GRADUATE PROGRAM IN GEOPHYSICAL FLUID DYNAMICS

ADMINISTERED BY THE DEPARTMENT OF SCIENTIFIC COMPUTING AND THE GEOPHYSICAL FLUID DYNAMICS INSTITUTE (GFDI)

COLLEGE OF ARTS AND SCIENCES

Website: *http://www.gfdi.fsu.edu/*

Program Director: Kevin Speer; **Coordinating Committee:** Speer (EOAS/Oceanography); Dewar (EOAS/Oceanography); Moore (Mathematics); Hoeflich (Physics); **Professors:** Bourassa, Cai (EOAS/Meteorology); Chicken (Statistics); Elsner (Geography); Hoeflich (Physics); Musslimani, Sussman, Wang (Mathematics); Clarke, Dewar, Huettel, Speer (EOAS/Oceanography); Chen, Tawfiq (Civil and Environmental Engineering); Gunzburger (Scientific Computing); Ye (EOAS/Geological Sciences); **Associate Professors:** Sura (EOAS/Meteorology); **Assistant Professors:** Collins (Physics); Aseel, Lee, Moore (Mathematics); Quaife (Scientific Computing); Tang (Civil and Environmental Engineering); Yaghoobian (Mechanical Engineering); **Associates Emeritus:** Pfeffer (EOAS/Meteorology); Barcilon, R. Krishnamurti (EOAS/Oceanography); **Research Affiliate:** Goodrick (U.S. Forest Service)

The Geophysical Fluid Dynamics (GFD) Program leads to a degree in Computational Sciences with a major in either GFD or Fire Dynamics. It is an interdisciplinary field of study whose primary goal is an improvement in our basic understanding of fluid flows that occur naturally, including such diverse topics as climate and paleoclimate, biogeochemical processes, hydrology and Karst dynamics, air-sea interaction, wild fire dynamics, double diffusive processes, and hurricane dynamics with strong links to the Applied Mathematics Program. The approach to this understanding is through quantitative analysis of observational records and theoretical, mathematical, numerical, and experimenting modeling. A geophysical fluid dynamicist must have a firm grasp of the fundamental principles of classical physics, knowledge of the techniques of applied mathematics, and an interest in the natural sciences. It follows that the course of study leading to a degree in geophysical fluid dynamics is a rewarding one in which the student gains an overview of the geophysical sciences not available from study in a single discipline.

The interdepartmental graduate program of study leads to the Doctor of Philosophy (PhD) degree; there is no master's degree offered. The program is administered by the Geophysical Fluid Dynamics Institute and has its own separate degree requirements. It differs from the regular departmental offerings in the earth sciences mainly by its interdisciplinary approach and emphasis on the fundamentals of mathematics, physics, and fluid dynamics, with less emphasis on descriptive material from any one discipline.

A major factor in the success of this PhD program is the strong support provided by the Departments of Earth, Ocean and Atmospheric Science (EOAS), Mathematics, Physics, Scientific Computing, and Statistics, and the College of Engineering. In particular, these departments offer a wide range of courses from which the student in geophysical fluid dynamics constructs an individualized curriculum. Faculty members of various departments who have an active research interest in geophysical fluid dynamics form the heart of the program by serving as advisors and instructors for the students in the program.

Facilities are situated in the **Geophysical Fluid Dynamics Institute**, whose primary function is to support and foster those theoretical, experimental, numerical, and observational studies of natural environmental fluid flows that transcend the traditional departmental disciplines.

These facilities include a large modern laboratory for hydrodynamics experiments, a colloquium room and reading room (furnished with books and periodicals in fluid dynamics, classical physics, applied mathematics, geophysical sciences, and astrophysical sciences), a photographic and illustrations laboratory, a large modern machine shop, a precision instrument-makers laboratory, and faculty and student offices. Institute facilities also include several precision rotating turntables, a six-meter water channel, convection tanks, temperature controlling systems, general and digital photographic systems, multi-channel data acquisition systems, laser facilities, various machine tools, and other electronic equipment. The institute houses a facility for measuring ocean turbulence as well.

COLLEGE REQUIREMENTS

Please review all college-wide degree requirements summarized in the "College of Arts and Sciences" chapter of this *Graduate Bulletin*.

ADMISSION REQUIREMENTS

Students may apply to the program through the Department of Scientific Computing or through Geophysical Fluid Dynamics Institute. Students are accepted into the program on the basis of their academic record in science and mathematics, their Graduate Record Examinations (GRE) and/or Test of English as a Foreign Language (TOEFL) score, and their letters of recommendation. To be admitted, students must have achieved a "B" average in the science and mathematics portions of their baccalaureate degree work (or any graduate degree work they may have taken) and achieved a GRE score at the 50th percentile or better on the verbal section and on the quantitative section. Students expecting to receive financial assistance (see below) will need a significantly higher GRE score. Foreign nationals are expected to have a score of 80 or better on the Internet-based TOEFL, 6.5 on the IELTS examination, or 77 on the MELAB examination.

The well-prepared student will have a strong background in mathematics and physics. The program director may, in some cases, admit students lacking formal credit in some areas, provided the deficiencies are overcome by subsequent coursework or study at Florida State University.

COMPLETION

The program of study for students is individually tailored to meet their particular needs and interests. The formal requirements are few and include completion of coursework from several different departments with a grade of "B" or better, participation in a seminar at least two times, mastery of modern computer techniques, particularly numerical analysis and the two Common Core Courses: Scientific Programming (ISC 5305) and Applied Computational Science-1 (ISC 5315) is the common core for all students. The remainder of the curriculum is chosen by the advisory committee in consultation with the student based upon the student's program of study. There is no foreign language requirement. The remainder of the curriculum is normally chosen from among courses offered by several departments. Typically, students, in consultation with their advisory committee, will choose from among the following areas.

ENGINEERING

Topics include: viscous fluid flows, turbulent flows, introduction to computational mechanics, water resources and environmental engineering, hydraulics, hydrology, and ground water.

Courses include: EGM 5810, 6845; ENV 5045.

GEOLOGICAL SCIENCES

Topics include: geophysics, geomechanics, geophysical methods, seismology, modeling of groundwater flow, hydrology.

Courses include: GLY 4451, 5425, 5455, 5465, 5556, 5573, 5575, 5825, 5826, 5827.

MATHEMATICS

Topics include: numerical analysis, vector and tensor analysis, ordinary and partial differential equations, matrix algebra, integral transforms and asymptotics, perturbation theory, hydrodynamic stability, wave propagation theory.

Courses include: MAA 4402; MAD 5738, 5739, 6408r; MAP 5207, 5217, 5345, 5346, 5423, 5431, 5441, 5513, 6434r, 6437r, 6939r.

METEOROLOGY

Topics include: atmospheric thermodynamics, atmospheric dynamics, large-scale atmospheric circulations, advanced topics in climatology, dynamical weather prediction, air/sea interaction, radiative transfer, satellite oceanography.

Courses include: MET 5311, 5312, 5340r, 5471, 5541r, 6308r, 6561r.

OCEANOGRAPHY

Topics include: ocean waves, stability of geophysical fluid flows, ocean dynamics and circulation, coastal ocean dynamics, main ocean thermocline, turbulence.

Courses include: OCP 5056, 5271, 5285, 5551, 5939r.

PHYSICS

Topics include: intermediate modern physics, principles of thermodynamics, mechanics, electricity and magnetism, theoretical dynamics, electrodynamics, radiative processes and transport in astrophysics (special topics in physics), statistical mechanics.

Courses include: PHY 3101, 4222, 4513, 4936, 5246, 5346, 5347, 5524.

SCIENTIFIC COMPUTING

Topics include: introduction to scientific programming, applied computational sciences I and II, numerical methods for earth and environmental sciences, applied ground water modeling.

Courses include: ISC 5305, 5315, 5226, 5236

STATISTICS

Topics include: computational methods in statistics, introduction to applied statistics, statistics in applications I, distribution theory and inference, statistical inference, nonparametric statistics, multivariate analysis, applied time series analysis.

Courses include: STA 5106, 5126, 5166, 5326, 5327, 5507, 5707, 5856

Note: Descriptions of these courses can be found under the departmental listings.

GERMAN LANGUAGE, LITERATURE IN TRANSLATION:
SEE MODERN LANGUAGES AND LINGUISTICS

GERONTOLOGY:
SEE AGING AND PUBLIC POLICY, THE PEPPER INSTITUTE ON; URBAN AND REGIONAL PLANNING

GREEK LANGUAGE, LITERATURE: WRITINGS:
SEE CLASSICS

GROWTH MANAGEMENT AND COMPREHENSIVE PLANNING:
SEE URBAN AND REGIONAL PLANNING

GUIDANCE AND COUNSELING:
SEE EDUCATIONAL PSYCHOLOGY AND LEARNING SYSTEMS

HEALTH AND AGING, PLANNING AND POLICY IN:
SEE URBAN AND REGIONAL PLANNING

HEALTH EDUCATION:
SEE TEACHER EDUCATION