Sudhanshu Pandey, Ph.D.

Scientist, Earth Science Section
Jet Propulsion Laboratory, California Institute of Technology
4800 Oak Grove Drive, Pasadena, CA 91109

Email: sudhanshu.pandey[at]jpl.nasa.gov
LinkedIn | Web | Google Scholar

Date: September 26, 2025

Professional Experience

Scientist *Jan 2022 – Present*
NASA Jet Propulsion Laboratory (JPL), Pasadena, CA, USA
Scientist *Aug 2016 – Jan 2022*
SRON Netherlands Institute for Space Research, Utrecht, The Netherlands

Education

Ph.D. in Physics *Aug 2012 – Feb 2017*
Utrecht University, Utrecht, the Netherlands
BS-MS in Earth Sciences *Jul 2007 – May 2012*
Indian Institute of Science Education & Research, Kolkata, India

Research Interests

My research centers on atmospheric chemistry and physics, with a focus on satellite remote sensing and modeling to advance understanding of the Earth's carbon cycle. I work on two fronts: space-based monitoring and improved prediction of carbon-cycle dynamics. Using multi-sensor observations, I develop quantitative methods and transport-inversion frameworks to estimate emissions from anthropogenic and natural sources.

- Satellite remote sensing of atmospheric trace gases
- Emission plume detection and quantification
- Atmospheric transport modeling and dispersion
- Bayesian statistics and flux inversions (variational and analytic)
- Machine learning for point-source detection and gridded emissions
- Improving global methane and carbon dio growth-rate estimates

Awards and Grants

- NASA ROSES Early Career Investigator Program in Earth Science (ECIP-ES) Grant, 2023
- Best Oral Presentation Award, SRON Netherlands Science Day, 2019
- INSPIRE Fellowship, Department of Science & Technology (DST), India, 2008

Presentations

Invited Presentations

- **AGU Fall Meeting, 2025:** "Accurate, Low-Latency Monitoring of Whole-Atmosphere CO_2 Growth Rates with Satellite Observations". Session: A089: Remote Sensing of CH4 and CO2 from Space: The Expanding Observing System
- **NOAA, 2023:** Global growth rate estimates of CO_2 from satellite observations
- **U.S. EPA, 2021:** Satellite reveals extreme leakage from a natural gas well blowout
- **Indian Institute of Tropical Meteorology (IITM), Pune, India, 2019:** Atmospheric monitoring using ESA's TROPOMI satellite
- **NASA JPL, 2019:** Satellite reveals extreme CH_4 leakage from a natural gas well blowout
- **NASA GISS, 2018:** TROPOMI detection of CH_4 leakage from a gas well blowout
- **NASA JPL, 2018:** CH_4 monitoring using ESA's TROPOMI satellite

Select Conference Presentations

- **American Geophysical Union (AGU) Fall Meetings:** 2015, 2018, 2019, 2021, 2022, 2023 & 2024
- **European Geosciences Union (EGU) General Assembly:** 2017, 2018 & 2019
- **ESA Living Planet Symposium:** 2013 & 2016
- **International Carbon Dioxide Conference (ICDC):** 2017
- **International Workshop on Greenhouse Gas Measurements from Space (IWGGMS):** 2014, 2018, 2021 & 2023

Mentoring and Supervision

- **Master's Thesis Project (9 months, full time):** Main supervisor for Dr. Simon van Diepen (Delft University) and Dr. Maria Tsivilidou (Utrecht University). Co-supervisor for Peter Bijh (Delft University).
- **Internship Supervision at JPL:** Ansh Tiwari (Caltech), Julia Gao (Caltech), Kayley Butler (USC), Zijian Qiu (Harvard University), Monica Amezquita (Cal Poly Pomona via JPL's MSP Program).
- Supervised seven university student projects at SRON, Leiden, each lasting between 3-6 months.

Community Service

- **Reviewer for scientific journals:** Nature, Science Advances, Nature Climate Change, Atmospheric Measurement Techniques, Atmospheric Chemistry and Physics, Carbon Management, Journal of Geophysical Research, Remote Sensing of Environment, Environmental Science & Technology, Environmental Research Letters, Geophysical Research Letters, and Remote Sensing.
- **Review Editor:** Frontiers
- **Proposal Review:** Scientific research proposals for NOAA and NASA.
- **Poster Judge:** EGU and AGU annual meetings.
- Hosted remote sensing session at the CEOS-GHG (Paris) 2023 meeting.

Publications

Peer-reviewed Publications

*Note: * indicates paper is under review.*

[1] **Pandey**, S. (2025). Taking Earth's Carbon Pulse from Space. *AGU Advances* doi:10.1029/2025AV002085

[2] *Yun, J., et al. Unprecedented role of Amazon fires in the record atmospheric CO2 growth in 2024. Under Review in *Science*. [Preprint] 10.22541/essoar.175874118.83695562/v1

[3] **Pandey**, S., et al. (2025). Reduction in Earth's Carbon Budget Imbalance. *Nature Communications*, 16, 6818, doi:10.1038/s41467-025-61588-2

[4] Bilir, E., et al (2025). Satellite-constrained reanalysis reveals CO_2 versus climate process compensation across the global land carbon sink. *AGU Advances* doi:10.1029/2025AV001689.

[5] *Varon, D., et al (2025). Seasonality and declining intensity of methane emissions from the Permian and nearby US oil and gas basins, Under review at *Environmental Science & Technology*.

[6] *Dasgupta, B., et al (2025). Harmonisation of methane isotope ratio measurements from different laboratories using atmospheric samples, Under review at *Atmospheric Measurement Techniques*, EGUsphere [preprint], 10.5194/egusphere-2025-2439.

[7] *Ke, X., et al. (2025). Low-latency global carbon budget reveals a continuous decline of the land carbon sink during the 2023/24 El Niño event. Under review at *National Science Review*. *arXiv preprint*. doi:10.48550/arXiv.2504.09189

[8] **Pandey**, S., et al. (2025). Relating multi-scale plume detection and area estimates of methane emissions: A theoretical and empirical analysis. *Environmental Science & Technology*, 59(16), 7931–7947. doi:10.1021/acs.est.4c07415

[9] Albuhaisi, A., et al. (2025). Integrating satellite observations and hydrological models to unravel large TROPOMI methane emissions in South Sudan wetlands. *Remote Sensing*, 16, 4744. doi:10.3390/rs16244744

[10] **Pandey**, S., et al. (2024). Toward low-latency estimation of atmospheric CO_2 growth rates using satellite observations: Evaluating sampling errors of satellite and in situ observing approaches. *AGU Advances*, 5, e2023AV001145. doi:10.1029/2023AV001145

[11] Varon, D. J., et al. (2024). Quantifying NO_x point sources with Landsat and Sentinel-2 satellite observations of NO_2 plumes. *Proceedings of the National Academy of Sciences*, 121, e2317077121. doi:10.1073/pnas.2317077121

[12] Byrne, B., et al. (2024). Carbon emissions from the 2023 Canadian wildfires. *Nature*. 633, 835–839 doi:10.1038/s41586-024-07878-z

[13] **Pandey**, S., et al. (2023). Daily detection and quantification of methane leaks using Sentinel-3: A tiered satellite observation approach with Sentinel-2 and Sentinel-5P. *Remote Sensing of Environment*, 296, 113716. doi:10.1016/j.rse.2023.113716

[14] Schuit, B. J., et al. (2023). Automated detection and monitoring of methane super-emitters using satellite data. *Atmospheric Chemistry and Physics*, 23, 9071–9098. doi:10.5194/acp-23-9071-2023

[15] Worden, J. R., et al. (2023). Verifying methane inventories and trends with atmospheric methane data. *AGU Advances*, 4. doi:10.1029/2023AV000871

[16] Naus, S., et al. (2023). Assessing the relative importance of satellite-detected methane superemitters in quantifying total emissions for oil and gas production areas in Algeria. *Environmental Science & Technology*. doi:10.1021/acs.est.3c04746

[17] Varon, D. J., et al. (2023). Continuous weekly monitoring of methane emissions from the Permian Basin by inversion of TROPOMI satellite observations. *Atmospheric Chemistry and Physics*, 23, 7503–7520. doi:10.5194/acp-23-7503-2023

[18] Maasakkers, J. D., et al. (2022). Reconstructing and quantifying methane emissions from the full duration of a 38-day natural gas well blowout using space-based observations. *Remote Sensing of Environment*, 270, 112755. doi:10.1016/j.rse.2021.112755

[19] Maasakkers, J. D., et al. (2022). Using satellites to uncover large methane emissions from landfills. *Science Advances*, 8, 1–9. doi:10.1126/sciadv.abn9683

[20] Sadavarte, P., et al. (2022). A high-resolution gridded inventory of coal mine methane emissions for India and Australia. *Elementa*, 10, 1–14. doi:10.1525/elementa.2021.00056

[21] **Pandey**, S., et al. (2022). Order of magnitude wall time improvement of variational methane inversions by physical parallelization: A demonstration using TM5-4DVAR. *Geoscientific Model Development*, 15, 4555–4567. doi:10.5194/gmd-15-4555-2022

[22] **Pandey**, S., et al. (2021). Using satellite data to identify the methane emission controls of South Sudan's wetlands. *Biogeosciences*, 18, 557–572. doi:10.5194/bg-18-557-2021

[23] Cusworth, D. H., et al. (2021). Multi-satellite imaging of a gas well blowout enables quantification of total methane emissions. *Geophysical Research Letters*, 48(2), 1–9. doi:10.1029/2020GL090864

[24] Sadavarte, P., et al. (2021). Methane emissions from super-emitting coal mines in Australia quantified using TROPOMI satellite observations. *Environmental Science & Technology*, 55(24), 16573–16580. doi:10.1021/acs.est.1c03976

[25] Mazzini, A., et al. (2021). Relevant methane emission to the atmosphere from a geological gas manifestation. *Scientific Reports*. doi:10.1038/s41598-021-83369-9

[26] Zavala-Araiza, D., et al. (2021). A tale of two regions: Methane emissions from oil and gas production in offshore/onshore Mexico. *Environmental Research Letters*. doi:10.1088/1748-9326/abceeb

[27] Ma, S., et al. (2021). Satellite constraints on the latitudinal distribution and temperature sensitivity of wetland methane emissions. *AGU Advances*, 2(3), 1–12. doi:10.1029/2021AV000408

[28] Zhang, Y., et al. (2020). Quantifying methane emissions from the largest oil-producing basin in the United States from space. *Science Advances*. doi:10.1126/sciadv.aaz5120

[29] **Pandey**, S., et al. (2019). Satellite observations reveal extreme methane leakage from a natural gas well blowout. *Proceedings of the National Academy of Sciences*, 116(52), 26376–26381. doi:10.1073/pnas.1908712116

[30] **Pandey**, S., et al. (2019). Influence of atmospheric transport on estimates of variability in the global methane burden. *Geophysical Research Letters*, 46, 2302–2311. doi:10.1029/2018GL081092

[31] Ganesan, A. L., et al. (2019). Advancing scientific understanding of the global methane budget in support of the Paris Agreement. *Global Biogeochemical Cycles*, 33(12), 1475–1512. doi:10.1029/2018GB006065

[32] Varon, D. J., et al. (2019). Satellite discovery of anomalously large methane point sources from oil/gas production. *Geophysical Research Letters*. doi:10.1029/2019GL083798

[33] Dekker, I. N., et al. (2019). What caused the extreme CO concentrations during the 2017 high pollution episode in India? *Atmospheric Chemistry and Physics*, 19, 3433–3445. doi:10.5194/acp-19-3433-2019

[34] Borsdorff, T., et al. (2019). Carbon monoxide air-pollution on sub-city scales and along arterial roads detected by the Tropospheric Monitoring Instrument. *Atmospheric Chemistry and Physics*, 19, 3579–3588. doi:10.5194/acp-19-3579-2019

[35] Naus, S., et al. (2019). Constraints and biases in a tropospheric two-box model of OH. *Atmospheric Chemistry and Physics*, 19(1), 407–424. doi:10.5194/acp-19-407-2019

[36] Nechita-Banda, N., et al. (2018). Monitoring emissions from the 2015 Indonesian fires using CO satellite data. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 373(1760), 20170307. doi:10.1098/rstb.2017.0307

[37] Bruhwiler, L. M., et al. (2017). US CH_4 emissions from oil and gas production: Have recent large increases been detected? *Journal of Geophysical Research: Atmospheres*, 122(7), 4070–4083. doi:10.1002/2016JD026157

[38] Worden, J. R., et al. (2017). Reduced biomass burning emissions reconcile conflicting estimates of the post-2006 atmospheric methane budget. *Nature Communications*, 8(1), 2227. doi:10.1038/s41467-017-02246-0

[39] **Pandey**, S., et al. (2017). Enhanced methane emissions from tropical wetlands during the 2011 La Niña. *Scientific Reports*, 7. doi:10.1038/srep45759

[40] **Pandey**, S., et al. (2016). Inverse modeling of GOSAT-retrieved ratios of total column CH_4 and CO_2 for 2009 and 2010. *Atmospheric Chemistry and Physics*, 16(8), 5043–5062. doi:10.5194/acp-16-5043-2016

[41] **Pandey**, S., et al. (2015). On the use of satellite-derived CH_4:CO_2 columns in a joint inversion of CH_4 and CO_2 fluxes. *Atmospheric Chemistry and Physics*, 15(15), 8615–8629. doi:10.5194/acp-15-8615-2015

Other Publications

[1] Varon, D.J., et al.: Reply to Chen et al.: Coarse simulations overestimate the distance to recover NO–NO2–O3 photochemical steady state in fresh NOx plumes, Proc. Natl. Acad. Sci. U.S.A. 122 (7) e2425976122, DOI.

[2] Sadavarte, P., et al. Rebuttal to Correspondence on "Methane Emissions from Superemitting Coal Mines in Australia Quantified Using TROPOMI Satellite Observations." *Environmental Science and Technology*. link, 2024.

[3] Maity, A., et al. Atmospheric CO2 inversion models overestimate northern extratropical land and ocean carbon uptake as assessed at background in-situ sites. [**Preprint**] Research Square. Under review. link, 2024.

[4] Bergamaschi, P., et al. Atmospheric monitoring and inverse modeling for verification of greenhouse gas inventories. *Publications Office of the European Union*. link, 2018.

[5] **Pandey**, S. Advancing the use of satellites to constrain atmospheric methane fluxes. Ph.D. Dissertation. Utrecht University. link, 2017.

[6] Chevallier, F., et al. Climate Assessment Report for the GHG-CCI project of ESA's Climate Change Initiative. *Publications Office of the European Union*. link, 2017.