GFD Newsletter 2024

Faculty of Walsh Cottage

The 2024 GFD Photograph

Lecturers, Visitors and Staff

The 2024 Geophysical Fluid Dynamics Summer Study Program started on June 17th with principal lectures given on the theme *Multiscale GFD*. Tragically for the GFD community, one of the originally scheduled Principal Lecturers, Keith Julien, from the University of Colorado, Boulder, unexpectedly passed away in April. Our community continues to grieve his loss, but more on this later.

Co-directors Greg Chini and Bruce Sutherland are incredibly grateful to Edgar Knobloch (University of California, Berkeley), who stepped in for his former close collaborator and dear friend Keith, giving four lectures alongside Basile Gallet (Université Paris-Saclay, CEA, CNRS), with another lecture being given by co-director Greg Chini (University of New Hampshire). Edgar introduced methods of weakly and strongly nonlinear asymptotic theory applied to convective and wave instabilities including rotation and magnetism. Basile's lectures focused on multiscale methods used to model geophysical turbulence with application to the oceans, and Greg applied these methods to develop reduced PDE models of and to predict scaling laws for strongly stratified turbulence.

Contributing to the vibrancy of Walsh Cottage were a large number of visitors, including many past WHOI GFD Fellows, who inspired this summer's Fellows with stimulating seminars and conversations over lunch and on the porch. The summer ran smoothly in large part to the excellent support staff including Anders Jensen, who assisted with laboratory experiments, and Janet Fields and Julie Hildebrandt, who dealt with the administration of the Program with their usual patience and efficiency. This year we also welcomed Lanie Plueddemann. She started to learn the ropes from Julie, who nears retirement. We continue to be grateful for the enthusiastic support we receive from the W.H.O.I. Academic Programs Office.

Schedule of Principal Lectures

Monday, June 17: *Weakly nonlinear theory for convective instabilities (EK)*

Tuesday, June 18: *Strongly nonlinear theory for convective instabilities (EK)*

Wednesday, June 19: Public holiday

Thursday, June 20: *Turbulence and turbulent convection with and without rotation (BG)*; *Reduced description of rapidly rotating turbulent convection (EK)*

Friday, June 21: *Reduced description of fingering instabilities and parametric instabilities (EK)*

Monday, June 24: *Multiscale modeling of layered anisotropic stratified turbulence (GC)*

Tuesday, June 25: *Two-dimensional turbulence above topography (BG)*

Wednesday, June 26: *Turbulent transport in the ocean, part I: baroclinic turbulence (BG)*

Thursday, June 27: *Turbulent transport in the ocean, part II: multiscale approach (BG)*

Friday, June 28: *Near-inertial waves interacting with balanced flows (BG)*

Principal Lecturers Basile Gallet (left) and Edgar Knobloch (right).

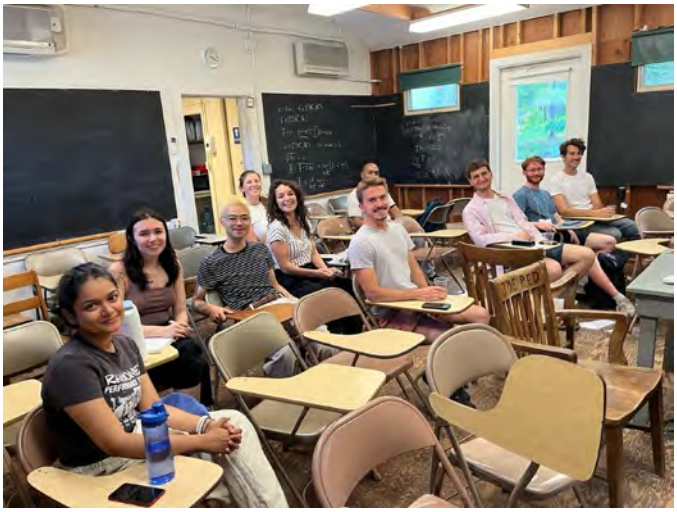
The 2024 WHOI GFD Fellows.

Fellows and visitors gather at the welcome BBQ.

Vincent and Claudia in the lab.

Fellows' Reports

Following the first two weeks of principal lectures, the Fellows shift their focus to summer research, supervised by GFD Faculty and visitors. Fellows are encouraged to choose a research project distinct from their Ph.D. research. This summer, three Fellows chose to do laboratory experiments, while the others pursued theory and numerical simulations, some inspired by the theme of the principal lectures. It is truly impressive to see how much gets accomplished in a relatively short time, as well as to hear the breadth of research topics during presentations given in the last week of the program.



Fellows gather on opening day.

Fellows chatting with seminar speakers over lunch.

Paul Curtis, Yale University
Idealized Models of Moist Convection

Cy David, University of California, Los Angeles
Interaction of Internal Gravity Waves with Magnetohydrodynamic Waves

Vincent Laroche, University of California, Berkeley
Interaction of Microplastics and Settling Sand

Cécile Le Dizes, Toulouse Institute of Fluid Mechanics
Density Layering in Rotating Stratified Turbulence

Matthew McCormack, University of Edinburgh
A Little Goes a Long Way: Dismantling Weakly Nonlinear, Non-normal Dynamical Systems

Camille Moisset, CEA
Internal Tides Get Phased by the Equator

Ishwari Mulkawar, University of California, San Diego
Not Too Spicy: Effects (or not) of Double Diffusion on Kolmogorov Flow

Nicolaos Petropoulos, Cambridge University
Meshes Don't Dance Anymore

Lulabel Ruiz Seitz, Brown University
Fast, Singular Limits of the Lagrangian-averaged Navier-Stokes-alpha Model

Adithiya Sivakumar, University of New Hampshire
The Dynamics of Stacked Stratified Shear Layers

Fellows celebrate after giving their final presentations.

Softball Report

The GFD Dynamos had a stellar season on the softball field, scoring more runs than any other Dynamo team in the history of the program! The Dynamos even won two games (one legitimately), closing the season by defeating MBL. Alas, the Fellows lost their end-of-program contest against the staff, as their former coach and new nemesis (co-director Chini) hit the game-winning RBI while co-director Sutherland produced out after out at first base. All in all, it was a terrific season, with softball providing a great outlet for building comradery and a much-needed diversion from project work.

Coach Chini showing blowout win over MBL: a true team effort!

Distinguished Scholar award

This year's Distinguished Scholar Award was presented to David Goluskin for his academic excellence and dedication to mentoring the next generation of Fellows. Congratulations, David!

David Goluskin (middle) presented with the Distinguished Scholar *award from co-directors Greg Chini (left) and Bruce Sutherland (right).*

Sears Lecture

The 2024 Sears lecture was delivered by J. Brad Marston, from Brown University. This lecture is intended to educate a public audience about the relevance of fluid mechanics in general and GFD in particular to societal issues. In his talk entitled *Fluid Earth: Climate Change and Climate Solutions*, Prof. Marston explored surprising connections between quantum physics and oceanic and atmospheric flow phenomena that directly impact climate. He went on to discuss opportunities–and challenges–in the areas of renewable energy (e.g., floating offshore wind farms) and environmental sustainability (e.g., the chemical direct-air capture of carbon dioxide) that involve novel fluid mechanics.

Sears Lecturer Brad Marston (right) enjoying a glass of wine with Greg Chini (left).

Remembering Keith Julien

Keith Julien passed away of a sudden illness on April 14th, 2024. Keith was a world-renowned applied mathematician of the highest caliber, equally adept at applied analysis of nonlinear PDEs, dynamical systems analysis, numerical analysis and high-performance scientific computing, and physical modeling. He was a prolific researcher and made pioneering contributions to the asymptotically-reduced modeling of turbulent flows subjected to rapid rotation, buoyancy, and magnetic fields, with important applications in both geophysical and astrophysical fluid dynamics. He possessed keen insight, a profound level of personal and professional integrity, and a hearty laugh and smile that warmed all fortunate enough to know him. He was also a force not to be trifled with on the football pitch! Keith left an indelible impact on the GAFD community, including many of the Faculty, staff, and regular visitors to Walsh Cottage. He will be missed immensely.

Keith Julien outside Walsh Cottage.

The WHOI GFD community remembered Keith at Walsh Cottage on Friday June 21. We are grateful to Edgar Knobloch, Steve Tobias, Greg Chini, Beth Wingate, Adrian van Kan and Jon Aurnou who shared their memories of Keith.

We ask that you consider helping Keith's family and, in particular, Keith's son, Theo. Keith's college fund calculations assumed the existence of his continued salary. For completion of Theo's senior year, financial support is needed. Please consider honoring Keith's memory by contributing to Theo's 529 College Invest Fund. You can make your contribution by following the bar code below.

In remembrance of Keith, please support his son, Theo, in his college fund.

Another memorial will take place in Salt Lake City on the Saturday, November 23, just before the APS Division of Fluid Dynamics conference.

The next summer program

The 2025 GFD summer program will start on June 16th, 2025, on the topic of Instabilities and Bifurcations in GFD. The principal lecturers are Laurette Tuckerman (CNRS, ESPCI Paris) and Joseph Pedlosky (WHOI). Please email the program directors, David Goluskin (goluskin@uvic.ca) and Pascale Garaud (pgaraud@soe.ucsc.edu), if you are interested in participating.

The GFD Website

The lectures notes and reports are available online at gfd.whoi.edu. The GFD website also contains:

- lecture and seminar schedules
- electronic versions of proceedings and newsletters
- lists of alumni and visitors
- application materials
- picture galleries of life at GFD
- useful information and links.

The GFD Faculty

The GFD Faculty handles the scientific and administrative duties of the school. This group is made up of members of the scientific community, across several disciplines, united by their interest in GFD. These are the faces to be seen at GFD over future summers, and their research interests help to define the scientific direction and flavor of the Program. The current executive committee of the GFD faculty is composed of Claudia Cenedese, Greg Chini, Pascale Garaud, Stefan Llewellyn Smith, and Bruce Sutherland.

Oliver Buhler *New York University*
Colm-cille Caulfield *University of Cambridge*
Claudia Cenedese *W.H.O.I.*
Eric Chassignet *Florida State University*
Greg Chini *University of New Hampshire*
Megan Davies Wykes *University of Cambridge*
Raffaele Ferrari *M.I.T.*
Glenn Flierl *M.I.T.*
Pascale Garaud *U.C. Santa Cruz*
Renske Gelderloos *Delft University of Technology*
David Goluskin *University of Victoria*
Alexis Kaminski *U.C. Berkeley*
Wanying Kang *M.I.T.*
Stefan Llewellyn Smith *U.C. San Diego*
James McElwaine *W.H.O.I.*
Colin Meyer *Dartmouth College*
Philip Morrison *University of Texas at Austin*
Joseph Pedlosky *W.H.O.I.*
Tiffany Shaw *University of Chicago*
Bruce Sutherland *University of Alberta*
Jean-Luc Thiffeault *University of Wisconsin*
Geoffrey Vallis *University of Exeter*
John Wettlaufer *University of Oxford*
Jack Whitehead *W.H.O.I.*

Contributions

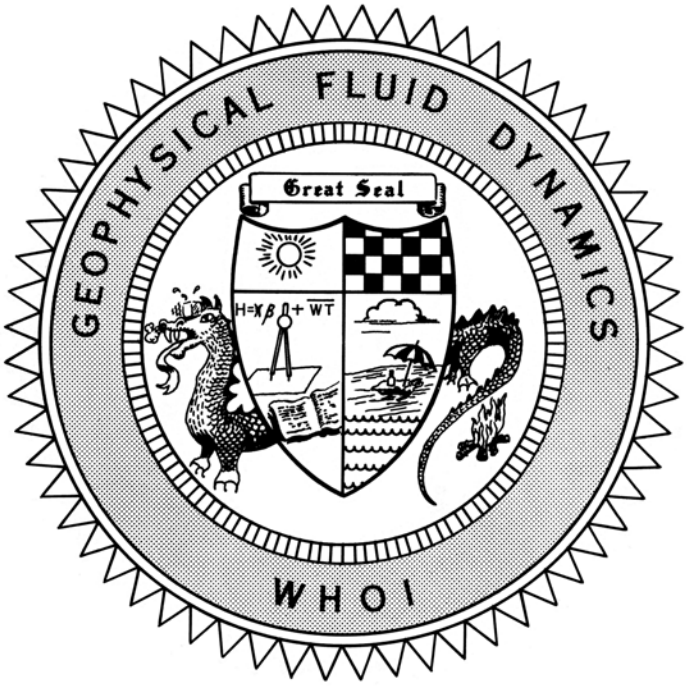
The GFD program has established an endowment fund to help support the program in the future and for a specially funded position intended to help finance the extended visit of a key participant, such as the summer's Principal Lecturer. The fund is administered by WHOI, under the guidance of Claudia Cenedese. If you would like to contribute, please send your check (made payable to WHOI) to

Woods Hole Oceanographic Institution
GFD Fund, MS 40
Woods Hole, MA 02543

Donations can also be made by credit card by calling the Development office at 508-289-4895.

Please send comments or suggestions about this newsletter or the GFD Program to ccenedese@whoi.edu.

The GFD Program is funded by the National Science Foundation.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