Cyril Gadal, PhD

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Scholar: Cyril Gadal

github.com/cgadal

https://cgadal.github.io/

University of Manchester
Department of Mathematics
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Scientific interests

Fluid and granular physics
Dilute, dense, multiphase granular flows
Instabilities, patterns and morphogenesis
Complex rheologies

Quantitative Geomorphology
Coupling fundamental physics and geophysical data
Sediment transport and bedforms
Suspensions, particle-driven gravity currents

Open Science

2024 - now **Newton international research fellow at the University of Manchester** Manchester, UK
Cohesion, seggregation and anisotropy in dense granular flows
in collaboration with Pr. J.M.N.T. Gray and Dr. C. Johnson.

2023 - 2024 **Postdoctoral researcher at the Institut de Mécanique des Fluides de Toulouse** Toulouse, France
Particle suspension flow through porous media: the example of riverbed clogging
in collaboration with Dr. L. Lacaze and Dr. M. Mercier.

2021 - 2023 **Postdoctoral researcher at the Institut de Mécanique des Fluides de Toulouse** Toulouse, France
Experimental study of turbidity currents
in collaboration with Dr. L. Lacaze and Dr. M. Mercier.

2019 (3 mths) **Visiting student at the DAMTP, University of Cambridge** Cambridge, UK
Experimental study of impact craters using yield-stress fluids
by supervised by Prof. J.A. Neufeld, Dr. M. Landeau and Prof. S.B. Dalziel.

Education

2017 - 2020 **Ph.D. in Geophysics**, supervised by Prof. C. Narteau and Prof. P. Claudin

Dune emergence in multidirectional wind regimes.

Defended on 2020, October 15th
Institut de physique du globe de Paris (IPGP) & PMMH - ESPCI. *Very Honorable, with Committee Praise*.

2016 - 2017 **Master of Science**, major in fundamental fluid dynamics.
École Normale Supérieure & Université Paris Cité, *magna cum laude honors*.
Master thesis: *Dune instability in bidirectional wind regimes.*
supervision: Prof. C. Narteau & Prof. P. Claudin [6 months], Institut de physique du globe de Paris (IPGP).

2014 - 2017 **Master of Science**, major in *Earth Sciences*.
École Normale Supérieure, *magna cum laude honors*.
Research internship: *Numerical study of Nebkha dunes.*
Supervision: Dr. J.M. Nield [6 months], University of Southampton (Southampton, UK).
Research internship: *Including non-linearities in the theory of mountain lee waves.*
Supervision: Dr. F. Lott [2 months], Laboratoire de Météorology Dynamique (Paris, France).

2012 - 2014 Preparatory classes for Grandes Écoles, *Physics-Chemistry*. Lycée Pierre de Fermat, Toulouse, France

2011 - 2012 Scientific baccalaureate certificate, *Physics-Chemistry-English major*, *summa cum laude honors*

1- Publications & Communications

⊙ **12 Referee articles** & **4 Datasets**
The list of publications is presented on page 3

⊙ **17 Oral communications**, among which:
1 invited talks, 6 contributed talks, 5 invited seminars, 5 posters
The list of oral communications is presented on page 4

2- Technical Skills

- **Theoretical modelling**: instabilities, sediment transport, dense granular flows, depth-averaged models
- **Experimental**: conception and design
- **Numerical simulations**: cellular automaton models, molecular dynamics (DEM)
- **Data analysis**: image processing, time series analysis, inference and inverse models
- **Programming**: Python (general, data analysis), basics of C_{++}, Fortran, HTML

2- Fundings

⊡ **Newton International fellowship**, 420 000 £ from the Royal Society (2024 – 2026)
⊡ **Grant for international mobility**, 2750 € from Institut de Physique du Globe de Paris (2019)
⊡ **Grant for international mobility**, 2750 € from Université Paris Cité (2019)
⊡ **Scholarship for PhD**, 3 yrs funding from Université Paris Cité (2017)

3- Student Supervision

♢ Lucy Bourne & Ruby Bradbury, **Master thesis**, co-supervision with Dr. J. Webb, 2024–2025.

- Downslope granular flows encountering a change in bottom roughness.

♢ Aarnav Panda, **2-month undergraduate internship**, 2024

- Dense granular flows in halfpipe channels.

♢ Jean Schneider, **Visiting PhD Student**, co-supervision with Dr. M. Mercier & Dr. L. Lacaze, 2022.

- Particle distribution in constant inflow three-phase turbidity current.

  Jean defended his PhD in October 2024 on gravity and turbidity currents.

♢ Aurélien Schaff, **Master thesis**, co-supervision with Dr. M. Mercier & Dr. L. Lacaze, 2022.

- Trapping suspended particles using bottom roughness in a channel flow.

  Aurélien is now a PhD student at the IMFT, France.

♢ Colin Chanteloube, **Master thesis**, co-supervision with Prof. C. Narteau & Dr. L. Barrier, 2020.

- Source-To-Sink Aeolian Fluxes From Arid Landscape Dynamics in the Lut Desert.
  Colin defended his PhD in October 2023 on aeolian sand dunes.

♢ Jeanne Alkalla, **2-month undergraduate internship**, co-supervision with Prof. C. Narteau, 2020.

- Linking defect density in dune patterns to the wind regime.
  Jeanne is now a PhD student at the IPGP, France.

5- Teaching

△ Mathematics for physics (statistics), 1st year (L1), University Paris Diderot, 2018-2019, 6 hrs/yr.
△ Mathematics for physics (numerical analysis), 3rd year (L3), University Paris Diderot, 2018-2020, 15 hrs/yr.
△ Physics for Geosciences (solid mechanics), 2nd year (L2), University Paris Diderot, 2017-2020, 21 hrs/yr
△ "Dealing with scientific articles", 3rd year (L3), University Paris Diderot, 2017-2020, 30 hrs/yr
△ "Flow in porous media", 1st year master (M1), University Paris Diderot, 2017-2018, 20 hrs/yr
△ Private lessons *Mathematics, Physics, Chemistry, Biology & Earth sciences*, Highschool, weekly, 5 students from 2014 to 2019

7- Peer reviewing

◈ Referee for *Scientific Reports*, 2023
◈ Referee for *Sedimentology*, 2023
◈ Referee for *Journal of Fluid Dynamics*, 2023, 2024
◈ Referee for *Water Resources Research*, 2022
◈ Referee for *Earth Surface Dynamics*, 2021

8- Other contributions

- EGU 2023 & 2024 session convenior
- Scientific mediation: European Night of Researchers 2023
- Contributor to open scientific codes: python packages (matplotlib, lmfit), lammps (mol. dynamics)

Cyril Gadal – Publication list

12 Refereed articles
1 Refereed conference proceeding
4 Datasets

Refereed articles

13. Chapter 16: Particle-laden gravity currents: the lock-release slumping regime at the laboratory scale
Gadal, C., Schneider J., Bonamy C., Chauchat J., Dossmann Y., Kiesgen de Richter S., Mercier M. J., Naaim-Bouvet F., Rastello M., and Lacaze L. (2023) *accepted for publication for AGU Books – Geophysical Monograph Series*

12. Complementary classifications of aeolian dunes based on morphology, dynamics, and fluid mechanics
Courrech du Pont, S., Rubin, D.M., ..., **Gadal, C.**, ..., & Wiggs, G.F.S. (2023) *in review for Earth-Science Reviews*

11. Slumping regime in lock-release turbidity currents
Gadal, C., Mercier, M., & Lacaze, L. (2023) *Journal of Fluid Mechanics*, 974, A4, doi:10.1017/jfm.2023.762

10. Local wind regime induced by giant linear dunes: comparison of ERA5-Land reanalysis with surface measurements.
Gadal, C., Delorme, P., Narteau, C., Wiggs, F.S.W., Baddock, M., Nield, J.M. & Claudin, P. (2022) *Boundary Layer Meteorology*, 185, pages 309–332, doi:10.1007/s10546-022-00733-6

9. Coexistence of Two Dune Growth Mechanisms in a Landscape-Scale Experiment.
Lü, P., Narteau, C., Dong, Z., Claudin, P., Rodriguez, S., An, Z., **Gadal, C** & Courrech du Pont, S. (2022). *Geophysical Research Letter*, 49(11), e2021GL097636, doi:10.1029/2021GL097636

8. Source-To-Sink Aeolian Fluxes From Arid Landscape Dynamics in the Lut Desert.
Chanteloube, C., Barrier, L., Derakhshani, D., **Gadal, C**. Braucher, R., Payet, V., Léanni, L. & Narteau, C. (2022) *Geophysical Research Letters*, 49, e2021GL097342, doi:10.1029/2021GL097342

7. Migration of Reversing Dunes Against the Sand Flow Path as a Singular Expression of the Speed-Up Effect.
Gao, X., Narteau, C., & **Gadal, C**. (2021) *Journal of Geophysical Research: Earth Surface*, 126, e2020JF005913, doi:10.1029/2020JF005913

6. Direct validation of dune instability theory.
Lü, P., Narteau, C., Dong, Z., Clauding, P., Rodriguez, S., An, Z., Fernandez-Cascales, L., **Gadal, C** & Courrech du Pont, C. (2021) *PNAS*, 118, e2024105118, doi:10.1073/pnas.2024105118

5. Spatial and Temporal Development of Incipient Dunes.
Gadal, C., Narteau, C., Ewing, R. C., Gunn, A., Jerolmack, D., Andreotti, B., & Claudin, P. (2020) *Geophysical Research Letters* 47, e2020GL088919, doi:10.1029/2020GL088919

4. Periodicity in fields of elongating dunes.
Gadal, C., Narteau, C., Courrech du Pont, S., Rozier, O. & Claudin, P. (2020) *Geology* 48, 343-347, doi:10.1130/G46987.1

3. Elongation and stability of a linear dune.
Rozier, O., Narteau, C., **Gadal, C.**, Claudin, P. & Courrech du Pont, S. (2019) *Geophysical Research Letters* 46, 14521-14530, doi:10.1029/2019GL085147

2. Incipient bedforms in a bidirectional wind regime.
Gadal, C., Narteau, C., Courrech du Pont, S., Rozier, O. & Claudin, P. (2019) *Journal of Fluid Mechanics* 862, 490-516, doi:10.1017/jfm.2018.978

1. Morphodynamics of barchan and dome dunes under variable wind regimes.
Gao, X., **Gadal, C.**, Rozier, O. & Narteau, C. (2018) *Geology* 46, 743-746, doi:10.1130/G45101.1

Refereed conference proceedings

1. The Role of Functionalized Organic Surfaces in Metal Biomineralization: Insights from Liquid-Cell STEM Experiments.
Dejean, C., Peña. N. O., Menez, B., **Gadal, C.**, Alloyeau, D. & Gelabert, A. (2018) *Microscopy and Microanalysis* 27, 81-82, doi:10.1017/S14319276210134

Datasets

4. Data and codes for "Chapter 16: Particle-laden gravity currents: the lock-release slumping regime at the laboratory scale"
   Gadal, C., Schneider, J., Bonamy, C., Chauchat, J., Dossmann, Y., Kiesgen de Richter, S., Mercier, M. J., Florence, N.-B., Rastello, M. and Lacaze, L. (2024) *Zenodo*, 10.5281/zenodo.10854247
3. Science Fair Kit for Granular and Two-Phase Flows (Kit de Médiation Scientifique pour les Écoulements Granulaires et Diphasiques)
   Barron, J.-D., Darvenne, A., **Gadal, C.**, Lacaze, L., Mercier, M. and Viroulet, S. (2024) *Zenodo*, doi:10.5281/zenodo.10631765
2. Data used in 'Slumping regime in lock-release turbidity currents'.
   Gadal, C., Mercier, M. and Lacaze, L., (2022) *Zenodo*, doi:10.5281/zenodo.7487190
1. Data used in 'Local Wind Regime Induced by Giant Linear Dunes: Comparison of ERA5-Land Reanalysis with Surface Measurements'.
   Gadal, C., Delorme, P., Narteau, C., Wiggs, F.S.W., Baddock, M., Nield, J.M. and Claudin, P., (2022) *Zenodo*, doi:10.5281/zenodo.7198452

PhD thesis

- Dune emergence in multidirectional wind regimes.
  Gadal, C. (2020) *Doctoral dissertation, Université Paris Cité*

Cyril Gadal – List of oral communications

17 Oral communications, among which:
1 invited talks, 6 contributed talks, 5 invited seminars, 5 posters

Invited Talks

1. Dune emergence: multidirectional wind regimes and boundary conditions.
   2020, American Geophysical Union, Fall Meeting 2020

Contributed Talks

6. Slumping regime in lock-release turbidity currents: bottom slope and particle settling.
   2023, Euromech 608: Dynamics of Gravity Currents
5. Experimental lock-release turbidity currents: slope, volume fraction and settling velocity.
   2022, IUTAM Symposium: From Stokesian suspension dynamics to particulate flows in turbulence
4. Experimental lock-release turbidity currents: slope, volume fraction and settling velocity.
   2022, THESIS-2022 Two-pHase modEling for Sediment dynamIcS
3. Periodicity in fields of elongating dunes.
   2019, WindyDay 2019
2. Dune growth under multidirectional wind regimes.
   2018, ICAR X
1. Dune growth under multidirectional wind regimes.
   2017, Euromech 588: Coupling Mechanisms and Multi-Scaling in Granular-Fluid Flows.

Invited Seminars

5. Unraveling the complexity of geophysical systems using idealized analogue configurations
   2023, Institut de Physique de Rennes, France
4. Turbidity (particle-laden gravity) currents: relevant processes and numbers.
   2023, laboratoire IUSTI, France
3. Geophysical data – Where to find them ?
   2023, PMMH, Paris, France
2. Dune emergence in multidirectional wind regimes.
   2020, Institut de Mécanique des Fluides de Toulouse, Toulouse, France
1. Dune emergence under bidirectional wind regimes.
   2019, Institut de physique du globe de Paris, France

Posters

5. An experimental set-up for the spatio-temporal quantification of fine particle infiltration in porous beds.
   2024, EGU General Assembly 2024
4. Slumping regime in lock-release turbidity currents.
   2023, EGU General Assembly 2023
3. Periodicity in elongating dune fields controlled by boundary conditions.
   2019, EGU General Assembly 2019
2. Size control in fields of elongating dunes.
   2018, WindyDay 2018
1. Dune growth under multidirectional wind regimes.
   2017, American Geophysical Union, Fall Meeting 2017