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Research / Discovery

Engineering professor obtains \$3.2 million grant with NASA JPL to develop airborne radiometer

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A Colorado State University electrical and computer engineering professor, in collaboration with NASA's Jet Propulsion Laboratory, will spend the next three years developing a new airborne radiometer instrument to demonstrate new technology in preparation for a planned NASA Earth observation satellite that will measure surface water levels around the globe.

NASA awarded Steven Reising, Colorado State associate professor who is leading the project that includes seven JPL scientists and one UCLA professor, a \$3.2 million grant. The project goal is to build and fly an airborne radiometer in advance of NASA's Surface Water and Ocean Topography, or SWOT, Earth science mission, which is planned for launch in 2020. The grant is designed to develop and demonstrate an aircraft prototype to determine the need for new satellite technology. It is one of only 16 prestigious NASA Instrument Incubator Program grants awarded once every three years.



Steven Reising, associate professor of electrical and computer engineering

CSU's Reising serves as principal investigator

Reising serves as the principal investigator on the grant from NASA. The high-frequency radiometer they are building will measure natural electromagnetic energy emitted from water vapor, or humidity in the atmosphere. Such measurements enable more accurate observations of how the ocean surface height changes over time and how this relates to climate change.

"This mission will let us look at the necessary level of detail to understand the fundamental processes of how both heat and carbon are exchanged between the ocean and the atmosphere," Reising said. "The challenge is to learn how these processes are connected to climate when both the ocean and the atmosphere are changing at the same time. This satellite will also allow scientists to look near the coast where sea level changes critically affect biological and human activity and marine life."

The SWOT mission aims to obtain higher-resolution images of the ocean, look more closely at what is happening near the coastlines and measure changes in inland water bodies across the globe, including water storage that is critical for life in the Rocky Mountain region.

Instrument will measure atmosphere's humidity

Reising's and JPL's teams, including undergraduate and graduate students at Colorado State, will design and build the high-frequency airborne radiometer instrument, which will measure humidity in the atmosphere with a high level of detail, comparable to choosing a digital camera with a large number of pixels. This increases the ability to measure humidity and therefore sea level near the world's coastlines.

"This effort will enable us to infuse new technology into future radiometer missions with lower cost and lower risk," said Diane Evans, JPL director for Earth Science and Technology.

"This technology development will enable future spaceborne radiometers to acquire global, high-resolution information about the atmospheric moisture over coastal oceans," added Eastwood Im,

JPL Earth Science Technology Research and Advanced Concepts Office Manager and Associate of NASA's Earth Science Technology Office.

Scientists need precise measurements of water vapor to understand its influence on surface water measurements by satellite radar.

Evaluating humidity influence on surface measurements

"There's natural emission from Earth's surface, clouds, and even the clear sky," he said. "When a satellite radar pulse is sent through the atmosphere, the question is, how much is the humidity slowing it down? Without accounting for that, one cannot measure sea level accurately."

Integration of the radiometer instrument on the airplane and its testing with airborne flights will be completed principally by CSU graduate students in collaboration with JPL engineers.

This is Reising's second grant from NASA. He was previously awarded a \$1.1 million grant from the NASA Earth Science Technology Office.

Contact: Emily Wilmsen
E-mail: Emily.Wilmsen@colostate.edu
Phone: (970) 491-2336

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