Paulo Penteado

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US Green Card Holder | U.S. Citizenship Naturalization in Progress

Remote Sensing Scientist | Science Data Systems Engineer

Remote Sensing Scientist and Systems Engineer with over a decade of experience at NASA/JPL developing physics-based retrieval systems and mission-scale science data pipelines. Expert in astrodynamics, mission design and planning, geospatial processing, radiative transfer modeling, atmospheric correction, and spectral signal extraction for Earth, planetary and solar observation. While working for JPL, I simultaneously managed 13 pipelines generating and delivering 221 distinct products daily for AIRS, SMAP and multiple instruments on Eyes on Earth, including reducing AIRS reprocessing time from a year to 3 days. I furthered the development and productionized the Plume Tracker toolkit for the automated detection and quantification of methane and SO_2 plumes, and developed algorithms and automated pipelines for extracting faint structures in solar corona observations.

SKILLS

Astronomy, Geospatial & Remote Sensing: Atmospheric retrievals, Atmospheric correction, Calibration / Validation, Hyperspectral / spectral analysis, Image processing, Inverse modeling, L2/L3/L4 product generation, NAIF SPICE, Radiative transfer (DISORT / MODTRAN), unsupervised anomaly detection, UV/VIS/NIR/TIR.

Instrument planning and data processing, archiving, visualization, and analysis: Astrodynamics, Geospatial data processing, Instrument tasking, Mission design, Observation planning optimization

Programming & Data Engineering: C/C++, CUDA, Fortran, GDAL, IDL, Java, MATLAB, OpenCV, OpenMP/MPI, Python (AstroPy, Dask, Numpy, Matplotlib, Pandas, Polars, Scikit-image, SunPy, xarray, xESMF), SQL, Test-Driven Development (TDD), CI/CD Automation, API Design, coding agents.

Cloud & DevOps: AWS (EC2 / S3 / Lambda), Docker, CI/CD, ETL, Git, JIRA

In person training: MODTRAN (SSI), SPICE (NAIF)

Online training (Coursera): GIS (UC Davis), Machine Learning (Stanford), MLOps (Duke), Satellite Formation / Relative Orbits (CU Boulder), Software Architecture for Big Data (CU Boulder)

WORK EXPERIENCE

GAIA, Los Angeles, CA
Founder & Principal Consultant **Feb 2026 – Present**

- Established a strategic consultancy focused on the technical evaluation and modernization of geospatial architectures for mission-scale science data systems.

NASA Jet Propulsion Laboratory (JPL), Pasadena, CA **January 2016 - October 2025**
Remote Sensing Scientist / Geospatial Software Engineer

- Led the redesign of the AIRS L2 reprocessing pipeline for NASA Worldview/GIBS, reducing end-to-end runtime from ~1 year to 3 days, decreasing near-real-time product latency and enabling mission-scale reprocessing.
- Operated and maintained automated product pipelines for SMAP and multi-instrument streams for Eyes on Earth (AIRS, SMAP, Jason, OCO-2, GRACE-FO, MLS, OMI, GPM), improving throughput and reliability via containerization and job orchestration. These 13 pipelines deliver 221 products daily.
- Productionized Plume Tracker retrieval algorithms for methane and SO_2 plumes and surface temperature/emissivity using thermal infrared radiative transfer modeling for airborne and satellite instruments (HyTES, ASTER, MODIS, VIIRS, simulated SBG), increasing detection accuracy and operationalizing both GUI and automated pipeline modes. Integrated GEOS-FP (NRT) and MERRA-2 (historical) profiles for atmospheric initialization. Redesigned retrieval architectures to improve computational throughput. Developed a synthetic scene generator to produce validation datasets for retrieval tuning. Performed rigorous sensitivity analyses to optimize the trade-off between radiative transfer accuracy and operational processing speed.

- Calibration & Solar Corona Imaging: Developed geometric calibration and image processing routines for corona imaging instruments, including WISPR (Parker Solar Probe) and SoloHI (Solar Orbiter). Focused on data alignment and mapping, and automated removal of strong background signals.
- Built and managed real-time plume detection and alerting for volcanic SO_2 emissions using AIRS data.
- Developed software for trade studies, science planning, image simulation, and operations for the Multi-Angle Imager for Aerosols (MAIA).

Northern Arizona University, Flagstaff, AZ **June 2013 - January 2016**
Postdoctoral Researcher

Universidade de São Paulo, São Paulo, Brazil **November 2008 - June 2013**
Postdoctoral Researcher

EDUCATION

Ph.D. Planetary Sciences
University of Arizona, Tucson, AZ
Thesis title: "Study of Titan's methane cycle"

M.Sc. Astronomy
Observatório Nacional, Rio de Janeiro, Brazil
Thesis title: "Study of the angular momentum after the fragmentation of a rubble-pile asteroid"

B.Sc. Astronomy
Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil
Thesis title: "Interacting Ellipsoids: a model for the fragmentation of a rubble-pile asteroid"

SELECTED PUBLICATIONS

Google Scholar Profile: https://scholar.google.com/citations?user=QWxVqrYAAAAJ

- *The Automated Detection and Mapping of Volcanic Plumes with VIIRS Multispectral TIR Imagery*
  V. Realmuto, **P. Penteado**. Proceedings of the AGU Fall Meeting (2024).
- *Latitudinal variations in Titan's methane and haze from Cassini VIMS observations*
  Paulo F. Penteado, et al. Icarus (2010) .
- *Ground-based measurements of the methane distribution on Titan*
  Paulo F. Penteado, Caitlin A. Griffith. Icarus (2010) .
- *Evidence for a Polar Ethane Cloud on Titan*
  C. A. Griffith, **P. Penteado**, et al. **Nature** (2006) .
- *Measurements of CH_3D and CH_4 in Titan from Infrared Spectroscopy*
  P. F. Penteado, C. A. Griffith, T. K. Greathouse, C. de Bergh. The Astrophysical Journal (2005).
- *A corridor of exposed ice-rich bedrock across Titan's tropical region*
  C. A. Griffith, **P. Penteado**, J. D. Turner, C. D. Neish, G. Mitri, N. Montiel, A. Schoenfeld, R. M. C. Lopes. **Nature Astronomy** (2019).
- *Possible tropical lakes on Titan from observations of dark terrain*
  Caitlin A. Griffith, Juan Lora, Jake Turner, **Paulo F. Penteado**, et al. **Nature** (2012) .
- *Radiative transfer analyses of Titan's tropical atmosphere*
  Caitlin A. Griffith, Lyn Doose, Martin G. Tomasko, **Paulo F. Penteado**, Charles See. Icarus (2012).
- *The Evolution of Titan's Mid-Latitude Clouds*
  C. A. Griffith, **P. Penteado**, et al. **Science** (2005).
- *Near-Sun observations of an F-corona decrease and K-corona fine structure*
  R.A. Howard, A. Vourlidas, V. Bothmer, R.C. Colaninno, C.E. DeForest, B. Gallagher, J.R. Hall, P. Hess, A.K. Higginson, C.M. Korendyke, A. Kouloumvakos, P.L. Lamy, P.C. Liewer, J. Linker, M. Linton, **P. Penteado**, et al. **Nature** (2019).