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Tools For The Future

By the end of the decade, it will be possible to log on to a computer for a bird's-eye view of the interaction between the earth's atmosphere, and its oceans, land masses, and polar regions. The series of satellites that will make this possible are called the Earth Operating System (EOS for short). The satellites will be launched between 1998 and 2003, and will send back observations for ten to fifteen years.

Dave Glover, a WHOI geochemist, looks forward to the EOS launches. He'll use the satellite data to make computer models that help explain how the earth uses carbon dioxide ($C0_2$).

Dave Glover uses satellite imagery to create computer-based models that tell the story of earth's changing climate. Someday, he hopes to use the models to make predictions.

What makes the EOS satellites different from those that have come before? "In the past," says Dave, "different instruments travelled on different satellites in different orbits, looking at the same piece of ground at different times. So the original idea of EOS was to build a humongous satellite, the size of a Greyhound Bus, and put all the instruments on one satellite, so that they could all look at the same piece of ground at the same time."

A CHANGE IN STRATEGY

As the project progressed, concerns were voiced. Such a satellite would be very expensive. What if it didn't work, or even exploded? As it moves from drawing board to reality the "Greyhound Bus" has become a series of smaller satellites.

The first EOS satellite is EOS-AM. "It's called AM because it crosses the Equator at 10:30 in the morning," says Dave. "EOS-AM will be a surface-imaging satellite. The instruments on it will look at the Earth's surface, both land and water.

Many scientists will work with the data sent back by EOS-AM. Dave and others will use it to create computer programs to study global warming. (See "The Greenhouse Effect and the Ocean.)" Along with a number of other people, I've been looking at the seasonal behavior of $C0_2$ in the upper ocean with respect to atmosphere," says Dave. On-site observations made from ships have shown that the $C0_2$ level in a given sea surface location varies from one season to another. Dave wonders what processes control this fluctuation.

The team he works with uses satellite data to make computer models that simulate the way these processes interact in nature. As better satellite data is collected, the models can come closer to simulating reality.

"We use these models to make predictions about what the ocean is doing with respect to $C0_2$," he says.

CLOSER AND CLOSER TO THE TRUTH

There are still many gaps in knowledge. "We know the rate at which $C0_2$ is increasing in the atmosphere, largely due to human causes," says Dave. "We all like to drive our own cars. When we look at historical records of how much fossil fuels have been mined or pumped out of the ground, and how much $C0_2$ that should generate, we find that only about half of the $C0_2$ is showing up in the atmosphere."

Where is the other half going? No one knows for sure. It's important to answer that question. "If the planet starts getting warmer, we're going to have some big problems that we'll have to solve," says Dave.

To begin to get answers, he believes, we need to construct what he calls "a three-legged stool." One leg is remote sensing satellite data. One leg is on-site measurements made by ships and buoys. And the third leg is computer modeling, "because in modeling you can pick your time and space scales. If you've got a fast enough computer, you can model almost anything."

Dave is encouraging when he speaks of his life as a scientist. "There's about 5% inspiration, 94% perspiration and then there's that one percent of the time when it's just a real high because you've figured something out and you're the only person on the planet who knows it," he says. "Of course, it's no good if you keep it to yourself. You have to publish it."