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 aims to enhance the understanding and modeling of climate and atmospheric trace gas transport. Focusing on methane and carbon dioxide, which are pivotal to climate change and atmospheric pollution, I utilize satellite remote sensing and numerical modeling techniques to estimate and analyze surface emissions, atmospheric transport, and chemical processes. I am passionate about theoretical scientific innovations to enhance the effectiveness of modern observations and model datasets for better climate change prediction and emission monitoring. My research includes:

- 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 atmospheric flux inversions using variational and analytical approaches.
- Machine learning tools to detect and measure strong point sources.
- Theoretical Development on discovering novel information on emissions processes, error characterizations of observing systems, and information theory.
- Improving the carbon dioxide growth rate estimates to reduce Earth's carbon budget imbalance.

Publications

Peer-reviewed

- Varon, D. J., et al: Quantifying NOx 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.
- 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.