

Research project tests remote sensing to measure Earth's water cycle

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This summer's dry Iowa weather has helped drive home the importance of soil moisture not just to farmers, but also to gardeners, homeowners and consumers looking for fresh produce.

For decades, Iowa State University researchers have studied the cycling of water among soil, vegetation and the atmosphere that is vital to production agriculture. Now a team of Iowa State and University of Iowa researchers is beginning a new project to perfect the use of remote sensing technology to monitor the water cycle.

The team has received a \$1.3 million, five-year grant from NASA. Brian Hornbuckle is principal investigator for the project. He's an assistant professor in agronomy, electrical and computer engineering and geological and atmospheric sciences at Iowa State.

"We know the landscape in which we live changes on many scales over space and time," Hornbuckle said. "Remote sensing is the only tool available that can capture all these changes. But is it accurate enough to be useful? That's the question we want to answer."

The research is taking place on 200 acres of Iowa State research farmland south of campus. On-site equipment will measure soil moisture, precipitation, radiation and evapotranspiration. Some manual measurements also will be taken.

Remote sensing equipment will be taken to the field once a year,

probably during each of the four seasons, to see if data from the on-site monitoring matches data from the remote monitoring. The remote monitoring equipment is expected to be in the field two to four weeks, or as long as is necessary to be able to measure a variety of soil moisture levels.

Hornbuckle said remote sensing instruments work like cameras and record the "brightness" of the earth's surface. But instead of detecting visible light like normal cameras, Hornbuckle's remote sensing instrument that will be used at the site "sees" microwaves. "Wet soils appear dark and dry soils appear bright. Eventually microwave remote sensing instruments on satellites will take pictures of the earth's surface and produce maps of soil moisture," he said.

Amy Kaleita, assistant professor in Iowa State's agricultural and biosystems engineering department, is a co-investigator on the project. "We know a key driver of crop yield is climate," Kaleita said. "Drought predictions can show up in soil moisture patterns. Anything we can do to support monitoring and projections of field conditions helps producers make better management decisions."

The research field is planted to soybean this year, with a corn-soybean rotation planned for future years. Hornbuckle said the goal of the project is to evaluate the use of several types of remote sensing devices to monitor the water cycle on a small scale. "The ultimate goal would be to someday use this type of information in conjunction with models to forecast soil moisture conditions, the weather and to detect climate change," he said.

Three University of Iowa scientists are co-investigators on the project. Witold Krajewski is an expert in remote sensing of precipitation. William Eichinger's expertise is remote sensing of evapotranspiration. Both Krajewski and Eichinger are professors of civil and environmental

engineering. Anton Kruger, a research engineer, is developing new wireless technology to communicate with the field instruments in the project.

The team also will collaborate with researchers at the National Soil Tilth Laboratory, a USDA Agricultural Research Service facility on the Iowa State campus, and share data generated at the site with other interested researchers.

Hornbuckle said a small conference was held at Iowa State June 21-22 where the project was outlined. "The conference brought together remote sensing experts from across the United States. The use of remote sensing to monitor the water cycle is a big idea but we're starting small in this one field. Eventually we expect the technology to be expanded and used on a larger scale - river basins, states, regions," he said.

Source: Iowa State University

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