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.
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

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
Elizabeth doesn’t buy what Peter and Jason are selling

Mattia faces the masked music after his seminar

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

Sam explains baroclinic instability to Joe P...

Old age and treachery beat youth and exuberance

Heidi Nepf’s super Sears Lecture on swaying seagrass
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

The GFD Website

The lecture notes and reports will eventually be 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.

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 or sgls@ucsd.edu. The GFD Program is funded by the National Science Foundation.

Gone, but not forgotten

Data-driven directing