Andrew Gunn

Citizenship: Australian & British D.O.B.: 17 July 1993 Palo Alto, CA USA agunn@stanford.edu https://algunn.github.io OCRID: 0000-0003-1386-0897

Education

Department of Earth & Environmental Science, University of Pennsylvania

Philadelphia, U.S.A August 2016 – March 2021

Doctor of Philosophy

GPA: 3.92. Advisor: Douglas Jerolmack. Thesis: Scale-dependent coupling between aeolian flow & form.

Institute for Marine & Antarctic Studies, University of Tasmania

Hobart, Australia

Bachelor of Marine Science, Honours

February 2015 – December 2015

GPA: 4.0. Advisor: Maxim Nikurashin. Thesis: The role of mixing and wind for the meridional overturning circulation and ocean carbon.

School of Mathematics and Statistics, University of Melbourne

Melbourne, Australia

Bachelor of Science

February 2012 – December 2014

GPA: 3.1. Major: Applied Mathematics. Minor: Ocean & Atmosphere Science.

Fellowships & Appointments

Postdoctoral Fellow

Stanford, U.S.A

Geological Sciences, Stanford University

April 2021 - ongoing

Advisor: Mathieu Lapôtre. Research: Martian aeolian processes, turbulent stratified flows, geomorphology, sediment comminution. Methods: experiments, fieldwork, computer simulations, remote sensing, theory.

Benjamin Franklin Fellow

Philadelphia, U.S.A

Earth & Environmental Science, University of Pennsylvania

August 2016 - March 2021

Advisor: Douglas Jerolmack. Research: atmospheric boundary layer (ABL) and dune field interactions, sediment transport measurement techniques, continental slope failure & rheology. Methods: experiments, fieldwork, computer simulations, remote sensing, theory.

Research Fellow Philadelphia, U.S.A

Earth & Environmental Science, University of Pennsylvania

June 2016 – *August* 2016

Advisor: Irina Marinov. Research: GFDL GCM Weddell Sea convection dynamics, phytoplankton functional-type ecology models. Methods: computer simulations.

Tsuneichi Fujii Scholar
Sapporo, Japan

Graduate School of Environmental Science, University of Hokkaido

August 2015 – November 2015

Advisors: Masakazu Yoshimori, Maxim Nikurashin. Research: Meridional overturning circulation (MOC) polynomials, MITgcm mixing and westerly MOC sensitivity testing, carbon-phosphate PDE coupling to MOC polynomials applied to the Last Glacial Maximum. Methods: theory, computer simulations.

Australian Research Council Climate System Science Scholar

Hobart, Australia

Institute for Marine & Antarctic Studies, University of Tasmania

November 2014 – February 2015

Advisors: Maxim Nikurashin, Peter Strutton. Research: Semi-analytical MOC coupling with biogeochemical parameterisation model sensitivity and dynamics testing. Methods: theory, computer simulations.

Publications

- 1. **Gunn, A.,** P. Schmutz, M. Wanker, D. Edmonds, R. Ewing, and D. Jerolmack, Macroscopic flow disequilibrium over aeolian dune fields, *Geophysical Research Letters* (<u>doi:10.1029/2020GL088773</u>).
- 2. Gadal, C., C. Narteau, R. Ewing, **A. Gunn**, D. Jerolmack, B. Andreotti, P. Claudin, Spatial and temporal development of the dune instability, *Geophysical Research Letters* (doi:10.1029/2020GL088919).
- 3. **Gunn, A.**, M. Wanker, N. Lancaster, D. Edmonds, R. Ewing, and D. Jerolmack, Circadian rhythm of dune-field activity, *Geophysical Research Letters* (doi:10.1029/2020GL090924).
- 4. Seiphoori, A., **A. Gunn**, S. Kosgodagan Acharige, P. Arratia and D. Jerolmack, Tuning sedimentation through surface charge and particle shape, *Geophysical Research Letters* (<u>doi:10.1029/2020GL091251</u>).

In review or submitted

- 1. Gunn, A. and D. Jerolmack, Conditions for aeolian transport in the Solar System, Nature Astronomy (in review) (EarthArXiv:1872).
- 2. **Gunn, A.,** G. Casasanta, L. Di Liberto, F. Falcini, N. Lancaster and D. Jerolmack, What sets aeolian dune height? *Nature Communications (in review)* (*EarthArXiv*:2379).
- 3. **Gunn, A.,** A. East and D. Jerolmack, 21st-century stagnation in sand-sea activity. *Nature Communications (in review)*.

In preparation

1. Gunn, A., J. Nield, P. Delorme, M. Baddock, G. Wiggs, R. Ewing, and D. Jerolmack, In situ laser-plane imaging of wind-blown sand.

Seminars, Conference Proceedings & Invited Talks (underline denotes student mentee, * denotes scheduled)

Invited Talks & Seminars

1. Texas A&M University, Geology & Geophysics Seminar, 19 March 2021, "Scale-dependent coupling between aeolian flow & form".

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- International Society for Aeolian Research, Virtuaeolian Seminar Series, 8 January 2021, "Scale-dependent coupling between aeolian flow & form".
- 3. **University of Pennsylvania,** Physics & Astronomy 'Disordered Colloids, Nanoparticles, Atoms, and Particulates' Seminar, 23 *October 2020,* "Tuning sedimentation through surface charge and particle shape".
- 4. **University of Pennsylvania,** Physics & Astronomy 'Disordered Colloids, Nanoparticles, Atoms, and Particulates' Seminar, 25 June 2020, "Conditions for aeolian transport across the Solar System".
- 5. **Princeton University**, Environmental Fluid Mechanics Seminar, 20 May 2019, "Land-atmosphere coupling at White Sands Dune Field, NM".
- 6. University of Pennsylvania, BenTalks, 17 March 2017, "Turbulence suppresses glacial cycles".
- 7. **University of Pennsylvania**, Earth & Environmental Science Lunch Seminar, 12 September 2016, "Diapyrical mixing inhibits ocean carbon storage".
- University of Tasmania, Thesis Defence Seminar, 24 November 2015, "The role of mixing and wind for the meridional overturning circulation and ocean carbon".
- 9. **Australian National University**, Geophysical Fluid Dynamics Seminar, 24 November 2015, "A comparison of the role of mixing and wind for the meridional overturning circulation in theory and the MITgcm".
- 10. **University of Hokkaido**, Ocean-Atmosphere Climate Dynamics Lecture, *1 September 2015*, "The role of ocean mixing and Southern Ocean Westerlies for ocean carbon: theory development and comparison with a GCM".
- 11. Commonwealth Scientific & Industrial Research Organisation (CSIRO), Lunch Seminar, 30 July 2015, "Understanding ocean carbon's response to wind and mixing: a theoretical and modelled approach".
- 12. **Institute for Marine & Antarctic Studies**, Physical Oceanography Seminar, 11 February 2015, "The role of the deep ocean ventilation for the carbon uptake and storage in the ocean".

Conference Presentations

- 1. A. Gunn, M. Wanker, N. Lancaster, D. Edmonds, R. Ewing, and D. Jerolmack, (2021) Circadian rhythm of dune-field activity, Australian Earth Sciences Convention, Oral Session.
- 2. A. Seiphoori, A. Gunn, S. Kosgodagan Acharige, P. Arratia, D. Jerolmack, (2021) Tuning sedimentation through surface charge and particle shape, *American Physical Society March Meeting*, Oral Session.
- 3. A. Gunn, D. Jerolmack, (2020) Conditions for aeolian transport in the Solar System, *American Geophysical Union Fall Meeting*, Oral Session.
- K. Cho, A. Gunn, D. Jerolmack, (2020) Understanding formative winds of intracrater aeolian dunes on Mars, American Geophysical Union Fall Meeting, Poster Session.
- 5. **A. Gunn**, G. Casasanta, F. Falcini, N. Lancaster, D. Jerolmack, (2020) Long-term dune geometry bounded by geology and climate, *American Geophysical Union Fall Meeting*, **Oral Session**.
- 6. C. Gadal, C. Narteau, R. Ewing, **A. Gunn**, D. Jerolmack, B. Andreotti, P. Claudin, (2020) Spatial and temporal development of the dune instability at White Sands Dune Field, USA, 6th International Planetary Dunes Workshop, Online Poster.
- 7. **A. Gunn**, N. Lancaster, R. Ewing, M. Wanker, D. Edmonds, F. Falcini, G. Casasanta, D. Jerolmack, (2019) Self-building landscapes: Sand seas grow by steering climate, *American Geophysical Union Fall Meeting*, **Oral Session.**
- 8. R. Fetell, A. Gunn, D. Jerolmack, (2019) Phase-space of sediment failure spanned by packing-fraction and grain-size, *American Geophysical Union Fall Meeting*, Poster Session.
- 9. **A. Gunn**, R. Ewing, M. Wanker, D. Edmonds, P. Schmutz, D. Jerolmack, (2019) Internal Boundary Layer Induced by Dune-Field Roughness, *American Physical Society Division of Fluid Dynamics*, **Oral Session**.
- 10. A. Gunn, D. Jerolmack, (2019) Dune geometry extraction from DEMs, EarthCube, OpenTopography, U. Potsdam Point-cloud Workshop, Oral Session.
- 11. A. Gunn, M. Wanker, D. Edmonds, R. Ewing, D. Jerolmack, (2019) How to make a dust storm: *In situ* observations at White Sands, New Mexico, *Australian Meteorological & Oceanographic Society Conference*, **Oral Session**.
- 12. D. Jerolmack, M. Houssais, B. Ferdowsi, C. Ortiz, N. Deshpande, A. Gunn, (2019) Phase transitions in geophysical flows, *European Geosciences Union General Assembly*, Oral Session.
- 13. A. Gunn, D. Jerolmack, (2019) Turbidity Current Rheology, Northeast Complex Fluids & Soft Matter Symposium, Poster Session.
- 14. **A. Gunn**, M. Wanker, K. Cheffer, D. Edmonds, R. Ewing, D. Jerolmack, (2018) The Unsung Aeolian Movers and Shakers: Atmospheric Stability and Humidity, *American Geophysical Union Fall Meeting*, **Oral Session**.
- 15. A. Gunn, J. Daif, D. Jerolmack, (2018) Experimental Turbidity Current Onset: Breaching Front Rheology, American Geophysical Union Fall Meeting, Oral Session.
- 16. **A. Gunn**, D. Jerolmack, (2018) Experimental Turbidity Current Onset: Breaching Front Rheology, *Binghamton Geomorphology Symposium*, Poster Session.
- 17. **A. Gunn**, M. Wanker, D. Edmonds, R. Ewing, D. Jerolmack, (2018) From geostrophic to grain: momentum transfer in aeolian systems, *International Conference on Aeolian Research*, **Oral Session**.
- 18. A. Gunn, D. Jerolmack, (2018) Coupled climate and dune feedbacks, Wolman Club, Poster Session.
- 19. A. Gunn, D. Jerolmack, (2018) Turbidity Current Rheology, Northeast Complex Fluids & Soft Matter Symposium, Poster Session.
- 20. **A. Gunn**, D. Jerolmack, D. Edmonds, R. Ewing, M. Wanker, S. David, (2017) Connecting meteorology to surface transport in aeolian landscapes: Peering into the boundary layer with Doppler lidar, *American Geophysical Union Fall Meeting*, **Oral Session**.
- 21. **A. Gunn**, D. Jerolmack, (2017) Diurnal Ekman layer cycles at White Sands, New Mexico observed with Doppler lidar, *American Physical Society Division of Fluid Dynamics*, **Oral Session**.
- 22. **A. Gunn**, D. Jerolmack, (2017) The role of diurnal surface heating for dune migration in White Sands, New Mexico, *International Association of Mathematical Geosciences*, Lightning Oral Session.
- 23. **A. Gunn**, D. Jerolmack, (2017) The role of diurnal surface heating for dune migration in White Sands, New Mexico, *International Association of Mathematical Geosciences*, Poster Session.
- A. Gunn, D. Jerolmack, (2017) Diurnal atmospheric stability cycles control transport at White Sands, New Mexico, Amtrak Club, Poster Session.
- 25. M. Nikurashin, A. Gunn, (2017) Sensitivity of the ocean overturning circulation to wind and mixing: theoretical scalings and global ocean models, *European Geosciences Union General Assembly*, Oral Session.
- 26. **A. Gunn**, D. Lee, P. Arratia, D. Jerolmack, (2017) Geophysical flows: 2D turbulence, lagrangian coherent structures, and particles, *Exxon Mobil Presentation*, Poster Session.
- 27. A. Gunn, I. Marinov, M. Nikurashin, (2016) Novel biogeochemical theory predicts ocean carbon reservoir response to changes in MOC strength and diapycnal mixing, *American Geophysical Union Fall Meeting*, Poster Session.
- 28. I. Marinov, A. Cabre, **A. Gunn**, A. Gnanadesikan, (2016) Tropical teleconnections via the ocean and atmosphere induced by Southern Ocean deep convective events, *American Geophysical Union Fall Meeting*, Poster Session.

- 29. A. Gunn, M. Nikurashin, (2016) Diapyncal mixing inhibits ocean carbon storage, Ocean Carbon Biogeochemistry Workshop, Poster Session
- 30. **A. Gunn**, M. Nikurashin, (2015) The role of the Southern Ocean overturning circulation for ocean carbon uptake, *Australian Meteorological & Oceanographic Society Conference*, **Oral Session**.

Grants, Scholarships & Awards

Grants

- Named Postdoctoral Scholar, Mars Data Analysis Program Grant \$632,468, 2021, National Aeronautics and Space Administration (NASA) awarded to PI Ryan Ewing.
- Named PhD Student, Petroleum Research Fund, New Directions Grant \$110,000, 2020, American Chemical Society (ACS) awarded to PI Douglas Jerolmack.

Scholarships

- International Society of Aeolian Research Elsevier Research Scholarship \$2,250, 2018, competitive student research grant.
- Benjamin Franklin Fellowship \$133,000+tuition, 2016-2021, 4-year stipend for UPenn School of Arts & Sciences PhDs.
- Tsuneichi Fujii Scholarship \$5,600, 2015, awarded to 1 graduate student at the universities of Tasmania and Hokkaido for exchange.
- ARCCSS Summer Student Scholarship \$3,050, 2015, awarded to 15 Australian students for climate science research projects.

Awards

- Schmidt Science Fellowship, Final Selection & Institutional Nomination, 2020, competitive science-wide postdoctoral fellowship.
- Greg & Susan Walker Endowment Award \$1,600, 2019, competitive departmental award used for AGU 2019.
- SASGov Travel Award \$300, 2019, competitive UPenn School of Arts & Sciences graduate student award.
- GAPSA Travel Award \$800, 2019, competitive UPenn graduate student award.
- UNAVCO Point Cloud Travel Award \$1,600, 2019, competitive US-based participant award to attend U. Potsdam workshop.
- Greg & Susan Walker Endowment Award \$2,000, 2019, competitive departmental award used for AMOS 2019.
- GAPSA Travel Award \$800, 2018, competitive UPenn graduate student award.
- Binghamton Student Award \$100, 2018, symposium conveners' cash award for best student contributor.
- NSF Binghamton Student Travel Award \$800, 2018, competitive student travel award used for BGS.
- Greg & Susan Walker Endowment Award \$1,400, 2018, competitive departmental award used for ICAR.
- SASGov Executive Stipend \$2,000, 2017, awarded for research purposes by democratic election.
- IAMG Student Travel Award \$1,200, 2017, competitive society award for conference.
- OCB Student Travel Award \$300, 2016, competitive travel award for students to the 2016 OCB Workshop.
- Melbourne Global Scholarship, 2014, awarded on academic merit for exchange to the London School of Economics.
- Trinity College Student Coordinator Scholarship, 2013, awarded to 10 Trinity College students for pastoral care.
- Peter McPhee Award, 2013, awarded to 4 students at the University of Melbourne for community service.
- Trinity College Academic Excellence Award, 2012, awarded for top grades at the University of Melbourne per semester.
- Western Australian Government Certificate of Excellence Award, 2011, awarded for top 1% students in that year.
- Christ Church Grammar School Academic Scholar Award (x4), 2010-2011, A grades for every subject for 2 years.

Teaching Experience

- 'Earth Surface Processes' GEOL305, Co-Instructor, 2021, sediment transport and fluid mechanics lectures, 18 students.
- 'Earth Surface Processes' GEOL305, Guest Lecturer & Field Teaching Assistant, 2020, boundary layer section of UPenn class, 20 students to White Sands dunes, administration, mentoring undergraduate field research projects.
- 'Oceanography' GEOL130, Head Teaching Assistant, 2020, ~300 students, office-hours, teaching, grading, reviews.
- University of Pennsylvania Center for Teaching & Learning, Teaching Certificate, 2018-2021, multi-component accreditation including teaching; experience, observations, philosophy development, and workshops. Workshops participated:
 - 'Engaging diverse audiences in the classroom'
 - 'Supporting students of diverse backgrounds in science'
 - 'Teaching field courses'
- 'Earth Surface Processes' GEOL305, Field Teaching Assistant, 2019, 15 students to Algodones dunes, administration, mentoring undergraduate field research projects.
- 'Earth & Life Through Time' GEOL125, Teaching Assistant, 2019, ~200 students, office-hours, guest lecturing, recitations, grading.
- 'Oceanography' GEOL130, Head Teaching Assistant, 2018, ~300 students, office-hours, teaching, grading, reviews.
- 'Structured, Active, In-class Learning' (SAIL) Teaching Certificate, 2017, semester-long course on 'flipped' undergraduate teaching.
- 'Oceanography' GEOL130, Teaching Assistant, 2017, ~300 students office-hours, teaching, grading, review sessions.
- GEOL204 'Global Climate Change', Guest Lecturer, 2016, ~40 students, climate modelling section of UPenn class.
- Private, Mathematics, Physics and English Tutor, 2012-2015, employed as tutor for over 15 students between high school and 1st year undergraduate level.
- MyGuru Ltd., Mathematics Tutor, Apr 2014-Nov 2015, employed as the primary content creator for online videos for Australian mathematics curricula accessed by thousands of students, as well as other written and in-person tutoring services.

Outreach & Service

- American Geophysical Union Fall Meeting, Session Co-Convener, 13-17 Dec 2021, "Granular and Fluid Physics in Geomorphology".
- NSPIRES Grant Panellist, 2021, NASA.
- Peer Reviewer, Ongoing, journals: Nature Communications, Science Advances, Geophysical Research Letters, Journal of Geophysical Research: Atmospheres, Journal of Geophysical Research: Earth Surface; book: Treatise on Geomorphology.
- Good Data Institute, Volunteer, Ongoing, consultant coder for NFPs on analytics and data-practices.
- Trinity College Alumni Career Event, Science Panelist, 4 Sept 2020, career mentoring for science undergraduates at my alma mater.
- American Geophysical Union Fall Meeting, Session Primary Convener, 1-17 Dec 2020, "Granular and Fluid Physics in Geomorphology".

- American Geophysical Union Fall Meeting, Session Co-Convener, 9-13 Dec 2019, "Centennial Session: Leopoldian, Bagnoldian, and Einsteinian Geomorphology Today: Historical Reflections and New Approaches".
- Hayden Fellowship Seminar, Discussion host, 7 Aug 2019, on helping dept. summer scholarship undergraduates apply for graduate school.
- Penn Prep Summer School 'Climate Change on the Blue Planet', Instructor, 7 Jul-2 Aug 2019, 2x 2-week course I devised and taught for rising-freshman students mostly on scholarships.
- Penn Prep Summer School 'Climate Change on the Blue Planet', Instructor, 24 Jul-3 Aug 2018, 2-week course I devised and taught for rising-freshman students mostly on scholarships.
- Philadelphia Science Festival, Presenter, 21-28 Apr 2017, flume river evolution at the Franklin Institute.
- Titjimbat Teachabout Inc., Science Program Coordinator, Aug 2013-Feb 2014, devised and implemented a 4-week STEM program for indigenous Australian school students. I also attracted government, private and university funding for this NGO.
- River Nile Learning Centre, ESL and Science Tutor, Feb 2012-Nov 2012, pro-bono tutoring for 10 South Sudanese refugees in Melbourne ranging across mature-aged vocational courses, undergraduate written English help, high school sciences.

Workshops

- InSightSeers Program, Jun 28-Jul 2 2021, NASA InSight Science Team Meeting observer for exposure to Mars mission work.
- Unlearning Racism in Geoscience (URGE), Jan 2021-May 2021, NSF-funded discipline-wide workshop, department `pod' member.
- Inclusive & Equitable Teaching Workshop, Feb 26-Apr 1 2020, U. Penn 5-week course committed to diversity-promoting education.
- From point clouds and full-waveform data to DEM analysis, Sept 30-Oct 4 2019, U. Potsdam week on elevation models.
- Mid-Atlantic Soft Matter Workshop, 12 Aug 2019, regional conference at Johns Hopkins University.
- Thinkful City Coho, Git & Github: your coding saftey net, 12 Feb 2019, course on colloborating through Github.
- Penn Institute for Computational Science, Data Analysis in Python, 8-9 Apr 2017, data packages i.e. Pandas.
- Woods Hole Oceanographic Institute, OCB Workshop, 25-28 Jul 2016, current and future topics in the OCB community.
- Monash University, ARCCSS Tropical Meteorology Winter School, 20-24 Jun 2016, course on tropical weather and climate systems.
- CLIVAR/JAMSTEC, 2nd Session of OMDP: Forcing Ocean-Ice Climate Models, 14-15 Jan 2016, live stream to session.
- University of New South Wales, ARCCSS Scientific Writing Workshop, 17-19 Nov 2015, journal publishing course.
- University of Queensland, AMOS Software Carpentry Workshop, 13-15 Jul 2015, Python and Git course.
- University of Tasmania, DaSH Software Carpentry Workshop, Jun 2015-Jul 2015, Unix, SQL and R weekly sessions.
- University of Tasmania, ARCCSS Biogeochemistry Winter School, 15-19 Jun 2015, course on global nutrient cycle, etc.

Standardised Tests

- Graduate Record Examinations (GRE), Aug 2015, Verbal: 163 (92nd%), Quantitative: 163 (86th%), Analytical: 5.0 (93rd%).
- Australian Tertiary Admissions Rank (ATAR), 2011, 99th% of Australians applying for undergraduate study in 2011.
- Various Olympiads, 2011, Higher Distinctions in Australasian Mathematics, Informatics, Computer Science, Economics Olympiads.

Leadership Responsibilities

- Student Representative, UPenn EES Faculty Meetings, 2019-2020, represent PhD students to the department faculty.
- Executive Board Member, Graduate Assembly UPenn, Aug 2017-Aug 2018, 1 of 6 students elected to represent ~2000 graduate students, maintain a budget of over US\$125K.
- Department Representative, Graduate Assembly UPenn, Aug 2016- Aug 2017, represent my department to the wider university.
- Executive Student Committee, Trinity College, Oct 2013-Oct 2014, 1 of 8 elected students to represent 350 residential students, oversee a AU\$300k annual budget, organise all social or pastoral activities, and manage an associated incorporated company.
- Director, Trinity Leadership Challenge, Nov 2012-Oct 2013, led a program in which 8 students raised AU\$20k, participated in
 professional development seminars, served charities and hiked an important Australian war trail in Papua New Guinea.
- Editor, Trinity College Students' Publication, Feb 2013-Nov 2013, sole editor of student-led quarterly university publication.

Referees

Dr. Douglas Jerolmack – PhD advisor

Professor, Departments of Earth & Environmental Sciences (Primary) and Mechanical Engineering & Applied Mechanics (Secondary)
University of Pennsylvania

Email: sediment@sas.upenn.edu

Dr. Mathieu Lapôtre – Postdoctoral advisor

Assistant Professor, Departments of Geological Sciences (Primary) and Geophysics (by courtesy) Stanford University

Email: mlapotre@stanford.edu

Dr. David Mohrig – PhD committee member

Associate Dean for Research and Peter T. Flawn Centennial Chair in Geology, Jackson School of Geosciences

University of Texas, Austin Email: mohrig@jsg.utexas.edu

Dr. Paulo Arratia – PhD committee member

Professor, Department of Mechanical Engineering & Applied Mechanics University of Pennsylvania

Email: parratia@seas.upenn.edu

Dr. Jane Dmochowksi - Teaching & Service mentor

Senior Lecturer, Department of Earth & Environmental Sciences University of Pennsylvania

Email: janeed@sas.upenn.edu

Dr. David Goldsby - Graduate Chair & PhD committee member

Associate Professor and Graduate Chair, Department of Earth & Environmental Sciences

University of Pennsylvania Email: dgoldsby@sas.upenn.edu

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