



Debbie Mackay at a controlled house fire.
Photo: Debbie Mackay

HOW COMPUTER MODELING HELPS FIGHT FIRES

Debbie Mackay gained notice in the first half of 2012 when her computer modeling research showed she might be able to help firefighters predict how blazes will spread and provide better strategies to fight them. Working on her Ph.D. at the time at the University of New South Wales, Australia, she became focused on gathering information on fires and even went to a blaze with firefighters. Taking time off to have her daughter after completing her doctorate, her mind swirls now on new places to take the project.

A goal is to build a big database with different scenarios to train firefighters," she says. "It's just a matter of getting in all the cases and modeling to see how all these fires started. The database is helpful because you can't keep burning things down for the sake of training." For example, Mackay was able to collect data on a house purposely burned before it was to be demolished. "The ideal would be to do control burns but use really accurate models to train them: If this fire happened in a factory this is what we might see. If in an apartment, this is what

we might see.' You could pull up a model and take a snapshot of temperatures."

USING CFD

For the modeling, the project utilized computational fluid dynamics. "Basically, we divide the space up into small elements and solve the equations for flow iteratively over each element," she says. The main software employed was Fire Dynamics Simulator, a freeware program offered by the National Institute of Standards and Technology.

She thinks much more can

GLOBAL

LAW AND GEO-ENGINEERING

A University of Iowa law professor is recommending the creation of a global governance structure to oversee efforts to slow climate change.

"Geo-engineering is a global concern that will have climate and weather impacts in all countries," said Jon Carlson, professor of law at the university. "The international community must act now to take charge of this activity to ensure that it is studied and deployed with full attention to the rights and interests of everyone on the planet." Carlson, an expert in environmental and international law, said he believes geo-engineering is inevitable and will likely happen sooner than later.

Some geo-engineering ideas are simple and locally focused, such as planting new forests to absorb carbon dioxide, or painting roofs and paved areas white to reduce solar heat absorption.

Others are more complex and controversial—cooling oceans so carbon dioxide-laden water sinks to the bottom more quickly or building space-based shields and mirrors to deflect solar heat from the planet.

But geo-engineering comes with international legal implications because no one country can implement its own geo-engineering plan without risking weather or climate changes in other countries, Carlson said.

There's also the law of unintended consequences, because while many geo-engineering concepts have proved promising in the lab, nobody knows what will happen when they are actually put into practice, he said.

Carlson proposed the International Monetary Fund as a model for the governing body. Like the IMF, his proposed organization would give all countries a place during discussions, but decisions would be made by a relatively small group of directors, each of which has a weighted vote that's based on their country's greenhouse gas production.

TECH BUZZ

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HOW COMPUTER MODELING HELPS FIGHT FIRES

be done through testing theories.

"We can talk to a lot of fire investigators who can say either this or that happened and then plug it in and see what was more likely," she says.

Mackay also says some of the work ahead is just convincing more firefighters to become a part of the research. "Some are hesitant because it's not the same as a real life scenario," she says. "As the technology develops, hopefully it can show even more how useful it can be. But many firefighters I've spoken to have been overwhelmingly positive."

CONTROLLING ENVIRONMENT

And Mackay gained a strong appreciation for their job through her research. "I felt quite privileged to go along to see how they work," she says. "I was impressed by what they can do and it's much more involved than I thought. You're controlling the environment and they know where the fire might go next so much of the time. A firefighter can tell what's happening in a fire just from the color of smoke. If we learn their knowledge better, models can

"A GOAL
DATA
SCENA
FIRES"

be more realistic...Hopefully the work done can be passed on to the next generation of firefighters and make their job easier."

Mackay also wants to put more time into her research on oxygen's effect during blazes. "We can learn if a window is cracked what the effect of airflow in the room would be," she says. "It's important to run many scenarios to see all the possibilities." Though Mackay admits to not immediately thinking of fires as an area to devote part of her career to, she's locked in now. But she also knows it requires a higher degree of accuracy since future lives could be saved through her work. ■

BY ERIC BUTTERMAN/ASME.ORG

Today, nearly 4,000 people in Haiti power their lights and electronic devices from 15 solar power stations in trailers. And now millions more worldwide may be in line to join them.

Haiti is a thus-far-successful test run for the trailers, called SunBlazers, and their creators have an ambitious plan to provide electricity for as many as 40 million people by the year 2020.

In 2011, the Institute of Electrical and Electronics Engineers' *The Institute*, published an article about the project by the IEEE Community Solutions Initiative group. CSI had just delivered nine trailers to Grand Goave, a small Haitian city that was devastated by a January 2010 earthquake.

Now, just over a year later, Ray Larsen and Robin Podmore, CSI

One of the CSI SunBlazers that was set up in Haiti in June 2011.

Photo credit: Jimmy Salazar/CSI/IEEE



SOLAR POWER WORLDWIDE

co-founders, have made inroads into communities in Nigeria, Cameroon, and South Sudan, and they have plans laid for markets in India and Bangladesh.

SunBlazers are portable, plug-and-play solar power stations composed of off-the-shelf parts.

When shipped, most of the trailer space is taken up by 12-volt lead-acid battery packs for the home, as well as six silicon photovoltaic panels, accord-

ing to *The Institute* article.

The panels can collect more than four kilowatt-hours of energy per day, enough to power 40 battery packs. Or some of that energy can be converted for use by a school, community center, or small business.

The solar panels charge four large station batteries in the trailer from which

the smaller home packs are charged. A pack is then carried to a home where each can provide power for LED lamps, mobile phones, radios, and small power tools. This can all be wired using wiring kits also shipped in the trailer. Several battery packs could also power small refrigeration units or water-purification or pumping stations.

Once the home battery pack is 50 percent depleted, it automatically cuts off to preserve a long battery life. Then it must be carried back to the trailer station, where the homeowner receives a battery recharge or an exchange unit,

4,000

NUMBER OF HAITIANS CURRENTLY GETTING ELECTRICITY FROM SOLAR POWER STATIONS IN TRAILERS

Sun at night: SunBlazer batteries provide light for communities off the grid.

