

## DEPARTMENT OF EARTH, OCEAN AND ATMOSPHERIC SCIENCE

### STRATEGIC PLAN

#### Preamble

The new Department of Earth, Ocean, and Atmospheric Science (EOAS) combines the previous Departments of Geology, Oceanography, and Meteorology. With this merger, completed in 2010, Florida State University seeks to enhance teaching and research across disciplines concerned with our planet.

Central tasks of EOAS are to offer excellent education in earth, ocean and atmospheric science, to contribute to scientific knowledge by conducting world-class research, and to be a source of information for the public and decision makers. The new department expands its efforts in classroom education by offering undergraduate degrees in environmental sciences with a strong interdisciplinary core.

In order to offer the best education, we emphasize that faculty personally teach and mentor students, thereby maintaining closest contact between faculty and students. EOAS faculty are resolute in the belief that their science plays an essential role in the life of the University and the education of tomorrow's leaders. They are committed to expanding and strengthening that role. EOAS faculty are also committed to offering students rigorous field-camps, research cruises, and internships; experiences that are essential to a rounded education. EOAS retains excellence in its established areas of research with vigorous recruitment of highly qualified graduate students and faculty.

The merged EOAS department recognizes an opportunity for fresh thinking and creative collaboration. For example, EOAS faculty foresee exciting new thrust in increasingly important systems approach reflecting that earth, ocean and atmosphere processes are coupled. The EOAS faculty is well positioned for broadly competitive funding and for developing research centers focused on emerging issues, thereby supporting the University's strategic goals.

The Department will continue with the University to offer the public beyond its campus rigorous scholarship on matters of immediate social concern. Finding solutions for a sustainable future requires fluency in complex issues and objective reasoning based on the latest research results. In the coming decades, EOAS will serve the state, nation and world by graduating highly competent professionals who will play crucial roles in this vital effort. Its faculty will provide scientific leadership by securing funding for cutting-edge research and publishing enduring scientific results, and teaching and mentoring students through innovative courses and research experience.

This strategic plan shows how the strength of EOAS will be enhanced by combining the proficiencies of its individual curricular branches. A plan of action lists specific initiatives designed to achieve our goals. Regular assessment of progress on these initiatives will ensure that EOAS succeeds as a combined department and becomes a world leader in the field.

## EOAS Elements

### Vision

Recognized international leadership in earth, ocean and atmospheric science education and research.

### Motto

The Environment and the Earth System

### Mission

- Embody high quality, innovative education that prepares, challenges, and inspires students to shape the future of earth sciences
- Be an international leader through excellence in scholarly research.
- Provide information to the public and decision makers, and increase public understanding of our science.

### Core values

The department is guided by these core values.

- Excellence
- Educational leadership
- Scholarship
- Fairness
- Diversity
- Academic freedom
- Integrity
- Responsibility
- Collegiality

## EOAS Proficiency in Research

*The Earth systems are transforming rapidly. EOAS uses a holistic approach to understand these changes and to predict their impact.*

Research in the interdisciplinary Earth Ocean and Atmospheric Sciences Department at FSU focuses on the physical, dynamic, chemical, and biological processes in the crust and surface of earth, the hydrosphere, and the atmosphere. The combined Earth system of these components provides humankind with environmental services that are essential to human survival and well-being. Effective responses to the increasing human pressures on Earth systems require detailed and holistic knowledge of Earth history, function, and complex interactions. Basic research and education in the EOAS department explores, characterizes and analyzes Earth processes and thereby also improves prediction of the causes and development of natural and human-induced hazards such as earthquakes, hurricanes, flooding, coastal hypoxia, landslides, and wildfires. Through integration of research in meteorology, oceanography, and geology, EOAS contributes to the development of concepts that can support decision making in Florida and the US. EOAS faculty actively seek intramural collaborators who need to understand Earth systems in disciplines of social sciences, law, business, and humanities. Basic research on climate change, carbon cycling, and biological complexity have been identified as target areas for funding by the National Science Foundation. Observations are essential for testing and developing research concepts. Applied science is vital for finding solutions to alternative and traditional energy requirements. Critical to the applied science is that the underlying basic science concepts are well known. Research in the basic science of the Earth, Ocean and Atmosphere will always be an important component of the department's mission and is a requirement for being an international leader.

### Earth

The reconstruction of the origin and evolution of the Earth produces important information on the process by which life developed and the mechanisms that are required to sustain life on our planet. It requires us to not only to document its history, but also determine the processes that actively shape the planet. The increasing human population combined with the effect of climate change puts a higher demand on Earth's resources. Availability of raw materials, land-use and proximity to geological hazards are examples where both the fundamental understanding of process as well as practical understanding of the specific geological environment are important.

EOAS research investigates the cycles of elements that link lithosphere, hydrosphere, biosphere and atmosphere. A fundamental understanding of these cycles is required to manage Earth's resources and predict the Earth's behavior. Human activities can significantly affect the element cycles and thereby cause fundamental changes in the pathways of elements and earth system functions. EOAS research quantifies the natural and human-induced changes. EOAS research of sediments and rocks produces key information on the Earth's history and provides the critical context in which the recent changes of the Earth's surface needs to be placed. EOAS research provides data that are critical for managing future natural resources. For example, water is increasingly becoming a limiting resource. For the development of comprehensive and predictive water-cycle models, EOAS investigates the coupling of atmospheric and hydrologic models. This requires also the investigation of subterranean water and coastal hydrology that are both represented in EOAS research.

### Ocean

Among the most challenging educational and research tasks addressed by EOAS is global climate change. Atmospheric carbon dioxide levels have risen rapidly within the last decades due to fossil-fuel combustion and land-use. The increased CO<sub>2</sub> levels contribute to global climate change and pose particular challenges in the ocean. The long coastline and large low-lying areas make Florida extremely vulnerable to sea level rise and the increased storm activity. The oceans slow the rate of climate change by removing CO<sub>2</sub> from the atmosphere. However, the behavior of the ocean and the response of the ocean to the global climate change require a fundamental understanding of the state of the oceans, their physical, chemical and biological dynamics and their variability.

The exploitation of ocean resources has led to the depletion of fish stocks, destruction of habitats and contamination of waters and sediments. Oceanographic research at EOAS investigates marine food webs within the physical environment, the fate of marine ecosystems and populations affected by human activities, and how marine environments can be protected and managed to sustain their health and productivity. The recent BP oil discharge has generated unprecedented need for basic and applied research across a broad spectrum of marine and coastal topics. Other research areas that are of great importance for the Gulf of Mexico are the prediction and modeling of toxic red tides and the development of coastal hypoxia. The Ocean Observatories Initiative (OOI), started in 2009, provides comprehensive data sets that help to address these complex questions. Close linkage to the Florida Institute of Oceanography fosters cooperation throughout the Florida University System.

## Atmosphere

National needs in atmospheric science include the necessity to advance our fundamental understanding of the atmosphere, increase our abilities to predict weather and climate variability, and identify and quantify environmental threats. Major research questions that can be addressed by our department include aspects of atmospheric radiation and electricity, cloud physics, convection and tropical meteorology, and boundary layer meteorology, as well as improved understanding of atmospheric dynamics across a range of scales from individual clouds to the planetary scales. The hydrologic cycle and its effects on all aspects of the earth system is another focus of the department, and cuts across all components of the EOAS department. In addition, we are leaders in critical understanding of the coupled interactions between the components of the Earth's climate systems, and plan to continue to expand on this expertise. Weather related activities include tropical cyclones, which can cause the most severe natural disasters for Florida and also the United States as a whole, as shown by the catastrophic damage inflicted by Andrew in 1992 and Katrina during 2005. Research on tropical cyclones has direct implications for the state of Florida.

Effective responses to climate change (and the associated changes in day to day weather and extreme events) requires detailed investigations of the complex interactions among atmospheric circulations and physical processes that cause severe weather as well as gradual and abrupt changes in climate. These processes and interactions can be included in the development of high-quality numerical models and verified with observations. The response to weather and climate also requires a deep understanding of how these processes occurred in the past, which can be supported, e.g. by the analysis of recent and historical observations of ice cores. Research in the field of atmospheric chemistry at EOAS addresses the investigation of environmentally important species that can affect the earth's radiative and/or chemical processes, affect climate, and affect ecosystems. Global circulation modeling integrates climate model activity into an earth system model that includes physical, chemical and biological processes. Such models, ideally coupled with ocean and ground models, enable prediction of Earth-system behavior and disclose patterns on broad spatial and temporal scales, thereby allowing prediction

of large-scale events. Satellite and in-situ observations are an important integral part of the Earth System modeling and model validation.

We strive to improve our knowledge of the links between local, regional and global impacts of weather and climate, to apply this knowledge, and to communicate the implications of our findings to the broader communities at local, state, national and international levels.

# EOAS Initiatives for Excellence

## Goal 1: Excellence in Education. Attract students with high-quality academic programs

### Strategy 1: Establish and strengthen attractive undergraduate programs

- Recruit a talented and diverse body of undergraduate students.
- Offer excellent teaching and mentoring by the full-time faculty.
- Promote a student culture of enquiry and learning beyond the classroom.
- Provide student support for required course work outside the Geosciences
- Offer opportunities for students to actively participate in cutting-edge research programs.
- Offer curriculum credit for undergraduate internships and fieldwork.
- Reassess undergraduate curriculum based on exit interview of students as well as outside advisory board.

### Strategy 2: Maintain and enhance a rigorous graduate program

- Enhance our web presence and recruitment activities
- Maintain current quality coursework and develop innovative interdisciplinary courses
- Uphold high standards for learning and graduate research.
- Increase exposure of graduate work through an emphasis on published papers and presentations
- Expand fieldwork opportunities in the graduate curriculum.

## Goal 2: Excellence in Research. Become a world-leader in Earth Sciences

### Strategy 1: Maintain and develop disciplinary strength

- Maintain and enhance EOAS research funding
- Conduct quality research with national and international collaboration.
- Attract world-class scientists

### Strategy 2: Grow interdisciplinary opportunities in research

- Develop interdisciplinary research programs
- Maintain and strengthen national and international collaboration

## Goal 3: Build strength through a well-integrated EOAS Department

### Strategy 1: Develop mechanisms and practices for effective integration of the three curricular groups Earth, Ocean and Atmospheric Sciences.

- Establish department-wide seminars.

- Strive to eventual location of the department in one building.
- Establish an outside advisory board of well-respected academics and professionals.
- Hold a yearly graduate student symposium where students present their research and where student awards are given.
- Provide ample opportunities for social interaction within the department.
- Make students aware of faculty research activities

### **Strategy 2: Develop interdisciplinary courses and research projects**

- Actively seek opportunities for cross-disciplinary research and teaching.
- Emphasize critical thinking in course lecture and study assignments.

## **Goal 4: Enhance national and international visibility**

### **Strategy 1: Become a center for scientific communication and networking in Earth Sciences**

- Sponsor national and international research networks through organization of conferences and workshops.
- Seek research opportunities that directly concern Florida.
- Show the people of Florida through active outreach how our research benefits their lives.

### **Strategy 2: Develop and maintain strong ties to alumni**

- Involve alumni in recruitment of new students.
- Keep alumni involved in the department to gauge the success of our educational efforts.
- Use alumni connections to represent the department.
- Enhance development efforts.

## **Goal 5: Strengthen the University mission**

### **Strategy 1: Advocate University-wide requirement for Earth sciences in the curriculum.**

- Offer rigorous degree programs at the undergraduate and graduate levels.
- Develop incentives that encourage talented and diverse students to consider the EOAS degree programs.
- Uphold high standards for teaching and learning.
- Vigorously participate in University interdisciplinary initiatives like FSUTeach and Pathways of Excellence.

### **Strategy 2: Emphasize departmental goals and priorities.**

- Inform upper administration on departmental goals, priorities and accomplishments.
- Document and update the mission plan as goals and priorities are refined.
- Establish criteria to benchmark departmental effectiveness with documented reference to comparable departments at other universities.
- Use our presence in the state Capitol to promote our reputation for scholarly responsibility.