Planning in the near term for climate change

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Researchers from IRI visited Ethiopia in May 2012, working with staff from a local relief society to talk with farmers.

When scientists talk about climate change, they usually mean significant changes in the measures of climate over several decades or longer. Climate variability generally refers to seasonal changes over a year or so.

Lisa Goddard, an expert on climate change and variability, focuses on where the two intersect. As director of the Earth Institute's International Research Institute for Climate and Society, based at Columbia's Lamont campus, she looks into climate variations over a two-to-20 year time frame.

"The need to plan for longer time frames has become an issue," says Goddard, also an adjunct associate professor in the Department of Earth and Environmental Sciences. "But very few of the decision makers we work with are thinking about the end of the 21st century or the next 50

years. They want to know if they will have water in their reservoirs for the next couple of years, or how to plan for agricultural evolution over the next 10 years."

The institute Goddard leads works primarily with developing countries to help them anticipate and manage climate-related events such as droughts, floods and heat waves. Near-term climate change research, which addresses the next decade or two, can help governments plan infrastructure projects that take years to build, such as irrigation for crops that are normally rain-fed, or water-management policies for energy generation.

The IRI is one of more than a dozen Columbia research centers affiliated with the Earth Institute that focus on virtually every aspect of climate-related science. The Center for Climate Systems Research, for instance, brings together experts from Columbia and the NASA/Goddard Institute for Space Studies, who examine the earth's climate sensitivity and variability and contributed to Mayor Michael Bloomberg's sustainability plan for New York City. IRI's research projects often involve collaborations with other Columbia schools, such as the Mailman School of Public Health and the School of International and Public Affairs.

Right now, Goddard and her colleagues are working with agriculture officials in Argentina, Brazil and Uruguay as well as farming consortiums to guide plans for soybean, maize and wheat crops over the next 10 to 20 years and determine whether irrigation will be necessary. It is funded by the National Science Foundation and the National Oceanic and Atmospheric Administration. IRI also works with NOAA's Climate Prediction Center to help design tools and methods that can forecast the severity of droughts in the Colorado River basin in the U.S. and Mexico.

The Institute already produces forecasts of land, ocean and atmospheric

conditions around the world that focus on the short-term—the next month to several seasons ahead. And it has developed an online tool with location-specific graphs that track seasonal variability and long-term temperature changes since the beginning of the 20th century.

Its library of some 400 data sets can show, among other things, the impact of naturally occurring year-to-year variations on long-term trends, which government officials and other planners can download and use to make decisions.

"We're not saying something is definitely going to happen, but there are quantifiable odds that it can happen based on what has gone on in the past. It brings all three of these time scales together," she says.

Goddard came to IRI in 1995 as a post-doctoral fellow when the institute was just starting. As a graduate student she had done research on climate variability and El Niño while earning a Ph.D. in atmospheric and oceanic sciences from Princeton. She was named director of IRI last year.

Over the years, IRI helped develop models for predicting the worldwide impact of El Niño, the warm ocean current in the Pacific that can cause catastrophic weath- er changes across multiple continents.

During an interview in her Lamont office overlooking the Hudson River from the Palisades, she explains how El Niño brings warmer water to the coast of South America every three to seven years, changing fish species along the coast and sometimes spawning new lakes and flowers in desert areas of Peru. In the U.S. El Niño affects rainfall on the West Coast and temperatures in the northern states.

Goddard lists some of the other effects of climate change and variability that IRI is investigating. Warmer water in the south Atlantic contributes to dry years in parts of West Africa but also spawns hurricanes in the

Caribbean and indirectly contributes to drought in the U.S. Research scientist Alessandra Giannini is examining whether such decade-by-decade variability will apply to long-term climate change.

Madeleine Thomson, a senior research scientist, has been leading research relating climate variability to health. For example, rising temperatures and rainfall create breeding grounds for mosquitoes that cause malaria and other diseases, especially in tropical climates. Increases in dust during the dry season has been linked to outbreaks of meningitis in Africa's Sahel region.

There are so many interesting scientific questions," Goddard says. "We want to understand the causes of regional climate variability and change, and to understand and quantify our current capability to provide credible information. We then want to create tools to make it useful for decision making. Even if we do something about greenhouse gases, the variability over two to 20 years can be as large or larger than the man-made part of climate change."

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