

# ZANE A. SELVANS

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## EDUCATION

**2002-2009 Ph.D., University of Colorado** **Boulder, CO**  
*Geological Sciences*

**1993-1998 B.S., California Institute of Technology** **Pasadena, CA**  
*Engineering & Applied Science*

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## SKILLS

- Programming in Python and C. Scripting in Perl and Unix shells.
- Familiar with object-oriented design principles.
- Scientific computation including Monte Carlo statistical sampling, efficient multi-dimensional parameter space search, vectorized calculation, heuristic graph algorithms, construction of heuristic fitness functions.
- Quantitative analysis using Scientific Python. Plotting and data visualization with Matplotlib. Network analysis using NetworkX.
- Mathematical background including calculus, linear algebra, ordinary and partial differential equations, graph theory, probability and statistics.
- Broad background in the physical and earth sciences including thermodynamics, geophysics, cosmochemistry, atmospheric physics, isotopic geochemistry.
- Mapping and geospatial analysis using ESRI ArcGIS, qGIS and the open source geospatial (OSGEO) libraries.
- Communication of technical and quantitative concepts to both expert and lay audiences, through writing, presentations, and hands-on workshops.
- Financial modeling employing concepts such as discounted cash flows, net present value, internal rates of return, portfolio asset allocation, and efficient frontiers.
- Working knowledge of web development using PHP, MySQL, CSS, and HTML.
- Basic fluency in spoken and written Spanish.

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## PUBLICATIONS & PROJECTS

- **Selvans Z.A.**, [Time, Tides and Tectonics on Icy Satellites](#), *PhD Dissertation*, 2009.
- Wahr, J., **Z. A. Selvans**, M. E. Mullen, A. C. Barr, G. C. Collins, M. M. Selvans, and R. T. Pappalardo, [Modeling Stresses on Satellites due to Non-Synchronous Rotation and Orbital Eccentricity Using Gravitational Potential Theory](#), *Icarus* v200, pp188-206, 2009.
- Released the [SatStress](#) Python module under an open source license via Google Code. It implements the models created over the course of my PhD research.
- [The High Cost of Parking at Caltech](#) is an example of informal analytical writing, unrelated to my research. It examines the extent and consequences of subsidized parking costs at Caltech.
- I have enjoyed spending time in elementary schools doing science outreach and education, giving talks and leading discussion on planetary science and space exploration.
- Organized a graduate student reading group on sustainability at Caltech, exploring a wide range of topics including: the efficacy of extended producer responsibility policies in the EU, the Swiss 2000 watt society initiative, the German PassivHaus building energy efficiency standard, tillage induced topsoil erosion, soil salinization resulting from irrigation in arid regions, and the embodied energy of transportation systems.
- Gave seminars for the Caltech Graduate Student Council and Postdoc Association on retirement investing, tailored to young scientists and engineers.

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## EXPERIENCE

**2011-2012 Selvans Analytics, LLC** **Boulder, CO**  
*Chief Scientist*

- Public education and outreach in support of the Boulder Light and Power ballot initiatives. Participated in debates and discussion fora, contributed editorials and online commentary.
- Performed coal cost modeling and analysis for Bardwell Consulting in support of various Colorado Public Utility Commission (CPUC) dockets. Used USGS, US EIA data, CPUC filings and spreadsheet-based models to evaluate and analyze Xcel Energy resource plans.

**2002-2009 Laboratory for Atmospheric and Space Physics**

**Boulder, CO**

*Research Assistant*

- Investigated the history of tidally-induced tectonics on icy satellites in the outer solar system.
- Created digital maps of geologic features on Jupiter's moon Europa based on imaging from NASA's Galileo spacecraft.
- Developed a closed-form model of Europa's frequency-dependent response to a time-varying gravitational potential, treating the icy shell as a Maxwell viscoelastic material.
- Tested the statistical significance of geometric correlations between tectonic features and tidal stresses using Monte Carlo methods and a specialized metric of shape similarity based on the Hausdorff distance.
- Devised novel algorithms for inferring temporal relationships within complex networks of intersecting geologic units, representing the mapped units and their ambiguous superposition relations as weighted directed acyclic graphs.
- Prepared and delivered oral and graphical presentations summarizing research at professional meetings as well as at smaller departmental seminars and colloquia.
- Provided support and documentation for software releases.
- Provided text, analysis and figures in support of successful NASA grant proposals.

**2003-2005 University of Colorado**

**Boulder, CO**

*Teaching Assistant*

- Provided support to professors teaching undergraduate courses in astronomy and astrobiology.
- Held regular office hours, reviewing lecture material and assisting students with homework sets.
- Prepared and conducted review sessions prior to exams.
- Prepared and delivered course lectures when professors were on travel.

**2001-2002 California Institute of Technology**

**Pasadena, CA**

*Technical Staff*

- Performed imaging and topographical data analysis for the NASA Mars Global Surveyor mission.
- Updated Fortran-based atmospheric photochemistry model to use standard input and output formats such as NetCDF.
- Maintained hardware and software on Linux web and data servers.