

ALEXANDER MATUS, Ph.D.

WEATHER ANALYST/ML RESEARCHER

avmatus@gmail.com | alex-matus.github.io | linkedin.com/in/avmatus | 215-350-3217 | College Park, MD

SUMMARY

Highly motivated Atmospheric Scientist with a PhD and 15+ years of experience engineering automated data pipelines, predictive machine learning models, and high-performance computing (HPC) workflows for chaotic earth systems. Expert at leveraging massive, multi-sensor gridded datasets to drive quantitative research, optimize predictive algorithms, and quantify structural uncertainty under constraints. Elite Python programmer with a proven track record of modernizing complex legacy scientific code into scalable, production-grade environments for operational monitoring and atmospheric predictability.

TECHNICAL SKILLS

Scientific Software: Python (expert), Fortran, R, C++, PyTorch, TensorFlow, Linux/Unix, Git/Version Control

Methodologies: Machine Learning, Predictive Analytics, Image Analysis, Algorithm Optimization

Data Assimilation: Ensemble/Variational Methods, Quality Control (QC), Grid Mapping, Bias Correction

HPC/Computing: Linux Clusters, SLURM, Parallel Processing, Job Scheduling, Zarr, Dask, NetCDF

Domain Expertise: Synoptic meteorology, Sub-Seasonal Prediction, Data Assimilation, NWP, Wind/Solar

EXPERIENCE

Assistant Research Scientist (40 hours per week)

10/01/2023 - Present

NASA Goddard Space Flight Center / UMBC

Greenbelt, MD

- **Multi-sensor Integration:** Combined massive satellite imagery and global model reanalysis data to study the global energy budget and close discrepancies in global precipitation models.
- **Technical Lead:** Lead studies for next-generation instrument requirements, successfully bridging the gap between scientific objectives and engineering constraints for future mission planning.
- **Operational Field Support:** Served as the onboard Instrument Scientist for major NASA airborne campaigns (IMPACTS, ACCLIP); managed real-time data and quality control on operational flights.

NASA Postdoctoral Fellow (40 hours per week)

10/01/2021 - 9/30/2023

NASA Goddard Space Flight Center

Greenbelt, MD

- **Predictive ML Modeling:** Developed a new air quality estimation algorithm by combining satellite lidar data with neural networks (PyTorch/TensorFlow) and data assimilation, improving prediction accuracy.
- **Bias Reduction:** Integrated satellite profile data into NASA's flagship GEOS-5 model to significantly reduce spatial and temporal biases in air quality forecasting of surface-level particulate concentrations.
- **Project Leadership:** Served as PI for a \$170K research grant; led cross-disciplinary teams to integrate satellite-derived products into the GEOS-5 model for operational-style air quality monitoring.

CloudSat Algorithm Developer (40 hours per week)

8/01/2017 - 9/30/2021

University of Wisconsin-Madison/CIMSS

Madison, WI

- **Product Development:** Led the development of NASA's global CloudSat radiative flux products; modernized the production pipeline by migrating legacy compiled scripts into clean, scalable Python.
- **Workflow Automation:** Ran large-scale data processing and high-dimensional earth system simulations on Linux supercomputers using parallel processing and automated job schedulers.
- **Model Verification:** Conducted rigorous uncertainty analyses for global radiative effects to ensure product reliability, resulting in multiple peer-reviewed publications in high-impact journals.

EDUCATION

Ph.D., Atmospheric and Oceanic Sciences, University of Wisconsin-Madison 08/2017
M.S., Atmospheric and Oceanic Sciences, University of Wisconsin-Madison 08/2013
B.S., Meteorology (honors), Pennsylvania State University 05/2009

* Transcripts available confirming 24+ semester hours in physical science/engineering

OPERATIONAL ROLES

Instrument Scientist | IMPACTS Airborne Campaign (10/2022 - 03/2023)

NASA Goddard Space Flight Center

Greenbelt, MD

- Managed real-time data streams and automated visualization tools on research aircraft for IMPACTS (Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms) campaign.

Instrument Scientist | ACCLIP Airborne Campaign (07/2021 - 09/2022)

NASA Goddard Space Flight Center

Greenbelt, MD

- Directed real-time hardware calibration, sensor alignment, and radiometric signal responses for deployed airborne lidar systems during critical impact operations in Osan Air Base, South Korea.

Algorithm Lead | CloudSat Algorithm Development (08/2016 – 09/2021)

University of Wisconsin-Madison/CIMSS

Madison, WI

- Directed the version upgrades and the operational deployment of CloudSat radiative flux products (2B-FLXHR-LIDAR) at the UW-Madison and Cooperative Institute for Meteorological Satellite Studies.

SELECTED PUBLICATIONS

Matus, A., R. Kramer, L. Oreopoulos, and N. Cho (2026). The Influence of the Atmospheric Radiative Budget on Global Precipitation. *Geophysical Research Letters*. (in review).

Matus, A., Nowottnick, E. P., Yorks, J., and da Silva, A. (2025). Enhancing surface PM_{2.5} air quality estimates in GEOS using CATS lidar data. *Earth and Space Science*, 12, e2024EA004078. doi: 10.1029/2024EA004078

Matus, A. and T. L'Ecuyer (2017). "The role of cloud phase in Earth's radiation budget." *Journal of Geophysical Research: Atmospheres*, 122, pp. 2559–2578, doi: 10.1002/2016JD025951

Matus, A., T. L'Ecuyer, et al. (2015). The role of clouds in modulating global aerosol direct radiative effects in spaceborne active observations and the Community Earth System Model. *Journal of Climate*. Vol. 28, pp. 2986–3003. doi: 10.1175/JCLI-D-14-00426.1

Total Citations: 700+ | **Publications:** 35

Awards: NASA Postdoctoral Fellowship, AOSS Best Poster, Lettau Award for Outstanding Thesis

AWARDS & HONORS

- Group Achievement Award IMPACTS Team**, NASA Goddard Space Flight Center (2025).
- Group Achievement Award ACCLIP Team**, NASA Goddard Space Flight Center (2024).
- NASA Postdoctoral Fellowship**, NASA Goddard Space Flight Center (2021).
- Lettau Award for Outstanding PhD Thesis**, UW-Madison (2017).
- AOSS Best Poster Award**, University of Wisconsin-Madison (2016).