetstone. "Scaling Urban Methane Emissions: Utility of Single-Site Measurements in Five Urban Domains." *Environmental Science & Technology* 59, no. 28 (2025): 14399-14409.
3. Liu, H., Vogel, F. R., Ishizawa, M., Zhang, Z., Poulter, B., Worthy, D. E. J., Feng, L., Gagné-Landmann, A. L., Chen, A., Huang, Z., Gaeta, D. C., Melton, J. R., Chan, D., Yadav, V., Huntzinger, D., and Miller, S. M.: Methane fluxes from arctic & boreal North America: Comparisons between process-based estimates and atmospheric observations, EGUsphere [preprint], https://doi.org/10.5194/egusphere-2025-2150, 2025.
4. 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. https://arxiv.org/abs/2503.03901
5. Mueller et al., IG3IS Urban Greenhouse Gas Emission Observation and Monitoring Good Research Practice Guidelines, Report, Under Revision. Accessible from https://wmoomm.sharepoint.com /:w:/s/wmocpdb/EfTH9KfixddBk29epuSQ088Bj_f5bTol80YG1C8QQN3bdA?e=323sHJ
6. Yadav, V., Verhulst, K., Duren, R., et al. (2023). "A declining trend of methane emissions in the Los Angeles basin from 2015 to 2020." *Environmental Research Letters*, 18(3), 034004.
7. Thorpe, A. K., Kort, E. A., Cusworth, D. H., et al. (2023). "Methane emissions decline from reduced oil, natural gas, and refinery production during COVID-19." *Environmental Research Communications*, 5(2), 021006.
8. Kim, J., Miller, J. B., Miller, C. E., et al. (2023). "Quantification of fossil fuel CO2 from combined CO, $\delta^{13}CO2$ and $\Delta^{14}CO2$ observations." *Atmospheric Chemistry and Physics*, 23(22), 14425-14436.
9. Yadav, V., Ghosh, S., & Miller, C. E. (2023). "Metrics for evaluating the quality in linear atmospheric inverse problems: a case study of a trace gas inversion." *Geoscientific Model Development*, 16(17), 5219-5236.
10. Cusworth, D. H., Thorpe, A. K., Ayasse, A. K., et al. (2022). "Strong methane point sources contribute a disproportionate fraction of total emissions across multiple basins in the United States." *Proceedings of the National Academy of Sciences*, 119(38), e2202338119.

11. Parazoo, N. C., Coleman, R. W., Yadav, V., et al. (2022). "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, 151335.

12. Hobbs, J., Katzfuss, M., Nguyen, H., & Yadav, V. (2022). "Functional ANOVA for Carbon Flux Estimates from Remote Sensing Data." *Geoscientific Model Development Discussions*, 2022, 1-24.

13. Yadav, V., Ghosh, S., Mueller, K., et al. (2021). "The impact of COVID-19 on CO2 emissions in the Los Angeles and Washington DC/Baltimore metropolitan areas." *Geophysical Research Letters*, 48(11), e2021GL092744.

14. Tadić, J. M., Miller, S., Yadav, V., & Biraud, S. C. (2021). "Greenhouse gas fluxes from Alaska's North Slope inferred from the Airborne Carbon Measurements campaign (ACME-V)." *Atmospheric Environment*, 248, 118239.

15. Thorpe, A. K., O'Handley, C., Emmitt, G. D., et al. (2021). "Improved methane emission estimates using AVIRIS-NG and an Airborne Doppler Wind Lidar." *Remote Sensing of Environment*, 266, 112681.

16. Thorpe, A. K., Duren, R. M., Conley, S., et al. (2020). "Methane emissions from underground gas storage in California." *Environmental Research Letters*, 15(4), 045005.

17. Cusworth, D. H., Duren, R. M., Yadav, V., et al. (2020). "Synthesis of methane observations across scales: Strategies for deploying a multitiered observing network." *Geophysical Research Letters*, 47(7), e2020GL087869.

18. Miller, J. B., Lehman, S. J., Verhulst, K. R., et al. (2020). "Large and seasonally varying biospheric CO2 fluxes in the Los Angeles megacity revealed by atmospheric radiocarbon." *Proceedings of the National Academy of Sciences*, 117(43), 26681-26687.

19. Coleman, R. W., Stavros, N., & Yadav, V. (2020). "A simplified framework for high-resolution urban vegetation classification with optical imagery in the Los Angeles Megacity." *Remote Sensing*, 12(15), 2399.

20. Yadav, V., Duren, R., Mueller, K., et al. (2019). "Spatio-temporally resolved methane fluxes from the Los Angeles Megacity." *Journal of Geophysical Research: Atmospheres*, 124(9), 5131-5148.

21. Bogue, R. R., Schwandner, F. M., Fisher, J. B., et al. (2019). "Plant responses to volcanically elevated CO2 in two Costa Rican forests." *Biogeosciences*, 16(6), 1343-1360.

22. Ware, J., Kort, E. A., Duren, R., et al. (2019). "Detecting urban emissions changes and events with a near-real-time-capable inversion system." *Journal of Geophysical Research: Atmospheres*, 124(9), 5117-5130.

23. Hu, L., Andrews, A. E., Thoning, K. W., et al. (2019). "Enhanced North American carbon uptake associated with El Niño." *Science Advances*, 5(6), eaaw0076.

24. He, L., Zeng, Z., Pongetti, T. J., et al. (2019). "Atmospheric methane emissions correlate with natural gas consumption from residential and commercial sectors in Los Angeles." *Geophysical Research Letters*, 46(14), 8563-8571.

25. Parazoo, N. C., Frankenberg, C., Köhler, P., et al. (2019). "Towards a harmonized long-term spaceborne record of far-red solar-induced fluorescence." *Journal of Geophysical Research: Biogeosciences*, 124(8), 2518-2539.

26. Cui, Y. Y., Vijayan, A., Falk, M., et al. (2019). "A multiplatform inversion estimation of statewide and regional methane emissions in California during 2014-2016." *Environmental Science & Technology*, 53(16), 9636-9645.

27. Duren, R. M., Thorpe, A. K., Foster, K. T., et al. (2019). "California's methane super-emitters." *Nature*, 575(7781), 180-184.

28. Shiga, Y. P., Tadić, J. M., Qiu, X., et al. (2018). "Atmospheric CO2 observations reveal strong correlation between regional net biospheric carbon uptake and solar-induced chlorophyll fluorescence." *Geophysical Research Letters*, 45(2), 1122-1132.

29. Gourdji, S. M., Yadav, V., Karion, A., et al. (2018). "Reducing errors in aircraft atmospheric inversion estimates of point-source emissions: the Aliso Canyon natural gas leak as a natural tracer experiment." *Environmental Research Letters*, 13(4), 045003.

30. Mueller, K., Yadav, V., Lopez-Coto, I., et al. (2018). "Siting background towers to characterize incoming air for urban greenhouse gas estimation: a case study in the Washington, DC/Baltimore area." *Journal of Geophysical Research: Atmospheres*, 123(5), 2910-2926.
31. Verhulst, K. R., Karion, A., Kim, J., et al. (2017). "Carbon dioxide and methane measurements from the Los Angeles Megacity Carbon Project--Part 1: calibration, urban enhancements, and uncertainty estimates." *Atmospheric Chemistry and Physics*, 17(13), 8313-8341.
32. Yadav, V., Michalak, A. M., Ray, J., & Shiga, Y. P. (2016). "A statistical approach for isolating fossil fuel emissions in atmospheric inverse problems." *Journal of Geophysical Research: Atmospheres*, 121(20), 12-490.
33. Alden, C. B., Miller, J. B., Gatti, L. V., et al. (2016). "Regional atmospheric CO2 inversion reveals seasonal and geographic differences in Amazon net biome exchange." *Global Change Biology*, 22(10), 3427-3443.
34. Bloom, A. A., Lauvaux, T., Worden, J., et al. (2016). "What are the greenhouse gas observing system requirements for reducing fundamental biogeochemical process uncertainty? Amazon wetland CH4 emissions as a case study." *Atmospheric Chemistry and Physics*, 16(23), 15199-15218.
35. Yadav, V., & Michalak, A. M. (2016). "Improving the computational efficiency of sparse matrix multiplication in linear atmospheric inverse problems." *Geosci. Model Dev. Discuss*, 204.
36. Ray, J., Lee, J., Yadav, V., et al. (2015). "A sparse reconstruction method for the estimation of multi-resolution emission fields via atmospheric inversion." *Geoscientific Model Development*, 8(4), 1259-1273.
37. Tadić, J. M., Qiu, X., & Yadav, V. (2015). "Mapping of satellite Earth observations using moving window block kriging." *Geoscientific Model Development*, 8(10), 3311-3319.
38. Ray, J., Yadav, V., Michalak, A. M., et al. (2014). "A multiresolution spatial parameterization for the estimation of fossil-fuel carbon dioxide emissions via atmospheric inversions." *Geoscientific Model Development*, 7(5), 1901-1918.
39. Fang, Y., Michalak, A. M., Shiga, Y. P., & Yadav, V. (2014). "Using atmospheric observations to evaluate the spatiotemporal variability of CO2 fluxes simulated by terrestrial biospheric models." *Biogeosciences*, 11(23), 6985-6997.
40. Shiga, Y. P., Michalak, A. M., Gourdji, S. M., Mueller, K. L., & Yadav, V. (2014). "Detecting fossil fuel emissions patterns from sub-continental regions using North American in-situ CO2 measurements." *Geophysical Research Letters*, 41(12), 4381-4388.
41. Ray, J., Lee, J., Lefantzi, S., Yadav, V., Michalak, A. M., van Bloemen Waanders, B. G., & McKenna, S. A. (2013). "Kalman-filtered compressive sensing for high resolution estimation of anthropogenic greenhouse gas emissions from sparse measurements." *Sandia National Lab. (SNL-CA), Livermore, CA (United States)*.
42. Yadav, V., Malanson, G. P. (2013). "A spatially explicit scheme for tracking and validating annual landscape scale changes in soil carbon." *Applied Geography*, 37, 101-113.
43. Yadav, V., Mueller, K. L., & Michalak, A. M. (2013). "A backward elimination discrete optimization algorithm for model selection in spatio-temporal regression models." *Environmental Modelling & Software*, 42, 88-98.
44. Yadav, V., & Michalak, A. M. (2013). "Improving computational efficiency in large linear inverse problems: an example from carbon dioxide flux estimation." *Geoscientific Model Development*, 6(3), 583-590.
45. Chatterjee, A., Michalak, A. M., Anderson, J. L., Mueller, K. L., & Yadav, V. (2012). "Toward reliable ensemble Kalman filter estimates of CO2 fluxes." *Journal of Geophysical Research*, 117(D22), D22306.
46. Gourdji, S. M. (2012). "North American CO2 exchange: Inter comparison of modeled estimates with results from a fine scale atmospheric inversion." *Biogeosciences*, 9, 457-475.
47. Yadav, V., Mueller, K. L., Dragoni, D., & Michalak, A. M. (2010). "A geostatistical synthesis study of factors affecting gross primary productivity in various ecosystems of North America." *Biogeosciences*, 7(9), 2655-2671.

48. Gourdji, S. M., Hirsch, A. I., Mueller, K. L., Yadav, V., Andrews, A. E., & Michalak, A. M. (2010). "Regional-scale geostatistical inverse modeling of North American CO2 fluxes: a synthetic data study." *Atmos. Chem. Phys*, 10, 6151-6167.

49. Mueller, K. L., Yadav, V., Curtis, P. S., Vogel, C., & Michalak, A. M. (2010). "Attributing the variability of eddy-covariance CO2 flux measurements across temporal scales using geostatistical regression for a mixed northern hardwood forest." *Global Biogeochemical Cycles*, 24(3), GB3023.

50. Yadav, V., Malanson, G. P., Bekele, E., & Lant, C. (2009). "Modeling watershed-scale sequestration of soil organic carbon for carbon credit programs." *Applied Geography*, 29(4), 488-500.

51. Yadav, V., & Malanson, G. P. (2009). "Modeling impacts of erosion and deposition on soil organic carbon in the Big Creek Basin of southern Illinois." *Geomorphology*, 106(3-4), 304-314.

52. Yadav, V., & Malanson, G. (2008). "Spatially explicit historical land use land cover and soil organic carbon transformations in Southern Illinois." *Agriculture, Ecosystems & Environment*, 123(4), 280-292.

53. Yadav, V., Del Grosso, S. J., Parton, W. J., & Malanson, G. P. (2008). "Adding ecosystem function to agent-based land use models." *Journal of Land Use Science*, 3(1), 27-40.

54. Yadav, V., & Malanson, G. (2007). "Progress in soil organic matter research." *Progress in Physical Geography*, 31(2), 131.