A satellite image of Earth's ocean surface, showing a large, swirling storm system (cyclone or hurricane) in the lower-left quadrant. The storm is characterized by a dark, dense core surrounded by concentric, lighter-colored bands of clouds. The surrounding ocean surface is a deep blue, with some lighter blue and white patches indicating wave activity or smaller weather systems. The top edge of the image shows the curvature of the Earth against a black background, suggesting a view from space.

# Center for Environmental Prediction

**RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY  
COOK COLLEGE • NEW JERSEY AGRICULTURAL EXPERIMENT STATION**



# Center for Environmental Prediction

*Environmental problems affect people, societies, and ecosystems around the world, and their impact will only increase over time. Solutions will cut across disciplinary lines, both within academia and science, and among science, policy, industry, and the public at large. The **Center for Environmental Prediction** is one pillar of the comprehensive, integrated approach to environmental understanding and solution science that is the hallmark of the New Jersey Agricultural Experiment Station, Cook College, and Rutgers, The State University of New Jersey.*



A storm unfurls when moisture, temperature differentials, and upward-moving air clash in an unstable atmosphere. This complex interplay is mirrored, on a larger scale, in the interactions among the Earth's systems—on land, on water, and in the atmosphere—that drive environmental change. The actions of people and the decisions we make now—to modify the landscape, to alter the atmosphere—add a layer of complexity with repercussions for the future. Understanding these complexities and predicting their outcomes are critical components of sound public planning and policy. At the **Center for Environmental Prediction**, based within the Department of Environmental Sciences at Cook College, the talents of faculty, staff, and students from several departments coalesce to form a focus for climate-related research, education, and service at Rutgers, The State University of New Jersey. A multi-disciplinary team like ours acts as a catalyst, creating a force to address the wide-ranging problems that face natural systems and human societies experiencing rapidly changing climate and environmental conditions.



# Center for Environmental Prediction

## *discovering knowledge*

The Center's researchers are an integral part of the scientific community, whether conducting experiments in the laboratory, modeling climate scenarios on high-performance computing systems, or measuring environmental phenomena along our waterways, among our landscapes, and in our atmosphere. This research has gained national and international recognition and has attracted funding at the federal, state, and local levels, indicating its high quality and relevance. The Center matches its research with outreach, collaborating with research groups from around the world, giving seminars at high-profile meetings and conferences, and sharing its expertise with planners, corporations, and the public.

The Center's scientists are committed to furthering our grasp of the links among the different Earth-system processes that control how the environment around us changes over time. The questions that drive this work cover a wide spectrum. What role do clouds and aerosols play in determining the Earth's climate? Can the "memory"

of past weather conditions contained in land-surface variables like soil moisture be used to improve the prediction of future rainfall? How do PCBs and trace metals like mercury move between New Jersey's atmosphere and its surface waters?

By finding answers to questions like these, the Center's researchers have furthered our understanding of critical environmental interactions. We have asked how the health and stability of sensitive wetlands regions are determined by the interplay of meteorology, coastal ocean and estuarine processes, ground water flow, and local ecology. We have predicted how Arctic regions might alter in response to global climate change. We have worked to improve seasonal forecasts and our understanding of global warming by examining the effects of volcanic eruptions on climate. And we have added to our knowledge of how regional weather and climate respond to deforestation and other land-use changes.

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## delivering education

The Center's scientists are also teachers, committed to an active participation in undergraduate and graduate education at Rutgers. Our focus is on promoting links among the atmospheric, oceanic, earth, and environmental sciences curricula and on providing enhanced research and educational opportunities for students.

While teaching important and innovative courses, the Center's faculty are continually working to maintain the rigor, creativity, and relevance of the core graduate and undergraduate curricula in atmospheric sciences, environmental sciences, and oceanography. Such work is crucial for providing a top-level and rewarding program of study. In addition, our graduate students are an integral part of the demanding research that forms the



*The Center is editorial home to Journal of Geophysical Research-Atmospheres, which for the past decade has had the highest number of citations in the geosciences.*

foundation of the Center's reputation as a leading resource for key environmental knowledge. The Center provides graduate students a multitude of opportunities for hands-on experience alongside top scientists and inside a sophisticated research laboratory, where they learn to analyze environmental data and conduct computer simulations of climate-system processes.

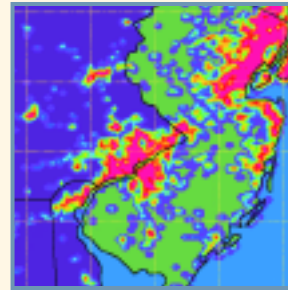
The Center also provides research experiences for motivated undergraduates, while funding scholarship and travel opportunities. In recent years, the Center has supported the trips of Rutgers undergraduates to the American Meteorological Society annual meetings in Orlando, Florida, and Long Beach, California; thanks to the Center's efforts, the Rutgers student chapter of the society has the largest representation of any university in the world at these meetings. In addition, the Center provides other travel support, for example, for one student per year to attend the National Center for Atmospheric Research Summer Undergraduate Leadership Conference. The Center has also established two annual scholarships for students planning to work on a George H. Cook Senior Honors Thesis with one of our researchers.

## serving the state

The global climate will change significantly over the next century, as humans continue to modify the land's surface and pollute the atmosphere with greenhouse gases and aerosols. The manifestations of these global changes will be felt in New Jersey, with potentially large impacts on the population through effects on agriculture, water resources, energy supply and demand, air pollution, the coastal region, urban areas, and public health.

Improving our ability to comprehend these climate changes and impacts, at global and regional scales, is the core of the Center's research. Such comprehension requires research into the fundamental processes in each of the climate system components as well as the interactions among them, along with the development of enhanced computer modeling tools to more accurately capture these processes and interactions.

As an example, the Center is currently working to determine what impacts future climate change may have on New Jersey's water resources. Will the 2002 drought be repeated more often in the



*The Center is studying how changing land use in New Jersey—for example, increased urbanization—will affect sea breezes, wetlands ecology, and peak summer temperatures.*

future? What might be the consequences of recurring or extended droughts? The Center's scientists, through research and modeling of regional climate-change scenarios, are creating a detailed hydrologic model of the state to answer these and related questions. This science-based understanding can help New Jersey to formulate critical decisions in water-resource planning—for example, whether to modify its drought plan.

A key resource for weather and climate information is the Office of the New Jersey State Climatologist, located within the Center. Outreach from this office—for example, through interviews in newspapers and on television—is often the primary means by which state residents learn about pressing issues such as droughts and severe weather. Through this office, the Center is helping to establish new networks of weather- and climate-monitoring stations that will provide first-line indications of changing conditions throughout New Jersey. These observations can also be used to evaluate the accuracy of predictions from the Center's climate-modeling tools.

Volcano photograph by Alan Robock

Rutgers, The State University of New Jersey, is dedicated by law and by purpose to serving all people on an equal and nondiscriminatory basis.



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## our mission

- n To facilitate close interaction between Rutgers researchers in atmospheric, oceanic, earth, and environmental sciences and to raise the visibility of this research throughout the scientific community and with the general public
- n To participate in undergraduate and graduate education at Rutgers, with emphases on promoting links among the atmospheric, oceanic, earth, and environmental sciences curricula and on providing enhanced research and educational opportunities
- n To fulfill our responsibility to the state of New Jersey by providing data-based weather and climate advice and by studying the impacts of climate and land-use change for the benefit of all New Jersey stakeholders
- n To communicate these scientific findings and impact scenarios to policymakers and expert groups, with the purpose of jointly working toward solutions for the environmental problems that we all face



## sharing science

Regardless of how successful the Center's scientific efforts are, a key test of effectiveness will be our ability to exchange information with those in academia, in government, in the community, and in other spheres who are involved in public policy, planning, and the social dimensions of environmental change. Effective communication of our scientific findings to those who need them is the ultimate measure of our impact, and the Center is dedicated to establishing these networks.

The Center's potential to inform sound policymaking springs from its ability to predict

the joint impact of global climate change and regional environmental change on New Jersey's agriculture, water availability and quality, energy needs, air pollution, coastal regions, ecosystems, and public health. For example, the Center is working to predict the varying consequences of different scenarios of land-use change in the coming decades, and to provide these predictions to planners.

The Center is an environmental resource for the state of New Jersey. We work with the New Jersey Department of Environmental Protection on many of our projects. We stand ready to be the weather and climate clearinghouse for the state, providing data and research-based answers to emerging environmental questions and problems. We are continually searching for ways that our science can better reach the public we serve.

*The development of new data sources for monitoring changes in New Jersey's weather, climate, and environment is a crucial aspect of the Center's mission.*

# Environmental Prediction

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