Ethan I. Schaefer

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Current as of: Feb. 18, 2026

Professional Profile

Geospatial technology expert, software developer, and planetary geologist specializing in the use of technology to support science research, NASA missions, education, and archiving, with professional experience including:

- developing a novel computational-geometry algorithm and other geospatial analysis software
- managing an academic technology lab (augmented reality, LIDAR, drones, structure from motion, etc.)
- helping to guide NASA's PDS4 data archiving standards and construct compatible archives, support tools
- conducting geomorphic research of Earth and Mars

Education

Ph.D. in Planetary Sciences, minor in Geosciences **graduated Dec. 2018**
University of Arizona, Tucson, AZ, USA

B.S. in Geology **graduated Aug. 2011**
Colorado State University, Fort Collins, CO, USA *summa cum laude*

Professional Experience

SETI Institute, Mountain View, CA **Feb. 2026 – present**
Research Scientist | Supervisor: Ross Beyer **Oct. 2022 – Dec. 2025**

- Developing software implementation and Web app for the Lunar Grid Reference System.
- Providing geospatial expertise and scientific knowledge to support the Lunar Foundation Model.

Washington University, St. Louis, MO **Jul. 2021 – Dec. 2025**
Staff Scientist, NASA/PDS Geosciences Node, Dragonfly Mission | PI: Paul Byrne **Oct. 2022 – Dec. 2025**

- As a member of the Dragonfly Mission Team, adapted and advanced the extensive Analyst's Notebook Web app to support both team and public access to data, reports, and documentation.
- Continuously developed software to facilitate curation and version migration of geoscience data archives in NASA's Planetary Data System (PDS). conforming to current standards.
- Developed and publicly released software to generate user guides for mission- and discipline-specific metadata models.
- Developed Node manual (33 pp.) for migrating to and managing the development cycle on GitHub.
- Refined and evolved NASA/PDS standards as part of Data Design Working Group (>3 years).

Manager of Fossett Laboratory for Virtual Planetary Exploration | PI: Phil Skemer **Jul. 2021 – Jun. 2023**

- Developed and documented coupled field–office workflow and software to process, georeference, and co-register point clouds captured by LiDAR drones. Co-visualized with drone photogrammetry.
- Technical lead of pilot study to build 3D architectural models from drone photogrammetry.
- Developed and documented software to semi-autonomously prepare augmented-reality (AR) scenes from input of 3D model or DEM + orthoimagery. Created and managed AR / 3D visualization EPO experiences to support diverse Geosciences and Humanities faculty.
- Developed interactive, cross-platform pedagogical software to derive and manipulate 3D models of geologic phase diagrams from traditional 2D ternary/isotherm inputs. (PI: Michael J. Krawczynski)
- Collaborated with History faculty to create a geo-aware mobile app prototype.
- Maintained HoloLens 1/2 hardware: scene deployment, software installs, and troubleshooting.
- Supervised undergraduate intern.
- Ran Lab with minimal supervision.

Western University, London, Ontario, Canada **Jul. 2019 – Jun. 2021**
Postdoctoral Associate | Advisor: Catherine Neish

- Developed scale-dependent (quasi)fractal analysis GIS software [10].
- Developed prototype software to autonomously co-register satellite images with sub-pixel precision, leveraging image-processing and computer vision (feature detection, correlation maximization). Used successfully to create Sentinel-1 (radar) time series of 2014–2015 Holuhraun eruption.
- Demonstrated that the putative fractality of lava flows margins is scale dependent and defined new guidelines for remote morphologic type interpretation from this fractality [2].

University of Arizona, Tucson, AZ **Jul. 2011 – Dec. 2018**
Research/Teaching Assistant | Advisors: Alfred McEwen, Christopher Hamilton, Jon Pelletier

- Developed scale-dependent (quasi)fractal analysis GIS software [10].
- Assembled high-resolution optical orthoimagery (satellite, aerial) for Mars [5] and Earth [2] to support field work [2] and built a multi-year time-series with sub-pixel co-registration [5].
- Mapped geomorphic features (e.g., recurring slope lineae (RSL), dust devil tracks, lava flow margins) on Mars [5] and Earth [2] in 3D by draping surface expressions on DEMs.
- Performed error analysis (e.g., cross-track pointing jitter), mitigation on stereo-derived DEMs [1,5].
- Developed skeletonization algorithm [9] combining Voronoi analysis with a novel graph-traversal-based filter to autonomously derive, for example, centerlines from river footprints, significantly improving accuracy over then state-of-the-art raster and AI/machine-learning approaches [4].
- Acquired differential GPS/GNSS expertise—collection through postprocessing.
- Created HiRISE DEM (Mars) and orthoimages from stereo inputs using USGS/UA SOCET SET protocol.
- Calculated slope-dependent relative albedo to enable discovery [5] that RSL at Tivat (Mars) do not brighten as they fade but rather adjacent slopes darken, consistent with regional deflation of bright surface dust and strongly supporting “dry” mass wasting hypothesis.

Technical Skills and Knowledge

- Software: ArcGIS Pro (+arcpy), GDAL/OGR, shapely, OpenCV, Google Earth Engine, GRASS, USGS/ISIS
- Programming languages: Python (advanced), C# (+Telerik), Dart/Flutter, JavaScript
- Development tools: GitHub (including REST API) / Git, Visual Studio, Spyder / IPython, Oxygen
- OSes: Windows (advanced), Unix shell (intermediate)
- Scientific software, algorithm, and Web app development (research, education, and archiving)
- Remotely-sensed images (optical, near-IR, radar) and topographic data (Earth, Mars, Moon, Venus)
- Spatial / geospatial computational analysis: image processing/image analysis, computational geometry, computer vision (including feature detection), graph analysis, fractal analysis, etc.
- Drone-based LiDAR and photogrammetry collection, processing, and georeferencing (Agisoft Metashape, GeoSLAM, Trimble Business Center, etc.)
- Extensive experience with NASA’s PDS4 planetary data standard, including as an active representative (3+ years) to the Data Design Working Group that helps manage and evolve the standard
- Full differential GPS/GNSS pipeline (from collection through postprocessing)
- 3D mesh generation/processing and augmented reality (Blender, MeshLab, HoloLens 1/2, and Unity)
- Intermediate SQL experience
- Intermediate computer modeling experience (e.g., glacial flowline model)
- Intermediate experience with cross-platform development of a mobile app

Publications

Sutton, S. S., M. Chojnacki, A. S. McEwen, R. L. Kirk, C. M. Dundas, **E. I. Schaefer**, S. J. Conway, S. Diniega, G. Portyankina, M. E. Landis, N. F. Baugh, R. Heyd, S. Byrne, L. L. Tornabene, L. Ojha, and C. W. Hamilton (2022), Revealing Active Mars with HiRISE Digital Terrain Models, *Remote Sensing*, *14*(10), 2403, https://doi.org/10.3390/rs14102403.

Schaefer, E. I., C. W. Hamilton, C. D. Neish, M. M. Sori, A. M. Bramson, and S. P. Beard (2021), Reexamining the potential to classify lava flows from the fractality of their margins, *Journal of Geophysical Research: Solid Earth, 126*(5), e2020JB020949, https://doi.org/10.1029/2020JB020949.

McEwen, A. S., **E. I. Schaefer**, S. S. Sutton, M. Chojnacki, C. M. Dundas, and L. Ohja (2021), Mars: Abundant Recurring Slope Lineae (RSL) Following the Planet-Encircling Dust Event (PEDE) of 2018, *Journal of Geophysical Research: Planets*, *126*(4), e2020JE006575, https://doi.org/10.1029/2020JE006575.

Schaefer, E. I., and J. D. Pelletier (2020), An algorithm to reduce a river network or other graph-like polygon to a set of lines, *Computers & Geosciences*, *145*, 104554 https://doi.org/10.1016/j.cageo.2020.104554.

Schaefer, E. I., A. S. McEwen, and S. S. Sutton (2019), A case study of recurring slope lineae (RSL) at Tivat crater: Implications for RSL origins, *Icarus*, *317*, 621–648, https://doi.org/10.1016/j.icarus.2018.07.014.

Neish, C. D., C. W. Hamilton, S. S. Hughes, S. Kobs Nawotniak, W. B. Garry, J. R. Skok, R. C. Elphic, **E. Schaefer**, L. M. Carter, J. L. Bandfield, G. R. Osinski, D. Lim, and J. L. Heldmann (2017), Terrestrial analogues for lunar impact melt flows, *Icarus*, *281*, 73–89, https://doi.org/10.1016/j.icarus.2016.08.008.

Ojha, L., A. McEwen, C. Dundas, S. Byrne, S. Mattson, J. Wray, M. Masse, and **E. Schaefer** (2014), HiRISE observations of Recurring Slope Lineae (RSL) during southern summer on Mars, *Icarus*, *231*, 365–376, https://doi.org/10.1016/j.icarus.2013.12.021.

Schaefer, E. I., J. W. Head, and S. J. Kadish (2011), Vaduz, an unusual fresh crater on Mars: Evidence for impact into a recent ice-rich mantle, *Geophys. Res. Lett., 38*, L07201, https://doi.org/10.1029/2010GL046605.

Open-Source Contributions

numgeo: a Python library to support fully automated centerline derivation from input polygons (e.g., river footprints). Wholly developed by EIS. https://github.com/eischaefer/numgeo

Scale-dependent Fractal Analysis, ver. 0.1: instructions and Python library to support scale-dependent fractal analysis of linestrings. Wholly developed by EIS. www.protocols.io/view/scale-dependent-fractal-analysis-ver-0-1-bmm2k48e