Curriculum Vitae   **Ian Grooms**

Engineering Center ECOT 320
(303) 492-7563
ian.grooms@colorado.edu
`colorado.edu/amath/grooms`

CURRENT POSITION

Assistant Professor
Department of Applied Mathematics
University of Colorado, Boulder

PREPARATION

- **New York University**
  Postdoc at the Courant Institute of Mathematical Sciences, June 2011–May 2015
- **University of Colorado at Boulder**
  Ph.D. in Applied Mathematics, May 2011
- **College of William and Mary, Williamsburg, VA**
  B.S. in Mathematics, *summa cum laude*, May 2005

RESEARCH INTERESTS

- Geophysical Fluid Dynamics, esp. Physical Oceanography
- Ocean Modeling
- Data Assimilation & Uncertainty Quantification

PUBLICATIONS

Refereed Journal Articles

[1] B. Pachev, J. P. Whitehead, G. Fantuzzi, **I. Grooms**, *"Rigorous bounds on the heat transport of rotating convection with Ekman pumping"* accepted to J. Math. Phys. 2019

[2] W. Barham and **I. Grooms**, *"On energy exchanges between eddies and the mean flow in quasigeostrophic turbulence"* J. Fluid Mech. **885** 2020.

[3] M. Watwood, **I. Grooms**, K. Julien, and K. S. Smith, *"Energy-conserving Galerkin approximations for quasigeostrophic dynamics"* J. Comp. Phys. **388** 2019.

[4] W. Barham and **I. Grooms**, *"Exact instantaneous optimals in the non-geostrophic Eady problem and the detrimental effects of discretization"* Theoretical and Computational Fluid Dynamics **33** 2019.

[5] **I. Grooms** and W. Kleiber, *"Diagnosing, modeling, and testing a multiplicative stochastic Gent-McWilliams parameterization"* Ocean Modelling **133** 2019.

[6] **I. Grooms** and K. Julien, *"Multiscale models in geophysical fluid dynamics"* Earth and Space Science **5** 2018.

[7] J. D. Christopher, N. T. Wimer, C. Lapointe, T. R. S. Hayden, **I. Grooms**, G. B. Rieker, and P. E. Hamlington, *"Parameter estimation for complex thermal-fluid flows using approximate Bayesian computation"* Phys. Rev. Fluids **3** 2018.

[8] A. Chen, W. Barham, and **I. Grooms** *"Comparing eddy-permitting ocean model parameterizations via Lagrangian particle statistics in a quasigeostrophic setting"* Journal of Geophysical Research: Oceans **123** 2018.

[9] G. Robinson, **I. Grooms**, and W. Kleiber *"Improving particle filter performance by smoothing observations"* Monthly Weather Review **146** 2018.

[10] W. Barham, S. Bachman, and **I. Grooms** *"Some effects of horizontal discretization on linear baroclinic and symmetric instabilities"* Ocean Modelling **125** 2018.

[11] W. Barham and **I. Grooms** "*An eddifying Stommel model: Fast eddy effects in a two-box ocean*" Geophysical & Astrophysical Fluid Dynamics **113** 2019.

[12] **I. Grooms** "*Simulations of eddy kinetic energy transport in barotropic turbulence*" Phys. Rev. Fluids **2** 2017.

[13] J. B. Weiss and **I. Grooms** "*Assimilation of ocean sea-surface height observations of mesoscale eddies*" Chaos **27** 2017.

[14] **I. Grooms** and L. Zanna "*A note on 'Towards a stochastic parameterization of ocean mesoscale eddies'*" Ocean Modelling **113** 2017.

[15] **I. Grooms** "*A Gaussian-product stochastic Gent-McWilliams parameterization*" Ocean Modelling **106** 2016.

[16] **I. Grooms** and L.-P. Nadeau "*The effects of mesoscale atmosphere-ocean coupling on the quasigeostrophic double gyre*" Fluids **1** 2016.

[17] D. Nieves, **I. Grooms**, K. Julien, and J. B. Weiss "*Investigations of non-hydrostatic, stably stratified and rapidly rotating flows*" J. Fluid Mech. **801** 2016.

[18] C. B. Rocha, W. R. Young, and **I. Grooms** "*On Galerkin approximations for the quasigeostrophic equations*" J. Phys. Oceanogr. **46** 2016.

[19] **I. Grooms** "*A computational study of turbulent kinetic energy transport in barotropic turbulence on the f-plane*" Phys. Fluids **27** 2015.

[20] **I. Grooms** and Y. Lee "*A framework for variational data assimilation with superparameterization*" Nonlin. Proc. Geophys. **22** 2015.

[21] **I. Grooms**, Y. Lee, and A. J. Majda "*Ensemble filtering and low resolution model error: Covariance inflation, stochastic parameterization, and model numerics,*" Mon. Weather Rev. **143**, 2015.

[22] **I. Grooms**, Y. Lee, and A. J. Majda "*Numerical Schemes for Stochastic Backscatter in the Inverse Cascade of Quasigeostrophic Turbulence,*" SIAM Multiscale Modeling & Simulation **13**, 2015.

[23] **I. Grooms** "*Submesoscale Baroclinic Instability in the Balance Equations,*" J. Fluid Mech. **762**, 2015.

[24] **I. Grooms**, A. J. Majda, and K. S. Smith "*Stochastic Superparameterization in a Quasigeostrophic Model of the Antarctic Circumpolar Current,*" Ocean Modelling **85**, 2015.

[25] **I. Grooms** and J. P. Whitehead "*Bounds on Heat Transport in Rapidly Rotating Rayleigh-Bénard Convection,*" Nonlinearity **28**, 2015.

[26] **I. Grooms** "*Asymptotic Behavior of Heat Transport for a Class of Exact Solutions in Rotating Rayleigh-Bénard Convection,*" Geophys. Astrophys. Fluid Dyn. **109**, 2015.

[27] **I. Grooms**, Y. Lee, and A. J. Majda "*Ensemble Kalman Filters for Dynamical Systems with Unresolved Turbulence,*" J. Comp. Phys. **273**, 2014.

[28] **I. Grooms** and A. J. Majda "*Stochastic Superparameterization in Quasigeostrophic Turbulence,*" J. Comp. Phys. **271**, 2014.

[29] A. J. Majda and **I. Grooms** "*New Perspectives on Superparameterization for Geophysical Turbulence,*" J. Comp. Phys. **271**, 2014.

[30] **I. Grooms** and A. J. Majda "*Stochastic Superparameterization in a One-Dimensional Model for Wave-Turbulence,*" Commun. Math. Sci. **12**, 2014.

[31] **I. Grooms**, L.-P. Nadeau, and K. S. Smith "*Mesoscale Eddy Energy Locality in an Idealized Ocean Model,*" J. Phys. Oceanogr. **43**, 2013.

[32] **I. Grooms** and A. J. Majda "*Efficient Stochastic Superparameterization for Geophysical Turbulence,*" Proc. Nat. Acad. Sci. USA **110**, 2013.

[33] **I. Grooms**, K. S. Smith, and A. J. Majda "*Multiscale Models for Synoptic-Mesoscale Interactions in the Ocean,*" Dyn. Atmos. Oceans **58**, 2012.

[34] K. Julien, A. Rubio, **I. Grooms**, and E. Knobloch "*Statistical and Physical Balances in Low Rossby Number Rayleigh-Bénard Convection,*" Geophys. Astrophys. Fluid Dyn. **106**, 2012.

[35] **I. Grooms**, K. Julien, and B. Fox-Kemper "*On the Interactions Between Planetary Geostrophy and Mesoscale Eddies,*" Dyn. Atmos. Oceans **51**, 2011.

[36] **I. Grooms** and K. Julien, "*Linearly Implicit Methods for Nonlinear PDEs with Linear Dispersion and Dissipation,*" J. Comp. Phys. **230**, 2011.

[37] **I. Grooms**, K. Julien, J. B. Weiss, and E. Knobloch, "*Model of Convective Taylor Columns in Rotating Rayleigh-Bénard Convection,*" Phys. Rev. Lett. **104**, June 2010. **Cover Article**

[38] **I. Grooms**, R. M. Lewis, and M. W. Trosset, "*Molecular Embedding via a Second Order Dissimilarity Parameterized Approach,*" SIAM J. Sci. Comp. **31**, 2009.

Conference Proceedings

[1] O. Doronina, C. Towery, J. Christopher, I. Grooms, P. Hamlington, "*Turbulence Model Development Using Markov Chain Monte Carlo Approximate Bayesian Computation*" AIAA Scitech Forum, 2019.

[2] J. Christopher, C. Lapointe, N. Wimer, T. Hayden, **I. Grooms**, G.B. Rieker, and P.E. Hamlington "*Parameter Estimation for a Turbulent Buoyant Jet with Rotating Cylinder Using Approximate Bayesian Computation*" 23rd AIAA Computational Fluid Dynamics conference, 2017.

[3] J. Christopher, C. Lapointe, N. Wimer, T. Hayden, **I. Grooms**, G.B. Rieker, and P.E. Hamlington "*Parameter Estimation for a Turbulent Buoyant Jet Using Approximate Bayesian Computation*" 55th AIAA Aerospace Sciences Meeting, 2017.

Submitted Manuscripts

[1] J. Small, A. DuVivier, D. Whitt, M. Long, **I. Grooms**, W. Large, "*On the control of subantarctic stratification by the ocean circulation*" Climate Dynamics, in revision.

[2] G. Robinson, I. Grooms, "*A tunable multiresolution smoother for scattered data with application to particle filtering*"

Software

- Computational fluid dynamics software used in my research on my github account: `https://github.com/iangrooms` Contributions to other projects may also be viewed through github.

TEACHING

- Linear Algebra with Statistical Applications, APPM 5720, Fall 2019
- Numerical Linear Algebra, APPM 5620, Spring 2018 & 2020
- Numerical Analysis 1, APPM/MATH 5600, Fall 2017 & 2018
- Data assimilation for high-dimensional dynamical systems, APPM 4/5510, Fall 2016 & 2019
- Matrix Methods and Applications, APPM 3310, Spring 2016–2018 & Fall 2018
- Calculus 2 for Engineers, APPM 1360, Summer 2007, Fall 2015, Spring 2019

AWARDS AND HONORS

- **Turcotte Award** "to recognize an outstanding dissertation by a recent graduate that contributes directly to nonlinear geophysics." Nonlinear Geophysics section of the American Geophysical Union, 2011
- **William and Mary Prize in Mathematics**, 2005

PROFESSIONAL MEMBERSHIPS

I am a lifetime member of:

- The Society for Industrial and Applied Mathematics (SIAM)
- The American Geophysical Union (AGU)