



## GFD Newsletter 2022

### Faculty of Walsh College



*The 2022 GFD Photograph*

### *The Structure of the Summer*

Having been rudely interrupted for a couple of years, the GFD program returned to repopulate Walsh Cottage in 2022. Participants had to get over the shock of the Cottage's renovation, featuring extensive air conditioning, a highly strung bean-to-cup coffee machine, and actually comfortable office chairs. Fortunately, although there were a few Covid cases in participants through the summer, there was no transmission at the Cottage. Throughout the summer the Cottage (and its porch) was once again a hive of activity, with traditional lively discussion and debate about geophysical fluid dynamics not being suppressed in the slightest in the seminar room by the precautionary mask-wearing policy.

*Data-Driven GFD* was the theme at the 2022 Program, and Professors Peter Schmid (PSE, KAUST) and Laure Zanna (Courant Institute, NYU) were the principal lecturers. In a tag-team tour-de-force they introduced the audience to an impressive range of data-driven techniques to gain real insight into underlying sampled physical systems, including of course our changing climate. They both continued the tradition of expanding on the lectures with the fellows over lunch,

and Peter exploited remote working technologies to remain deeply involved with several fellows' projects, and even returned for the fellows' presentations at the end of the summer.

At the beginning of August, Heidi Nepf (MIT) gave a fascinating and well-received Sears Lecture on "Coastal Vegetation and Coastal Flows: Restoration, Climate Mitigation and Adaptation". Stefan Llewellyn Smith and Colm-cille Caulfield co-directed the summer, with Stefan doing most of the heavy lifting as Colm-cille was often distracted from his GFD duties, even though there wasn't even a Men's Soccer World Cup on. A good number of long-term staff members still ensured that the fellows never lacked for guidance, in science and softball, though the Dynamos were distinguished more for enthusiasm and team spirit than clutch hitting...or fielding...

Anders Jensen worked his usual magic in the Lab, dealing inventively with ever expanding gel balls and (still) recalcitrant coastal plumes with typical good humour, and Janet Fields and Julie Hildebrandt smoothly ran the program as always, not least making sure that there were fresh masks for the forgetful!



*The principal lecturers: aka the dynamic duo of data*



*GFD Dynamos Rookies of 2022: Winless but Willing*



*And then my eigenvalue shot off to infinity...*

## *Fellows' Reports*

Ruth Moorman, California Institute of Technology  
*Continental Shelf Waves around a Pseudo-Iceland*

Tilly Woods, University of Oxford  
*Fun with Squishy Balls: Theory and Experiments on Deformable Porous Media*

Claire Valva, New York University  
*Understanding Invariant Solutions of the Korteweg-de Vries Equation*

Rui Yang, University of Twente  
*Equatorial Ocean Dynamics on Enceladus Driven by Ice Topography*

Iury Simoes-Sousa, U. Massachusetts Dartmouth  
*Stochasticity of Turbulence*

Ludovico Giorgini, Stockholm University  
*Statistical Analysis of Multidimensional Dynamical Systems*

Sam Lewin, University of Cambridge  
*Experiments on the Instability of Buoyancy-driven Coastal Currents*

Kasturi Shah, Massachusetts Institute of Technology  
*Scaling with the Stars: Emergence of Self-organised Criticality in Low Péclet Flows*



*Squishy splats from Balmforth's blaster*

## *Schedule of Principal Lectures*

*June 21 (PS): Review of Data-decomposition Based on Linear Algebra*

*June 22 (LZ): Spatio-temporal Decomposition of Time Series*

*June 23 (PS): Transfer Operator for Data Analysis (part 1)*

*June 24 (PS): Transfer Operator for Data Analysis (part 2)*

*June 27 (LZ): Forced Response from Climate Statistics*

*June 27 (PS): Uncertainty, Outliers, Predictability*

*June 28 (LZ): Bayesian and Markovian Approaches to Data Analysis*

*June 29 (LZ): Discovering Equations and Operators from Data*

*June 30 (PS): Advanced Approaches in Signal Processing*

*July 1 (LZ): Advanced Approaches in ML for Physics*



*Fellows new and old(er) plugged in on the porch*





*Elizabeth doesn't buy what Peter and Jason are selling*



*Team Triathlon: GFD's First (R) and Third (L)*



*Mattia faces the masked music after his seminar*



*Sam explains baroclinic instability to Joe P...*

**2022 Sears Public Lecture**  
Geophysical Fluid Dynamics Program

Thursday, August 3, 2:00 pm  
Redfield Auditorium, WHOI  
Reception to follow on lawn

**Professor Heidi Nepf**  
MIT



**Coastal Vegetation and Coastal Flows:  
Restoration, Climate Mitigation & Adaptation**

Coastal vegetation, such as seagrass and salt marsh, provide ecosystem services, including coastal protection and carbon sequestration. Because of this, coastal vegetation is considered an integral part of climate mitigation and adaptation. After introducing the important role of vegetation in coastal systems, Prof. Nepf will present an overview of work done in her lab that describes the interaction of coastal vegetation with waves and currents, and the impact of this on sediment transport. New insights inform coastal restoration.



*Heidi Nepf's super Sears Lecture on swaying seagrass*



*Old age and treachery beat youth and exuberance*



## 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.

Neil Balmforth *University of British Columbia*  
 Oliver Buhler *New York University*  
 Colm-cille Caulfield *University of Cambridge*  
 Claudia Cenedese *W. H. O. I.*  
 Eric Chassignet *University of Miami*  
 Gregory Chini *University of New Hampshire*  
 Glenn Flierl *M. I. T.*  
 Pascale Garaud *U.C. Santa Cruz*  
 David Goluskin *University of Victoria*  
 Karl Helfrich *W. H. O. I.*  
 Alexis Kaminski *University of California, Berkeley*  
 Richard Kerswell *University of Cambridge*  
 Norman Lebovitz *University of Chicago*  
 Stefan Llewellyn Smith *U. C. San Diego*  
 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*  
 Mary-Louise Timmermans *Yale University*  
 John Wettlaufer *Yale University*  
 John Whitehead *W. H. O. I.*  
 Megan Davies Wykes *University of Cambridge*



*Gone, but not forgotten*

## The GFD Website

The lecture notes and reports will eventually be available online at [gfd.whoi.edu](http://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.

## 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. 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 to [cpc12@cam.ac.uk](mailto:cpc12@cam.ac.uk) or [sgls@ucsd.edu](mailto:sgls@ucsd.edu). The GFD Program is funded by the National Science Foundation.



*Data-driven directing*