



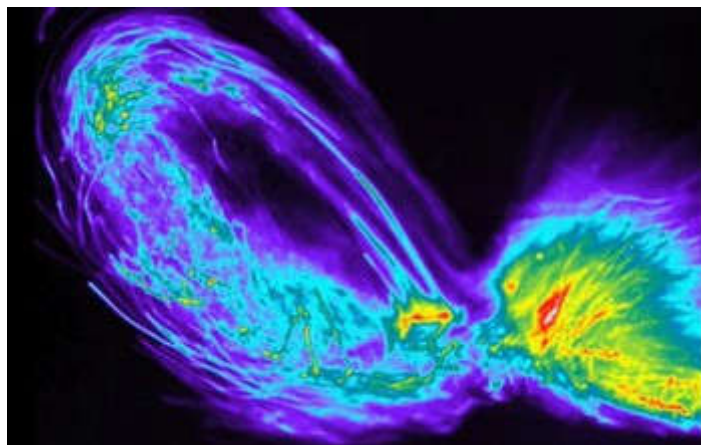
National Science Foundation  
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News Release 17-109

## NSF awards \$2.8 million grant to develop advanced ocean and atmosphere simulator

**First-of-its-kind simulator will replicate a range of ocean conditions and generate gale-force winds in controlled setting**



Bioluminescence shines in a wave. In SOARS-like research, scientists studied waves with this light.

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**November 8, 2017**

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Can Earth's complex ocean-atmosphere system be mimicked in a laboratory? The National Science Foundation (NSF) has awarded \$2.8 million to the Scripps Institution of Oceanography (SIO) in La Jolla, California, to construct just such a replica.

The new Scripps Ocean Atmosphere Research Simulator (SOARS) will accurately duplicate ocean conditions, capturing the interactions of wind, waves, microbial marine life and chemistry in a laboratory setting.

With SOARS, scientists will also explore how the introduction of pollutants by human activities is changing the chemistry of the ocean and the atmosphere, changes that could affect how nature regulates climate.

Researchers will be able to generate winds up to 50 kilometers (31 miles) per hour; control air and water temperatures to replicate conditions ranging from tropical to polar; induce phytoplankton blooms in a range of species; and add inputs such as air pollutants, including greenhouse gases, for studies of potential climate change effects now and in the future.

"This will be the only instrument in the world capable of studying the current and future ocean-atmosphere system, and is a testament to 21st century science," said project principal investigator Grant Deane, a Scripps oceanographer. "We're building the tools we need to understand our changing planet and to educate the next generation of scientists and engineers in whole Earth science."

The team behind SOARS includes an atmospheric chemist, a microbiologist and three physical oceanographers. The experiments planned for the facility are similarly broad and interdisciplinary.

"Research at this new facility will lead to an understanding of how pollutants and higher carbon dioxide levels affect marine animals and plants, cloud formation, and, ultimately, us," said Rick Murray, director of NSF's Division of Ocean Sciences, which awarded the grant. "Through these studies, scientists will simulate how ocean ecosystems ranging from the polar regions to the offshore California current may respond to future environmental conditions."

According to SOARS co-principal investigator Kim Prather, who also directs the NSF [Center for Aerosol Impacts on Chemistry of the Environment \(CAICE\) \(/cgi-bin/good-bye?https://caice.ucsd.edu/\)](https://caice.ucsd.edu/), SOARS will enable more detailed study of aerosols -- particles composed of sea salts, organic matter, viruses and bacteria that are ejected from the ocean surface when waves break and winds blow.

Such particles directly seed and form clouds. Sea-spray aerosols and gases emitted from the ocean can change the properties of clouds, which in turn change the temperature of the planet. Aerosol-cloud interactions are considered to be the most difficult variables in climate to understand.

"Futuristic scenarios can be tested by increasing atmospheric carbon dioxide and pollutant concentrations," said Prather. For example, sunlight and sea-surface pollutants might interact to create new gases and aerosols that could be re-introduced into the atmosphere as toxins with potential health effects.

"SOARS will open doors for the exploration of scenarios that will allow scientists to sort out human-natural interactions at a level that cannot be achieved in the real world."

Another project co-principal investigator, Scripps microbiologist Farooq Azam, said SOARS could lead to an improved understanding of the ocean food web.

"SOARS should help address fundamental questions on the ecology of microbes at the air-sea interface, important for predicting the future state of the ocean-atmosphere system," said Azam.

"The capability of SOARS to simulate controlled ecosystem scenarios will help us understand the mechanisms of variability in the microbial food web, and the significance for the carbon cycle and climate change."

SOARS marks a significant advance in the development of Scripps' environmental simulation equipment. For nearly 50 years, Scripps scientists had been using tanks to generate waves and replicate some ocean processes in the laboratory. The new instrument will continue these experiments in fluid dynamics, physical oceanography and marine engineering.

The total cost of SOARS is \$4 million, with \$1.2 million provided by Scripps. Design of the instrument has begun, with experiments scheduled to start in 2021.

-NSF-

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Waves send plumes of sea spray into the atmosphere, altering the formation and duration of clouds.

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Sun, pollution, cloud droplets, ice formation and ocean biology will be studied at the NSF center.

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Earth's oceans and atmosphere are inextricably linked in determining how long clouds last.

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Scripps Institution of Oceanography scientists are at work on instruments for the new NSF center.

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Clouds' ability to reflect solar energy and absorb radiation affect Earth's climate.  
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### Media Contacts

Cheryl Dybas, NSF, (703) 292-7734, [cdybas@nsf.gov](mailto:cdybas@nsf.gov) (<mailto:cdybas@nsf.gov>)

Rob Monroe, SIO, (858) 822-4487, [rmonroe@ucsd.edu](mailto:rmonroe@ucsd.edu) (<mailto:rmonroe@ucsd.edu>)

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*The National Science Foundation (NSF) is an independent federal agency that supports fundamental research and education across all fields of science and engineering. In fiscal year (FY) 2018, its budget is \$7.8 billion. NSF funds reach all 50 states through grants to nearly 2,000 colleges, universities and other institutions. Each year, NSF receives more than 50,000 competitive proposals for funding and makes about 12,000 new funding awards.*

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National Science Foundation, 2415 Eisenhower Avenue, Alexandria, Virginia 22314, USA Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (800) 281-8749

