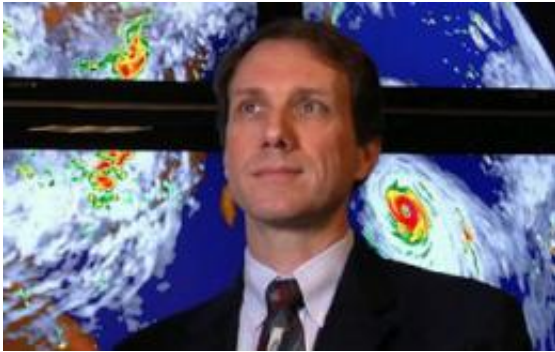


Looking ahead to local climate models

July 15 2011, By Valene Marshall



Jim Kinter explains how supercomputers are used to learn about climate variability and change.

When research scientist Jim Kinter describes the interactions between the Earth's ocean, land and atmosphere, he talks of dancing. "The atmosphere and the ocean, and the atmosphere and the land surface have to go together," he says. "It's as if they were dancing, and that dance turns out to influence climate."

Kinter, a professor of [climate dynamics](#) at George Mason University and director of the Center for Ocean-Land-Atmosphere Studies (COLA), along with COLA scientists, study this "dance" to better understand the predictability of climate--how it varies.

According to Kinter, today many of us are familiar with [climate change](#) and its causes. In fact, he adds, we've known for well over a hundred years that human influences that increase carbon dioxide and other

[greenhouse gases](#) in the atmosphere affect the global average [climate](#). One look at the increased occurrence of floods, drought and [extreme weather](#) across the Earth, and it's easy to conclude that something is up.

Tough next step

"What we are having a harder time being able to pin down," says Kinter, "is what's going to happen at the local scale or the regional scale, where decisions are made."

With support from the National Science Foundation (NSF), [NOAA](#) and NASA, scientists at COLA are working to provide the world with more accurate climate predictions--with longer leads--of where climate changes will occur and what the impacts will be on human societies and ecosystems.

"If people want to know where to build the clean energy solutions, where to put up the wind farms, where is the right place to invest in solar energy," says Kinter, "that all depends on the climate and, importantly, it depends on the variability and the change that we expect."

Countries like Bangladesh and Maldives are already at risk of being flooded due to sea-level rise and harsh weather. If decision makers in nations that are most vulnerable to climate change are provided with the right information and resources, a decade or more in advance, then they will be better able to plan for the expected changes.

The El Niño example

Climate-related predictions coming out of COLA and other organizations are already improving the way decisions are being made, according to Kinter and others.

"El Niño is a big fluctuation in the surface temperature of the tropical Pacific Ocean," says Kinter. The repercussions of those changes in surface temperature are worldwide. Kinter says they're related to droughts in South America, forest fires in Indonesia, floods in North America, and higher snow packs in the Colorado Rockies. "A major El Niño event or its inverse, which we call La Niña, might be really good for the ski industry," he said.

Over the past two decades, COLA has helped to quantify and calibrate the degree to which El Niño can be predicted. Today, predictions of El Niño are made six months or more in advance.

"So there are many countries, particularly in the tropics and in the developing world that are using our El Niño forecasting system to make decisions," says Kinter. "If they know that El Niño is more likely to push them into drought conditions then they may invest in a more resilient seed to make sure that [crops] are going to make it through a drought."

Supercomputers and climate predictability

Supercomputers are helping researchers learn more about the complex interactions that influence climate change. "We use the supercomputers to solve the equations that govern the Earth's atmosphere, the global ocean and the [land surface](#), and we do that in a fully coupled mode," explains Kinter. "We let the simulated atmosphere, the simulated ocean and the simulated land surface interact with each other inside the computer, so it's really very exciting to watch these simulations."

Although the simulations have come a long way in providing high quality regional information, Kinter finds there is room for improvement.

"Convective clouds--the thunder storm clouds--turn out to be very poorly represented in the models that we're using for climate simulation today," he says. "But if we could get to a model that can resolve the clouds, then

we think we will actually have a breakthrough."

Kinter believes towards the end of the decade we'll have better supercomputers that will give us the opportunity to simulate the global climate more accurately. "We're talking all the way down to the cloud scale, all the way down to the scale of eddies in the ocean and all the way down to the landscape scale at the land surface."

"When we get to that point," he says, "we think that we're going to have climate simulations that will be able to tell you: is this predictable, is it not predictable, here are the predictions and here's the reliability that we believe in."

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