SAN DIEGO, CALIFORNIA—From his corner office on the terraced seaside campus of the Scripps Institution of Oceanography, Veerabhadran Ramanathan can look out 25 kilometers across the blue Pacific Ocean on a clear day. When San Diego’s pollutant “brown cloud” blows in, the dim view reminds him of his current scientific bread and butter: the pernicious boost that such hazes give to global warming.

More personally, the brown smudge on the horizon takes him back to his childhood summers in rural southern India half a century ago, where his grandmother would cough endlessly over her smoky indoor cooking fire of sticks and dung. Fires like hers still stoke the mother of all brown clouds, the one over South Asia.

That connection helps explain Ramanathan’s latest zigzag in a career full of unpredictable redirections. After discovering the unrecognized warming threat of trace greenhouse gases, provoking a reexamination of tropical meteorology, and revealing the insidious climate effects of brown clouds, the 64-year-old climate scientist is now going back to rural India. There he hopes to show how today’s rural Indian women can cook more cleanly than his grandmother did—though he doesn’t expect them to use the same fuel.

“Going back to rural India. There he hopes to show how today’s rural Indian women can cook more cleanly than his grandmother did—though he doesn’t expect them to use the same fuel.”

An aimless beginning

That drive came late. From his years working on his bachelor’s degree in engineering at the Annamalai University in Chidambaram, south India, Ramanathan says, “all I can remember is honing my skills in tennis and table tennis. I had this vision of being a tennis star.” Academically, “I had no goals for myself,” he recalls. He did bring a certain independence of mind to his studies. When Ramanathan—Ram for short—was 11, his father, a traveling salesman for Goodyear Tire and Rubber Company, moved the family from Madurai to Bangalore. School there was taught in English, not Ramanathan’s native Tamil. While picking up English, “I lost the habit of listening to teachers” he couldn’t understand, Ramanathan says. “I had to figure out everything on my own. It helped me enormously in research.”

After graduating from the university in 1965, he took a job at a refrigerator manufacturing plant. “Two years into it, I hated it. My job was preventing the [refrigerant] chlorofluorocarbons from escaping. I was not successful.” He quit manufacturing and went back to school for a master’s degree in engineering.

There he got his first taste of research: building India’s first Mach-Zehnder interferometer, an optical instrument for studying turbulent fluids. “I hadn’t felt capable of anything like that,” he recalls. “That gave me confidence.”

Off to the planets

Research was not popular in India, however, and Ramanathan was reluctant to go back to manufacturing. “My dream was to come to America and drive American cars and enjoy the good life,” he says. So he wrote to fellow engineer Robert Cess of the State University of New York at Stony Brook (now Stony Brook University) asking about graduate work with the university’s brand-new Mach-Zehnder interferometer. Cess took him on but “got bored with what I was doing” just as Ramanathan arrived, says Cess. He switched from studying combustion to studying the planets, taking Ramanathan with him. They applied an engineer’s understanding of radiative transfer—the way heat is emitted, absorbed, and scattered—to the nature of the atmospheres of Venus and Mars and the way carbon dioxide traps radiation to produce a greenhouse. That was when “I realized I’d found my calling,” says Ramanathan, “working on the natural environment.”

No climate jobs came up, but Ramanathan’s radiative-transfer expertise won him a postdoctoral position in a NASA laboratory that applied radiative transfer to the problem of how spacecraft can blaze safely home through the atmosphere. Then his new boss, like Cess, switched fields, putting him to work on how ozone in the stratosphere influences surface climate.

This latest random twist in the road carried Ramanathan into climate for good. At an ozone workshop, he learned of a recent landmark paper that tied chlorofluorocarbons (CFCs) to the chemical destruction of stratospheric ozone. Ramanathan recalled from his refrigerator days that CFCs would trap heat escaping from Earth and add to greenhouse warming. But were CFCs powerful enough greenhouse gases? The one he’s been chasing. In 1981, he showed how stratospheric ozone destruction favours the formation of the pernicious “brown cloud” over southern Asia.

Focus on the tropics

Ramanathan did not stop there. He got on board with a “brown cloud” workshop in Singapore and started going to tropical climate conferences. “It was a conscious choice to focus on the tropics,” he says. “We were really the only team studying tropic climate.” The tropics, he says, “are the most dynamic part of the climate system.”

In 1999 Ramanathan, along with 13 other scientists, published a paper that tied the brown cloud to global warming. Ramanathan reckons that brown clouds could be responsible for all of 20% of global warming, which he calls “a very serious climate warming threat.”

From Burning Dung To Global Warming And Back Again

His childhood in rural India inspired the latest twist in climate scientist V. Ramanathan’s long career studying—and now fighting—climate change.
SCIENCE

CREDIT: ADAM FERGUSON/VII MENTOR PROGRAM

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Ramanathan, but it did point him to the

CEPEX may not have won the day for

and melting Himalayan glaciers, as

was doing a lousy job of simulating the effect

rainfall, depressing Indian agricultural pro-

pall of brown clouds through cleaner ways of

Looking for a fix. Ramanathan is looking to clear the air with cleaner cook stoves in northern India.

A shy African girl asked, ‘What are you

“by the new science about the brown cloud over

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something suggested to him that climate models

were doing a lousy job of simulating the effect

of aerosols, the microscopic particles of
dust, sea salt, and pollutant crud that form

a sun-dimming visible haze. To find out,

Ramanathan co-led with Nobelist Paul

Crutzen the $20 million Indian Ocean Exp-

iment (INDOEX) in 1995 involving six air-
craft and 200 international scientists.

INDOEX was wildly successful, unfortu-
nately. Researchers flew into an awe-inspiring

brown cloud 3 kilometers thick spread over an

area the size of the continental United States.

It was so dense that it reduced sunlight reach-
ing the surface by as much as 10% to 15%, an

effect missing in the models. The problem was

soot. The brown cloud’s particles incorporated

black carbon spewed by combustion—burning

coil, diesel engines, and dung fires like the

one Ramanathan’s grandmother used to cook

on. Black carbon–laden aerosols absorb sun-

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good.” At about the same time, he was shaken

by the new science about the brown cloud over

Asia. He learned that “most of the black car-

bon is from biofuel burning,” he says. “That

was it. It took me back to what I had seen in

my childhood” watching his grandmother
coughing over her cooking fire.

Then, 3 years ago, he got yet another
push. At the United Nations, “I gave a pas-
sionate speech” about global warming to an

international group of high school students.

“A shy African girl asked, ‘What are you

personally doing about this problem? I had

nothing to say.’ ”

On a personal level, he started taking the

bus from home to Scripps and installed solar-

electric panels on his house. More globally, he

has launched Project Surya—Sanskrit for

“sun.” Surya “was a gift from God … that I

have a chance to go back and fix an age-old

problem.” Surya is an experiment aimed at

someday clearing a major part of South Asia’s

CEPEX may not have won the day for

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remainder of his life’s work. CEPEX observa-
tions suggested to him that climate models

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