

GFD Newsletter 2023

Faculty of Walsh College



The 2023 GFD Photograph

Summer Lectures

The 2023 Geophysical Fluid Dynamics Summer Study Program started on June 20th and the topic this year was *GFD on other worlds*. The principal lectures were given by Professors Heather Knutson (Caltech) and Geoff Vallis (University of Exeter). Heather's lectures described what we can find out about GFD on other worlds from observations of extrasolar planets, and reminded everyone of the power of well-designed blackboard talks in engaging their audience. Geoff's lectures covered a number of 'hot' theoretical topics on the atmospheric dynamics of our solar system planets as well as giant and terrestrial exoplanets. We also had two tutorials: a fun "DYNAMics" demonstration of properties and instabilities of rotating fluids by Jon Aurnou (UCLA) and the now yearly "Dedalus tutorial" by Keaton Burns (MIT).

Pascale Garaud (UC Santa Cruz) and Tiffany Shaw (University of Chicago) were co-directors. They welcomed many long- and short-term visitors, and the atmosphere at Walsh Cottage was finally back to its pre-COVID self. Almost all of the long-term visitors were able to advise fellows, either individually, or in group. Some faculty managed to participate in many projects at a time!

As usual, laboratory experiments were facilitated by able support from Anders Jensen. Janet Fields and Julie Hildebrandt made sure that the administrative side of the summer ran smoothly. We continue to be indebted to W.H.O.I. Academic Programs Office, who once more provided a perfect atmosphere.

Schedule of Principal Lectures

Tuesday, June 20: *Exoplanet Demographics (HK)*

Wednesday, June 21: *Techniques for Characterization, Bulk and Atmospheric Compositions (HK)*

Thursday, June 22: *Terrestrial Planets: Atmospheric Structure and Circulation (GV)*

Friday, June 23: *Circulation of Tidally-locked Planets (GV); Observations of Atmospheric Circulation on Short-period Gas Giants (HK)*

Monday, June 26: *Cold Giant Planets; Jets, Deep Convection and Shallow Weather (GV); DYNAMICS, (Jon Aurnou)*

Tuesday, June 27: *Atmospheric Characterization of Young, Hot Gas Giant Planets and Brown Dwarfs (HK)*

Wednesday, June 28: *Atmospheric Characterization of Terrestrial Planets (HK); Dedalus (Keaton Burns)*

Thursday, June 29: *Icy Moons and Exo-oceans (GV)*

Friday, June 30: *Effects of Condensibles: Steam Atmospheres and Runaway Greenhouse (GV)*

HK = Heather Knutson; GV = Geoff Vallis



Fun with rotating fluids with DIYNamics.



Heather Knutson



Geoff Vallis

Fellows' Projects

As always, the focus for the faculty is the guidance of the GFD Fellows through their summer research projects. The fellows are strongly encouraged to work in areas unrelated to their PhD thesis topics and to engage with as many of the faculty and visitors as possible. The reward for all involved is the final week of the summer when the fellows give lectures on their projects, which are as widely varied as the fellows' backgrounds.



The fellows and the directors

Nathan Magnan, University of Cambridge
Convection in the Ice Shells of Icy Moons

Yifeng Mao, University of Colorado Boulder
Chemical Transport by Waves in Stars

Hao Fu, Stanford University
Boiling Stratified Flow: A Lab Analog of Quasi-equilibrium Moist Convection

Quentin Nicolas, University of California Berkeley
Simple Models of Superrotation in Planetary Atmospheres

Arefe Ghazi Nezami, University of Texas Austin
Stratified turbulence: a black hole for internal waves?

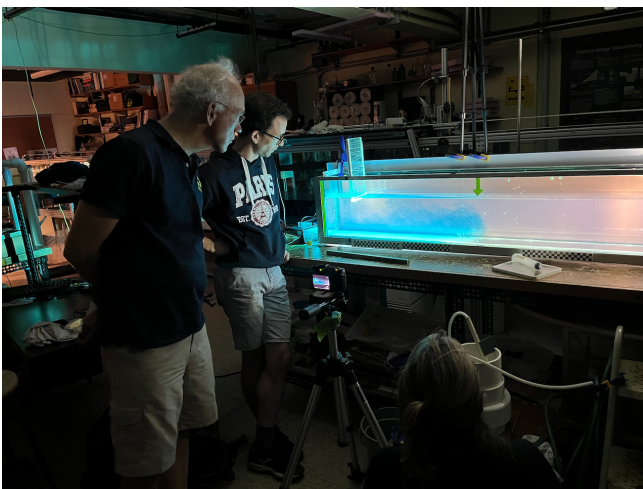
Quentin Kriaa, Aix-Marseille Universite
Transport of Microplastics in Turbidity Currents

Nimrod Gavriel, Weizmann Institute of Science
Can AI-based Climate Models Learn Rare, Extreme Weather Events?

Ellie Ong, University of New South Wales
Asymmetries in Formation of Gulf Stream Warm Core Rings and Filaments

Yaoxuan Zeng, University of Chicago
Jets on Gas Giants – A Tale of Two Forcings

Deborah Cotton, University of Oxford
Into the Mix: How Biological Dynamics Affect Turbulent Transport



*Left: Quentin Kriaa showing Detlef Lohse his experiments on microplastic transport.
Right: Arefe Ghazi Nezami working with her advisors, Daniel Lecoanet and Alexis Kaminski.*



Left: Yearly Women of GFD lunch. Right: Fellows lunch with the speaker.

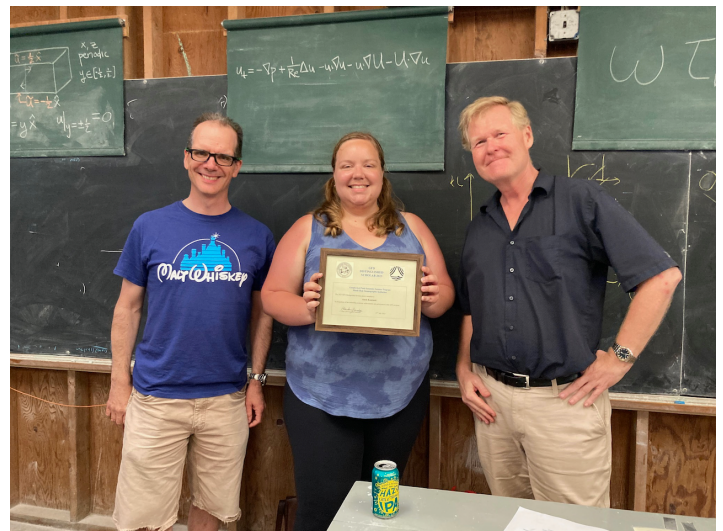


Daytime porch and night-time porch

The Distinguished Scholar award

This year's Distinguished Scholar Award was presented to Alexis Kaminski, for her academic excellence and dedication to mentoring the next generation of fellows. Congratulations Alexis!

Alexis Kaminski (middle) receiving her award from awards night hosts Colm-cille Caulfield (left) and Bruce Sutherland (right)



Softball Report

When it emerged at the “*Introduction to softball*” lecture that this year’s fellows had a combined experience of one hour of softball between them, we knew that league matches would prove to be quite challenging to win. Nevertheless, each fellow managed to make contact with the ball in the first practice (some taking more attempts than others), with the occasional hit even scraping into the outfield, so confidence was high for the first match against biology. Sadly, while we had hoped for close match, that ended up being far from the case. However, the beer and post-match swim ended the day with spirits still high.

Throughout the rest of the season various new tactics were employed to maintain some level of competitive dignity in each match, including attempting to stop the ball with one’s nose, inviting children under 10 to be our lead scorers and hitting the ball straight to the fielders in an attempt to confuse the opposing team. Unfortunately, although these unconventional tactics occasionally proved to be fruitful, the resulting final score differential for each match did not improve. Such was the caliber of this year’s group of fellows that the radical decision was made to replace the staff vs. fellows game by a volleyball match.

The inaugural volleyball match took place at Claudia’s, and was a closely fought competition with the staff just scraping a win. With Jim’s giant backyard swing and zip line, pizza for all afterwards and lots of tears as people said goodbye for the last time, it was a lovely way to end GFD 2023.



The staff vs. fellows volleyball game.

The Sears Public Lecture

The 2023 Sears Public Lecture was delivered by Professor Sara Seager, of the Massachusetts Institute of Technology, on “Planetary Atmospheres, and the search for signs of life beyond Earth”. Sara’s talk explained how eclipses in exoplanetary systems can be used to detect the presence of certain chemical elements in the planet’s atmosphere, and how finding specific chemical species can reveal the presence of life, in exoplanets, but also tantalizingly closer to home in our own solar system planets.

Next summer program

The 2024 GFD summer program will start on June 17th, 2024, on the topic of *Multiscale GFD*. The principal lecturers are Keith Julien (CU Boulder) and Basile Gallet (CEA Saclay). Please email the program directors, Greg Chini (greg.chini@unh.edu) and Bruce Sutherland (bruce.sutherland@ualberta.ca), if you are interested in participating.

The GFD Website

The lectures notes and reports are available online at gfd.whoj.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

The GFD Faculty

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*
 Raffaele Ferrari, *M. I. T.*
 Glenn Flierl, *M. I. T.*
 Pascale Garaud, *U.C. Santa Cruz*
 Renske Gelderloos, *Johns Hopkins University*
 David Goluskin, *University of Victoria*
 Alexis Kaminski, *U.C. Berkeley*
 Stefan Llewellyn Smith, *U. C. San Diego*
 James McElwaine, *University of Durham*
 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*
 John Wettlaufer, *University of Oxford*
 Jack Whitehead, *W. H. O. I.*
 Megan Davies Wykes, *University of Cambridge*

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 varied 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.

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 a Principal Lecturer, or a long-term stays by junior members of the scientific community. The fund is administered at 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 thanks the National Science Foundation for many years of financial support. The Woods Hole Oceanographic Institution also provides support, including the use of the historic Walsh Cottage.