

Introduction

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Ben Santer is the kind of guy you could never imagine anyone attacking. He's thoroughly moderate—of moderate height and build, of moderate temperament, of moderate political persuasions. He is also very modest—soft-spoken, almost self-effacing—and from the small size and nonexistent décor of his office at the Lawrence Livermore National Laboratory, you might think he was an accountant. If you met him in a room with a lot of other people, you might not even notice him.

But Santer is no accountant, and the world has noticed him. He's one of the world's most distinguished scientists—the recipient of a 1998 MacArthur "genius" award and numerous prizes and distinctions from his employer—the U.S. Department of Energy—because he has done more than just about anyone to prove the human causes of global warming. Ever since his graduate work in the mid-1980s, he has been trying to understand how the Earth's climate works, and whether we can say for sure that human activities are changing it. He has shown that the answer to that question is yes.

Santer is an atmospheric scientist at the Lawrence Livermore National Laboratory's Model Diagnosis and Intercomparison Project, an enormous international project to store the results of climate models from around the globe, distribute them to other researchers, and compare the models, both with real-world data and with each other. Over the past twenty years, he and his colleagues have shown that our planet is warming—and in just the way you would expect if greenhouse gases were the cause.

Santer's work is called "fingerprinting"—because natural climate variation leaves different patterns and traces than warming caused by greenhouse gases. Santer looks for these fingerprints. The most important one involves two parts of our atmosphere: the troposphere, the warm blanket closest to the Earth's surface, and the stratosphere, the thinner,

colder part above it. Physics tells us that if the Sun were causing global warming—as some skeptics continue to insist—we'd expect both the troposphere and the stratosphere to warm, as heat comes into the atmosphere from outer space. But if the warming is caused by greenhouse gases emitted at the surface and largely trapped in the lower atmosphere, then we expect the troposphere to warm, but the stratosphere to cool. Santer and his colleagues have shown that the troposphere is warming and the stratosphere is cooling. In fact, because the boundary between these two atmospheric layers is in part defined by temperature, that boundary is now moving upward. In other words, the whole structure of our atmosphere is changing. These results are impossible to explain if the Sun were the culprit. It shows that the changes we are seeing in our climate are not natural.

The distinction between the troposphere and the stratosphere became part of the Supreme Court hearing in the case of *Massachusetts v. EPA*, in which twelve states sued the federal government for failing to regulate carbon dioxide as a pollutant under the Clean Air Act. Justice Antonin Scalia dissented, arguing that there was nothing in the law to require the EPA to act—but the honorable justice also got lost in the science, at one point referring to the stratosphere when he meant the troposphere. A lawyer for Massachusetts replied, "Respectfully, Your Honor. It is not the stratosphere. It's the troposphere." The justice answered, "Troposphere, whatever. I told you before I'm not a scientist. That's why I don't want to deal with global warming."

But we all have to deal with global warming, whether we like it or not, and some people have been resisting this conclusion for a long time. In fact, some people have been attacking not just the message, but the messenger. Ever since scientists first began to explain the evidence that our climate was warming—and that human activities were probably to blame—people have been questioning the data, doubting the evidence, and attacking the scientists who collect and explain it. And no one has been more brutally—or more unfairly—attacked than Ben Santer.

THE INTERGOVERNMENTAL PANEL ON Climate Change (IPCC) is the world's leading authority on climate issues. Established in 1988 by the World Meteorological Organization and the United Nations Environment Program, it was created in response to early warnings about global warming. Scientists had known for a long time that increased greenhouse gases

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