

Sudhanshu Pandey

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Professional Experience

- **Scientist** 1/2022 - Present
NASA Jet Propulsion Laboratory (JPL), Pasadena, CA, USA
- **Scientist** 8/2016 - 1/2022
SRON Netherlands Institute for Space Research, Utrecht, The Netherlands

Education

- **Ph.D. in Physics** 8/2012 – 2/2017
Utrecht University, Utrecht, The Netherlands
- **BS-MS in Earth Sciences** 7/2007 – 5/2012
Indian Institute of Science Education & Research, Kolkata, India

Research

My research is on improving the understanding and modeling capability of climate and atmosphere. My work focuses on atmospheric trace gases like methane and carbon dioxide contributing to climate change and atmospheric pollution. I use satellite remote sensing and numerical modeling techniques to estimate and understand surface emissions, atmospheric transport, and chemical processes. I am passionate about theoretical scientific advances to enhance the effectiveness of modern state-of-the-art observations for climate change prediction and emission mitigation monitoring.

- Remote sensing of atmospheric trace gases (GOSAT, OCO-2, OCO-3 & TROPOMI).
- Plume detection and quantification (EMIT, Sentinel-2, Landsat, AVIRIS-NG & PRISMA).
- Atmospheric transport models to track trace gas movements (TM5 & WRF-CHEM).
- Bayesian data assimilation methods (variational and analytical approaches).
- Machine learning tools to detect and measure strong point sources (CNNs).
- Theoretical development for understanding Earth's carbon cycle and reducing carbon budget imbalance.

Publications

Peer-reviewed

- Varon, D. J., et al: Quantifying NO_x point sources with Landsat and Sentinel-2 satellite observations of NO₂ plumes, Proc. Natl. Acad. Sci., 121, e2317077121, <https://doi.org/10.1073/pnas.2317077121>, 2024.
- Byrne, B., et al. Unprecedented Canadian forest carbon emissions during 2023. Accepted in Nature, preprint DOI: 10.21203/rs.3.rs-3684305/v1, 2024.
- Pandey, S. et al. Towards Low-Latency Estimation of Atmospheric CO₂ Growth Rates using Satellite Observations: Evaluating Sampling Errors of Satellite and In Situ Observing Approaches, Accepted AGU Advances. Preprint: 10.22541/essoar.170758128.83990102/v1, 2024.

- Sadavarte, P., et al. Rebuttal to Correspondence on "Methane Emissions from Superemitting Coal Mines in Australia Quantified Using TROPOMI Satellite Observations". *Environ. Sci. Technol.*, 2024.
- Pandey, S., et al. 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, 2023.
- Schuit, B. J., et al. Automated detection and monitoring of methane super-emitters using satellite data. *Atmos. Chem. Phys.*, 23, 9071–9098, 2023.
- Worden, J. R., et al. Verifying Methane Inventories and Trends With Atmospheric Methane Data. *AGU Adv.*, 4, 2023.
- Naus, S., et al. Assessing the Relative Importance of Satellite-Detected Methane Superemitters in Quantifying Total Emissions for Oil and Gas Production Areas in Algeria. *Environ. Sci. Technol.*, 2023.
- Varon, D. J., et al. Continuous weekly monitoring of methane emissions from the Permian Basin by inversion of TROPOMI satellite observations. *Atmos. Chem. Phys.*, 23, 7503–7520, 2023.
- Maasakkers, J. D., et al. Reconstructing and quantifying methane emissions from the full duration of a 38-day natural gas well blowout using space-based observations. *Remote Sens. Environ.*, 270, 112755, 2022.
- Maasakkers, J. D., et al. Using satellites to uncover large methane emissions from landfills. *Science Advances*, 8, 1–9, 2022.
- Sadavarte, P., et al. A high-resolution gridded inventory of coal mine methane emissions for India and Australia. *Elementa*, 10, 1–14, 2022.
- Pandey, S., et al. Order of magnitude wall time improvement of variational methane inversions by physical parallelization: a demonstration using TM5-4DVAR. *Geoscientific Model Development*, 15, 4555–4567, 2022.
- Pandey, S., et al. Using satellite data to identify the methane emission controls of South Sudan's wetlands. *Biogeosciences*, 18, 557–572, 2021.
- Cusworth, D. H., et al. Multi-Satellite Imaging of a Gas Well Blowout Enables Quantification of Total Methane Emissions. *Geophys. Res. Lett.*, 48(2), 1–9, 2021.
- Sadavarte, P., et al. Methane Emissions from Super-emitting Coal Mines in Australia quantified using TROPOMI Satellite Observations. *Environmental Science & Technology*, 55 (24), 16573-16580, 2021.
- Mazzini, A., et al. Relevant methane emission to the atmosphere from a geological gas manifestation. *Nature Publishing Group UK*, 2021.
- Zavala-Araiza, D., et al. A tale of two regions: methane emissions from oil and gas production in offshore/onshore Mexico. *Environmental Research Letters*, 2021.
- Ma, S., et al. Satellite Constraints on the Latitudinal Distribution and Temperature Sensitivity of Wetland Methane Emissions. *AGU Adv.*, 2(3), 1–12, 2021.
- Zhang, Y., et al. Quantifying methane emissions from the largest oil-producing basin in the United States from space. *Sci. Adv.*, 2020.
- Pandey, S., et al. Satellite observations reveal extreme methane leakage from a natural gas well blowout. *Proc. Natl. Acad. Sci. U. S. A.*, 116(52), 26376–26381, 2019.
- Ganesan, A. L., et al. Advancing Scientific Understanding of the Global Methane Budget in Support of the Paris Agreement. *Global Biogeochem. Cycles*, 33(12), 1475–1512, 2019.
- Varon, D.J., et al. Satellite discovery of anomalously large methane point sources from oil/gas production. *Geophysical Research Letters*, 2019.

- Dekker, I. N., et al. What caused the extreme CO concentrations during the 2017 high pollution episode in India? *Atmospheric chemistry and physics*, 19, 3433–3445, 2019.
- Borsdorff, T., et al. 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, 2019.
- Naus, S., et al. Constraints and biases in a tropospheric two-box model of OH. *Atmospheric Chemistry and Physics*, 19(1), 407-424, 2019.
- Nechita-Banda, N., et al. Monitoring emissions from the 2015 Indonesian fires using CO satellite data. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 373(1760), 20170307, 2018.
- Bruhwiler, L.M., et al. US CH₄ emissions from oil and gas production: Have recent large increases been detected? *Journal of Geophysical Research: Atmospheres*, 122(7), 4070-4083, 2017.
- Worden, J.R., et al. Reduced biomass burning emissions reconcile conflicting estimates of the post-2006 atmospheric methane budget. *Nature communications*, 8(1), 2227, 2017.
- Pandey, S., et al. Enhanced methane emissions from tropical wetlands during the 2011 La Niña. *Scientific Reports*, 7, 2017.
- Pandey, S., et al. Inverse modeling of GOSAT-retrieved ratios of total column CH₄ and CO₂ for 2009 and 2010. *Atmospheric chemistry and physics*, 16(8), 5043-5062, 2016.
- Pandey, S., et al. On the use of satellite-derived CH₄: CO₂ columns in a joint inversion of CH₄ and CO₂ fluxes. *Atmospheric chemistry and physics*, 15(15), 8615-8629, 2015.

Other Publications

- Bergamaschi, P., et al. Atmospheric monitoring and inverse modelling for verification of greenhouse gas inventories. *Publications Office of the European Union*, 2018.
- Pandey, S. Advancing the use of satellites to constrain atmospheric methane fluxes. Ph.D. Dissertation. Utrecht University, 2017.
- Chevallier, F., et al. Climate Assessment Report for the GHG-CCI project of ESA’s Climate Change Initiative. *Publications Office of the European Union*, 2017.

Presentations

- American Geophysical Union (AGU) Fall meetings in 2015, 2018, 2019, 2021, 2022, 2023
- European Geosciences Union (EGU) General Assembly in 2017, 2018 & 2019
- ESA Living Planet Symposium (LPS) in 2013 & 2016
- International Carbon Dioxide Conference (ICDC) in 2017
- International Symposium on Non-CO₂ Greenhouse Gases (NCGG) in 2014
- International Workshop on Greenhouse Gas Measurements from Space (IWGGMS) in 2014, 2018 & 2021

Community Service

- Reviewer for scientific journals, including Nature Climate Change, Atmospheric Measurement Techniques, Atmospheric Chemistry and Physics, Carbon Management, Journal of Geophysical Research, Remote Sensing of Environment, Environmental Science & Technology, and Environmental Research Letters, Geophysical Research Letters and Remote Sensing.
- Scientific research proposals review for NOAA.