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NASA Postdoc (NPP), Jet Propulsion Laboratory
PhD, University of Arizona
MS, International Space University
BS, California Institute of Technology
Origin: Pearl City, HI, USA

Research Interests and Future Goals

- Develop simple mathematical models of planetary surface feature formation and evolution
- Using analysis and simulation, determine connections between environmental conditions and landform morphology
- Promote the education/interest of the next generation in mathematics, engineering, and science

Education

University of Arizona (UA), PhD in Applied Mathematics, minor in Planetary Science*:* 2004-2010
Dissertation: Modeling Aeolian Dune and Dune Field Evolution*
MS in Applied Mathematics (2005)

International Space University (ISU; Strasbourg, France), MS in Space Studies*:* 2003-2004
Thesis: Regolith distribution model for sub-kilometer ellipsoidal asteroids**

California Institute of Technology (Caltech), BS, with honors, Mathematics: 1999-2003

Current Research

Inflationary lava flow model development Fall 2010-present

We aim to formulate a simple model to evaluate to what extent large changes in lava flow dynamics can be driven by natural small rheological variations within the lava flow and to investigate possible connections between these dynamics and measurable lava field landforms. Investigations will include numerical simulation, model equation analysis, remote-sensed images, and field studies. Advisor: *Sue Smrekar (JPL)*

*Dune and dune field evolution model development, analysis, and application** Fall 2005-present

Phenomenological continuum models of dune and dune field evolution were used to explain and explore the behavior and morphology of dune fields, with special focus on identifying and quantifying influential environmental factors that create apparent characteristic dune sizes and spatial distributions. The effects of polar processes and reversing winds have also been added to the model to explain the distinctive slipface morphology observed on martian polar dunes. Advisors: *Shane Byrne (UA; Planet. Sci.)and Karl Glasner (UA; Math)*.

Active gullies on Martian dunes Summer 2009-present

Surveys of gullies located on dunes yield gully activity during the last six Martian years. We aim to define general characteristics of these gullies, explore the relationship between dune gullies and slope gullies found on non-dune slopes, and understand mechanisms for gully formation and evolution; the observed timing of activity implies that CO2 frost drives current activity. We are also continuing to monitor potentially active dune gullies with HiRISE. Colleagues: *Nathan Bridges (APL, John Hopkins; Planet. Sci.), Shane Byrne (UA; Planet. Sci., advisor), Colin Dundas (UA; Planet. Sci.), Candice Hansen (Planet. Sci. Inst.; Planet. Sci.), and Alfred McEwen (UA, HiRISE; Planet. Sci.)*.

Prior Research

Influence of orogenic faults/joining on channel orientation Fall 2008

We used numerical simulation and statistical analysis to explore the effect of small-scale bedrock defects on regional drainage channel orientation and longitudinal profiles, in the Rincon Mountains. Advisor: *Jon Pelletier (UA; Geo. Sci.)*.

*Impact ejecta distribution on a small asteroid*** 2004-2005

This study determined the probable depths and locations of regolith deposits on a small monolithic asteroid, using a physics-based Matlab model of impact ejecta orbits. The model was applied to asteroid 25143 Itokawa (1998SF36), the target of JAXA spacecraft MUSES-

C: Hayabusa. Advisors: *Akira Fujiwara and Hajime Yano (Inst. of Space & Astro. Sci., Japan. Aerospace Exploration Agency)*.

Southern-spring martian wind patterns 2002-2003

We mapped mesoscale southern-spring wind-flow patterns for Martian south-polar region, through surveys of MOC images of the martian south pole and atmospheric circulation models. Advisor: *Mark Richardson (Caltech, Geo. & Planet. Sci.).*

Near-infrared spectra of Galilean moons Summer 2001

Using Matlab, we combined near-infrared spectra of Jupiter's inner moons, to generate "clean" spectra and identify weak absorption bands. Advisor: *Thomas McCord (Univ. Hawai'i, Geophys. & Planet.).*

Microplate tectonic rotation Summer 2000

For this study, we analyzed magnetometer data taken over pillow basalts near Easter Island to characterize the process of microplate tectonic rotation. Advisor: *Richard Hey (Univ. Hawai'i, Geo. & Geophys.).*

Publications

Hansen, C. J., M. Bourke, N.T. Bridges, S. Byrne, C. Colon, S. Diniega, C. Dundas, K. Herkenhoff, A. McEwen, M. Mellon, G. Portyankina, N. Thomas (2011), Seasonal erosion and restoration of Mars' northern polar dunes. *Science* 331, no. 6017, 575-578, doi: 10.1126/science.1197636

Diniega, S., S. Byrne, N.T. Bridges, C.M. Dundas, A.S. McEwen (2010), Seasonality of present-day Martian dune-gully activity. *Geology* 38, no. 11, 1047-1050. doi:10.1130/G31287.1

C. M. Dundas, A. S. McEwen, S. Diniega, S. Byrne, S. Martinez-Alonso (2010), New and recent gully activity on Mars as seen by HiRISE. *Geophys. Res. Lett*. 37, L07202. doi:10.1029/2009GL041351

Diniega, S., K. Glasner, S. Byrne (2010), Long scale evolution of aeolian sand dune fields: influences of initial conditions and dune collisions. *Geomorphology (special edition: Planetary Dunes)* 121, 55-68. doi:10.1016/j.geomorph.2009.02.010

Pelletier, J.D., T. Engelder, D. Comeau, A. Hudson, M. Leclerc, A. Youberg, S. Diniega (2009), Tectonic and structural control of fluvial channel morphology in metamorphic core complexes: The example of the Catalina-Rincon core complex, Arizona. *Geosphere* 5, 385-407. doi:10.1130/GES00221.1

Hey, R.N., F. Martinez, S. Diniega, D.F. Naar, J. Francheteau, Pito93 Scientific Team (2002), Preliminary attempt to characterize the rotation of seafloor in the Pito Deep area of the Easter Microplate using a submersible magnetometer. *Marine Geophysical Research* 23, 1-12. doi:10.1023/A:1021257915420

Honors & Fellowships

NASA Postdoctoral Fellow (JPL, with advisor Sue Smrekar)	2010-present
NASA Harriett G. Jenkins Pre-doctoral Fellow	2007-2010
Al Scott Lecture and Prize, UA Program in Applied Math	2010
Lunar Planet. Inst. Career Development Award (LPSC)	2010
Served as rapporteur for Planetary Decadal Survey, Mars Panel: meetings 1 - 3	2009-2010
NASA Jenkins Mini Research Award (advisor: Nathan Bridges, JPL/APL)	Summer 2009
UA GIDP Travel Award (ICIAM, Geomorphology)	2007, 2009
SIAM, First place award for Educational Article: *Math Matters in Dune Modeling*	2008
LPI Mars Student Travel Award (Planet. Dune Workshops)	2008, 2010
VIGRE Fellow	2004, 2006
NASA Space Grant/University of Arizona Graduate Fellow *(see Outreach)	2005

Conference Presentations

Diniega, S., S. Byrne, C. M. Dundas, A. McEwen, N. Bridges, (2010), Present-day Martian dune gully formation. *Lunar Planet. Sci. Conf.* 42. Ab. 1540.

Diniega, S., S.E. Smrekar, S. Anderson, E. Stofan (2011) Lava flow dynamics driven by temperature-dependent viscosity variations. *Lunar Planet. Sci. Conf.* 42. Ab. 1538. (poster)

Dundas, C. M., S. Diniega, A. S. McEwen, S. Byrne (2011), Observations of present-day gully activity on Mars. *Lunar Planet. Sci. Conf.* 42. Ab. 2709. (poster)

Bridges, N.T., M.C. Bourke, C.M. Colon, S. Diniega, P.E. Geissler; M.P. Golombek; C.J. Hansen, S. Mattson, A.S. McEwen, N. Stantzos (2011) Planet-wide sand movement on Mars as documented by the HiRISE camera. *Lunar Planet. Sci. Conf.* 42. Ab. 1215.

Diniega S., Bridges N.T., Byrne S., Dundas C.M., Hansen C.J. & McEwen A.S. (2011) Seasonal activity within Martian dune gullies. *IAG Region. Conf. Geomorphology* (Addis Ababa, Ethiopia).

Hansen, C., N. Bridges, M. Bourke, S. Byrne, S. Diniega, C. Dundas, K. Herkenhoff, A. McEwen, G. Portyankina, N. Thomas, C. Colon (2010) Mars' Northern Dunes: Volatiles and Geology. AAS DPS meeting 42, Ab. 30.22.

Diniega S., S. Byrne, K. Glasner (2010), Connecting aeolian and nivean processes with martian polar dune morphology. *Planetary Dunes Workshop: planetary analog* (Alamosa, CO). Ab. 2005.

Diniega, S., S. Byrne, N. Bridges, C. M. Dundas, A. McEwen (2010), Present-day martian dune gully activity. *Lunar Planet. Sci. Conf.* 41. Ab. 2216.

Dundas, C. M.*, A. S. McEwen, S. Diniega, S. Byrne (2010), New and recent gully activity on Mars as seen by HiRISE. *Lunar Planet. Sci. Conf.* 41. Ab. 2114.

Diniega, S., S. Byrne, K. Glasner (2010), Niveo-aeolian process interactions and resultant martian polar dune morphology. *Lunar Planet. Sci. Conf.* 41. Ab. 2192. (poster)

Diniega, S., S. Byrne, N. Bridges, C. M. Dundas, A. McEwen (2009), Active martian S. hemisphere dune gullies. *AGU Fall Meeting*. Ab. P22A-01.

Dundas, C. M., A. S. McEwen, S. Diniega, S. Byrne (2009), New and recent gully activity on Mars. *AGU Fall Meeting*. Ab. P22A-02.

Diniega, S., S. Byrne, K. Glasner (2009), Controls on the shape and size of dunes by non-erodible, underlying topography. *7th International Conference on Geomorphology* (Melbourne, Australia).

Diniega, S., K. Glasner (2008), 2D Dune Interactions: moving toward a dune field model. *Planetary Dunes Workshop: a record of climate change* (Alamogordo, NM). Ab. 7016.

Diniega, S., K. Glasner (2007), Analysis and Simulation of Barchan Sand Dunes. *6th International Congress on Industrial and Applied Mathematics* (Zurich, Switzerland). Ab. 5699.

Diniega, S., K. Glasner (2007), Analysis and Simulation of Barchan Sand Dunes. *SIAM Conference on Applications of Dynamical Systems*.

Diniega, S. (2006) Dynamic Evolution of One-Dimensional Dune Fields. *New Mexico Tech, Graduate Student Associate Conference: Standing at a Crossroad*.

Diniega, S., H. Yano, D. Scheeres*. (2005) Simulating Regolith Deposition on 25143 Itokawa and other small asteroids*. 56th International Astronautical Congress* (Fukuoka, Japan). Ab. IAC-05-A3.P.06. (poster)

Diniega, S., M.I. Richardson, S.P. Ewald, A.D. Toigo, S. Byrne. (2003) Martian Polar Wind Patterns Derived from Mapping of Seasonal Cap Dark Streaks. *Lunar Planet. Sci. Conf.* 34. Ab. 2125.

Invited/Prize Presentations

Dune and dune field evolution, 30 April 2010, *UA, Applied Math Colloquium, Al Scott Lecture.*
Present-day martian gully activity, 18 Feb. 2010, *UA, HiRISE Team Meeting.*
Modeling dune and dune field evolution, 17 Nov. 2009, *MIT, Mathematical Physics Seminar*.
Present-day martian gully activity, 16 Nov. 2009, *MIT, Planetary Science Seminar*.
Dune and dune field evolution, 3 Nov. 2009, *Caltech, Mechanical Engineering Seminar*.

Graduate level University-affiliated Presentations

Applied Math., Graduate Student Brown Bag Seminars: Apr. 2006, Apr. 2007, Sept. 2007, Sept. 2008, Feb. 2010
Applied Math., weekly Modeling and Computation Seminar: Nov. 2006, March 2009
Planetary Sci., weekly Colloquium: Sept. 2008

Planetary Sci., annual Lunar and Planetary Laboratory Conference: 2007, 2008, 2009
HiRISE Targeting Specialist Workshop: Oct. 2009
Graduate Interdisciplinary Programs, Annual Meeting (poster, featured student): 2007

Professional Affiliations

Geological Society of America (GSA), American Geophysical Union (AGU), Mars-Dune.org Consortium, Society for Industrial and Applied Mathematics (SIAM)

Instruction & Outreach in Math & Science

Geology of the Solar system (PTYS411/511), unofficial teaching assistant 2007, 2010
Organized and held review sessions on background and course material
Planet. Sci. Dept. semester field trip (to NM, focus on sedimentary rocks), co-organizer 2010
NASA Student Ambassador (Virtual Community COHORT II) 2009-present
UA Sonia Kovalevski Day, organizer: 2008, 2010
Full-day workshop with high school women, promoting and showing STEM studies
College Algebra (Ma112), instructor 2008-2009
Fall: 31 students, 5th highest of 38 sections avg. score on common final
Spring: 26 students, 3rd highest of 28 sections avg. score on common final
Numerical Modeling class (Ma485), mentor for undergrad. group, discrete dune model 2007-2009
SIAM University Chapter, member: 2004-present
President/ Student chapter "Most active member," featured in National SIAM newsletter 2007
Officer 2005, 2006
Organized panel discussions about post-graduation options 2007, 2008
Tucson Kids Club Math Event, organizer 2006-2010
This SIAM chapter outreach event has been commended by the National SIAM organization. I initiated it, and was the primary organizer 2006-2009.
2006 -- Mental math and problem-solving; 2007 -- Tesselations and problem-solving; 2008 -- Units and scaling; 2009 – Polynominoes; 2010 -- Probability.
Partial Differential Equations (Ma456), grader Spring 2008
Solar System event supervisor/exam writer for the state-level Science Olympiad 2006, 2007
Participant in Mentoring Seminar, for Mathematical Modeling (Ma485) Fall 2006
Presented on encouraging individual and group creativity, student assessment methods, and discussion techniques
*Designed/taught planetary science curriculum for middle school students** 2005
Taught 180 6th-8th grade students at three schools in Tucson
Girl Scout Gold Award 1997
Organized two-day math workshop for 4th-7th grade girls; encouraged varied, unusual, and creative approaches to math

Non-Academic Employment & Activities

Women in Math (UA Noertherian Ring), Participant 2008-2010
Math (HS algebra) private tutor 2006-2007
Student Coffeehouse (food service), Caltech: 2000-2003
Writing tutor, Hixon Writing Center, Caltech: 2001-2003
Member of Caltech Fencing Team (club and NCAA, women's saber) 2000-2003
NCAA Fencing Team Captain/Club President 2003
Spreading the Aloha Spirit:
Organizer of Math Dept.'s Christmas Charity Drive (for relocated hurricane victims) 2005
Hula (Hawaiian dance) performer 1986-present