



## GFD Newsletter 2015

### Faculty of Walsh College



*The 2015 GFD Photograph.*

typically fortunate to experience in Walsh Cottage. Importantly, some of the newer staff ably jumped into the supervision of fellows projects—directly or indirectly.

Support from Anders Jensen in the laboratory was appreciated, particularly as the going with some sensors got tough. Annie Doucette, Janet Fields and Julie Hildebrandt formed the administrative team that ensured the program ran with admirable efficiency. We continue to be indebted to *WHOI*–Academic Programs Office, who continue to provide an ideal atmosphere.

### *Louis Norberg Howard*



### *The Summer Summary*

*Stochastic Processes in Atmospheric & Oceanic Dynamics* was the theme at the 2015 GFD Program. Professors Charlie Doering (University of Michigan) and Henk Dijkstra (University of Utrecht) were the principal lecturers. Their lectures were collectively two-pronged. The first prong was launched by Charlie, who laid down the mathematical foundations of random variables, stochastic processes and the nature and analysis of stochastic differential equations. In the second, Henk took us through the many places in the Atmosphere, Ocean and Climate system where the infrastructure from the first prong manifest themselves.

John Wettlaufer and Oliver Bühler were the stochastic co-directors. In keeping with the theme, the Cottage was in constant motion with many visitors and long-term staff members. Following the thematic principal lectures, the seminar room was busy all summer, with talks spanning an impressive range of topics that we are

The passing of Louis Howard, who impacted the program in countless ways, marked the summer in a different manner. On 13 August a memorial for Louis at Carriage House was organized by George Veronis. Those of us who were fortunate to attend were emboldened by the many and varied stories shared by the participants. He will be deeply missed. A detailed obituary is found at the following link: <https://math.mit.edu/about/history/obituaries/howard.php>



*Principal Lecturer Week 1: Charlie Doering*



*Principal Lecturer Week 2: Henk Dijkstra*

**Fellows Research:** The nature of the interaction between fellows and staff is such that they are always free to engage in any topical material that they find compelling as the basis for their project. As an illustration of the enthusiasm that the first two weeks infused upon the fellows and staff for stochastic processes, seven of the ten fellows projects had stochasticity as a central theme. On the other hand, it could have also been the superb BBQs hosted by Charlie and Paula!?

## *Schedule of Principal Lectures*

Monday, June 15: *Stochastic processes, Markov processes and the Wiener process*

Tuesday, June 16: *Gaussian white noise and Itô stochastic differential equations*

Wednesday, June 17: *Fokker-Planck equations, the Ornstein-Uhlenbeck process and a stochastic-logistic process*

Thursday, June 18: *Kolmogorov backward equations and the exit time (O. Bühler substitute!)*

Friday, June 19: *Stratonovich stochastic differential equations*

Monday, June 22: *Midlatitude sea surface temperature variability*

Tuesday, June 23: *El Niño variability: deterministic theory*

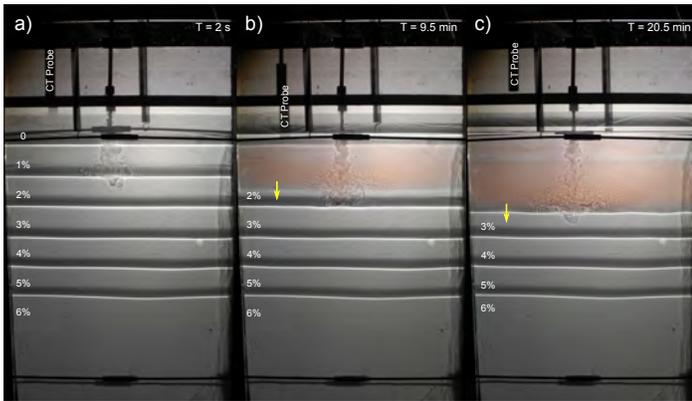
Wednesday, June 24: *El Niño variability: stochastic theory*

Thursday, June 25: *The Dansgaard-Oeschger events*

Friday, June 26: *Variability of the wind-driven ocean circulation*



*The Fellows. Top Row (L-R): Andre Souza, Chris Spalding, Florence Marcotte, Tom Beucler, Anna Fitz-Maurice. Bottom Row (L-R): Tom Eaves, Gunnar Peng, Giovanni Fantuzzi, Cesar Rocha, Yana Bebieva*



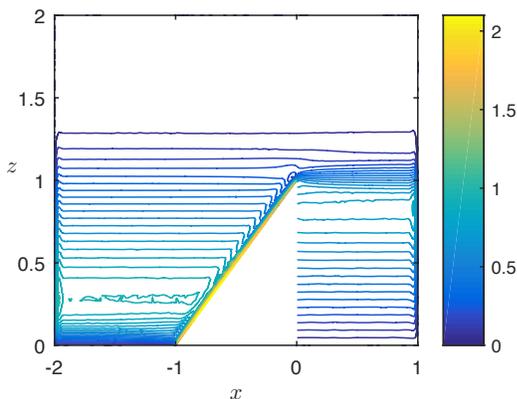
*Yana Babieva's Experiment: Plumes migrating through stably stratified interfaces*



*Anna and Florence teaching the staff in week 10.*



*David Goluskin fearlessly takes to uncharted waters—with Brian Von Herzen's boat!*



*Gunnar's Diffusion Fish swims behind ... but in which direction does it swim?*

## *Fellows' Projects & Presentations*

Gunnar Peng, University of Cambridge

*The diffusion fish*

Tom Eaves, University of Cambridge

*Noisy homoclinic pulse dynamics: back to the origin*

Andre Souza, University of Michigan

*Instantons in the presence of chaos: is noise really your friend?*

Giovanni Fantuzzi, Imperial College London

*Bounds for deterministic and stochastic dynamical systems using sum-of-squares programming*

Tom Beucler, Massachusetts Institute of Technology

*Large-scale advection, condensation and diffusion of water vapor*

Cesar Rocha, University of California, San Diego

*Scaling Ocean Stratification: coupled asymptotic model equations for strongly stratified flows*

Chris Spalding, California Institute of Technology

*The most catastrophic catastrophe: Population dynamics under random extreme events*

Yana Babieva, Yale University

*Punctuated plume penetration: Entrainment dynamics of the layered filling box*

Florence Marcotte, Inst. Physique du Globe de Paris

*Fast cooling of a hot disc*

Anna FitzMaurice, Princeton University

*A stochastic approach to examining the predictability of Arctic sea ice*



*The conquering of Nobska.*



*A hierarchy of well-oiled infield play and a crushing at bat*

## *Softball Report*

The GFD Dynamos had an unusual year in 2015. We won three games outright and outscored a fourth team but paid a penalty for scoring too many runs in one inning. The penalty cost us the win. GFD is not known for scoring many runs or even scoring more than one win, but this year we had three experienced alumni fellows return to the program for the whole summer and they provided excellent help in all of the games. Normally, all of the fellows play and seldom do we have returning talent, and given the fact that practically none

of the fellows ever is an avid player, we seldom have an experienced team. But this summer was an exception and we were able to come out on top for half of the season. In the last game with fellows against staff the staff prevailed. That is not a foregone conclusion, because by the end of each summer even a team that had little experience at the outset normally develops into a coherent team, often one that can compete effectively against an aging staff team. The score between the fellows and staff this year was 19 to 13.

## *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  
 Bühler *New York University*  
 Colm-cille Caulfield *University of Cambridge*  
 Claudia Cenedese *WHOI*  
 Eric Chassignet *Florida State University*  
 Charles Doering *University of Michigan*  
 Glenn Flierl *MIT*  
 Pascale Garaud *U.C. Santa Cruz*  
 Karl Helfrich *WHOI*  
 Maranda Holmes-Cerfon *New York University*  
 Joseph B. Keller *Stanford University*  
 Norman Lebovitz *University of Chicago*  
 Stefan Llewellyn Smith *UC San Diego*  
 Willem Malkus *MIT*  
 Philip Morrison *University of Texas at Austin*  
 Joseph Pedlosky *WHOI*  
 Antonello Provenzale *ISAC-CNR, Torino*  
 Tiffany Shaw *University of Chicago*  
 Edward Spiegel *Columbia University*  
 Jean-Luc Thiffeault *University of Wisconsin*  
 George Veronis *Yale University*  
 John Wettlaufer *Yale University & Nordita*  
 Jack Whitehead *WHOI*

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](mailto:ccenedese@whoi.edu).

The GFD Program is funded by the National Science Foundation and the Office of Naval Research.

## The Sears Public Lecture

The 2015 GFD Public Lecture was given by Susan Solomon (MIT), who took us through a fascinating success story of how science impacted policy and eventually the global economy in her talk “Ozone Depletion: A Science and Policy Success Story”. As a key player in the *Ozone Hole Saga*, Susan’s talk drew a large and engaged audience to Redfield Auditorium.

**2015 Sears Public Lecture**  
Geophysical Fluid Dynamics Program

*Professor Susan Solomon*  
Massachusetts Institute of Technology

Tuesday, June 30<sup>th</sup>, 5:00 pm  
Redfield Auditorium, W.H.O.I.  
Reception to follow



**“Ozone Depletion:  
A Science and Policy Success Story”**

This talk describes how the combination of science, public policy, technological advances, and the engagement of citizens led to solutions for the risk to the Earth's ozone layer. This remarkable combination holds many interesting lessons for dealing effectively with current environmental challenges.




## Parting shots...



*Some advantages of the cape...*

Joseph V. McKee Ballfield									
Team	1	2	3	4	5	6	7	8	Total
G.F.D.	3	5	2	0	1	1	1		
G & G	0	0	0	3	0	1	0		



*Just saying...*

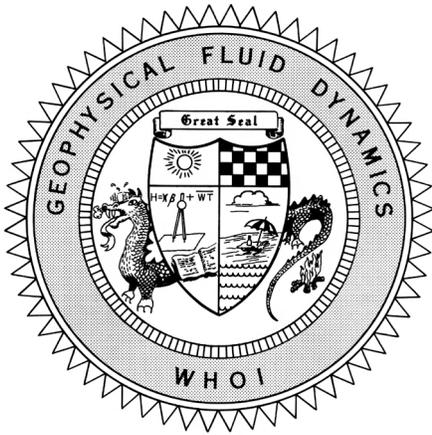
## The GFD Website

The lectures notes and reports are 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, under the guidance of George Veronis. If you would like to contribute, please send your check (made payable to WHOI) to



# Fellowships in Geophysical Fluid Dynamics

at  
Woods Hole Oceanographic Institution

*June 20 to August 26, 2016*

Since 1959 the GFD program has promoted an exchange of ideas among researchers in the many distinct fields that share a common interest in the nonlinear dynamics of fluid flows in oceanography, meteorology, geophysics, astrophysics, applied mathematics, engineering and physics. Each year, the program is organized around a ten-week course of study and research for a small group of competitively selected graduate-student fellows. The overall philosophy is to bring together researchers from a variety of backgrounds to provide a vigorous discussion of concepts that span different disciplines, and thereby to create an intense research experience. For the student fellows, the centerpiece of the program is a research project, pursued under the supervision of the staff. At the end of the program, each fellow presents a lecture and a written report for the GFD proceedings volume. Over its history, the GFD Program has produced numerous alumni, many of whom are prominent scientists at universities throughout the world. The interdisciplinary atmosphere of the Program is the ideal place for young scientists to learn the habits of broad inquiry, of speaking to others with very different backgrounds and viewpoints, and of seeking answers in unfamiliar places.

The Program commences with two weeks of Principal Lectures focusing on a particular theme in GFD. For 2016, the theme is "**Fluid-Structure Interaction in the Living Environment**", and the lecturers will be **Michael Shelley** (New York University) and **Anette (Peko) Hosoi** (MIT).

Up to ten competitive fellowships are available for graduate students. Successful applicants will receive stipends of \$6,284 and an allowance for travel expenses within the United States. A small number of unpaid fellowships may also be available for strongly qualified students who can support themselves financially. Fellows are expected to be in residence for the full ten weeks of the program. The application deadline is February 15, 2016. Awards will be announced by April 1, 2016. We seek applicants from all areas of Geophysical Fluid Dynamics, and particularly encourage applications from women and members of underrepresented groups. Further information and application forms may be obtained at <http://gfd.who.edu>, or by writing to: [gfd@who.edu](mailto:gfd@who.edu)

*Prospective visitors should contact Neil Balmforth at [njb@math.ubc.ca](mailto:njb@math.ubc.ca),  
or Colm-cille Caulfield at [cpc12@cam.ac.uk](mailto:cpc12@cam.ac.uk)*

WHOI is an Equal Employment Opportunity/Affirmative Action Organization  
The GFD Program is funded by the National Science Foundation and the Office of Naval Research