Grace Fanson

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Earth Atmospheric & Planetary Sciences | Massachusetts Institute of Technology

Research Interests

I study planetary surface evolution with the goal of understanding how planetary bodies have developed into their present-day states. My work integrates a range of research methods including numerical modeling, remote sensing data analysis, and field studies at terrestrial analog sites to explore surface processes. I am particularly interested in developing our understanding of the early water cycle on Mars and investigating the dynamics of icy shells on ocean worlds such as Europa and Enceladus.

Education

Massachusetts Institute of Technology (MIT) Cambridge, Massachusetts
Doctor of Philosophy (PhD) in Planetary Science Est. 2028

- Department | Earth, Atmospheric & Planetary Sciences
- Advisor | Dr. Gaia Stucky de Quay

Georgia Institute of Technology Atlanta, Georgia
Bachelor of Science (BS) in Physics 2018 - 2022

- School of Sciences | Physics
- Advisors | Dr. James Wray & Dr. Frances Rivera-Hernández

Research Experience

Gaia Lab 2023 - present

- Institution | Massachusetts Institute of Technology
- Advisor | Dr. Gaia Stucky de Quay
- Project Title | Quantifying valley network preservation on Mars after impact cratering.

Project Description

- Impact cratering model created in Python to simulate the destruction of valley networks on Mars.
- Synthetic landscape developed with the Python toolkit LandLab used as starting topography
- Principels of Geomorphology applied to eroded valley volume to calculate volume of valley carving precipitation

MIT Glaciology 2025 - present

- Institution | Massachusetts Institute of Technology
- Advisor | Dr. Brent Minchew
- Project Title | Quantifying the effects of surface stretching on the morphology of craters on Enceladus

Project Description

- Developed an ice stretching model representing the global ice shell of Enceladus in Python based on the fundamentals of fluid mechanics

LandLab Research Collaboration 2025

- Institution | University of Cambridge | Trinity College
- Advisor | Dr. Emily Bamber
- Project Title | Modeling the relationship between rainfall and river valley depth as a proxy for Martian valley incision

Project Description

- Developed landscape evolution model in the python toolkit LandLab to simulate valley incision to build relationship between cumulative precipitation and valley incision depth

ARES Lab / PLANETAS Group 2021 - 2023

- Institution | Georgia Institute of Technology
- Advisors | Dr. James Wray and Dr. Frances Rivera-Hernandez
- Project Title | Assessing the role of ancient volcanism in northern Arabia Terra, Mars

Project Description

- Analyzed CRISM data using ENVI software to determine if mineralogy in Northern Arabia Terra is consistent with past volcanic activity
- Developed Python tool to aid in analysis of silica spectra

FELDSPAR 2022 - 2023

- Institution | Georgia Institute of Technology & University of Idaho
- Advisor | Dr. Erika Rader & Dr. Anna Simpson
- Project Title | Large-scale sampling of biosignature distribution in aeolian- and volcanism-resurfaced Icelandic Mars analogs: integrating ground data, artificial landscape models, and satellite data

Project Description

- Analyzed WorldView-3 data using QGIS Software to investigate potential biosignatures at Mars analogue sites in Iceland

Publications

- Hughes, E., Wray, J., Karunatillake, S., **Fanson, G.**, Harrington, E., Hood, D. (2024) Water-Limited Hydrothermalism and Volcanic Resurfacing of Eridania Basin, Mars. JGR-Planets. DOI: 10.1029/2024JE008461

In Preparation

- **Fanson, G.**, & Stucky de Quay, G. Quantifying valley network preservation on Mars after impact cratering. JGR-Planets (in prep, Est. 2025)

In Revision

- **Fanson, G.**, Wray, J., Rivera-Hernández, F., Hughes, E. Assessing the role of ancient volcanism in northern Arabia Terra, Mars. JGR-Planets (in prep, Est. 2025)

Presentations & Talks

Conference Presentations
* = oral

- **Fanson, G.**, & Stucky de Quay, G. (2024). Impact events destroy Martian valley networks. AGU Fall Meeting
- **Fanson, G.**, & Stucky de Quay, G. (2024). Constraining the fraction of ancient Martian valleys destroyed by impact events. Tenth International Conference on Mars
- *__Fanson, G.__ & Stucky de Quay. (2024). Constraining the Fraction of Ancient Martian Valleys Destroyed by Impact Events. Boston Area Planetary Science Meeting.
- *__Fanson, G.__, Wray, J., Rivera-Hernández, F., Hughes, E., & Matiella Novak, A. (2022). Further evidence for ancient explosive volcanism in Northern Arabia Terra, Mars. GSA Annual Meeting.
- Simpson, A., Rader, E., Pital, A., Zinzer, B., **Fanson, G.**, Wroblewski, F., Wray, J., Cable, M., Stockton, A., & FELDSPAR. (2022). Large-scale sampling of biosignature distribution in aeolian- and volcanism-resurfaced Icelandic Mars analogs: integrating ground data, artificial landscape models, and satellite data. AbSciCon22
- *__Fanson, G.__ & Wray, J. (2022). Testing the hypothesis of ancient volcanism in Arabia Terra. ExplOrigins Colloquium

Invited Talks

- **Imperial College London** | Department of Earth Science and Engineering 2025
- **University of Cambridge** | Department of Earth Sciences 2025

Grants & Fellowships

Massachusetts Institute of Technology
- NSF Graduate Research Fellowship Program (full tuition + stipend) 2025 - 2028
- Massachusetts Space Grant Fellowship ($7,600) 2025
- Professor Patrick M. Hurley Graduate Fellowship (full tuition + stipend) 2024 - 2025
- Travel Award - 10th International Conference on Mars 2024
- Praecis Presidential Graduate Fellowship (full tuition + stipend) 2023 - 2024

Georgia Institute of Technology
- President's Undergraduate Research Award ($1,500) 2022
- College of Sciences Dean's Scholarship (in-state tuition ∼$80,000) 2018 - 2022

Workshops

- Social Field Safety - Field Inclusive 2026

Academic Awards / Honors

Georgia Institute of Technology

- Highest Honors in Physics 2022
- Dean's List 2018 - 2022

Service and Outreach

Application Mentorship Program (AMP) at MIT 2024 - present

- Organize AMP events and coordinate mentorship
- Mentor to applicants to EAPS graduate programs

Volunteer at Cambridge Science Festival 2024

- Worked as a part of the "Ask a Scientist Booth"

Cambridge School Volunteers 2023 - 2024

- Tutor 6th grade student in math and science

Atlanta Science Festival 2022

- Created and led spectroscopy and impact cratering workshops for children

Science and Entertainment Exchange 2021

- Moderated and organized live panel discussion

Mentoring Experience

Charlotte Whitworth 2024 - 2025

Undergraduate Research Opportunity Program (UROP) at MIT

- Institution | Imperial College London
- Project Title | Quantifying the alteration of Martian valley drainage density post impact

Professional Experience

Intro Geophysics & Planetary Science Teaching Assistant (MIT) 2024

- Led class discussions

Optics Teaching Assistant (Georgia Tech) 2022

- Held office hours and graded assignments / exams

Systems Engineering Intern at Sierra Nevada Corporation Space Systems Group 2020

- Developed requirements for Crew, Internal Thermal Control, Environmental Control, and Life Support systems for the Human Landing System
- Aided development of test plans for the Thermal Control System for Dream Chaser

Technical Skills

Software

- **Mapping Software** |ArcPro, QGIS, etc.
- **Python** | Arcpy, GDAL, Landlab
- **Microsoft Office** | Word, Excel, Power Point, etc.
- **ENVI/IDL** | CRISM Analysis Toolkit (CAT)
- **Adobe Illustrator** | Figures & Schematics
- **LaTeX**

Field Work

Catalina Island 2024

- Deploying seismometers
- GPS measurements
- Calibrating and taking gravity measurements

Baker River New Hampshire 2023

- Measure river valley profile
- Grain Size measurements
- Water flow velocities

Data Sets

- Compact Reconnaissance Imaging Spectrometer (CRISM)
- High Resolution Imaging Experiment (HiRISE)
- WorldView III
- Context Camera (CTX)
- Mars Orbiter Laser Altimeter (MOLA)
- Thermal EMission Imaging Spectrometer (THEMIS)
- Thermal Emission Spectrometer (TES)